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September 28, 2023

Via Hand Delivery & Electronic Mail

Mr. Steve Kahl
North Dakota Public Service Commission
600 E. Boulevard, Dept. 408
Bismarck, ND 58505-0480
ndpsc@nd.gov

In re: Oliver Wind IV, LLC
Oliver Wind IV Energy Center - Oliver County
Siting Application
Our File No. 035218-000083

Dear Mr. Kahl:

Enclosed for filing please find the following:

1) Oliver Wind IV, LLC's Application for a Certificate of Site Compatibility in Oliver County, North Dakota (5 copies);

2) NextEra Energy Resources Development LLC's check in the amount of $150,000 for the Commission's filing and administrative fees set forth under North Dakota Century Code Sections 49-22-22(1)(a) and 49-22-22(4);

3) Publication Map (5 copies); and,

4) Notice of Appearance.

We are also enclosing a USB containing project GIS and an electronic version of the application for your convenience.

Please feel free to contact me if you have any questions. Thank you.

Sincerely,

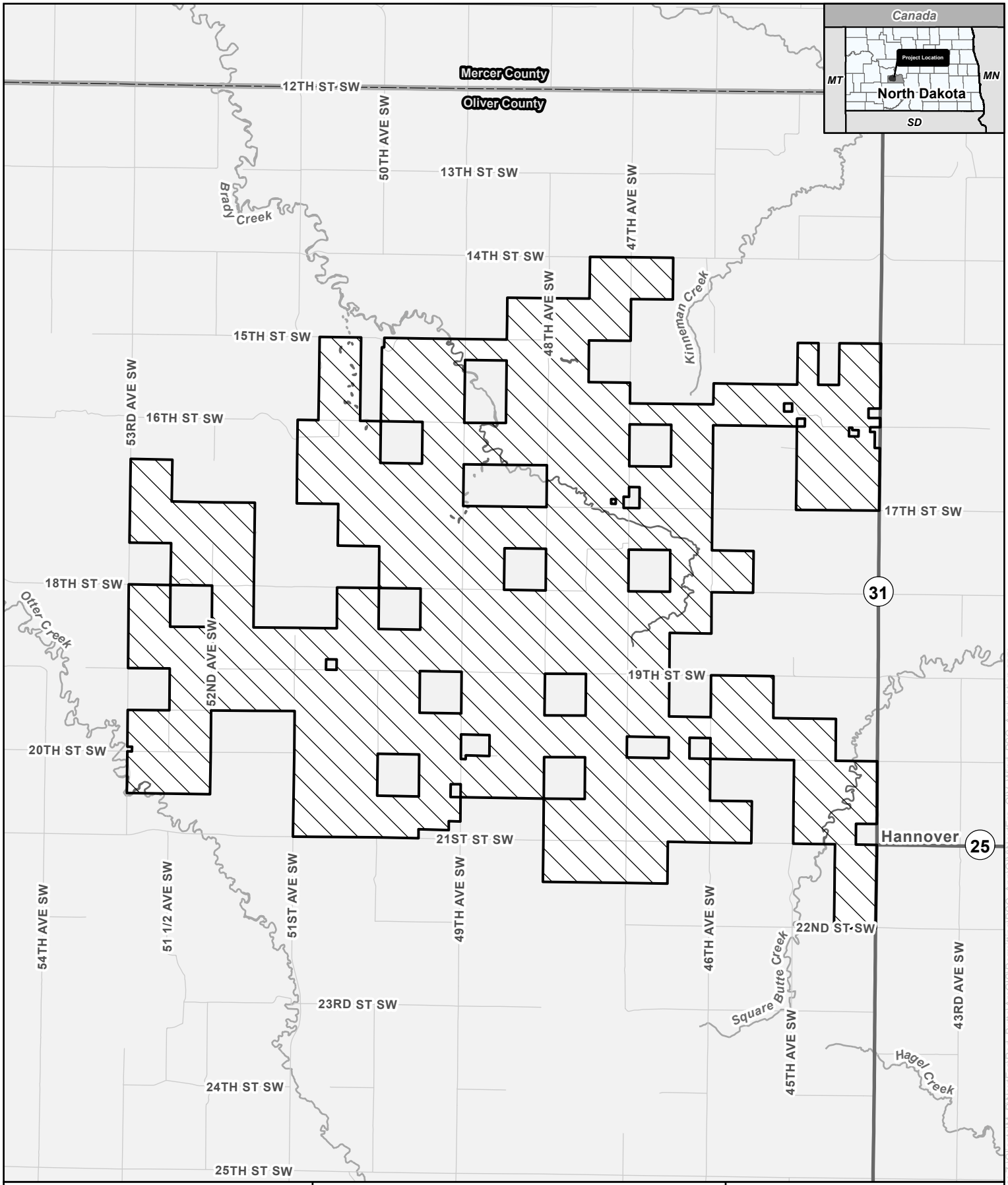
Casey A. Furey

CAF/lh

1 PU-23-317 Filed 09/28/2023 Pages: 992
Application for Certificate of Site Compatibility
Oliver Wind IV, LLC
Casey Furey, Crowley Fleck, PLLP

Enc.

cc:	Erik Edison	(via email)
	Tracy Davis	(via email)
	Dina Brown	(via email)
	Clay Cameron	(via email)
	Sarah Montone	(via email)



Oliver Wind IV Energy Center

Oliver County, North Dakota

Source: Z:\Clients\W_P\NextEra\Red_Butte\ArcGIS\Permitting\PSC_App\OlIVNextEra_OIV_Wind_PSC_Application.aprx

Date: (9/11/2023)

BEFORE THE STATE OF NORTH DAKOTA

PUBLIC SERVICE COMMISSION

In the Matter of the Application of Oliver Wind IV, LLC for a Certificate of Site Compatibility to construct the approximately 200 MW Oliver Wind IV Energy Center in Oliver County, North Dakota	**Case No. PU-23-___**

NOTICE OF APPEARANCE

Notice is hereby given that Casey A. Furey and Erik J. Edison, Crowley Fleck PLLP, will be appearing in the above-entitled matter on behalf of Oliver Wind IV, LLC. All correspondence, notices, pleadings, and other material relevant to this matter should be served upon the undersigned.

Dated this 28th day of September, 2023.

By: _____

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APPLICATION FOR A CERTIFICATE OF SITE COMPATIBILITY

OLIVER WIND IV ENERGY CENTER

OLIVER COUNTY, NORTH DAKOTA

SUBMITTED TO:

North Dakota Public Service Commission

SUBMITTED BY:

Oliver Wind IV, LLC
700 Universe Boulevard
Juno Beach, Florida 33408

PREPARED BY:

Merjent, Inc.
1 Main Street SE, Suite 300
Minneapolis, Minnesota 55414

SEPTEMBER 2023

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C18. ND Game and Fish Department and U.S. Fish and Wildlife Service

1.0 INTRODUCTION

Oliver Wind IV, LLC (Oliver Wind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC (NextEra), respectfully submits this application for a Certificate of Site Compatibility (Certificate) to the North Dakota Public Service Commission (Commission or PSC) to construct the Oliver Wind IV Energy Center (Project), which will have a nameplate capacity of approximately 200 megawatts (MW). The Project consists of up to 73 wind turbines, three alternative turbine locations, access roads, underground electrical collection and communication systems, two aircraft detection lighting systems (ADLS), a collection substation, an operations and maintenance (O&M) facility, a permanent and a temporary meteorological evaluation tower (MET tower), and temporary workspaces for a construction laydown area and a concrete batch plant. The Project Area encompasses approximately 22,291 acres in Oliver County, North Dakota (Figures 1 through 3). Oliver Wind IV expects the Project to be placed in service by December 2024.

Interconnection of the Project consists of a single Southwest Power Pool (SPP) interconnection request (GEN-2016-130) for 202 MW into the new Basin Electric Power Cooperative (Basin Electric) Leland Olds Station (LOS) 345-kilovolt (-kV) Substation in Mercer County, North Dakota (Figure 4). Oliver Wind IV executed the generator interconnection agreement with SPP and Basin Electric in January 2021. An amended and restated generator interconnection agreement was executed in April 2023 that included an entity name change, updated commercial operation date from 2022 to 2024, and reduction in affected system and network upgrade costs. Interconnection studies performed by SPP and Basin Electric show that the Project will not adversely impact reliability to the transmission system.]

The Project's generated power will interconnect to the electrical grid through a planned approximately 19.5-mile-long 345-kV transmission line (Project Transmission Line) that will connect to the new LOS 345-kV Substation. Per Commission regulations, the Project Transmission Line requires a separate application for a Certificate of Corridor Compatibility and Route Permit, which Oliver Wind IV is filling concurrently with this application.

In July 2023, Oliver Wind IV executed a 15-year power purchase agreement (PPA) with Verizon Communications, Inc. that will purchase 150 MW of the Project's electrical output. Oliver Wind IV is actively marketing the Project's remaining 50 MW electrical output to several potential offtakers, including utilities and commercial or industrial customers seeking a PPA. Oliver Wind IV will update the Commission if a PPA for the remaining 50 MW is executed.

NextEra, through its subsidiaries and affiliates, develops renewable projects throughout the United States and Canada. NextEra is one of the world's leading generators of wind energy, operating more than 15,000 MW of emissions-free wind energy in North America. In North Dakota, NextEra affiliates own and/or operate 15 wind facilities (that generate approximately 1,615 MW) and two pipelines, with another up to 900 MW of wind energy currently in development. Since 2003, NextEra's subsidiaries have been helping fuel the state's economic growth and quality of life and moving our country toward energy independence. NextEra designs, constructs, and operates its facilities in an environmentally sound and responsible manner. NextEra's 2022 Environmental, Social and Governance Report in Appendix A describes NextEra's environmental accountability, management, and stewardship policies that are intended to:

- design, construct, operate, and maintain its facilities in an environmentally sound and responsible manner;
- prevent pollution, minimize waste, and conserve natural resources;
- avoid, minimize, and/or mitigate impacts to habitat and wildlife; and
- engage stakeholders to build trust and partner toward common goals for environmental stewardship and protection.

1.1 COMPLIANCE WITH THE ENERGY CONVERSION AND TRANSMISSION FACILITY SITING ACT

The North Dakota Energy Conversion and Transmission Facility Siting Act (Siting Act), North Dakota Century Code (N.D.C.C.) Chapter 49-22 requires the proponent of a wind energy conversion facility exceeding 0.5 MW to obtain a Certificate from the Commission in order to locate, construct, and operate the facility in the state of North Dakota. An application for a Certificate must meet certain criteria set forth in the Siting Act, as well as in North Dakota Administrative Code (N.D. Admin. Code) Chapter 69-06-08. An energy conversion facility is required to be sited in an orderly manner compatible with environmental preservation and the efficient use of resources (N.D.C.C. Section 49-22-02).

In this application, Oliver Wind IV presents the information required by the Siting Act and the Commission's siting rules. Oliver Wind IV has considered the exclusion and avoidance areas, selection criteria, and policy criteria in the design of the Project, in accordance with N.D.C.C. Chapter 49-22 and N.D. Admin. Code Chapter 69-06-08. Information regarding Project design, wind resources, and technical information has been included in this application to allow a thorough understanding of the Project and to aid in review by the Commission, regulatory agencies, and the public. Table 1.1-1 provides a summary of information included in this application and the section of the application in which each siting requirement is addressed, if applicable.

TABLE 1.1-1
Certificate Completion Checklist

State Authority and Description	Section Addressed
North Dakota Administrative Code Chapter 69-06-04-01. Application. 2. Contents.	
1. The application must contain:	
a. A description of:	
(1) The type of energy conversion facility proposed	1.0, 1.3
(2) The gross design capacity	1.0, 1.3
(3) The net design capacity	1.3
(4) The estimated thermal efficiency of the energy conversion process and the assumptions upon which the estimate is based	Not applicable
(5) The number of acres that the proposed facility will occupy	5.3
(6) The anticipated time schedule for:	1.6
(a) Obtaining the certificate of site compatibility	1.6
(b) Completing land acquisition	1.6
(c) Starting construction	1.6
(d) Completing construction	1.6

TABLE 1.1-1
Certificate Completion Checklist

State Authority and Description	Section Addressed
(e) Testing operations	1.6
(f) Commencing commercial production	1.6
(g) Beginning any expansions or additions	1.6, 1.7
b. Copies of any evaluative studies or assessments of the environmental impact of the proposed facility submitted to any federal, regional, state, or local agency.	Appendix B
c. An analysis of the need for the proposed facility based on present and projected demand for the product or products to be produced by the proposed facility, including the most recent system studies supporting the analysis of the need.	2.1
d. A description of any feasible alternative methods of serving the need.	2.2
e. A study area that includes the proposed facility site, of sufficient size to enable the commission to evaluate the factors addressed in N.D.C.C. Section 49-22-09.	1.5, 3.5, All figures
f. A discussion of the utility's policies and commitments to limit the environmental impact of its facilities, including copies of board resolutions and management directives.	Appendix A
g. A map identifying the criteria that provides the basis for the specific location of the proposed facility within the study area.	All figures
h. A discussion of the criteria evaluated within the study area, including exclusion areas, avoidance areas, selection criteria, policy criteria, design and construction limitations, and economic considerations.	3.1, 3.2, 3.3, 3.4, 3.8, 3.9, 4.0, 5.0, Figure 7
i. A discussion of the mitigative measures that the applicant will take to minimize adverse impacts which result from the location, construction, and operation of the proposed facility.	6.1.2, 6.2.2, 6.3.2, 6.4.2, 6.5.2, 6.6.2, 6.7.2, 6.8.2, 6.9.2
j. The qualifications of each person involved in the facility site location study.	9.0
k. A map of the study area showing the location of the proposed facility and the criteria evaluated.	All figures
l. An eight and one-half-inch by eleven-inch black and white map suitable for newspaper publication depicting the site area.	Electronically provided
m. A discussion of present and future natural resource development in the area.	1.8, Figure 6
n. Map and GIS requirements. The applicant shall provide information that is complete, current, presented clearly and concisely, and supported by appropriate references to technical and other written material available to the commission.	All figures, GIS provided
North Dakota Century Code 49-22-08. Application for a certificate - Notice of filing - Amendment - Designation of a site or corridor.	
1. An application for a certificate shall be in such form as the commission may prescribe, containing the following information:	
a. A description of the size and type of facility.	1.0, 1.3, 4.0
b. A summary of any studies which have been made of the environmental impact of the facility.	6.4.2, 6.6.2, 6.7.2, 6.8.2, 6.9.2, Appendix B
c. A statement explaining the need for the facility.	1.0, 2.1
d. An identification of the location of the preferred site for any energy conversion facility.	1.5, all figures
e. An identification of the location of the preferred corridor for any transmission facility.	Figure 4

TABLE 1.1-1
Certificate Completion Checklist

State Authority and Description	Section Addressed
f. A description of the merits and detriments of any location identified and a comprehensive analysis with supporting data showing the reasons why the preferred location is best suited for the facility.	1.0, 1.3, 1.8, 2.1, 3.0, 6.0, Figure 6,
g. A description of mitigative measures that will be taken to minimize all foreseen adverse impacts resulting from the location, construction, and operation of the proposed facility.	6.1.2, 6.2.2, 6.3.2, 6.4.2, 6.5.2, 6.6.2, 6.7.2, 6.8.2, 6.9.2
h. An evaluation of the proposed site or corridor with regard to the applicable considerations set out in section 49-22-09 and the criteria established pursuant to section 49-22-05.1.	1.5, 3.5, 3.6
i. Such other information as the applicant may consider relevant or the commission may require.	Appendix B
North Dakota Century Code 49-22-09. Factors to be considered in evaluating applications and designation of sites, corridors, and routes.	
1. The commission shall be guided by, but is not limited to, the following considerations, where applicable, to aid the evaluation and designation of sites, corridors, and routes:	
a. Available research and investigations relating to the effects of the location, construction, and operation of the proposed facility on public health and welfare, natural resources, and the environment.	1.5, 3.0, 5.0, 6.3, 6.5, 6.7
b. The effects of new energy conversion and transmission technologies and systems designed to minimize adverse environmental effects.	3.5, 4.0, 5.0
c. The potential for beneficial uses of waste energy from a proposed energy conversion facility.	Not applicable
d. Adverse direct and indirect environmental effects which cannot be avoided should the proposed site or route be designated.	3.5, 6.0
e. Alternatives to the proposed site, corridor, or route which are developed during the hearing process and which minimize adverse effects.	3.5
f. Irreversible and irretrievable commitments of natural resources should the proposed site, corridor, or route be designated.	3.5, 6.5, 6.6, 6.7
g. The direct and indirect economic impacts of the proposed facility.	3.5, 3.9, 6.1
h. Existing plans of the state, local government, and private entities for other developments at or in the vicinity of the proposed site, corridor, or route.	1.8, 3.5, Figure 6
i. The effect of the proposed site or route on existing scenic areas, historic sites and structures, and paleontological or archaeological sites.	3.5, 6.4
j. The effect of the proposed site or route on areas which are unique because of biological wealth or because they are habitats for rare and endangered species.	3.5, 6.8, 6.9
k. Problems raised by federal agencies, other state agencies, and local entities.	3.5, 7.0, Appendix C

1.2 SITING FLEXIBILITY

Oliver Wind IV seeks a Certificate for the Project Area (Figures 1 through 3), as opposed to specific infrastructure locations, which facilitates siting flexibility and allows Oliver Wind IV to modify the Project site plan to avoid constraints as they are identified. If any changes to the Project site plan are made after submission of this application, Oliver Wind IV will submit to the Commission an updated site plan and site plan modification memorandum. A pre-construction conference call will be held with Commission staff to ensure that the final Project site plan conforms to the Certificate requirements. Oliver Wind IV believes that this siting process is consistent with North Dakota siting

rules and provides Oliver Wind IV with the flexibility necessary to develop a timely, cost-effective project in an environmentally responsible manner.

1.3 PROJECT SUMMARY

Oliver Wind IV proposes to site, construct, and operate the proposed wind generation facility in Oliver County, North Dakota. The Project will have a nameplate (gross) capacity of approximately 200 MW, with a net capacity factor of 47.08 percent.

The Project's permanent facilities will include:

- Up to 73 wind turbines and associated equipment
- Access roads to wind turbine locations
- Underground electrical collection and communication systems
- A collection substation
- An O&M facility
- Two ADLS
- A MET tower

The Project's temporary facilities will include:

- A concrete batch plant
- A construction laydown area for equipment and construction management facility
- Intersection improvements to existing roads for transport and access during construction
- Staging areas at the turbine locations to accept the turbine deliveries
- Crane paths between turbines during construction

Oliver Wind IV will own the entire Project and, as a result, will manage the construction of all equipment and associated facilities. Oliver Wind IV will select a third-party engineering, procurement, and construction (EPC) contractor to manage and complete construction of the Project.

1.4 PROJECT DEVELOPMENT HISTORY

In 2019, NextEra, through its subsidiary, began development of the Red Butte Wind Energy Center, a 400 MW wind project that overlapped with the current Oliver Wind IV Project Area. In 2023, the Red Butte Wind project was split into two projects that are being developed separately: the Oliver Wind IV 200 MW project and the Red Butte Wind 200 MW project . The Oliver Wind IV Wind Energy Center includes the northern 200 MW portion and is the focus of this application, while the southern 200 MW portion remains under development as the Red Butte Wind Energy Center. Both projects are independent but have some overlapping design and development elements. During development of Oliver Wind IV, the point of interconnection was changed from the existing Basin Electric LOS 230-kV Substation (T144N, 84W, S21) to the new Basin Electric LOS 345-kV Substation (T144N, 84W, S27).

Throughout this application, the former Red Butte Wind Project and Red Butte Wind, LLC will be referred to as the Project or Oliver Wind IV. The current, southern 200 MW Red Butte Wind Project under development will be referred to as Red Butte.

1.5 PROJECT LOCATION

Multiple factors and inputs contributed to the selection and development of the Project Area. The Project Area must have an optimal wind resource and proximity to an interconnection point (substation) to meet the customer's need. Stakeholder engagement and input, including community support, landowner participation, and agency feedback, has been vitally important, as this feedback has helped to identify developable and suitable areas. Environmental studies, setback analyses, and N.D. Admin. Code criteria further defined potential constraints and feasibility. Finally, the Project Area and all Project infrastructure avoid existing coal lease parcels and all active coal mining operations.

The Project Area is approximately 22,291 acres. Oliver Wind IV has negotiated easements or received verbal agreements for easements with landowners (Figure 5). Oliver Wind IV is in the process of negotiating the remaining easements with landowners. All facilities are on private land except where electrical collection and communication systems cross public road rights-of-way. Table 1.5-1 summarizes the townships, sections, and ranges included in the Project Area.

TABLE 1.5-1
Project Area Location

County	Township	Range	Section [1]
Oliver	142 N	85 W	5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, 22
	142 N	86 W	1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 17
	143 N	85 W	17, 18, 19, 20, 21, 22, 27, 29, 30, 31, 32, 33
	143 N	86 W	13, 22, 23, 24, 25, 26, 27, 29, 32, 33, 34, 35, 36

[1] Note that the Project Area may be located within the section but may not encompass the entire section.

1.6 SCHEDULE

A summary of the anticipated schedule for the Project, from obtaining the Certificate through construction and operation, is provided in Table 1.6-1.

TABLE 1.6-1
Anticipated Time Schedule

Activity	Anticipated Time
Obtaining the Certificate of Site Compatibility	March 2024
Completing land acquisition	October 2023
Starting construction	May 2024
Completing construction	December 2024 with one year for reclamation
Testing operations	November 2024
Commencing commercial operation	December 2024
Beginning any expansions or additions	Not applicable (see Section 1.7)

1.7 EXPANSIONS OR ADDITIONS

Oliver Wind IV does not propose any additions or expansions to the Project at this time. Should Oliver Wind IV seek to develop adjacent areas in the future, all necessary permits and approvals would be obtained to allow such an expansion.

1.8 PRESENT AND FUTURE NATURAL RESOURCE DEVELOPMENT

In Oliver County, publicly known present and future natural resource development projects associated with energy development include surface coal mining, coal fired generation plants, carbon capture facilities, oil exploration, and wind energy development. Publicly known present and future natural resource development projects in Oliver County and within the Project Area are described below and depicted in Figure 6.

Within Oliver County there are two active coal mines, including the Beulah Mine and Center Mine, as well as historic abandoned underground, partially underground, and surface coal mines (Commission 2022). The approximate location of known abandoned coal mines (NDGIS 2023), reclaimed coal mines and areas of mined coal (NDGS 2007, USDA 2023), and active coal mine permit boundaries (BNI 2023, DWC 2020) are shown on Figure 6.

The Beulah Mine is owned and operated by Dakota Westmoreland Corporation and is located east and west of ND Highway 49 and three miles south of Beulah in Mercer and Oliver counties. The Beulah Mine mines approximately 2.9 million tons of coal annually. The Beulah Mine supplies Coyote Station south of Beulah in Mercer County and Heskett Station north of Mandan in Morton County (Commission 2015).

The Center Mine is owned and operated by BNI Coal, Ltd. (BNI) and is located south of Center, North Dakota. The Center Mine mines approximately 4.5 million tons of coal annually and has a reserve of about 600 million tons (Commission 2015). The Center Mine supplies the Milton R. Young Station electric generating station Units I and II south of Nelson Lake in Oliver County.

The Leland Olds Power Station is owned and operated by Basin Electric and is located southeast of Stanton in Mercer County along the Missouri River and ND Highway 200. The plant receives coal shipped by rail from the Freedom Mine.

Oil exploration wells are present within the Project Area and throughout Oliver County and North Dakota. In Oliver County, none of the drilled wells have yielded oil, and therefore these wells are considered dry holes (NDOGD 2023). The location of oil exploration wells near the Project Area are shown on Figure 6.

Within Oliver County, Minnkota Power Cooperative is proposing to develop a project to capture and sequester carbon dioxide (CO_2) emissions produced from the electric generating stations at the Milton R. Young Station (Project Tundra 2023). The CO_2 capture project is known as Project Tundra, and the anticipated CO_2 capture rate for the project is estimated at 4 million metric tons per year. Minnkota Power Cooperative is leading Project Tundra, along with research support from the Energy & Environmental Research Center at the University of North Dakota.

Within Oliver County, SCS Carbon Transport LLC is proposing to develop the Summit Carbon Solutions Midwest Carbon Express, a CO_2 pipeline and sequestration project (See Case PU-22-391 Midwest Carbon Express CO_2 Pipeline Project). SCS Carbon Transport LLC is partnering with 32 ethanol plants across a five-state region. The project will transport CO_2 via pipeline from existing ethanol plants to Oliver County where it will be sequestered in subsurface geologic formations. The

pipeline will have a maximum design flow rate and deliver 936 million standard cubic feet of CO_2 per day which is approximately equivalent to 18 million metric ton per annum of CO_2. Summit Carbon Solutions, LLC has a strategic test well named Slash Lazy H 5, which was spudded in early 2022 (NDOGD 2023). This well is situated in Oliver County near the Project Area, as depicted on Figure 6.

Within Oliver County, there are a total of 147 existing wind turbines associated with seven different existing wind facilities (Commission 2023 and NDGIS 2023). The wind facilities include all of or portions of the Oliver Wind I, II, and III Wind Projects, which are operated by subsidiaries of NextEra, and all of or portions of the Bison 1 through 4 Wind Projects, which are operated by Minnesota Power. The wind turbines in Oliver County collectively produce approximately 383 MW of generation power. Also within Oliver County are three proposed wind facilities, including this Project, the Red Butte Wind Energy Center, and the Flat Rock Wind Project, LLC proposed by Enel Green Power in Oliver and Morton counties (See Case PU-22-267, Docket No.1 Flat Rock Wind Project, LLC's Ten Year Plan for 2022-2032 Ten Year Plan). Existing and proposed wind turbine locations and wind project boundaries are included on Figure 6.

2.0 NEED FOR THE FACILITY

2.1 NEED ANALYSIS

This section provides an analysis of the need for the Project based on present and projected demand for wind energy, including the most recent studies supporting the analysis of the need. Demand for wind energy and the Project come from a variety of needs, including state energy goals from North Dakota Governor Doug Burgum, the executed PPA, and power forecast demands from the North Dakota Transmission Authority. A more detailed description of each of the needs for the Project are described in detail below.

On May 12, 2021, North Dakota Governor Doug Burgum announced a goal to get North Dakota to carbon neutrality by 2030 (Office of the Governor 2021). Since electricity generation from wind power does not directly create carbon emissions, this Project supports this goal.

Consistent with these overall state energy goals and needs, in July 2023, Oliver Wind IV executed a 15-year PPA for the Project, which will interconnect to the electrical grid via LOS 345-kV Substation. Interconnection studies determined that the substation was the best point of interconnection based on the Project's proximity and that the interconnection of the Project at this point would not result in transmission congestion or significant network upgrades.

The North Dakota Transmission Authority's (NDTA) updated 2021 Power Forecast Study forecasts that North Dakota will face an electrical power challenge in the coming years due to announcements of a number of large industrial/commercial uses that will require an estimated 2,250 MW of electric generating capacity within the next 15 years. The study states: "There are several options [to achieve the required electric generating capacity], but the options are limited by demand for lower carbon intense resources and a push to use renewable alternatives. Developers have a strong interest in building more wind generation in North Dakota" (NDTA 2022). The Project will connect low-carbon-intense electric generation in North Dakota.

2.2 ALTERNATIVE METHODS TO SERVICE THE NEED

Due to wind energy's cost effectiveness and the state's goal of adding new wind energy, non-renewable alternatives were not considered. Based on the size, type, and timing of the Project, it is unlikely that an alternative to wind would meet the same need.

2.3 TEN YEAR PLAN

In accordance with N.D.C.C. Section 49-22-04 and N.D. Admin. Chapter 69-06-02, Oliver Wind IV will file a Ten-Year Plan for the Project with the Commission.

3.0 SITE SELECTION CRITERIA

Siting turbines is an iterative process, balancing wind resources, transmission, stakeholder engagement and input, economics, setbacks, and environmental constraints. Oliver Wind IV evaluated the Project Area to determine optimal locations for up to 73 turbines. As part of this process, Oliver Wind IV identified an additional three alternate turbine locations in the Project layout in order to provide siting flexibility. As such, Oliver Wind IV seeks approval of 76 turbine locations however, only up to 73 wind turbines will be constructed.

Oliver Wind IV has secured voluntary wind option agreements with landowners and identified turbine locations based on site inspection, topographic maps, known environmentally sensitive areas, review of North Dakota's energy conversion facility siting exclusion and avoidance areas, review of Oliver County and state wind siting requirements, and communications with local, state, and federal agencies. NextEra subsidiaries have used this siting process in developing past wind energy projects, including its existing wind energy projects in North Dakota. Through this process, NextEra subsidiaries address environmental issues that commonly arise during project development and work within the parameters of local, state, and federal requirements. Oliver Wind IV has reviewed the criteria in N.D. Admin. Code Chapter 69-06-08 and has considered these criteria in Project design. These criteria are discussed in the sections below.

3.1 EXCLUSION AREAS

In accordance with N.D. Admin. Code Section 69-06-08-01(1), the geographical areas identified must be excluded in the consideration of a site for an energy conversion facility and N.D. Admin. Code Section 69-06-08-01(2) lists geographical areas that must be excluded in the consideration of a site for a wind energy conversion facility. The applicability of these exclusion areas is summarized below in Table 3.1-1. Exclusion areas in the Project Area are depicted on Figure 7.

TABLE 3.1-1
Exclusion Areas

Energy Conversion Facility Siting Criteria		Description if Present in or Applicable to the Project	Section Addressed
1.	**Exclusion areas.**		
a.	Designated or registered national: parks; memorial parks; historic sites and landmarks; natural landmarks; historic districts; monuments; wilderness areas; wildlife areas; wild, scenic, or recreational rivers; wildlife refuges; and grasslands.	Not applicable.	6.5
b.	Designated or registered state: parks; forests; forest management lands; historic sites; monuments; historical markers; archaeological sites; grasslands; wild, scenic, or recreational rivers; game refuges; game management areas; management areas; and nature preserves.	Archaeological sites, as identified through a Class I Literature Search and a Class III Cultural Resources Inventory are present, which the Project will avoid.	6.4, 6.5, Figure 7[1]
c.	County parks and recreational areas; municipal parks; parks owned or administered by other governmental subdivisions; hardwood draws; and enrolled woodlands.	Not applicable.	6.5
d.	Areas critical to the life stages of threatened or endangered animal or plant species.	Not applicable.	6.8, 6.9

TABLE 3.1-1
Exclusion Areas

Energy Conversion Facility Siting Criteria	Description if Present in or Applicable to the Project	Section Addressed
e. Areas where animal or plant species that are unique or rare to this state will be irreversibly damaged.	Not applicable.	6.8, 6.9
f. Areas within 1,200 feet of the geographic center of an intercontinental ballistic missile launch or launch control facility.	Not applicable.	3.6
g. Areas within thirty feet [9.14 meters] on either side of a direct line between an intercontinental ballistic missile launch facility and a missile alert or launch control facilities to avoid microwave interference. This restriction only applies to aboveground structures, not to surface features, such as roads, or belowground infrastructure.	Not applicable.	3.6
2. Additional exclusion areas for wind energy conversion facilities.		
a. (1) One and one-tenth times the height of the turbine from the nearest edge of an interstate or state roadway right of way.	No turbines will be located within this area. [2]	3.6
a. (2) One and one-tenth times the height of the turbine plus seventy-five feet from the centerline of any county or maintained township roadway	No turbines will be located within this area. [2]	3.6
a. (3) One and one-tenth times the height of the turbine from the nearest edge of railroad right of way	No turbines will be located within this area. [2]	3.6
a. (4) One and one-tenth times the height of the turbine from the nearest edge of a one hundred fifteen kilovolt or higher transmission line right of way	No turbines will be located within this area. [2]	3.6
a. (5) One and one-tenth times the height of the turbine from the property line of a nonparticipating landowner and three times the height of the turbine from an inhabited rural residence of a nonparticipating landowner, unless a variance is granted. A variance may be granted if an authorized representative or agent of the permittee, the nonparticipating landowner, and affected parties with associated wind rights file a written agreement expressing all parties' support for a variance to reduce the setback requirement in this subsection. A nonparticipating landowner is a landowner that has not signed a wind option or an easement agreement with the permittee of the wind energy conversion facility as defined in North Dakota Century Code chapter 17-04.	No turbines will be located within this area. [2]	3.6

[1] Known archaeological sites are not depicted on Figure 7 due to confidentiality.

[2] Setback to the exclusion area has been provided by a registered Land Surveyor.

3.2 AVOIDANCE AREAS

In accordance with N.D. Admin. Code Section 69-06-08-01(3) and (4), the geographical areas listed in Table 3.2-1 may not be approved as a site for an energy conversion facility unless the applicant shows that, under the circumstances, there is no reasonable alternative. In determining whether an

avoidance area should be designated for a facility, the Commission may consider, among other things: the proposed management of adverse impacts, the orderly siting of facilities, system reliability and integrity, the efficient use of resources, and alternative sites. The area of avoidance must include a buffer zone of a reasonable width to protect the integrity of the area. Avoidance areas are depicted on Figure 7.

TABLE 3.2-1
Avoidance Areas

Energy Conversion Facility Siting Criteria	Description if Present in or Applicable to the Project	Section Addressed
3. Avoidance areas.		
a. Historical resources which are not designated as exclusion areas.	Historic farmsteads and cemeteries are present, which the Project will avoid.	6.4, Figure 7, Appendix B4
b. Areas within the city limits of a city or the boundaries of a military installation.	Not applicable.	6.2, 6.3, 7.0, Appendix C14, C15, C16
c. Areas within known floodplains as defined by the geographical boundaries of the hundred-year flood.	Not applicable.	6.7
d. Areas that are geologically unstable.	A geotechnical analysis is being performed at each turbine location and areas which are geologically unstable will be avoided as necessary. No turbine locations are located within a landslide deposit, as indicated by the North Dakota Geological Survey's landslide mapping program.	6.6
e. Woodlands and wetlands.	Permanent impacts to wetlands will be avoided and minimized as practicable. The Project minimizes impacts to trees/shrubs and for unavoidable impacts will comply with the Commission's Tree and Shrub Mitigation Specifications.	6.7, Figure 7, Figure 14
f. Areas of recreational significance which are not designated as exclusion areas.	Not applicable.	6.5
4. Additional avoidance areas for wind energy conversion facilities.		
A wind energy conversion facility site must not include a geographic area where, due to operation of the facility, the sound levels within one hundred feet of an inhabited residence or a community building will exceed forty-five dBA. The sound level avoidance area criteria may be waived in writing by the owner of the occupied residence or the community building.	The Project complies.	6.3, Figure 16, Appendix B2

3.3 SELECTION CRITERIA

In accordance with N.D. Admin. Code Section 69-06-08-01(5), a site can be approved in an area only when the applicant has demonstrated to the Commission that any significant adverse effects resulting from the location, construction, and operation of the facility in that area, as they relate to the criteria listed in Table 3.3-1, will be at an acceptable minimum, or that those effects will be managed and maintained at an acceptable minimum.

TABLE 3.3-1
Selection Criteria

Energy Conversion Facility Siting Criteria	Description if Present in or Applicable to the Project	Section Addressed
5. Selection criteria.		
a. The impact upon agriculture:		
(1) Agricultural production	Negligible/minimal effect anticipated. Landowners will be compensated through an easement payment for loss of agricultural production. Only land needed during operations will be permanently affected. Temporarily disturbed areas will be restored as practicable.	6.1
(2) Family farms and ranches	Negligible/minimal effect anticipated. Wind development is compatible with existing family farms and ranches and will not displace any farms or ranches.	6.1
(3) Land which the owner demonstrates has soil, topography, drainage, and an available water supply that cause the land to be economically suitable for irrigation	No effect anticipated. Participating landowners have not expressed concerns related to economically suitable irrigation on their land. No irrigation is occurring within the Project Area.	Not applicable
(4) Surface drainage patterns and ground water flow patterns	No effect anticipated. Project infrastructure will be designed in such a manner that runoff from the upper portions of the watershed can flow unrestricted to the lower portion of the watershed.	6.7, Figure 14, Appendix B6
(5) The agricultural quality of the cropland	No effect anticipated. If compaction of soils occurs during construction, Oliver Wind IV will work with landowners to alleviate the compaction.	Not applicable
b. The impact upon the availability and adequacy of:		
(1) Law enforcement	Positive effect anticipated. The Project will have a positive economic effect on law enforcement due to increased county tax revenue.	Not applicable
(2) School systems and education programs	Positive effect anticipated. The Project will have a positive economic effect on school systems and education programs due to increased county tax revenue.	Not applicable
(3) Governmental services and facilities	Positive effect anticipated. The Project will have a positive economic effect on governmental services and facilities due to increased county tax revenue.	Not applicable
(4) General and mental health care facilities	No effect anticipated.	Not applicable
(5) Recreational programs and facilities	Negligible/minimal effect anticipated. Recreational impacts will be auditory and visual in nature and limited to individuals using land in and near the Project Area for hunting, fishing, or nature observation.	Not applicable
(6) Transportation facilities and networks	Negligible/minimal effect anticipated. Vehicle traffic will temporarily increase during construction, but no long-term effects are expected. Project operation will have a negligible effect on transportation facilities and networks.	Not applicable
(7) Retail service facilities	Positive effect anticipated. Local services such as motels, restaurants, and convenience stores are likely to experience an increase in business during Project construction.	Not applicable
(8) Utility services	No effect anticipated. The Project will utilize station service from Roughrider Electric Cooperative, Inc., which will suggest appropriate configurations for the electrical system, and Oliver Wind IV will abide by the recommendations to prevent impacts to the transmission system.	Not applicable
c. The impact upon:		

TABLE 3.3-1
Selection Criteria

Energy Conversion Facility Siting Criteria		Description if Present in or Applicable to the Project	Section Addressed
(1)	Local institutions	No effect anticipated.	Not applicable
(2)	Noise-sensitive land uses	Negligible/minimal effect anticipated. The noise sensitive land uses near the Project are inhabited residences and community buildings. Acoustic modeling results indicated that predicted sound limits will not exceed the Commission's current sound limit of 45 dBA within 100 feet of an inhabited residence or community building.	6.3, Figure 16, Appendix B2
(3)	Light-sensitive land uses	Negligible/minimal effect anticipated. The Project will include Federal Aviation Administration (FAA)-approved ADLS, consistent with N.D. Admin. Code Chapter 69-06-11.	1.0, 1.3, 4.1.7, 6.3
(4)	Rural residences and businesses	Negligible/minimal effect anticipated. The Project will comply with state and local setbacks.	3.6
(5)	Aquifers	No effect anticipated. Based on the small amount of increased impervious surface area, which will be created by Project components, relative to the separation of these components and the size of the entire Project Area, the Project would likely have minimal impacts to regional groundwater recharge.	6.7
(6)	Human health and safety	No effect anticipated based on compliance with sound, shadow flicker, and light regulations and standards.	6.3, Appendix B2 and B3
(7)	Animal health and safety	No effect anticipated. Oliver Wind IV will implement measures to avoid and minimize effects to wildlife by siting turbines at least 2 miles from active eagle nests and 0.5 miles from confirmed sharp-tailed grouse leks and avoid tree removal of trees and shrubs designated as potential northern long-eared bat habitat from April 1 through October 31 within the three-mile conservation buffers to reduce potential impacts to northern long-eared bat. Oliver Wind IV will implement a Wildlife Response and Reporting System once wind turbine construction is complete.	6.8, 6.9, Figure 15 and 16, Appendix B7 through B17
(8)	Plant life	Negligible/minimal effect anticipated. Minimal impact to native plant life due to siting predominantly in cropland and broken grassland. Trees/shrubs will be replaced according to the Commission's Tree and Shrub Mitigation Specifications. Temporarily disturbed areas will be restored as practicable.	6.5, 6.7, 6.8, Figure 12, Appendix B5
(9)	Temporary and permanent housing	Positive effect anticipated. Operations staff are likely to live in the region. Existing temporary housing, such as hotels, will be utilized during construction.	6.1
(10)	Temporary and permanent skilled and unskilled labor	Positive effect anticipated. Local contractors employed for construction will result in increased wages.	6.1
d.	The cumulative effects of the location of the facility in relation to existing and planned facilities and other industrial development.	The Project has been sited to avoid conflict with existing development plans of federal, state, local, and private businesses (where known), addressing potential cumulative effects on surrounding infrastructures. Strategic setbacks and avoidance measures have been incorporated to mitigate potential impacts on existing and planned facilities, as well as other existing industrial development in the area.	1.8, 3.6, Figure 6
e.	The impact upon military installations, assets, and operations.	The impact of the Project upon military installations, assets, and operations has been assessed and addressed during the planning phase. Coordination with relevant military authorities and agencies has taken place to ensure that the Project's location and design will not adversely affect installations, assets, and operations.	6.3, Appendix C14, C15, C16

3.4 POLICY CRITERIA

In accordance with N.D. Admin. Code Section 69-06-08-01(6), the Commission may give preference to an applicant who will maximize benefits that result from the adoption of the policies and practices listed in Table 3.4-1 and may require the adoption of such policies and practices as appropriate.

TABLE 3.4-1
Policy Criteria

Energy Conversion Facility Siting Criteria	Description if Present in or Applicable to the Project	Section Addressed
6. Policy Criteria		
a. Recycling of the conversion byproducts and effluents.	Not applicable.	Not applicable
b. Energy conservation through location, process, and design.	Oliver Wind IV designed the Project to optimize wind resources and maximize energy output while maintaining compliance with Commission siting criteria.	4.1
c. Training and utilization of available labor in this state for the general and specialized skills required.	Oliver Wind IV has utilized several local firms in developing the Project and compiling this application and will continue to use local labor to the extent practicable.	6.1
d. Use of a primary energy source or raw material located within the state.	The energy generated at the site will utilize the wind resources in North Dakota.	1.0, 1.3
e. Not relocating residents.	Not applicable.	6.1
f. The dedication of an area adjacent to the facility to land uses such as recreation, agriculture, or wildlife management.	Not applicable.	Not applicable
g. Economies of construction and operation.	Oliver Wind IV will utilize local contractors to the extent practicable.	6.1
h. Secondary uses of appropriate associated facilities for recreation and the enhancement of wildlife.	Not applicable.	Not applicable
i Use of citizen coordinating committees.	Not applicable.	Not applicable
j. A commitment of a portion of the energy produced for use in this state.	The energy produced by the Project will be transmitted along the Project Transmission Line into the Basin Electric LOS 345-kV Substation.	1.0, 2.1
k. Labor relations.	Not applicable.	Not applicable
l. The coordination of facilities.	Oliver Wind IV coordinated with existing facilities by adhering to setback requirements and avoidance measures as required.	Not applicable
m. Monitoring of impacts.	The engineering, procurement, and construction contractor will employ best management practices during construction to monitor soil impacts and segregate topsoil. A storm water pollution prevention plan will be prepared for the Project. Oliver Wind IV will implement a Wildlife Response and Reporting System once wind turbine construction is complete.	6.5.2, 6.6.2, 6.7.2, 6.8.2
n. A commitment to installing light mitigation technology for wind energy conversion facilities subject to commercial availability and federal aviation administration approval.	Oliver Wind IV will install an FAA-approved ADLS consistent with N.D. Admin. Code Chapter 69-06-11.	1.0, 1.3, 4.1.7, 6.3

3.5 FACTORS TO BE CONSIDERED

The North Dakota Energy Conversion and Transmission Facility Siting Act, N.D.C.C. Section 49-22-09, lists the factors in Table 3.5-1 to be considered in evaluating applications and designation of sites, corridors, and routes.

TABLE 3.5-1
Factors to be Considered

Factors to be Considered	Evaluation	Section Addressed
1. The commission shall be guided by, but is not limited to, the following considerations, where applicable, to aid the evaluation and designation of sites, corridors, and routes:		
a. Available research and investigations relating to the effects of the location, construction, and operation of the proposed facility on public health and welfare, natural resources, and the environment.	Research and investigations relating to the effects of the location, construction, and operation of the proposed facility on public health and welfare, natural resources, and the environment have been evaluated.	1.0, 1.3, 4.0, 5.0, 6.0, Appendix B
b. The effects of new energy conversion and transmission technologies and systems designed to minimize adverse environmental effects.	Oliver Wind IV will utilize best management practices that minimize impacts to the environment. Current wind turbine technologies, including equipment and siting tools, optimize the wind and land resources.	3.0, 4.0, 5.0, 6.0
c. The potential for beneficial uses of waste energy from a proposed energy conversion facility.	This factor is not applicable to this Project. No waste energy is created using wind energy.	Not applicable
d. Adverse direct and indirect environmental effects which cannot be avoided should the proposed site be designated.	The Project is expected to impact up to 55.3 acres of land during operation, which will not be available for other uses. An additional 934.32 acres of land will be temporarily affected due to construction.	5.3
e. Alternatives to the proposed site which are developed during the hearing process and which minimize adverse effects.	Oliver Wind IV believes that the proposed site is the most viable alternative. Oliver Wind IV is committed to being flexible on the site layout and will work closely with landowners to examine all reasonable alternatives to the site layout.	2.2
f. Irreversible and irretrievable commitments of natural resources should the proposed site be designated.	There are few commitments of resources associated with this Project that are irreversible and irretrievable, but these include those resources primarily related to construction.	5.0, 6.0
g. The direct and indirect economic impacts of the proposed facility.	Wind energy development removes less total land from agricultural use than other forms of development. Long-term beneficial impacts to the counties' tax base as a result of the construction and operation of the Project will contribute to improving the local economy in this area of North Dakota.	3.9, 6.1
h. Existing plans of the state, local government, and private entities for other developments at or in the vicinity of the proposed site, corridor, or route.	No conflicts are anticipated with existing state and local government and private entities' development plans.	1.8. Figure 6
i. The effect of the proposed site on existing scenic areas, historic sites and structures, and paleontological or archaeological sites.	There are no designated recreational or scenic resources that will be affected by the Project. Archaeological sites, as identified through a Class I Literature Search and a Class III Cultural Resources Inventory, and historical sites identified through a Class II Architectural History Inventory are present, and the Project will avoid.	6.4, Appendix B4
j. The effect of the proposed site on areas which are unique because of biological wealth or because they are habitats for rare and endangered species.	No effect anticipated. All rare and endangered species habitats will be avoided.	6.5, 6.6, 6.7, 6.8, 6.9

TABLE 3.5-1
Factors to be Considered

Factors to be Considered	Evaluation	Section Addressed
k. Problems raised by federal agencies, other state agencies, and local entities.	Concerns raised by federal, state, or local entities have been addressed. Oliver Wind IV is in ongoing discussions with North Dakota Game and Fish Department/U.S. Fish and Wildlife Service regarding mitigation of potential indirect impacts to grassland breeding birds. Oliver Wind IV is in ongoing discussions regarding studies of potential visual impacts to Knife River Indian Villages.	7.0, Appendix C

3.6 SETBACKS

The setbacks used in designing the Project comply with or exceed those required by the Commission's wind energy-specific exclusion area setbacks, per N.D. Admin. Code Section 69-06-08-01(2) and N.D.C.C. Section 49-22-05.1, Oliver County Zoning Ordinances setbacks for wind turbines (Oliver County 2016), and vendor standards. Tables 3.6-1 and 3.6-2 include the setbacks and buffers utilized in designing the Project. The setback distances were measured from the base of the tower to the tip of the upright blade, which, for the General Electric (GE) 2.82 wind turbine design, is 500.3 feet. See Figure 8 for the GE 2.82 wind turbine design features Table 3.6-1 includes the setback distances as designated by the Commission.

TABLE 3.6-1
Setback Distances as Designated by the North Dakota Public Service Commission

Setback Type	Setback Distance Description	Setback Distance
Interstate and state road right-of-way	1.1 x height of the turbine	550 feet
Centerline of any county or maintained township roadway	1.1 x height of the turbine plus 75 feet	625 feet
Railroad right-of-way	1.1 x height of the turbine	550 feet
115-kilovolt or higher transmission lines	1.1 x height of the turbine	550 feet
Property line of non-participating landowners	1.1 x height of the turbine [1]	550 feet
Non-participating residences	3 x height of the turbine	1,501 feet
Geographic center of an intercontinental ballistic missile (ICBM) launch or launch control facility	1,200 feet [2]	1,200 feet
Inhabited residence or a community building	A wind energy conversion site must not include a geographic area where, due to the operation of the facility, the sound levels within 100 feet of an inhabited residence or a community building will exceed 45 dBA [3]	-

[1] Per N.D.C.C. Section 49-22-05.1 - A variance may be granted if an authorized representative or agent of the permittee and affected parties with associated wind rights file a written agreement expressing all parties' support for a variance to reduce the setback requirement in this subsection. A non-participating landowner is a landowner that has not signed a wind option agreement or a wind easement, as defined in N.D.C.C. 17-04, with the permittee of the wind energy conversion facility.

[2] The nearest turbine to an ICBM launch or launch control facility is over 28 nautical miles (170,131 feet).

[3] Per N.D. Admin. Code Section 69-06-08-01 - The sound level avoidance area criteria may be waived in writing by the owner of the occupied residence or the community building.

Table 3.6-2 includes the setback distances as designated by Oliver County.

TABLE 3.6-2
Setback Distances as Designated by Oliver County Zoning Ordinance

Setback Type	Setback Distance Description	Setback Distance
Occupied dwelling, commercial building, publicly used structure or facility, or state and county park	1.25 x height of the turbine or 1,320 feet, whichever is greater	1,320 feet
Interstate, state, or county road; or above-ground communication or electrical lines; or railroad right-of-way	1.1 x height of the plus 75 feet from the centerline of the existing right-of-way or object	625 feet
Section line	100 feet	100 feet
Setback from the wind energy facility perimeter	1.5 x height of the turbine [1]	751 feet
Blade tip of turbine	Ground clearance of no less than 70 feet	-

[1] A variance may be granted if an authorized representative or agent of the applicant and those affected parties of adjoining properties with associated wind rights sign a formal and binding agreement expressing all parties' support for a variance that may reduce the setback requirements.

3.7 WIND CHARACTERISTICS

Oliver Wind IV utilized wind data from existing MET towers and sonic detection and ranging (SODAR) devices placed in and around the Project Area to quantify and analyze the wind resource. Wind speeds range between 8.77 and 7.69 meters per second (19.62 to 17.20 miles per hour [mph]) and therefore the wind resource in this region is optimal.

Oliver Wind IV has secured information from other long-term references to aid in correlating the wind data on site, including 30-year re-analysis data processed by the National Aeronautics and Space Administration (NASA) and processed by Oliver Wind IV. Industry standard software, such as Windographer, Openwind, Weather Research and Forecasting, and ArcGIS as well as internal Oliver Wind IV tools were used to analyze the available wind data and make corrections for site effects (topography, surface roughness, and obstacles) to produce a site independent characterization of the local wind climate. The resulting local wind climate was applied in conjunction with the Project Area effects to predict the spatial wind variations. Various site layouts and wind turbine generator parameters can be tested to predict energy production and array efficiency in order to optimize the site layout and turbine selection. Project site data have been compared to regional wind measurements using a parallel time period. Based on analysis by Oliver Wind IV's internal wind resource group, NextEra Analytics, an indirect, wholly owned subsidiary of NextEra and an affiliate of Oliver Wind IV, there is good correlation between the long-term wind measurements and the short-term Project-specific wind.

3.8 DESIGN AND CONSTRUCTION LIMITATIONS

Key design and construction limitations when building a wind farm are wind resources, landowner easements, regulatory setbacks (local and state), environmental and cultural exclusion and avoidance areas, and available transmission. Wind resources are essential to selecting and designing a wind farm. Oliver Wind IV has conducted an analysis to ensure that the site has ample wind resources for efficient use. Easements allowing construction of turbine towers and transmission facilities are also critical to the Project. Oliver Wind IV has secured voluntary land agreements with landowners necessary to develop the Project.

3.9 ECONOMIC CONSIDERATIONS

Economics were considered when selecting a location for the Project. Oliver Wind IV estimates that the Project will provide approximately $37 million in tax revenue over 35 years and over $30

million in payments to participating landowners for over 30 years, which will not only benefit those landowners, but also the local economy as that money is reinvested in local goods and services. In addition, the Project will create approximately five to eight full-time O&M jobs, most of whom are expected to reside locally. Additionally, the Project and Project Transmission Line will create approximately 300 temporary construction jobs during the approximately eight-month construction period.

3.10 COUNTY CRITERIA

The Project has been designed to minimize the disruption to farmland and agricultural operations to the extent reasonably possible per the Oliver County Zoning Ordinances construction and maintenance standards for wind turbines (Oliver County 2016). Adherence to Oliver County setbacks is discussed in Section 3.6.

Oliver Wind IV has prioritized close coordination with Oliver and Mercer counties throughout the development of the Project and the Project Transmission Line. As part of Oliver Wind IV's commitment to transparency and community involvement, the project team recently conducted meetings with the county planning and zoning departments, as well as the county commission, to provide comprehensive updates on the Project's progress.

Oliver Wind IV met with Oliver County Planning & Zoning on July 28, 2022, to provide an update on the Project. On December 9, 2022, Oliver Wind IV presented a Project update to the Mercer County Commission. On March 16, 2023, a Project update was provided to the Mercer County Planning & Zoning.

Oliver Wind IV will continue to meet with county officials as the Project and the Project Transmission Line move forward for any necessary local construction permits (*e.g.*, building permits, road use agreements). A conditional use permit application for the Project was submitted to Oliver County in September 2023 and is currently pending before the County. The conditional use permit will be submitted to the Commission after it is issued.

4.0 PROJECT DESIGN

4.1 WIND TURBINE COMPONENTS

4.1.1 Project Layout

Oliver Wind IV has developed a wind farm layout that optimizes the wind resource while minimizing potential impacts on land resources and any sensitive areas. Wind-powered electric generation is entirely dependent on the availability of the wind resource at a specific location. The energy available from the wind increases at the third power of the wind speed. In other words, a doubling of the wind speed will increase the available energy by a factor of eight times. Design of the turbine array and collection system will minimize energy loss due to wind turbine wakes (*e.g.*, adverse impacts of one turbine on an adjacent turbine) and turbulence, and electrical line losses. Figure 9 is a diagram of the path of energy from a wind energy center to energy users, and Figure 10 shows a typical wind energy center layout.

4.1.2 Wind Turbine Technology

As previously stated, Oliver Wind IV is seeking flexibility from the Commission to select the most appropriate technology for the Project at the time of construction to ensure optimization of wind and land resources and cost efficiency. Oliver Wind IV is considering several different turbine models for the Project. Throughout this application, Oliver Wind IV analyzed the GE 2.82 wind turbine, the largest turbine model being considered. Regardless of the turbine model selected, the Project will meet all applicable Commission and Oliver County setbacks and other requirements. If a turbine model other than the GE 2.82 is selected, Oliver Wind IV will provide the Commission with updated turbine specifications and sound and shadow flicker modeling that demonstrates compliance with the applicable siting requirements.

4.1.3 Wind Turbine

The GE 2.82 wind turbine is a three-bladed, upwind, horizontal-axis wind turbine. The wind turbine generator employs active yaw control (designed to steer the machine with respect to the wind direction), active blade pitch control (designed to regulate turbine rotor speed), and a generator/power electronic converter system. The wind turbine generator features a distributed drive train design consisting of a main shaft bearing, gearbox, and generator. The wind turbine design features and characteristics of the GE 2.82 wind turbine are summarized in Table 4.1.3-1 and depicted on Figure 8.

TABLE 4.1.3-1
Wind Turbine Characteristics

Description	**Specification**
Wind Turbine Model	General Electric 2.82
Nameplate capacity	2.82 megawatts
Hub height	89 meters (292 feet)
Rotor diameter	127 meters (417 feet)
Total height (base of the tower to the tip of the upright blade)	500.3 feet
Rated output	2,200 to 2,820 kilowatts
Number of blades	3
Rotor swept area	12,704 meters^2
Rotor speed range	7.4 to 15.7 rotations per minute

TABLE 4.1.3-1
Wind Turbine Characteristics

Description	Specification
Rotational direction	Clockwise looking downwind
Maximum total sound power level with Low-Noise-Trailing-Edges	108.5 dBA
Tip speed at rated power	85.1 meters/second to 89.1 meters/second
Orientation	Upwind
Speed regulation	Electric drive pitch control with battery backup
Aerodynamic brakes	Full feathering of blade pitch

4.1.4 Rotor

The rotor consists of three blades mounted to a rotor hub. The hub is attached to the nacelle, which houses the generator, brake, cooling system, and other electrical and mechanical systems. Rotor speed is regulated by a combination of blade pitch angle adjustment and generator/converter torque control. The rotor spins in a clockwise direction under normal operating conditions when viewed from an upwind location.

4.1.5 Blades

There are three rotor blades for each wind turbine generator. The airfoils transition along the blade span with the thicker airfoils being located in-board towards the rotor hub and gradually tapering to thinner cross sections out towards the blade tip.

Where needed to reduce sound emissions, the blades are equipped with Low-Noise-Trailing-Edges (LNTE), which are thin jagged plastic strips, at the pressure side of the blade's rear edge.

4.1.6 Tower

The tower is comprised of cylindrical, tapered steel consisting typically of sections joined together via factory fabricated welds, which are automatically controlled and ultrasonically inspected during manufacturing per American National Standards Institute specifications. Surfaces are coated for protection against corrosion and will be painted. Each turbine can be accessed through a lockable steel door at the base of the tower, through which the nacelle and turbine blades can be accessed. Inside each tower, platforms are accessible via ladders that are equipped with fall arresting safety systems. Interior lights are factory installed at interval points from the base of the tower to the tower top.

4.1.7 Lightning and Ground Protection

Each turbine will be grounded and shielded to protect against lightning. The grounding system will be installed during foundation work, must be designed for local soil conditions, and must be in accordance with local utility or code requirements. Lightning receptors will be placed in each rotor blade and in the turbine tower. The electrical components will also be protected from lightning.

4.1.8 Lighting

Subject to Federal Aviation Administration (FAA) approval, Oliver Wind IV will install two FAA-approved ADLS, consistent with N.D. Admin. Code Chapter 69-06-11, at the locations shown on all figures in this application. The proposed ADLS locations were submitted to the FAA on July 12, 2023 and are currently undergoing FAA review.

4.1.9 Foundation

Each turbine will sit atop a concrete foundation. Foundation designs will be dependent on final turbine selection and the pending geotechnical investigation. The actual foundation dimensions will be established after completion of the geotechnical investigation and mechanical loading analysis that will be performed to support final engineering design. The estimated foundation will be approximately 50 to 65 feet in diameter and 6 to 12 feet in depth.

4.1.10 Control System

Each turbine tower base will have a control panel housing electronic and communication equipment. The nacelle equipment includes a sensor that detects wind speed and direction to signal conditions for safe operation. Each turbine is equipped with variable-speed control and independent blade pitch to enhance efficiency. An automated Supervisory Control and Data Acquisitions (SCADA) system will provide remote supervision and control of turbine equipment and performance.

4.2 ASSOCIATED FACILITIES

In addition to wind turbines, the Project includes access roads, an underground electrical collection system, an underground SCADA communication system, a collection substation, an O&M facility, ADLS, and a MET tower. The turbine-generated electricity is transmitted to a pad-mounted transformer, where it is converted to the 34.5-kV collection line voltage. The underground collection line system transmits the electricity to the collection substation. The land for the Project collection substation and O&M facility will be purchased.

4.2.1 Access Roads

Access roads to each turbine will be facilitated by a compacted gravel road. Access roads have been sited in consultation with the landowner to avoid or minimize impacts to land use and the environment. Where possible, access roads were sited along the edges of fields to minimize disruption of farming activities. Access roads were also sited to minimize tree removal and utilize existing two-tracks, where present. The access roads will be approximately 16 feet wide and constructed with locally sourced gravel, if available. The access roads will support the size and weight of maintenance vehicles.

Access road corridors are included on all figures in this application and have been surveyed for environmental and cultural constraints. These corridors provide enough area for the final design of the access roads to avoid all environmental and cultural constraints during construction while still meeting design specifications. Following construction, temporarily affected areas around the access roads will be restored to pre-construction conditions, to the extent practicable, and pursuant to landowner agreements.

4.2.2 Electrical Collection System and Communication System

Each turbine will have a pad-mounted step-up transformer which will convert the voltage to the power collection line voltage of 34.5-kV. The power from these transformers will be run through an underground collection system consisting of variously sized buried cables. Collection lines will be buried approximately 48 inches deep. Bores will be utilized for crossings as necessary with depth determined by applicable crossing requirements. The wind turbines will be interconnected by underground power collection cables and co-located fiber optic communication cables. All the collection system cables will terminate at the Project collection substation. The substation will

include power transformers to step up the voltage from 34.5-kV to 345-kV and provide the necessary protection and control for interconnection to the transmission grid.

Collection line corridors are included on all figures in this application and have been surveyed for environmental and cultural constraints. These corridors provide enough area for the final design of the collection lines to avoid all environmental and cultural constraints during construction while still meeting design specifications. The disturbed area will be reclaimed upon installation of the collection lines and normal agricultural practices can continue where applicable.

All utility protection and metering equipment will meet Oliver Wind IV and National Electrical Safety Code standards for parallel operations. The construction manager will ensure that proper interconnection protection is established.

4.2.3 Meteorological Towers

The Project will include one permanent MET tower that will remain in place for the life of the Project. The MET tower will be as tall as the hub height of the wind turbine and will provide data critical to assessing the performance of the Project and aid in short-term forecasting and operation protocols for the Project.

4.2.4 Operations and Maintenance Facility

The O&M facility will include an O&M building that includes office space for O&M personnel, storage, and shops for equipment to operate and maintain the Project, and parking for vehicles. The O&M facility will be constructed within the Project Area as shown on all figures in this application.

4.2.5 Collection Substation

The Project's underground collection system will extend from the turbines to a collection substation. The collection substation will be designed to provide voltage step-up from the collection system to the 345-kV transmission system voltage. This facility will house the production metering, various collection system, and facility isolation and protective functions. The facility will be fenced to provide site security and safety.

4.2.6 Temporary Facilities

Temporary facilities will be required for the construction phase of the Project, including a concrete batch plant, construction laydown area for an equipment and construction management facility, intersection improvements to facilitate over-length turning, crane paths and working pads, and staging areas for turbine delivery. The temporarily affected areas will be restored to preconstruction conditions, to the extent practicable after construction has been completed, and in accordance with landowner agreements.

5.0 CONSTRUCTION, OPERATION, AND DECOMMISSION

5.1 CONSTRUCTION

5.1.1 Construction Management

The EPC contractor will be primarily responsible for construction management. The EPC contractor will use the services of local contractors, where possible, to assist in construction. The EPC contractor, in coordination with local contractors, will undertake the following activities:

- Securing building, electrical, grading, road, and utility permits
- Performing detailed civil, structural, and electrical engineering
- Scheduling and execution of construction activities
- Forecasting labor requirements and budgeting

The EPC contractor will oversee the installation of roads, concrete foundations, turbine towers, and blades, communication and power collection lines, collection substation, as well as the coordination of materials receiving, inventory, and distribution. The Project will be constructed under the direct supervision of an on-site construction manager with the assistance of local contractors. The construction process will encompass a series of essential tasks completed by the construction team including the following:

- Site development and road construction
- Foundation excavation
- Concrete foundation installation
- Electrical and communications installation
- Assembly of turbine tower and machinery erection
- System testing

The construction team will be on site to handle materials purchasing, construction, quality control, testing, and start-up. The EPC contractor will manage subcontractors to complete all aspects of construction. Throughout the construction phase, ongoing coordination will occur between the development and the construction teams. The on-site construction manager will help to coordinate all aspects of the Project, including ongoing communication with local officials, citizens groups, and landowners. Even before the Project becomes fully operational, the O&M staff will be integrated into the construction phase. The construction manager and the O&M staff manager will work together continuously to facilitate a smooth transition from construction through wind farm commissioning and operations.

5.1.2 Civil Works

Construction will require various types of civil works and physical improvements to the land. These civil works may include the following:

- Improvement of existing public access roads
- Construction of roads adjacent to the wind turbine strings (turbine access roads) to allow construction and continued servicing of the wind turbines

- Clearing and grading for wind turbine tower foundation installations
- Installation of underground electrical collection system for connecting the individual wind turbines
- Installation of an on-site feeder system for connecting wind turbine strings for delivery to the electricity collection/metering location
- Installation of site fencing and security where necessary
- Restoration and revegetation of disturbed land when construction activities have been completed

Any improvements to existing public access roads will consist of re-grading and filling the surface to allow access in inclement weather. No asphalt or other paving is anticipated. Turbine access roads will be constructed along turbine strings or arrays. These roads will be sited in consultation with local landowners and completed in accordance with local building requirements where these roads intersect with public roads. Turbine access roads will be located to facilitate both construction (such as access for cranes) and continued operation and maintenance. Siting roads in areas with unstable soil will be avoided wherever possible. All roads will include appropriate drainage and culverts while still allowing for the crossing of farm equipment. The roads will be covered with road base designed to allow passage under inclement weather conditions. The roads will consist of graded dirt and will be covered with an aggregate surface. Once construction has been completed, the roads will be re-graded, filled, and dressed as needed.

5.1.3 Commissioning

The Project will be commissioned after completion of the construction phase. The Project will undergo detailed inspection and testing procedures prior to final turbine commissioning. Inspection and testing will occur for each component of the wind turbines, as well as the communication system, meteorological system, obstruction lighting, high voltage collection and feeder system, and the SCADA system.

5.2 OPERATION AND MAINTENANCE

Oliver Wind IV will operate and maintain the Project with five to eight full-time employees located locally. The O&M staff will have full responsibility in ensuring the Project operates consistent with applicable permits, prudent industry practice, and equipment manufacturer recommendations.

The on-site O&M staff will be responsible for maintenance of the Project on a daily basis and for completing weekly visual inspections of the site. Service and maintenance will be carefully planned and consistent with prudent industry practices. An initial maintenance inspection of each turbine will be performed after turbine commissioning. Following this initial inspection, each turbine will receive annual visits that will include inspections of the various systems and components such as the gearbox, generator, brake, pitch, lubricant, bolts, and transformer.

O&M field duties include performing all scheduled and unscheduled maintenance, including periodic operational checks and tests, regular preventive maintenance on all turbines, related plant facilities and equipment, safety systems, controls, instruments, and machinery, including:

- Maintenance of the wind turbines and of the mechanical, electrical power, and communications system
- Performance of all routine inspections

- Maintenance of all oil levels and changing oil filters
- Maintenance of the control systems, all structures, access roads, drainage systems and other facilities necessary for operation
- Maintenance of all O&M field maintenance manuals, service bulletins, revisions, and documentation
- Maintenance of all parts, price lists, and computer software
- Maintenance and operation of substation facilities
- Provision of all labor, services, consumables, and parts required to perform scheduled and unscheduled maintenance on the wind farm, including repairs and replacement of parts and removal of failed parts
- Cooperation with avian and other wildlife studies as may be required, to include reporting and monitoring
- Management of lubricants, solvents, and other hazardous materials as required by local and/or state regulations
- Maintenance of appropriate levels of spare parts to maintain equipment; order and maintain spare parts inventory
- Provision of all necessary equipment including industrial cranes for removal and reinstallation of turbines
- Hiring, training, and supervision of a work force necessary to meet the general maintenance requirements
- Implementation of appropriate security methods
- Remote monitoring on a daily basis

In addition to the on-site O&M staff, remote staff will control, monitor, operate, and maintain the Project by means of a SCADA computer software program 24 hours a day, seven days a week and can shut down turbines via remote computer if necessary. The operation of the entire wind farm, including discrete settings for individual turbines, will be managed by the on-site operations staff and remotely via the SCADA system. For example, in the unlikely scenario on-site staff must evacuate the site or are unable to access the O&M facility, the remote staff can effectively manage system operations.

The SCADA system offers access to wind turbine generation or production data, availability, meteorological, and communications data, as well as alarms and communication error information. Performance data and parameters for each machine (*e.g.*, generator speed, wind speed, power output) can also be viewed, and machine status can be changed. There is also a “snapshot” facility that collects frames of operating data to aid in diagnostics and troubleshooting of problems. The SCADA communication system will be collocated with the collection line system. The primary functions of the SCADA system are to do the following:

- Monitor wind farm status
- Allow for autonomous turbine operation
- Alert operations personnel to wind farm conditions requiring resolution
- Provide a user/operator interface for controlling and monitoring wind turbines

- Collect meteorological performance data from turbines
- Monitor field communications
- Provide diagnostic capabilities of wind turbine performance for operators and maintenance personnel
- Collect wind turbine and wind farm material and labor resource information
- Provide information archive capabilities
- Provide inventory control capabilities
- Provide information reporting on a regular basis

5.3 ESTIMATED PROJECT IMPACTS

Within the Project Area, permanent impacts are considered the final operational footprint (*e.g.*, turbine foundation, turbine pads, access roads), which will occupy approximately 55.3 acres, or less than one percent of the total Project Area. These permanent impacts will remain for the life of the Project but will be removed upon decommissioning. Temporary impacts are those that result from certain construction activities but are later reclaimed (*e.g.*, construction laydown area, underground systems installation). Table 5.3-1 summarizes the estimated impact for each Project component during construction, reclamation (or the Project temporary impacts), and operation (or the permanent Project impacts).

TABLE 5.3-1
Estimated Project Impacts

Project Facility	Impact Type	Total Construction Impacts	Temporary/Reclaimed Impacts	Permanent Operational Impacts [6]
Wind Turbines [1]	Impact Assumption	6.49 acres per turbine	6.43 acres per turbine	0.06 acres per turbine
	Total Impacts	473.77 acres	469.39 acres	4.38 acres
Access Roads [2]	Impact Assumption	50 feet wide per linear foot of road	34 feet wide per linear foot of road	16 feet wide per linear foot of road
	Total Impacts	139.92 acres	95.08 acres	44.84 acres
Collection Lines [3]	Impact Assumption	50 feet wide per linear foot for a single line	50 feet wider per linear foot minus 12 feet by 8 feet per junction box	12 feet by 8 feet for each junction box
	Total Impacts	293.79 acres	293.76 acres	0.03 acres
MET Tower [4]	Impact Assumption	4 acres per tower	3.99 acres per tower	0.01 acres per tower
	Total Impacts	4 acres	3.99 acres	0.01 acres
ADLS	Impact Assumption	0.5 acres per tower	0.48 acres per tower	0.02 acres per tower
	Total Impacts	1.0 acre	0.96 acres	0.04 acres
Crane Paths [5]	Impact Assumption	100 feet wide per linear foot	100 feet wide per linear foot	0 acres
	Total Impacts	42.14 acres	42.14 acres	0 acres
O&M Facility	Impact Assumption	5 acres	2 acres	3 acres
	Total Impacts	5 acres	2 acres	3 acres
Collection Substation	Impact Assumption	5 acres	2 acres	3 acres
	Total Impacts	5 acres	2 acres	3 acres
Concrete Batch Plant	Impact Assumption	5 acres	5 acres	0 acres
	Total Impacts	5 acres	5 acres	0 acres
Construction Laydown Area	Impact Assumption	20 acres	20 acres	0 acres
	Total Impacts	20 acres	20 acres	0 acres

TABLE 5.3-1
Estimated Project Impacts

Project Facility	Impact Type	Total Construction Impacts	Temporary/Reclaimed Impacts	Permanent Operational Impacts [6]
Project	**Total Impacts**	**989.62**	**934.32**	**55.30**

1 Construction impacts assumed a maximum 300-foot construction radius around the turbine, which equates to approximately 6.49 acres per turbine. Assumes 73 turbines times 6.49 acres of ground disturbance during construction; 0.06 acre/turbine of that remaining as permanent. Three alternate turbine locations have been identified to allow siting flexibility but were not included in the calculation; calculations for associated roads and collection lines included all roads and collection lines shown in the layout because these facilities may be needed to access the proposed turbine locations. Impacts during operation account for an 18-foot diameter turbine base with a 20-foot buffer for the gravel pad, or 0.06 acres per turbine. Actual construction impacts may be less.

2 Easement width necessary for construction based on turbine types. Temporary and permanent impacts represent a conservative estimate of disturbance. Access road impacts also assume all proposed roads are new access roads and do not consider improvements to existing roads separately. Assumes a 50-foot-wide disturbance for roads during construction; 16 feet of that remaining during operation. Roads required to support crane access to turbines during construction and operation would remain up to 38 feet wide and reduced later to 16 feet. Assumes a total of approximately 27 linear miles of service roads. The overlapping areas for turbines were excluded from the road impact calculations to avoid double counting the same footprint.

3 Fifty feet is the width needed for a single collection line with a maximum width of 100 feet where five collection lines run parallel. The overlapping areas between the collection line corridor buffer and the turbine and access road buffers were removed from impact calculation to avoid double counting the same footprint. The layout includes approximately 75 miles of collection lines. Junction boxes will be located on the ground throughout the Project Area and will each require approximately 12 feet by 8 feet. A total of 13 junction boxes are required.

4 Once installed, the tower has a small 2–3-foot diameter foundation but requires guy wires for support in three directions. The permanent impacts are an over-calculation and include fencing around the MET tower.

5 The overlapping areas between the crane path buffer and turbines, access roads, and collection line corridor impact buffers were removed from the impact calculation to avoid double counting the same footprint.

6 Permanent disturbance during the life of the Project; following decommissioning all areas will be reclaimed per landowner preference and Commission requirements.

5.4 DECOMMISSIONING AND RESTORATION

Oliver Wind IV will develop a Decommissioning Plan in accordance with the requirements set forth in N.D. Admin. Code Chapter 69-09-09 and file the plan with the Commission for approval prior to commercial operations as required by N.D. Admin. Code Section 69-09-09-06. Consistent with the Commission's requirements, Oliver Wind IV will engage a North Dakota-licensed engineer to develop this Decommissioning Plan, which will outline how the Project will be decommissioned at the end of its useful life, including the following requirements of N.D. Admin. Code Section 69-09-09-05:

- Dismantling and removal of all towers, turbine generators, transformers, and overhead cables
- Removal of underground cables to a depth of 24 inches (two feet)
- Removal of foundations, buildings, and ancillary equipment to a depth of 48 inches (four feet)
- Restoration and reclamation to the approximate original topography that existed prior to construction of the Project with topsoil respread over the disturbed areas at a depth similar to adjacent lands
- Grading and topsoil of areas disturbed by the Project
- Reseeding according to resource conservation service recommendations

Oliver Wind IV will also submit to the Commission financial assurance sufficient to ensure decommissioning, as required by N.D. Admin. Code Section 69-09-09-08. Oliver Wind IV will provide its financial assurance for the construction period prior to commencement of construction, as required by N.D. Admin. Code Section 69-09-09-08(1).

In addition to meeting the Commission's decommissioning requirements, Oliver Wind IV has a contractual obligation to the landowners to remove the wind facilities, including foundations to a depth of four feet below ground, when the wind easement expires and to restore the area to the same approximate physical condition that existed immediately before the construction of the turbines. Oliver Wind IV also reserves the right to explore alternatives regarding decommissioning at the end of the Project's term. For example, retrofitting the turbines and power system with upgrades based on new technology may allow the wind farm to produce efficiently and successfully for many more years.

6.0 ENVIRONMENTAL ANALYSIS

6.1 LOCAL ECONOMICS

6.1.1 Description of Resources

According to Job Service North Dakota Labor Market Information Center (NDLMI), Oliver County's 2022 resident population was 1,856, a one-year numeric change of -17 or a change of -0.9 percent (NDLMI 2023). The unemployment rate for Oliver County in May 2023 was 2.7 percent. One year prior, the unemployment rate was 2.3 percent. There were five job openings in Oliver County in June 2023. On average in the fourth quarter of 2022, the private industry in Oliver County employing the largest number of workers was utilities. The private industry with the highest average weekly wage in the fourth quarter of 2022 was Administrative and Waste Services.

In Oliver County, agriculture is an important part of the economy with 234 farms located in the county (USDA, NASS 2017). According to the 2017 Census of Agriculture, the total market value of agricultural products produced in Oliver County was $47,326,000, 46 percent of which was from crops and 54 percent from livestock. The principal crops include corn, wheat, oats, barley, soybeans, forage, and sunflowers and the primary livestock is cattle.

In July 2023, Oliver County had zero homes for sale; however, housing was available in the nearby towns of Stanton, Washburn, Hazen, Beulah, New Salem, Mandan, and Bismarck (Zillow 2023). U.S. Census Bureau data from the 2020 census indicates there are approximately 152 vacant housing units in Oliver County (U.S. Census Bureau 2020). Lodging facilities including hotels, inns, and motels are available in Washburn, Hazen, Beulah, New Salem, Mandan, and Bismarck.

6.1.2 Impacts/Mitigation

The Project will have positive economic impacts for the local population, including lease and royalty payments for participating landowners, employment, and property and sales tax revenue. Economic losses from farmland that is taken out of production for operation of the Project are anticipated to be minimal in comparison to the additional income provided by the Project.

Oliver Wind IV estimates that the Project will provide approximately $37 million in tax revenue over 35 years. The Project also will provide over $30 million in payments to participating landowners for over 30 years, which will not only benefit those landowners, but also the local economy as that money is reinvested in local goods and services. Oliver Wind IV estimates that the total cost for the Project will be $316 million.

The Project and the Project Transmission Line will create approximately five to eight full-time O&M jobs. Most of these employees are expected to reside locally. The full-time positions include one site manager and several technicians. Additionally, the Project and the Project Transmission Line will create approximately 300 temporary construction jobs during the approximately eight-month construction period.

Landowner compensation has been established under individual lease agreements and includes compensation for crop damage during surveys and construction. In an environment of uncertain and often declining agricultural prices and yields, the supplemental income provided to farmers from wind energy leases is expected to provide stability to farm incomes and thus will help assure the continued viability of farming in the Project Area. Project construction will not cause additional impacts to leading industries within the Project Area.

To the extent that local contractors are used for portions of the construction, total wages and salaries paid to contractors and workers in Oliver County will contribute to the total personal income of the region. Additional personal income will be generated for residents in the counties as well as the state by circulation and recirculation of dollars paid out by the applicant as business expenditures and state and local taxes. Expenditures made for equipment, energy, fuel, operating supplies, and other products and services will benefit businesses in the counties and the state.

It is likely that general skilled labor is available either in the county or the state to serve the basic infrastructure and site development needs. Specialized labor will be required for certain components of Project development. It is likely that this labor will be imported from other areas of the state or from other states, as the relatively short duration of construction does not warrant special training of local or regional labor. Balancing the use of local contractors and imported specialized contractors will likely alleviate any labor relations issues.

During construction, out-of-town laborers will likely use lodging facilities in and around the cities of Washburn, Hazen, Beulah, New Salem, Mandan, and Bismarck. It is expected that full-time O&M staff will reside in nearby towns with available housing.

Long-term beneficial impacts to Oliver County's tax base will contribute to the local economy as a result of the construction and operation of the Project. The development of wind projects in the region has spurred the development of wind-related businesses in the area and contributes to the economic growth in the region. In North Dakota, there is one wind manufacturing facility that produces fiberglass wind turbine blades and one construction company that specializes in wind project installation (EnergyND 2023).

6.2 PUBLIC SERVICES

6.2.1 Description of Resources

Local Government Services

Within the Project Area is a network of established roads and utilities that provide access and necessary services to cities, communities, homesteads, and farms. There are no incorporated or unincorporated cities within the Project Area. The Project Area is located adjacent to the unincorporated town of Hannover, North Dakota and approximately six miles west of the city of Center, North Dakota.

Electrical Service

The local electric co-op provides rural electrical service in the Project Area.

Roads

Public roads within the Project Area are North Dakota Highway 31, county roads, township roads, section lines, and private roads. The Project Area lies in the North Dakota Department of Transportation (NDDOT) District 1 – Bismarck.

Traffic

Existing daily traffic volumes for state highways, county roads, and township roads that are located within and near the Project Area are documented in Table 6.2.1-1. In general, the NDDOT indicates that roads with vehicle counts under 100 annual average daily traffic are rarely counted and roads with no count data are likely lower than those with count data.

TABLE 6.2.1-1
Existing Daily Traffic Levels

Roadway Segment	Average Daily Traffic	Average Daily Truck Traffic	Year
ND Highway 31, north of Hannover, ND	120	N/A	2006
ND Highway 25, east of Hannover, ND	330	45	2022
ND Highway 31, south of Hannover, ND	625	N/A	2022
21st Street Southwest, west of Hannover, ND	115	35	2022
49th Avenue Southwest, north of 21st Street Southwest	25	N/A	2022
49th Avenue Southwest, north of 17th Street Southwest	55	N/A	2006
Source: NDDOT's Transportation Information Map (NDDOT 2023)			

Communications

Oliver Wind IV's affiliate, NextEra Analytics, has prepared an Electromagnetic Interference Report based on available government information provided by the Federal Communications Commission (FCC) and internal analysis methods (Appendix B1). The primary purpose of the report was to assess the potential for interference with licensed communication links in close proximity to the Project Area, aiming to determine exclusion zones to facilitate the design of the Project.

No microwave towers or links were identified within the Project Area, and there was no intersection with any microwave links. No cellular towers were identified within the Project Area, with seven cellular towers identified within a 25-kilometer radius. No active AM radio towers were identified within the Project Area, with only one AM tower identified within a 25-kilometer radius and four others within a 100-kilometer radius. No digital or analog television stations were identified within the Project Area, and there were no broadcasting stations within a 50-kilometer radius likely to cover the region. No active aviation towers were found within the Project Area, although one aviation tower was discovered within a 25-kilometer radius.

6.2.2 Impacts/Mitigation

Local Government Services

No impact to local government services is anticipated, and no mitigation is required.

Electrical Service

The Project will use station service from one of the local utilities, who will suggest appropriate configurations for the electrical system, and Oliver Wind IV will abide by the recommendations to prevent impacts to the existing transmission system. As such, no mitigation is required.

Roads

Oliver Wind IV is working closely with local landowners to site access roads in order to minimize land-use disruptions to the extent possible. The preliminary layout of the turbines and access roads

is shown on all figures in this application. Additionally, lease agreements allow landowners to utilize access roads, which can be beneficial for agriculture operations by providing access to fields.

Project construction will require approximately 27 miles of new aggregate-surfaced access roads. During Project operation, access roads will be used by operation and maintenance crews while inspecting and servicing the wind turbines. The access roads will be designed to allow for adequate crane access. One road will be required for each string of turbines. Although the access road construction easement is 200 feet wide on average, temporary disturbance is limited to 50 feet on average, and the final permanent access roads will primarily be 16 feet wide with a low profile to allow farm equipment to cross the access roads. Oliver Wind IV will coordinate with Oliver County and NDDOT to obtain necessary road use agreements and approach permits. No mitigation is required. Oliver Wind IV will coordinate with Oliver County and NDDOT to obtain necessary road use agreements and approach permits.

Traffic

There will be a temporary increase in vehicular traffic during construction activities. The maximum construction workforce is expected to generate approximately 1,000 additional vehicle trips per day on each road within the Project Area. Approximately 32 concrete trucks will be required to pour the foundation for each turbine. This is typically completed in two days per foundation. While there may be some noticeable increase in heavy vehicle traffic in discrete locations for limited amounts of time, any impacts to public use of roadways in the Project Area will be negligible and temporary, resolving with the completion of construction. Specific truck routes will be dictated by delivery location. Additional operating permits will be issued by the state or county for over-sized truck movements. No mitigation is necessary.

Water Supply

Construction will not significantly impact local water supply. Construction will require approximately 1 million gallons of water for foundations, backfill, and compaction; 24.5 million gallons of water for road construction and civil infrastructure; and 8.5 million gallons of water for dust control. Construction water estimates are subject to change due to final site investigation and weather. Water for operation of the O&M facility may be obtained from the Southwest Water Authority or via an on-site water well. The Project will not require appropriation of surface water or permanent dewatering. Temporary dewatering of groundwater (*i.e.*, locally lowering groundwater levels in the vicinity of the excavation) may be required during construction of turbine foundations.

The abandonment of wells is not anticipated. However, in the event wells are abandoned, they will be sealed as required by North Dakota law.

Communications

The Electromagnetic Interference Report summarizes the findings related to microwave links, towers, local cellular towers, media towers (AM and FM), television, and aviation towers identified within and near the Project Area. Based on the results of the electromagnetic analysis, it was concluded that interference is not expected to have any significant impact on nearby microwave, AM, FM, cellular, television, or aviation towers, given the current array design.

Federally operated communications systems can be identified through consultation with the National Telecommunications and Information Administration (NTIA). Oliver Wind IV contacted the NTIA, and the NTIA consulted with federal agencies represented in the Interdepartment Radio Advisory Committee; no concerns regarding radio frequency blockage were identified (Appendix

C16). The Department of Commerce had minor issues with turbine placement in this area. According to their findings, the Project Area is situated over 48 kilometers northwest of the Bismarck, ND NEXRAD radar, placing it within the notification zone of that radar. The Department of Commerce stated that there will be low impact and only the lowest elevation angle will be contaminated. They requested additional consultation only if the Project Area changes or if the turbine height increases by 10 meters or more.

Coverage of AM and FM radio services are not expected to be impacted by the wind farm because turbines will be constructed a sufficient distance from each dwelling. With the switch to digital television in 2009, the concern of ghost images and flickering caused by wind turbine interference with analog signals is no longer an issue (Angulo et al. 2014).

Collection and telecommunication lines will be buried underground. North Dakota One Call will be contacted prior to construction to locate and mark underground facilities. To the extent Project facilities cross or otherwise affect existing communications systems, Oliver Wind IV will enter into agreements with service providers as necessary to avoid interference with their facilities.

6.3 PUBLIC HEALTH, WELFARE, AND SAFETY

6.3.1 Description of Resources

Aerospace and Military Operations

Oliver Wind IV and its representatives have contacted the following aerospace and military operations agencies/organizations to notify them of the Project and solicit feedback concerning the development of the Project: the FAA, North Dakota Aeronautics Commission, Grand Forks Air Force Base (AFB), Minot AFB, 91st Missile Maintenance Squadron, U.S. Department of Defense (DoD), and Military Aviation and Installation Assurance Siting Clearinghouse (Clearinghouse). Responses from the aerospace and military operations agencies/organizations are summarized in Section 7.0 and correspondence is included in Appendix C14, C15, and C16.

The Minot AFB responded to the notification that the 91st Missile Wing does not have any operations in Oliver or Mercer counties but did state that the 5th Bomb Wing on Minot AFB does have flying routes in this area.

The FAA reviews potential impacts to DoD radar as part of its aviation hazard review of structures that file a Notice of Construction or Alteration (FAA Form 7460-1). The FAA will request that the DoD and the U.S. Department of Homeland Security (USDHS) review the filing to determine if impacts to radar are considered significant. The impact of a wind energy project on radar systems primarily depends on the distance to the radar, and the number and configuration of the turbines.

The nearest turbine to an intercontinental ballistic missile (ICBM) launch or launch control facility is approximately 26 nautical miles (158,000 feet or 30 miles).

There are no public airports or private airports/airstrips within the Project Area. The nearest airport certified for commercial carrier operations is the Bismarck International Airport located approximately 38 miles southeast of the nearest turbine. Existing public and private airports within approximately 10 miles of turbines are documented in Table 6.3.1-1.

TABLE 6.3.1-1
Public/Private Airports and Heliports

Airport and Heliports	Type	Distance from Nearest Turbine	Direction from the Project
Mercer County Regional Airport (HZE)	Public	6.89 miles	North
Minnkota Private Airport (23ND)	Private	7.98 miles	East-Southeast
Letzing Airport	Private	8.74 miles	Southeast
Sakakawea Medical Center Heliport (ND50)	Medical	7.80 miles	North-Northwest
Source: NDGIS 2023			

Sound

The existing acoustic environment is defined primarily by distant traffic sounds from the nearby arterial highways and will also include intermittent aircraft overflights and sound from agricultural operations. In addition to anthropogenic sound sources, the windy conditions of this site define a somewhat elevated ambient sound level, which increases with wind speed. Windy conditions can generate sound caused by the rustling of grass and tree leaves and wind interaction with natural or man-made formations/structures.

Shadow Flicker

A wind turbine's moving blades can cast a moving shadow on locations within a certain distance of a turbine. These moving shadows are called shadow flicker and can be a temporary occurrence experienced by people at nearby residences or public gathering places. The impact area depends on the time of year and day (which determines the sun's azimuth and altitude angles) and the wind turbine's physical characteristics (height, rotor diameter, blade width, and orientation of the rotor blades). Shadow flicker generally occurs during low angle sunlight conditions, typical during sunrise and sunset times of the day.

Electromagnetic Fields

Power frequency electric and magnetic fields (EMF) are created wherever electricity flows, which includes the wiring in our homes and schools, power lines, and the electrical equipment and devices we use at work and home. Leading U.S. and international scientific organizations, such as the National Cancer Institute and the World Health Organization, have evaluated EMF research. These organizations generally conclude that overall, the body of scientific research does not show that exposure to EMF causes or contributes to any type of cancer or any other disease or illness (NIEHS 1999).

Hazardous Materials/Hazardous Waste

The Project is located in a rural area of North Dakota. Hazardous wastes from large industrial or commercial activities are not likely to be present in the Project Area. Potential hazards may exist in rural areas from farm dumps and agricultural chemicals. A Phase I Environmental Site Assessment (Phase I ESA) was conducted for the Red Butte project in 2018 for an area that contained the Oliver IV Project Area. The Phase I ESA was conducted to identify any recognized environmental conditions that may exist. A recognized environmental condition includes the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property. The opinion of the report concluded that there was no evidence of any recognized environmental conditions in connection with the site.

Potentially hazardous materials associated with the Project include fluids found in association with turbines and substation/transformer equipment. There will be three types of fluids used in the operation of the wind turbines, all of which are petroleum products. These fluids are necessary for the operation of each turbine and include gear box oil, hydraulic fluid, and gear grease. The transformers contain mineral oil. When more than 1,320 gallons of oil storage is located on-site, a Spill Prevention, Control, and Countermeasures (SPCC) Plan is required to address the safe and secure containment of oil as well as procedures for operations and spill prevention practices.

Public Safety

The Project Area is located in a region characterized by low population density and there are no cities or towns within the Project Area. The Project Area falls within the jurisdiction of Oliver County emergency services boundary and fire response boundary. Both boundaries determine the designated ambulance response service and fire department service for incidents reported through the 9-1-1 emergency system. The nearest hospital is Sakakawea Medical Center in Hazen, North Dakota.

6.3.2 Impacts/Mitigation

Aerospace and Military Operations

The wind turbines and MET tower will have lighting and markings that comply with FAA requirements, which includes the FAA's evaluation of any potential interference with air traffic. Oliver Wind IV has submitted a Notice of Construction or Alteration (FAA Form 7460-1) for a preliminary turbine array and the final turbine array to the FAA. Both the preliminary and final wind turbine arrays have undergone review and have been approved by both the DoD Siting Clearinghouse and the FAA. The DoD had no concerns, and the FAA has issued Determinations of No Hazard for the preliminary and final turbine arrays. Oliver Wind IV has submitted one final revised turbine location to the FAA for review. The response from the FAA for this single turbine location will be submitted to the Commission when received. In addition, and subject to the receipt of FAA approval, Oliver Wind IV will install two ADLS that are consistent with the Commission's requirements in N.D. Admin. Code Chapter 69-06-11.

The North Dakota Aeronautics Commission (NDAC) responded to the agency coordination letter stating that no impacts are expected to the nearest NDAC public airport, the Mercer County Regional Airport in Hazen (Appendix C2).

Oliver Wind IV will work with local farmers and spray plane operators so that spray planes are able to safely spray agriculture fields within the Project Area. Local farmers and spray plane operators can coordinate with the Oliver Wind IV O&M Manager to curtail turbines to accommodate for spraying.

Sound

The Commission's rules (N.D. Admin. Code Section 69-06-08-01(4)) specify that sound levels from a wind facility may not exceed 45 A-weighted decibels (dBA) within 100 feet of an inhabited residence or a community building, unless waived in writing by the owner. Wind turbine generators produce sound through a number of different mechanisms roughly grouped into mechanical and aerodynamic sources. Modern wind turbines include design features that minimize sound emission from mechanical sources. The interaction of air and the turbine blades produces aerodynamic sound through a variety of processes as air passes over and past the blades. Unlike other sound sources, wind turbines generally radiate more sound as wind speed increases. However, at

elevated wind speeds the wind tends to generate significant background sound by moving trees and grasses, which can create a masking effect and may aid in reducing the audibility of wind turbine sound.

An acoustic engineering analysis was developed to assess potential sound levels resulting from wind turbine operations (Appendix B2). Wind turbine operation was analyzed for the Project employing the GE 2.82 wind turbine. Acoustic modeling was completed at both wind turbine cut-in and maximum rotational conditions, inclusive of the entire range of future Project operational conditions. Project compliance was assessed at a total of 76 receptors (occupied residences) in and near the Project Area. Acoustic modeling results indicated that predicted sound limits will not exceed the Commission's current sound limit of 45 dBA within 100 feet of an inhabited residence or community building. The acoustic modeling conservatively predicts outdoor sound levels and assumes no shielding or attenuation by trees or other vegetation.

Project construction may cause short-term, but unavoidable sound impacts. The sound levels resulting from construction activities vary significantly depending on several factors, such as the type and age of equipment, the specific equipment manufacturer and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers. Sounds generated by construction activities are typically exempt from state and local sound oversight provided that they occur within weekday, daytime periods as may be specified under local zoning or legal codes. Reasonable efforts will be made to minimize the impact of sound resulting from construction activities.

Construction activity will generate traffic having potential sound effects, such as trucks traveling to and from the site on public roads. At the early stage of the construction phase, equipment and materials, such as hydraulic excavators and associated spreading and compacting equipment needed to form access roads and foundation platforms for each turbine, will be delivered to the site. Once the access roads are constructed, equipment for lifting the towers and turbine components will arrive. Traffic sound is categorized into two categories: (1) the sound that will occur during the initial temporary traffic movements related to turbine delivery, haulage of components, and remaining construction; and (2) maintenance and ongoing traffic from staff and contractors, which is expected to be minor.

Shadow Flicker

Shadow flicker impacts are not regulated in applicable county, state, or federal law, and there is no permitting threshold with regard to hours per year of anticipated impacts to a receptor from a wind energy project. An annual limit of thirty hours per year of shadow flicker impacts is the standard that has been utilized by the Commission and is the wind power generation industry's generally accepted standard.

An analysis of potential shadow flicker impacts from the Project turbine layout was conducted using the WindPro software package (Appendix B3). The WindPro analysis was conducted to determine shadow flicker impacts under realistic sunshine conditions (the analysis accounts for historical sunshine probability). This analysis calculated the total amount of time (hours and minutes per year) that shadow flicker could occur at receptors out to 4,167 feet. The analysis assumes that the receptors all have a direct in-line view of the incoming shadow flicker sunlight and does not account for trees or other obstructions which may block sunlight. In reality, the windows of many houses will not face the sun directly to be affected by the key shadow flicker impact times. Additionally, the analysis did not account for maintenance time or low wind speeds.

Project compliance was assessed at a total of 76 receptors in and near the Project Area (for the 73 planned and three alternate turbine locations). The predicted shadow flicker impacts are less than 30 hours per year at all receptors (the model includes both primary and alternative turbine locations). The maximum predicted shadow flicker impact at any occupied residence receptor is 29.6 hours per year and occurs on a participating landowner's parcel.

Electromagnetic Fields

Low-level power frequency EMF will occur around the wind turbine generators (in the nacelles), around the generator step-up transformers, along the collector lines, and at the collection substation. All Project facilities will be set back from residences as required by state and county regulation. At these distances, EMF levels will not be above background levels. The only exposure will be brief exposure to maintenance workers, primarily at the collection substation. Based on the above, no significant adverse impacts are anticipated.

Hazardous Materials/Hazardous Waste

All petroleum fluids will be contained within the wind turbines and electrical equipment. Potentially hazardous materials associated with the Project include fluids found in association with turbines and substation/transformer equipment. There will be three types of fluids used in the operation of the wind turbines, all of which are petroleum products. These fluids are necessary for the operation of each turbine and include gear box oil, hydraulic fluid, and gear grease. The transformers contain mineral oil. Any petroleum wastes generated will be handled and disposed of in accordance with local, state, and federal regulations.

Prior to construction, Oliver Wind IV will conduct another Phase I ESA and the results will be used avoid and minimize risk associated with potential recognized environmental conditions in the Project Area. Significant findings are not anticipated due to the known historic uses of the property. As with any construction activity, there is the possibility of accidentally spilling fuel, hydraulic fluid, or other hazardous substances during construction of the Project. The potential of such events will be minimized through implementation of a SPCC Plan, which will include the following:

- Construction equipment will be equipped with spill cleanup kits
- Equipment refueling will take place at secure areas, away from wetlands or drainages
- Workers will be trained in spill clean-up and the use of spill cleanup kits

These measures will ensure that surface and groundwater quality will not be degraded through inadvertent spillage of contaminants.

Public Safety

Oliver Wind IV will collaborate with emergency service providers to establish safety precautions and standards and develop an Emergency Response Plan for implementation.

Prior to construction, Oliver Wind IV will prepare fire protection and medical emergency plans in consultation with the rural fire district, Sheriff's Department, Emergency Management, and the local emergency medical service provider having jurisdiction over the area. Each wind tower will be marked with a visible identification number to assist with the provision of emergency services, and Oliver Wind IV will file with the Oliver County Emergency Manager a wind energy facility map identifying wind turbine locations and numbers.

Oliver Wind IV will provide educational material to landowners within the Project Area and, upon request, to interested people about the Project and any restrictions or dangers associated with the Project.

Within 24 hours of an occurrence, Oliver Wind IV will notify the Oliver County Emergency Manager, and the Commission, of any extraordinary event. Extraordinary events include, but shall not be limited to, fires, tower collapse, thrown blade, collector or feeder line failure, or injured wind turbine facility worker or private person. Oliver Wind IV will, within thirty calendar days of an extraordinary event, submit a report to the County Emergency Manager describing the cause of the occurrence and the steps taken to avoid future occurrences.

Project construction and operation will have minimal impacts to the security and safety of the local communities. The following security measures will be taken to reduce the chance of physical and property damage, as well as personal injury, at the site:

- Security measures will be taken during the construction and operation of the Project, including temporary and permanent (safety) fencing, warning signs, and locks on equipment and wind power facilities.
- Turbines will sit on solid steel-enclosed tubular towers in which all electrical equipment will be located, except for the pad-mounted transformer. Access to the tower is only through a solid steel door that will be locked when not in use.
- Where necessary or requested by landowners, Oliver Wind IV will construct gates or fences such as those around the collection substation.
- Oliver Wind IV will provide educational materials to landowners within the site boundaries and upon request to interested persons about the Project.

6.4 CULTURAL RESOURCES

6.4.1 Description of Resources

Archaeological Resources

Between 2019 to 2020, before the split of the two separate 200 MW wind projects, AECOM coordinated with the State Historical Society of North Dakota (SHSND) on the appropriate scope and level of survey for cultural resources and was assigned North Dakota State Historic Preservation Office (NDSHPO) reference number 19-0332. A Class I: Literature Review was completed for the respective area and a Class III: Intensive Cultural Resources Inventory was completed. The results of these studies are contained in “Red Butte Wind Energy Center: Class III Cultural Resource Inventory Results for the 2019 and 2020 Field Seasons in Oliver County, North Dakota” (MS No. 19304 [Huling et. al 2021]), which is on file with the NDSHPO. The report received NDSHPO concurrence on July 14, 2021 (Appendix C5). The Class III survey area includes both Oliver Wind IV and Red Butte.

After the split of the Red Butte and Oliver Wind IV projects in March 2023, the Project was assigned the new NDSHPO reference number 23-0203. Burns & McDonnell completed a Class I: Literature Review for the Project Area plus a one-mile buffer. Burns & McDonnell also completed further Class III: Intensive Cultural Resources Inventories in 2022 and 2023 for new Project design areas, which had not previously been surveyed. The Class III surveys were completed within a survey corridor for all areas potentially affected by temporary and/or permanent ground disturbance to identify archaeological resources. A Class III Cultural Resource Inventory report is currently underway for

these inventories. Once complete, the report will be submitted to the SHSND for review and concurrence. A summary of all the relevant Class III: Cultural Resources Inventory Reports for Oliver Wind IV are included in Appendix B4. The results presented in this application pertain only to the Oliver Wind IV Project.

The Class I: Literature Review followed the NDSHPO Guidelines Manual for Cultural Resources Inventory Projects (SHSND 2020) and included a file search of the North Dakota Cultural Resources Survey (NDCRS) data files maintained by the SHSND. Review of NDCRS data files included review of archaeological, historical, and architectural resource forms and cultural resources survey reports, as well as Cultural Heritage Forms available at the SHSND in Bismarck, North Dakota. The file search also included a review of the National Register of Historic Places (NRHP) records maintained by the National Park Service to identify historic properties listed on the NRHP, historic plat maps, and U.S. Geological Survey (USGS) topographic maps.

The Class I: Literature Review identified 19 previous cultural resource inventories and a total of 149 previously recorded cultural resources. No previously recorded Cultural Heritage Sites or resources currently listed on the NRHP were identified in the Class I: Literature Review.

Cultural resources can be defined as any resource that has cultural character (King 2012). Expanding upon this simple definition, “cultural resources” include all landscapes, buildings, sites, districts, structures, or objects that have been created by or associated with humans and are considered to have historical or cultural value. The term “historic property” includes only those cultural resources that are listed in or eligible for listing on the NRHP, which was established by the National Historic Preservation Act, 1966 (16 U.S. Code 470 *et seq*., as amended). Finally, “site” refers to any location in which human activities have occurred and where material evidence of those activities remains. Sites are defined as locations of past human activity older than 50 years, containing one or more cultural features, six or more artifacts, intact subsurface cultural materials, or a combination of these qualities, within an area of approximately 60 square meters (645 square feet), and spatially discrete from areas of similar content by approximately 60 meters (approximately 200 feet) (SHSND 2020). Isolated finds are defined as areas of past human activity older than 50 years, containing five or fewer artifacts with limited potential to possess subsurface cultural materials. Site leads are either a) isolated finds, as defined above, with the potential to possess substantial subsurface deposits, or b) locations reported by non-archaeologists as containing cultural resources that have not been field verified by an archaeologist (SHSND 2020).

Among the 149 previously recorded cultural resources recorded on NDCRS forms, four architectural sites have been previously recommended as eligible for the NRHP. These include three farmsteads and a cemetery. One further architectural resource, a cemetery, has been recommended potentially eligible for the NRHP. None of the eligible or potentially eligible sites cross into the temporary or permanent construction easement for the Project.

A total of 122 cultural resources have not been formally evaluated for eligibility for the NRHP. These include 31 Native American site leads, 68 Native American sites, four Euro-American site leads, 14 Euro-American sites, three architectural site leads, one architectural site, and one multicomponent site. Nearly all of the Native American sites or site leads were lithic scatters or stone circle sites. The Euro-American sites include collapsed abandoned farmsteads, foundations, cultural material scatters, or a combination of these feature types. None of the unevaluated sites will be impacted by the Project’s temporary or permanent construction easement.

A total of 22 cultural resources have been previously recommended not eligible for the NRHP. These include ten Native American isolated finds, two Euro-American sites, one architectural site lead, and nine architectural sites.

Architectural Resources

AECOM conducted a Class II/III Architectural Inventory to identify architectural resources within two miles of all proposed turbine locations. An architectural historian surveyed the area in the winter of 2019 and the summer of 2020. The results of these inventories are contained in "A Class II/III Architectural Survey – Red Butte Wind Energy Center in Oliver County, North Dakota" (MS No. 19270 [McCarthy 2021]), which is on file with the NDSHPO. This report received NDSHPO concurrence on July 14, 2021 (Appendix B4).

Burns & McDonnell conducted updated Class II/III Architectural Inventories to identify architectural resources within two miles of all proposed turbine locations. An architectural historian surveyed the area in the winter of 2022, and the spring and summer of 2023, and two significant architectural resources were identified. A Class II/III report is currently underway for these inventories. A summary of all the relevant Class II/III Architectural Inventory Reports will be filed separately from this application.

Native American Coordination

On June 25, 2019, outreach letters were sent to the following 19 Native American Tribes:

- Cheyenne River Sioux Tribe
- Crow Nation
- Flandreau Santee Sioux Tribe
- Fort Belknap Indian Community
- Fort Peck Assiniboine and Sioux Tribes
- Lower Brule Sioux Tribe
- Lower Sioux Indian Community
- Mandan, Hidatsa, and Arikara Nations
- Northern Arapaho
- Northern Cheyenne Tribe
- Oglala Lakota Nation
- Rosebud Sioux Tribe
- Santee Sioux Nation
- Sisseton-Wahpeton Oyate
- Spirit Lake Sioux Tribe
- Standing Rock Sioux Tribe
- Turtle Mountain Band of Chippewa Indians
- Upper Sioux Community
- Yankton Sioux Tribe

Since that time, numerous discussions have taken place with the following ten interested Native American Tribes to discuss the Project, survey plans, and cultural resource report content and format:

- Cheyenne River Sioux Tribe
- Mandan, Hidatsa, and Arikara Nations
- Northern Arapaho
- Northern Cheyenne Tribe
- Rosebud Sioux Tribe
- Sisseton-Wahpeton Oyate

- Spirit Lake Sioux Tribe
- Standing Rock Sioux Tribe
- Turtle Mountain Band of Chippewa Indians
- Yankton Sioux Tribe

The first stage of tribal participation focused on assisting with the micrositing of proposed turbine and access road locations. During this stage, Traditional Cultural Surveyors (TCS) from the Standing Rock Sioux Tribe and the Rosebud Sioux Tribe visited each turbine and service road location with representatives from Oliver Wind IV to assess the locations for potential cultural resources and Sites of Religious and/or Cultural Significance to Tribes (SRCSTT). After completion of this preliminary stage, the Previous Project layout was revised prior to the second stage of study.

In August through November 2019 and in October 2020, stage two of the tribal study focused on field surveys. During stage two, TCS from the Rosebud Sioux Tribe, Turtle Mountain Band of Chippewa Indians, Northern Cheyenne Tribe, Northern Arapaho, Standing Rock Sioux Tribe, and the Spirit Lake Sioux Tribe completed a joint field survey together with cultural resources consultants. Results of these field efforts are recorded in "Red Butte Wind Energy Center: Class III Cultural Resource Inventory Results for the 2019 and 2020 Field Seasons in Oliver County, North Dakota" (MS No. 19304 [Huling et. al 2021]), which is on file with the NDSHPO. As previously noted, this report received NDSHPO concurrence on July 14, 2021.

Further rounds of micrositing were conducted in August 2022 to maintain continued tribal coordination on the Project. A tribal representative from the Rosebud Sioux Tribe and Standing Rock Sioux Tribe participated in this effort. In October 2022 and June 2023, TCS from the Rosebud Sioux Tribe, the Standing Rock Sioux Tribe, Turtle Mountain Band of Chippewa Indians, and the Spirit Lake Sioux Tribe completed field surveys together with cultural resources consultants.

If future location changes in Project infrastructure occur, further fieldwork and tribal coordination will be completed. TCS from the Rosebud Sioux Tribe, Mandan, Hidatsa, and Arikara Nations, Turtle Mountain Band of Chippewa Indians, Northern Arapaho, Yankton Sioux, Northern Cheyenne Tribe, and the Spirit Lake Tribe will be invited to assist in joint tribal and cultural resource consultant field surveys.

Oliver Wind IV, participating Tribal Historic Preservation Officers (THPOs), Burns & McDonnell, and the SHSND are coordinating preparation of reports that include the results of the joint surveys into Class III Cultural Resources Inventory Reports.

6.4.2 Impacts/Mitigation

Archaeological sites, including SRCSTT, will be avoided during construction in accordance with input from the SHSND and participating THPOs. Cultural sites that are recommended for avoidance by the SHSND and participating THPOs that are in close proximity to proposed construction easements will be fenced to reduce the potential for inadvertent disturbance. Therefore, no direct impacts to cultural resources are anticipated.

An Unanticipated Discoveries Plan will be prepared that will outline the procedure utilized to address any unanticipated discoveries of cultural resources, including possible human remains. In the event that unanticipated discoveries are made during construction, the Unanticipated Discoveries Plan will provide direction to on-site personnel and their consultants regarding proper procedures for addressing the discoveries. In the event that burials are discovered during construction, construction activities would stop within 100 feet of the site and the site would be protected until the appropriate county sheriff's office has been contacted. The Sheriff will be responsible for contacting

the North Dakota State Forensic Examiner to determine if the remains are associated with a crime scene. If the remains are determined not to be part of an active crime scene or investigation, the North Dakota Chief Archaeologist will be contacted to coordinate how to proceed.

Archaeological Resources

The Project utilizes an avoidance strategy design to completely avoid previous and newly documented archaeological sites that are recommended for avoidance by the SHSND and participating THPOs. Avoidance buffers will be delineated prior to construction to avoid impacts to archaeological resources.

The pedestrian surveys and shovel testing associated with the Class III: Intensive Cultural Resources Inventories were completed between August 2019 and November 2020, June through November 2022, and April through August 2023. The 2019 and 2020 surveys are documented in "Red Butte Wind Energy Center: Class III Cultural Resource Inventory Results for the 2019 and 2020 Field Seasons in Oliver County, North Dakota" (MS No. 19270 [Huling et al. 2021]), which is on file at the NDSHPO. Once complete, the 2022 and 2023 cultural resources report will be submitted to the SHSND for review and concurrence and a management summary will be submitted to the Commission.

Architectural Resources

The Project has been designed to avoid direct impacts to the two identified significant architectural resources. Oliver Wind IV is coordinating with SHSND to determine whether the current Project will have potential indirect impacts to these resources and if so, what mitigation will be requested. Historical resources such as historic farmsteads and cemeteries, which are not designated as exclusion areas, are present within the Project Area. Oliver Wind IV will avoid impacts to historic resources determined unevaluated or eligible for the NRHP.

6.5 LAND USE RESOURCES

6.5.1 Description of Resources

The Project Area is located in rural North Dakota in an area predominantly comprised of cultivated land, hayfields, pasturelands, and grasslands. Accordingly, much of the Project Area is used for agricultural purposes supporting both livestock grazing and crops, and most of the Project Area has been converted to commercial crops. Wooded areas within the Project Area are limited to shelterbelts and tree rows between fields, windbreaks surrounding farmsteads, along drainages, and near wetlands. Tree clearing will be necessary at select tree rows where additional space is required to accommodate construction of turbines.

Public Lands

The Project Area is not located within any federal, state, or local land (NDGIS 2023). The Project Area is not located within any designated or registered national sites, including parks, memorial parks, historic sites and landmarks, natural landmarks, historic districts, monuments, wilderness areas, wildlife areas, wild, scenic, or recreational rivers, wildlife refuges, and grasslands. The Project Area is not located within any designated or registered state sites, such as parks, forests, forest management lands, historic sites, monuments, historical markers, archaeological sites, grasslands, wild, scenic, or recreational rivers, game refuges, game management areas, management areas, and nature preserves. The Project Area is not located within any county parks and recreational

areas, municipal parks, parks administered by other governmental subdivisions, hardwood draws, and enrolled woodlands.

School trust land properties, which are managed by the North Dakota Department of Trust Lands (NDDTL), are located adjacent to the Project Area to the northwest and to the southeast (NDGIS 2023) (Figure 11). These lands are dedicated to producing income for the schools and designated trust funds of North Dakota. School trust land is generally open to walk-in public use; however, lessees may restrict access if livestock are present.

The closest federally managed land to the Project Area is the Knife River Indian Villages (KRIV) National Historic Site, which is a unit of the National Park System and administered by the National Park Service (NPS) (NDGIS 2023). It is located approximately nine miles to the northeast of the Project Area, along the Missouri River. The Fort Clark State Historic Site is also located along the Missouri River and is located approximately 7.5 miles to the northeast of the Project Area. Currently, existing infrastructure is within the viewsheds of both sites including transmission lines, wind turbines, mining operations, and the Leland Olds Power Station. To date, NDSHPO has not expressed concern to Oliver Wind IV regarding viewshed impacts to KRIV or Fort Clark. However, the NPS has requested a viewshed analysis to compare the existing surrounding landscape to the proposed Project development. Oliver Wind IV has been actively collaborating with NPS on the viewshed analysis and will provide the Commission with the final report and updated correspondence with NPS.

The closest North Dakota Game and Fish Department (NDGFD)-managed land to the Project Area is the Missouri Breaks Wildlife Management Area which is dedicated to public use and wildlife habitat management. It is located approximately five miles to the northeast of the Project Area, mostly in an area that is a reclaimed coal mine.

Easements and Agreements

Within the Project Area there are no Private Land Open to Sportsmen (PLOTS) easements (NDGIS 2023) and there are also no lands or waters (wetland or grassland easements) administered by the U.S. Fish and Wildlife Service (USFWS; USFWS 2023a) (Figure 11).

Conservation Reserve Program (CRP) lands administered by the Farm Service Agency (FSA) through the U.S. Department of Agriculture (USDA) have the potential to occur in the Project Area. In exchange for yearly compensation, CRP lands are removed from agricultural production and planted with species that will improve environmental quality and health, with a long-term goal of establishing valuable land cover to improve water quality, prevent soil erosion, and reduce the loss of wildlife habitat (USDA, FSA 2023). Specific CRP acres are subject to privacy laws between each landowner and the FSA.

Unbroken Grasslands

There are unbroken grasslands within the Project Area. Unbroken grassland is grassland that has not been actively or historically disturbed by tilling, construction, or other mechanical methods. Other disturbance methods such as grazing, haying, fire, or other types of management actions, as well as undesirable species, did not qualify a grassland as broken. The NDGFD defines unbroken grasslands as “grasslands that have not been tilled or otherwise broken” (NDGFD 2021).

An unbroken grassland assessment report was conducted for the Project (Appendix B5). The unbroken grassland assessment report describes the results of the desktop assessment and field surveys completed for the Project and provides greater detail than the application as to how the

turbine locations and their associated construction easements avoid impacts to unbroken grassland. Using a combination of the desktop assessment and field surveys, the results of the assessment concluded 10,442 acres, or 46.8 percent of the Project Area were determined to be unbroken grassland (Figure 12). All of the 73 planned and three alternative turbine locations are located in cropland or broken grassland. Table 6.5.1-1 summarizes the sod type per turbine location.

TABLE 6.5.1-1
Number of Turbines by Sod Type

	Grassland Sod Type		
Turbine Type	Non-Grassland (Cropland)	Broken Grassland	Unbroken Grassland
Planned Turbine	45	28	0
Alternative Turbine	3	0	0

6.5.2 Impacts/Mitigation

Oliver Wind IV will work with landowners to minimize impacts to their land. Where feasible, turbine and access road locations were positioned along section lines and field edges to lessen the fragmentation of land. Once construction activities have been completed, temporary construction areas will be able to go back to their previous use. Oliver Wind IV will protect existing trees and shrubs by avoiding tree removal for turbines, access roads, and underground collector lines whenever possible. If removal is necessary, Oliver Wind IV will replace trees and shrubs consistent with the Commission's Tree and Shrub Mitigation Specifications. Oliver Wind IV requests a modification to the Commission's Tree and Shrub Mitigation Specifications which limits clearance to up to 50 feet in width. Specifically, Oliver Wind IV requests clearance of up to 600 feet in width for nine turbine locations to accommodate construction and final turbine placement to remove obstructions from adjacent tree rows. These locations are depicted in more detail in Figure 13.

The development of the Project will not result in a significant change in land use in the Project Area. Oliver Wind IV proposes the following mitigation measures for impacts on existing land uses:

- Site turbines, access roads, and associated facilities off public recreational lands.
- Develop and implement a noxious weed prevention plan.
- Avoid all direct, permanent impacts to unbroken grassland from construction of turbines, roads, MET tower, O&M facility, and collection substation, where possible.
- Provide contractors with static constraint maps and facilitate compliance through onsite environmental construction monitoring.
- Coordinate with local Natural Resources Conservation Service staff to revegetate non-cropland and pasture areas temporarily disturbed during construction or operation of the wind facility with locally sourced native seed mixes appropriate for the region.
- Reseed temporarily disturbed areas or restore to crop, based on the conditions of the area prior to construction and based on landowner preference.

Public Lands

No wind turbines or associated facilities are located on public lands. Any potential impacts to public lands would be visual in nature and would conform with existing development in the surrounding

landscape. A visual analysis is underway to demonstrate no significant viewshed impacts to KRIV or Fort Clark State Historic Site. Currently, no mitigation is proposed.

Easements and Agreements

No wind turbines or associated facilities are located on PLOTS or USFWS easements. No mitigation is required.

Any land taken out of CRP will be negotiated between the individual landowner and the FSA. No mitigation is required.

Unbroken Grasslands

Less than one acre of unbroken grassland will be permanently impacted by an access road to Turbine 24. The shortest route from the existing roadway to the turbine was selected in order to minimize impacts to unbroken grassland. Although the turbine is not within unbroken grassland, some unbroken grassland remains within the parcel outside of the turbine footprint. Oliver Wind IV is coordinating with NDGFD and USFWS regarding voluntary offsets for potential indirect impacts to grassland breeding birds that utilize unbroken grasslands as habitat.

6.6 GEOLOGICAL AND SOIL RESOURCES

6.6.1 Description of Resources

Geology and Soils

The Project Area is in the Missouri Plateau Class IV ecoregion, which is a more detailed ecoregion for state-level applications (Bryce et al. 1996). The Missouri Plateau was largely unaffected by glaciation and retains its original soils and complex stream drainage pattern. The surface geology in the Project Area is dominated by Paleocene sediments made up of silt and sand with an approximate thickness of 650 feet and Quaternary sediments with an approximate thickness of 100 feet (NDGIS 2023).

Soil characteristics within the Project Area were assessed using the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO). The SSURGO database provides a description of the soils present and information about their unique properties and productivity (USDA 2023). In all, 70 soil types are found within the Project Area. The dominant soil map units found within the Project Area are classified as fine sandy loams and are well drained.

Mining and Mineral Interests

The Project Area contains no active sand or gravel mines (Anderson 2012, Google Earth 2023); one dry non-active oil and gas exploration well (NDOGD 2023); four abandoned underground, partially underground, and surface coal mines (Commission 2022); and no active coal mines (Commission 2015). There are no active coal leases within the Project Area. The closest permitted coal mine is the Center Mine operated by BNI under permit number BNCR-9702 which is located approximately three miles east of the Project Area (BNI 2023). The locations of the active coal leases and permitted coal boundaries are shown on Figure 6.

Per coordination with NDDTL, there is one coal lease managed by NDDTL within the area studied per the agency notification letters (Appendix C6). However, the coal lease identified by NDDTL is outside of the Project Area.

Geotechnical and Geophysical Investigation

A geophysical investigation to assess potential mine spoils across eight turbine locations, or 10 percent of all turbine locations has been completed. No mine spoils were observed during the geophysical investigation.

As of August 2023, 81 out of the planned 97 geotechnical investigation boring locations have been surveyed. The boring locations include 83 turbine borings (which includes instances where turbine locations were shifted or removed) and 14 ancillary structure borings for substation, O&M building, MET towers, and ADLS towers. Based on the geotechnical investigation at the surveyed turbine locations, the subsurface stratigraphy typically consists of topsoil overlaying clay glacial till, occasionally with sand layers. Underlying the soil, weathered to intact shale is commonly found, sometimes accompanied by a layer of sandstone. Some interbedded lignite (also known as coal) has been observed. No voids were observed during the geotechnical investigation.

6.6.2 Impacts/Mitigation

Geology and Soils

Impacts to soils will be limited to areas removed from their current use by the occupancy of Project structures. Permanent impacts are considered the final operational footprint (*e.g.*, turbine foundation, turbine pads, access roads). These permanent impacts will remain for the life of the Project but will be removed upon decommissioning. Temporary impacts are those that result from certain construction activities but are later reclaimed (*e.g.*, construction laydown area, underground systems installation). Soil disturbance activities including grading for the roads, turbine pads, and associated facilities, and excavation activities for turbine foundations and underground utilities have the potential to contribute to soil erosion through the exposure of soils that were previously vegetated and stable. Areas temporarily affected during construction will be restored to preconstruction conditions, to the extent practicable after construction has been completed, and in accordance with landowner agreements.

Oliver Wind IV proposes the following mitigative measures:

- Use the Project Storm Water Pollution Prevention Plan (SWPPP) during construction to mitigate disturbed soils and prevent erosion.
- Maintain appropriate water and soil conservation practices during construction through the implementation of best management practices (BMPs). These practices include silt fencing, temporary reseeding, permanent seeding, mulching, filter strips, erosion blankets, grassed waterways and sod stabilization, and separation of topsoil and subsoil.
- Implement a 25- mph speed limit on Project roads to minimize dust.
- Alleviate compaction of soils if it occurs during construction.

The estimated impact for each Project component during construction, reclamation (or the Project temporary impacts), and operation (or the permanent Project impacts) is discussed further is Section 5.3 and decommissioning and restoration is discussed further in Section 5.4.

No impacts to geological resources are anticipated due to the limited depth of Project construction.

Mining and Mineral Interests

No existing mines or coal leases will be impacted by the Project. No mitigation is required.

Geotechnical and Geophysical Investigation

Based on the results of the geotechnical investigation, no areas were identified as unstable and do not pose concerns for the turbines (Figure 16). No turbine locations are located within a landslide deposit, as indicated by the North Dakota Geological Survey's landslide mapping program (NDGS 2007). Overall, while most layers demonstrated adequate strength for construction, a few soft clay layers were noted. Based on the information available as of August 2023, the investigated areas suggest that the site is suitable for turbine construction.

6.7 SURFACE WATER AND GROUNDWATER RESOURCES

6.7.1 Description of Resources

Groundwater

The state has two major types of aquifers: surficial and bedrock. The Project Area is located within the Missouri Slope ecoregion, an unglaciated region of North Dakota that includes minimal natural wetland basins and abundant small creeks and streams (NDGFD 2015). A very minor portion of the southwest region of the Project Area overlaps with the Otter Creek aquifer, a sensitive groundwater area with an average depth to water of approximately 43 feet (NDDWR 2023). The Project does not overlap any community source water protection areas.

Water wells that draw water from aquifers or groundwater are located within the Project Area (NDDWR 2023). These water wells serve various purposes, including domestic and stock uses.

Surface Waters

Within the Project Area, there are numerous intermittent, unnamed tributaries within the Project Area. The majority of the Project Area is drained into the Lower Otter Creek watershed, Middle Otter Creek watershed, Upper Otter Creek watershed, Headwaters Square Butte Creek watershed, Kinneman Creek watershed, and Brady Creek watershed.

Merjent delineated wetlands and other waters in support of the Project (Appendix B6). Other waters can include, but are not limited to, streams, ponds, impoundments, prairie potholes, and lakes. Field surveys occurred from 2019 to 2023 within the survey corridor. The survey corridor is any location where potential Project infrastructure could be sited within the Project Area. Wetlands and other waters delineations followed methodology from the U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory 1987) and Regional Supplement to the USACE Wetland Delineation Manual: Great Plains Region (Version 2.0) (USACE 2010). The USFWS National Wetlands Inventory (NWI) and U.S Geological Survey National Hydrography Dataset (NHD) were used to identify potential surface waters within the Project Area (USFWS 2023b, USGS 2023, Figure 14). This data served as a precursor for field delineations. Wetlands and other waters delineated in support of the Project are shown on Figure 14.

Floodplains

No digital data for Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps are available for the Project Area (USDHS, FEMA 2023). North Dakota Department of Water

Resources (NDDWR) Risk Assessment MapService (NDRAM) base level engineering flood data is present along creeks and streams located within the Project Area (NDDWR, NDRAM 2023). The 2023 agency response letter received from the NDDWR stated that there are floodplains identified and/or mapped at the proposed project location; however, those locations are associated with the study area for the Project Transmission Line. For the Wind Project, no floodplain permits are necessary from Oliver County relative to the National Flood Insurance Program.

6.7.2 Impacts/Mitigation

Groundwater

No turbines are located on top of the Otter Creek aquifer. If shallow groundwater is disturbed by the construction of turbine foundations, it is anticipated that it would resume its natural course of flow upon construction completion and would not be significantly impacted. Based on the relatively small amount of increased impervious surface at each turbine and large distance between each turbine foundation, the Project would not contribute to significant impacts on groundwater flow or recharge.

Temporary dewatering of groundwater (*i.e.*, locally lowering groundwater levels in the vicinity of the excavation) may be required during construction of turbine foundations. If dewatering of excavations is necessary during foundation construction and as long as the water is known to be uncontaminated, all water would be discharged according to items outlined in the SWPPP. If discharge water is suspected to be contaminated, an application for a temporary discharge permit (NDG-070000) will be submitted to the North Dakota Department of Environmental Quality (NDDEQ).

Surface Waters

The Project will not require appropriation of surface water or permanent dewatering.

The Project has been designed to minimize impacts to wetlands and other waters to the extent practicable. Based on wetlands and other waters delineation surveys, the Project is expected to permanently impact approximately 0.02 acres of wetlands. The two impacted wetlands are located alongside two access roads, with one impact occurring along an existing quarter-section dirt trail, while the other is necessary to preserve unbroken grassland. Horizontal directional drilling will be used where necessary to avoid impacts to wetlands and other waters from collection line trenching during construction.

Oliver Wind IV proposes the following measures:

- Minimize impacts to wetlands and other waters to the extent practicable.
- Employ horizontal directional drilling where necessary to avoid permanent impacts to wetlands and other waters from collection line trenching.
- The Project will be built to allow unrestricted flow of stormwater runoff.
- Wetlands will be delineated and flagged prior to construction when in close proximity to Project features.
- Maintain appropriate water and soil conservation practices during construction through the implementation of BMPs outlined in the SWPPP. These practices include silt fencing, temporary reseeding, permanent seeding, mulching, filter strips, erosion blankets, grassed waterways, and sod stabilization.

- Coverage under the NDDEQ's National Pollutant Discharge Elimination System (NPDES) general construction permit will be obtained prior to the start of construction.
- Provide contractors with static constraint maps and ensure compliance through onsite environmental construction monitoring.

Floodplains

Project facilities will be located and constructed in such a manner that no impacts are anticipated to floodplains based on the FEMA Flood Insurance Rate Maps. No mitigation is required.

6.8 WILDLIFE RESOURCES

6.8.1 Description of Resources

Oliver Wind IV conducted numerous wildlife studies to evaluate, avoid and minimize potential impacts to species of concern from Project development and operation. Wildlife surveys were conducted in coordination with USFWS and NDGFD. The voluntary USFWS 2012 Final Land-Based Wind Energy Guidelines (WEG; USFWS 2012), Eagle Conservation Plan Guidance (ECPG; USFWS 2013), and Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests (2016 Final Eagle Rule; USFWS 2016) served as the basis for the approach taken to document wildlife habitat and use within the Project Area. The following desktop assessments and field studies were conducted with respect to the WEG to document wildlife habitat and use.

- Avian use surveys were completed from June 2019 to May 2020 (Appendix B7) and March 2022 to February 2023 (Appendix B8).
- Sharp-tailed grouse (*Tympanuchus phasianellus*) lek surveys were completed in May 2019 (Appendix B9) and April 2020 (Appendix B10).
- Raptor nest surveys were completed from February to July 2020 (Appendix B11) and February to June 2022 (Appendix B12).
- Desktop whooping crane (*Grus americana*) habitat review was completed in 2023 (Appendix B13).
- Northern long-eared bat (NLEB; *Myotis septentrionalis*) presence/absence surveys completed July 26 to August 16, 2019 (Appendix B14); July 22 to July 28, 2020 (Appendix B15); and August 11 to August 24, 2022 (Appendix B16).
- Dakota skipper (*Hesperia dacotae*) surveys were completed from August 10, 17 to 19, and 22 to 23, 2022; and June 15, June 26 to 27, July 6, and July 17, 2023 (Appendix B17).
- Desktop and parcel-level identification of unbroken grassland tracts completed in 2020 and were updated throughout field surveys until 2023 (Appendix B5).

Avian Species

The Migratory Bird Treaty Act (MBTA) was enacted in 1918 for the purpose of prohibiting the use of birds and bird parts in the millinery industry. Under the MBTA, it is illegal "to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import …transport or cause to be transported… any migratory bird, any part, nest, or eggs of any such bird …" (16 United States Code 703). The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 Code

of Federal Regulation [CFR] 10.12). The USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13.

Additionally, bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA). The BGEPA protects bald eagles (*Halieeatus luecocephalus*) and golden eagles (*Aquila chrysaetos*) throughout their range in the United States. Although it does not designate critical habitat, BGEPA protects individual eagles and nests from disturbance.

Avian Use Surveys

Oliver Wind IV completed two years of baseline general avian use surveys to evaluate potential impacts to avian species. Avian species information is described relative to surveys from a larger study area which largely encompasses the Project Area. Based on the field observations and habitat present within the Project Area, most avian species that are likely to occur within the Project Area are those which are found in grassland, wetland, and agricultural habitats. Studies conducted for the Project included avian use point count surveys from June 2019 through May 2020 and March 2022 through February 2023 to document species presence and overall avian use (Appendix B).

Avian use surveys altogether totaled 1,223 hours of standardized effort in keeping with the ECPG (USFWS 2013), 2016 Final Eagle Rule (USFWS 2016), and Tier 3 of the WEG (USFWS 2012). In addition, incidental (*i.e.*, non-standardized) eagle and species of concern observations were recorded when those species were observed outside of the standardized survey timeframe. Surveys recorded a total of 6,723 observations in 1,422 separate groups in 2019 to 2020 and 2,762 observations in 935 groups in 2022 to 2023. No federally listed species were observed during the avian use surveys.

During the 2019 to 2020 surveys, golden eagles were only recorded in fall and spring and bald eagles were recorded in all seasons. Overall eagle use was relatively low, and eagles were observed at 15 of the 64 survey locations. Waterfowl comprised the majority of large bird use during fall, winter, and spring, with Canada goose making up the majority of this use. Red-tailed hawks (*Buteo jamaicensis*) and northern harriers (*Circus cyaneus*) made up the majority of raptor observations across all seasons.

During the 2022 and 2023 surveys, golden eagles were only recorded in the spring and summer and bald eagles were recorded in the spring, summer, and fall. The most abundant large bird species observed were Canada goose and sandhill crane (*G. canadensis*). Waterbirds were the most prevalent non-raptor group/type during spring, shorebirds during summer, waterfowl during fall, and upland game birds during the winter. Overall, diurnal raptors were the most frequently observed groups during spring and fall (the most abundant diurnal raptor species was red-tailed hawk) and upland game birds during the summer and winter.

Sharp-tailed Grouse Lek Surveys

Oliver Wind IV completed two years of aerial and ground sharp-tailed grouse lek surveys. Surveys were conducted within a larger study area; the 2019 Study Area largely encompasses the Project Area and the 2020 Study Area includes the Project Area. Four confirmed leks were located within the Project Area during the 2019 and 2020 surveys.

Raptor Nest Surveys

Oliver Wind IV completed two years of aerial and ground raptor nest surveys. Surveys were conducted in a larger study area which encompasses the Project Area. Aerial and ground-based

surveys were conducted following the timeframes recommended by the USFWS Region 6 protocol (USFWS 2021a) and ECPG (USFWS 2013). During the 2020 surveys, 135 nests were documented, with 23 nests documented within the Project Area. One active bald eagle nest was documented 2.4 miles east of the Project Area. During the 2022 surveys, 73 nests were documented, with 21 nests recorded within the Project Area. Similar to 2020, the 2022 surveys recorded a bald eagle nest east of the Project Area. No eagle nests were located within the Project Area.

Bat Species

Eleven bat species are found in North Dakota (Gullickson 1999). Based on the presence of suitable habitat, known distribution ranges, and documented occurrences, five of these species are expected to have a moderate to high potential to occur within the Project Area: little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasioncycteris noctivagans*), eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*). These bat species are often found roosting in attics, barns, or in trees underneath a canopy of leaves. The remaining six species are expected to have a low potential for occurrence in the Project Area. Additionally, given the lack of caves or other features that could serve as hibernacula, wintering use is not expected in the Project Area.

Suitable natural roosting habitats in the Project Area are limited to individual trees, windrows, wooded drainages, buildings, bridges, and riparian zones. Farmstead buildings (*e.g.*, houses, barns) could also provide potential roosting locations within the Project Area; however, the suitability of these man-made structures has not been evaluated. Bat acoustic and mist net surveys were completed within the Project Area to determine the presence or probable absence of the federally listed NLEB. The survey results related to NLEB are included in Section 6.9.

6.8.2 Impacts/Mitigation

Avian Species

Potential impacts from the Project to avian species include direct impacts, such as collisions with wind turbines, and potential indirect impacts, such as displacement or habitat loss and fragmentation.

Studies have been completed to analyze bird fatalities from collision with wind turbines at wind energy facilities. Erickson et al. (2014) calculated the fatality rate estimate for birds at the Prairie Winds ND1 wind project located near Minot, North Dakota to be 1.4 bird fatalities per megawatt per year. Loss et al. (2013) calculated the fatality rate estimate for birds in the Great Plains, which included North Dakota, to be 1.81 bird fatalities per megawatt per year. The collision risk for birds at the Project Area will likely be low based on records of fatalities at other wind energy facilities in the region and nationally overall (Erickson et al. 2014).

Turbines were sited outside of unbroken grasslands, which minimizes impacts to grassland birds that rely on native, unbroken grassland habitat. No turbines were sited within one-half mile of confirmed lek locations. No turbines were sited within 2-miles of active eagle nests.

Bat Species

Potential impacts from the Project to bat species include direct impacts, such as collisions with wind turbines, and potential indirect impacts, such as displacement or habitat loss and fragmentation.

Highly suitable habitats (*i.e.*, woodlands) for bats are largely absent from the Project Area. Natural roosting habitat (individual trees, windrows, woodlots, and riparian zones) is limited and fragmented. Lower quality habitat in the form of grasslands and agriculture lands compose the majority of the Project Area. Bat species may transit through the Project Area during spring and fall migration; however, identifiable migration and movement corridors for bats are not known in the Project Area. There are no large forested riparian corridors for bat species to follow or utilize as stopover day roosting sites. Forested areas within the Project Area consist mainly of small, wooded parcels that are disconnected from each other. Given the lack of large, forested riparian corridors and limited roosting habitat within the Project Area, use of the Project Area by migrating bats, and thus risk of collision, is likely to be low.

Mitigation

Oliver Wind IV conducted desktop assessments and field studies and consulted with the NDGFD and USFWS on appropriate avoidance, minimization, and offset measures so that the Project would have minimal environmental impacts (Section 6.0 and Appendix B). Based on the above the following measures will be used, to the extent practicable, by Oliver Wind IV:

- Turbine locations have been sited in agricultural croplands and broken grassland, thus minimizing native habitat fragmentation and loss.
- Turbine locations have been sited at least two miles from known active eagle nests and 0.5 mile from confirmed sharp-tailed grouse leks.
- Implement pad-mounted transformers to reduce the risk of bird electrocution.
- Construct wind turbines using tubular, monopole towers as opposed to a lattice structure, to minimize perching opportunities for raptors and other birds.
- Implement a 25-mph speed limit on Project roads to minimize wildlife collisions.
- Bury collection lines from the turbines to the collection substation to avoid collision risk in accordance with the Avian Power Line Interaction Committee (APLIC) suggested practices (APLIC 2012).
- Minimize construction activities to the extent practicable within 0.5 mile of known sharp-tailed grouse lek locations during the lekking and breeding season.
- Avoid construction to the extent practicable within two miles of active eagle nest locations during the nesting season.
- If any raptor nest is discovered during construction, the nest will be monitored to determine if there is a change in the nest activity status to avoid impacts that might have the potential to precipitate nest abandonment.
- Prepare a voluntary Wildlife Conservation Strategy (WCS) that includes an adaptive management approach, so that information gathered during post-construction monitoring can be used to inform future management decisions at the Project.
- Conduct one year of Tier 4 post-construction monitoring to better understand bird and bat impacts that are attributable to operations.
- Once turbine construction is completed, implement a Wildlife Response and Reporting System (WRRS). The WRRS will include reporting protocols to report and document bird and bat mortality during routine maintenance activities. If a dead or injured bird or bat is found, its location will be marked and reported to the Plant Lead/Site Supervisor. The dead or injured bird or bat will not be removed from the location it was found.

- Oliver Wind IV is coordinating with NDGFD, USFWS, and the North Dakota Agricultural Commissioner to provide voluntary offsets for potential indirect impacts to grassland breeding birds. Oliver Wind IV is preparing a mitigation plan and will present it to the agencies. The approved mitigation plan will be provided to the Commission.
- Provide contractors with static constraint maps and ensure compliance through onsite environmental construction monitoring.

6.9 RARE AND UNIQUE NATURAL RESOURCES

6.9.1 Description of Resources

The USFWS administers the Endangered Species Act of 1973 (ESA), which mandates protection of species federally listed as threatened and endangered (T&E) and their associated habitats. An endangered species is a species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is a species that is likely to become endangered in the foreseeable future. Critical habitat for these species can be designated if that habitat includes specific areas that are occupied by a species at the time of listing or unoccupied areas that are considered essential to the conservation of a species. Candidate species receive no statutory protection from the USFWS unless they are formally listed. North Dakota does not have a state T&E species list; however, it recognizes those federally listed under the ESA.

Seven federally listed species are believed or known to occur in North Dakota; however, the USFWS Information for Planning and Conservation (IPaC) tool (USFWS 2023c), indicated that five T&E species could potentially occur within the Project Area. These species include three birds, one mammal, and one insect: piping plover (*Charadrius melodus,* threatened), red knot (*Calidris canutus rufa,* threatened), whooping crane (*Grus Americana,* endangered), NLEB (endangered), and Dakota skipper (*Hesperia dacotae*, threatened). These T&E species are described in greater detail below.

Piping Plover

The preferred habitat of piping plover is generally characterized as exposed, sparsely vegetated shores and islands of shallow, alkali lakes and impoundments for breeding (NDGFD 2015). Piping plovers prefer salt-encrusted, alkali, or sub-saline semi-permanent lakes, ponds, and rivers with wide shorelines of gravel, sand, or pebbles. The piping plover nest in the sand or shoreline, generally near an object such as a clump of grass, rock, or small log but never in heavy vegetation. Piping plover forage on fly larvae, beetles, crustaceans, mollusks, and other small animals near the shoreline, or sometimes by the nest.

Critical habitat has been federally designated for the piping plover in North Dakota, mainly along the shores of the Missouri River and wildlife refuge areas (NDGFD 2015). Key areas and conditions for piping plover in North Dakota include the Alkali Lakes Core Area, which follows the Missouri Coteau landform from central North Dakota to northeast Montana.

The closest designated critical habitat is along the Missouri River, located approximately seven miles northeast of the Project Area (USFWS 2023d). The Project Area is located outside of the Alkali Lakes Core Area. The nearest part of the Alkali Lakes Core Area is located approximately 30 miles northeast of the Project Area. The Project Area is located outside the primary range and within the possible range of the piping plover (NDGFD 2015).

During the field surveys in the Project Area, no sandy or gravelly beaches, sandbars, alkaline wetlands, or lakes were delineated or observed. With the absence of preferred nesting habitat, it is unlikely that piping plover may occur within the Project Area. Additionally, no potential piping plover habitat was identified during the field surveys in the Project Area.

Red Knot

The red knot is noted for its long-distance migrations of more than 9,000 miles between circumpolar breeding habitats and marine wintering habitats in southern latitudes of South America (USFWS, 2022a). Most of the known migration routes for the Rufa subspecies are along coastal regions of Canada and the United States. However, an interior migratory route was identified to and from the Arctic, passing through Saskatchewan and Alberta Canada, through the Great Plains states, to non-breeding areas mostly in Texas and Louisiana along coastal areas of the Gulf of Mexico.

Critical habitat has been federally proposed for the red knot, although there is no proposed critical habitat in North Dakota (USFWS 2021b). In North Dakota during migration, both alkaline and freshwater lakes have been used by red knots (NDGFD 2015). The observations of red knots in North Dakota are scattered throughout the state. Red knots have been observed in the Missouri River system as well as sewage lagoons and large permanent freshwater wetlands. There are no stopover sites consistently used by red knots in North Dakota. The entire state of North Dakota is within the possible range of the red knot.

During the field surveys in the Project Area, no sandy or gravelly beaches, sandbars, alkaline wetlands, or lakes were delineated or observed. With the absence of preferred nesting habitat, it is unlikely that red knots may occur within the Project Area. Additionally, no potential red knot stopover sites were identified during the field surveys in the Project Area.

Whooping Crane

Whooping cranes typically migrate from their breeding grounds in the Wood Buffalo National Park in Canada, to their wintering areas in the Aransas National Wildlife Refuge in Texas, moving through Oklahoma, Kansas, Nebraska, North Dakota, and South Dakota (USFWS 2022b). A 200-mile-wide migration corridor has been delineated for the whooping crane that contains 95 percent of all verified sightings. Stopover habitat during migration includes a variety of croplands with roosting occurring in shallow, freshwater inland wetlands. This entire migration corridor includes a swath of the central U.S. and extends from southcentral North Dakota along the Missouri River to northwest North Dakota through the Project Area.

According to a comprehensive monitoring report focusing on whooping crane and sandhill crane (*G. canadensis*) activity around five wind energy facilities in North and South Dakota during their migratory seasons (spring and fall), observers monitored crane behavior for three consecutive years at each facility from 2009 to 2013, with no dead or injured cranes found (Derby et al. 2018). These comprehensive findings, combined with monitoring efforts at other wind energy facilities within the migration corridor, have not documented any whooping crane fatalities. It appears that while migrating cranes utilize areas near turbines, they do not display significant susceptibility to collisions with wind turbines.

A whooping crane habitat review was completed for the Project (Appendix B13). The habitat review evaluates whether the Project Area represents unique or high-quality whooping crane habitat compared to the surrounding landscape. The analysis concluded the Project Area is within the whooping crane migratory corridor and that the Project Area is similar to the surrounding landscape. No USFWS whooping crane sightings have been recorded within the Project Area. However, one

record of a telemetered whooping crane occurrence was recorded within the Project Area. The predicted probability of whooping crane habitat use within the Project Area ranged from 0.0001-0.1. Given the low probability of use of the Project Area, similarity of probability of use compared to areas outside of the Project Area, and lack of whooping crane mortalities to date, impacts to whooping cranes are unlikely.

Northern Long-Eared Bat

NLEB generally roosts in trees under loose bark or within holes, hibernates within caves and mine shafts, and occupies forested habitats between mid-May and mid-August, depending on latitude (NDGFD 2015). The NLEB prefers large, contiguous tracks of upland forested habitat during the summer residency period. Natural roosting habitats in the Project Area are limited to individual trees, trees along drainages, and trees near wetlands. The Project Area and all of North Dakota is within the NLEB range. The closest primary range of the NLEB is along the Missouri River, located approximately seven miles northeast of the Project Area.

Western EcoSystems Technology, Inc. (WEST) conducted NLEB presence/absence acoustic and mist-net surveys in support of the Project (Appendix B14 through B16). The presence of NLEBs was initially assessed with a desktop assessment of potential habitat. Acoustic assessments were conducted at these potential habitat locations using specialized bat detectors that recorded ultrasonic calls made by bats. Data collected over multiple nights were then analyzed to identify and distinguish NLEB calls from other species. Following the acoustic assessment, targeted mist-netting surveys were carried out at the locations where previously identified NLEB calls were detected. The mist-netting method allowed for the safe capture and examination of bats, aiding in the confirmation of NLEB presence near the Project Area. During this process, WEST biologists successfully captured and identified NLEB at several locations.

Dakota Skipper

Dakota skipper is an obligate of high-quality, untilled prairie habitat dominated by native species. Dakota skipper larvae exclusively feed on native bunch grasses, and adults require native forbs that flower during their flight-period as sources of nectar. The species is not likely to be present in cropped or previously cropped areas, non-native haylands, pasture, grasslands dominated by non-native species, or in areas with significant trees and/or shrub cover.

As of 2022, over the past three decades, Dakota skipper have been documented in three townships within Oliver County (USFWS, 2022c). The Project Area is located outside all Dakota skipper township detection locations. The nearest documented Dakota skipper township detection is a 2020 township detection located approximately two miles east of the Project Area in Township 143N, Range 84W with the exact location of the Dakota skipper detection location located somewhere within the 36-square-mile township.

WEST completed a Dakota skipper habitat assessment in support of the Project (Appendix B17). The overall purpose of the analysis was to assess unbroken grasslands where potential Project infrastructure could be sited to determine whether the existing vegetative conditions are suitable to support the reproductive needs of Dakota skipper during its larval stage. Within the construction easement there is one area of suitable Dakota skipper habitat, totaling approximately 0.26 acres (Figure 16).

6.9.2 Impacts/Mitigation

Oliver Wind IV is developing a voluntary WCS, which includes an adaptive management approach so that information gathered, and experience gained from post-construction monitoring can be used to inform future management decisions at the Project. Per the WRRS protocol, if a dead or injured federally listed species is found, it must be left undisturbed and reported to USFWS. No irreversible damage to rare or unique animal or plant species is anticipated. Individual species are discussed below.

Piping Plover

There were no piping plover observed during the avian use surveys conducted for the Project (Appendix B7 and B8). The closest designated critical habitat is located approximately seven miles northeast of the Project Area, so it is unlikely, although possible, that piping plover will occur within the Project Area.

Red Knot

There were no red knots observed during the avian use surveys conducted for the Project (Appendix B7 and B8). With no red knot observations during avian surveys and since there is no preferred stopover habitat identified within the Project Area, it is unlikely that the Project will affect the red knot.

Whooping Crane

Although the Project Area is located within the western half of the 50 percent whooping crane migration corridor (Pearse et al. 2018) the majority of whooping crane sightings have been recorded to the north and east of the Project Area (Appendix B13). No whooping crane fatalities and no sandhill crane fatalities (a more abundant surrogate species), have been recorded at wind facilities in the migration corridor, suggesting that likelihood of collision is low (Derby et al. 2018). The Project is not anticipated to affect whooping cranes.

Northern Long-Eared Bat

To minimize potential impacts on the NLEB and its roosting habitat during the active season, restrictions on tree removal will be in effect within a three-mile conservation buffer around the three NLEB positive locations from April 1 to October 31 (Figure 15). Consequently, trees considered suitable roosting habitat, including both alive and standing dead trees with a diameter of ≥3 inches at breast height and possessing exfoliating bark, cracks, crevices, and/or cavities, will be retained and not removed within the designated conservation buffer during that time. If trees considered suitable roosting habitat require removal for construction between April 1 to October 31, an emergence survey will be completed for each tree to ensure bats are not roosting in trees during removal. This survey protocol will follow standard USFWS survey guidelines (USFWS 2023e).

Additionally, the Project has been designed to minimize potential impacts to NLEB during operations by implementing turbine curtailment during nighttime during the bat migration season. Turbine curtailment limits the operational output of turbines from April 1 to October 15, which is the NLEB migration period, during low wind conditions when temperatures are 50 degrees Fahrenheit or higher. Specific curtailment plans will be included in the WCS and provided to USFWS.

Dakota Skipper

Project infrastructure was sited and the construction easement was designed to avoid impacts on all suitable Dakota skipper habitat. No Project construction activities will occur within identified suitable Dakota skipper habitat. Avoidance of the suitable Dakota skipper habitat will include boring the collection line under the suitable habitat. Suitable Dakota skipper habitat boundaries will be marked during construction to restrict entry by construction equipment. Thus, no impacts to Dakota skipper are anticipated.

Mitigative Measures

Oliver Wind IV conducted environmental studies and consulted with the NDGFD and USFWS on appropriate avoidance, minimization, and offset measures so that the Project would have minimal environmental impacts. Based on the above, including all aforementioned mitigation measures in Section 6.8, Oliver Wind IV will apply the following additional measures, to the extent practicable:

- Given the Project's location within the USFWS whooping crane corridor, implement NextEra's internal guidance document determining whooping crane curtailment triggers during migratory periods as part of the WCS. These curtailment steps include shutting down all operational turbines when a whooping crane is identified within one mile of the Project Area, with the turbines remaining shut down for 15 minutes following the departure of the whooping crane or until the whooping crane is observed moving away.
- Provide the appropriate whooping crane identification guide materials to be in all Project maintenance and operations vehicles for reference.
- Implement a tree removal restriction for suitable NLEB habitat within three miles of NLEB positive locations from April 1 to October 31 unless an emergence survey clears trees for clearing.
- Implement a turbine curtailment plan from April 1 to October 15 during the bat migration season.
- Field-verified suitable Dakota skipper habitat has been and will continue to be avoided. High visibility fencing (*e.g.,* snow fence) will be placed around field-verified suitable Dakota skipper habitat areas near construction to restrict construction equipment from disturbing these areas.
- Provide contractors with training, spatial data and static constraints maps that identify where field verified suitable Dakota skipper habitat is located and where construction equipment is restricted.
- Educate construction contractors about threatened and endangered species and associated mitigative measures being implemented for each respective species.

7.0 PUBLIC AND AGENCY COORDINATION

As part of development of the Project and the Project Transmission Line, Oliver Wind IV and its representatives have maintained close coordination with agencies, as well as other groups and organizations.

Throughout development of the Project, Oliver Wind IV has coordinated with landowner stakeholders through a combination of in-person meetings, mailers, and phone calls. Landowner dinners and open house events were held on October 13, 2022, and August 15, 2023, providing an opportunity for open communication and feedback from landowners. Oliver Wind IV is committed to maintaining coordination with landowner stakeholders throughout the development and lifetime of the Project.

Oliver Wind IV has actively engaged with various stakeholders during the Project's development, including Native American Tribes as described in Section 6.4, Oliver and Mercer counties, as detailed in Section 3.10., and worked in collaboration with NDGFD and USFWS, as detailed in Table 7.0-1.

In July and August 2019 and March 2022, Oliver Wind IV distributed Project notification letters to local, state, and federal agencies per Section 69-06-01-05 of the N.D. Admin. Code. The Project notification letters included a description of the Project, a solicitation request for any sensitive resources, current or planned development, or property interests the agency may have in or around the Study Area that Oliver Wind IV should consider, request for applicable permits, and a map of the Study Area.

The table below provides a summary of the correspondence between Oliver Wind IV and agencies, groups, and organizations. Attachment C includes templates of the Project notification letters, and correspondence with agencies and organizations including letters received in response to the Project notification letters, emails, and meeting summaries as of September 2023. Table 7.0-1 below and Appendix C are generally organized in the order in which the agency appears in Section 69-06-01-05 of the N.D. Admin. Code and are generally organized with the earliest correspondence date first, apart from email chains. Some agencies have been grouped together when the correspondence includes more than one agency.

TABLE 7.0-1
Summary of Agency and Organization Correspondence

Agency, Group, or Organization	**Correspondence Date**	**Summary of Correspondence[1]**
North Dakota Aeronautics Commission (NDAC) **(Appendix C2)**	August 23, 2019	The NDAC responded to the agency notification letter that the Project location will not have an impact on the nearest NDAC public airport, Mercer County Regional Airport (Hazen). If the height of the construction equipment is above 200 feet above ground level, then a case needs to be submitted to the Federal Aviation Administration for review.
North Dakota Attorney General	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Department of Agriculture	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Department of Health	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Department of Human Services	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Department of Labor and Human Rights	NA	The agency did not provide a response to the 2019 or 2023 notification letters.

TABLE 7.0-1
Summary of Agency and Organization Correspondence

Agency, Group, or Organization	Correspondence Date	Summary of Correspondence[1]
North Dakota Department of Career and Technical Education	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Department of Commerce	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
Energy Infrastructure and Impact Office	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Industrial Commission (NDIC) **(Appendix C3)**	April 25, 2023	The NDIC responded to the agency notification letter that after reviewing the "Wind Project Study Area" it appears that the only well that exists is: File no. 38701, Summit Carbon Solutions, LLC, Slash Lazy H 5, Section 6-142N-86W. There are no wells within the "Transmission Line Study Area".
Office of Governor Doug Burgum	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Department of Transportation (NDDOT) **(Appendix C4)**	September 4, 2019	The NDDOT responded to the agency notification letter that the Project should have no adverse effects on NDDOT highways. If any work needs to be done on a highway right-of-way, appropriate permits and risk management documents will need to be obtained.
State Historical Society of North Dakota (SHSND) **(Appendix C5)**	August 6, 2019, and April 4, 2023	The SHSND responded to both the 2019 and 2023 agency notification letters and recommended a Class I Literature Review and a Class II Reconnaissance and Class III Cultural Resources Inventory by a permitted architectural historian for standing buildings and structures within a two-mile radius of individual turbine locations.
	September 12, 2023	SHSND provided a letter acknowledging that Oliver Wind IV is coordinating with the National Park Service on a viewshed analysis for the Project. SHSND stated that no viewshed analysis is required for the Transmission Line.
North Dakota Indian Affairs Commission	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
Job Service North Dakota	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Department of Trust Lands (NDDTL) **(Appendix C6)**	August 12, 2019	The NDDTL responded to the agency notification letter that to obtain an easement across School Trust land, an online application form must be completed. Any proposed towers or lines would be subject to review by the surface division staff and approval by the Land Commissioner on behalf of the Board of University and School Lands. There are School Trust surface interests that are managed by the NDDTL on behalf of the Board of University and School Lands located within the Project Area. There are no active Coal Leases on School Trust Lands within the Project Area.
	April and May, 2023	The NDDTL responded stating that any proposed project crossing NDDTL managed property would need to apply for a Right of Way agreement and would be subject to review and approval by the Board of University and School trust Lands. Merjent responded stating that no infrastructure is planned on NDDTL surface lands due to the NDGFD preference for siting turbines on unbroken grasslands.
North Dakota Parks and Recreation Department (NDPRD) **(Appendix C7)**	April and May, 2023	The NDPRD requested shapefiles of the Project areas. Merjent sent over the shapefiles. The NDPRD used the map to draw out the approximate boundary. The NDPRD did not follow up with any additional responses.
Natural Resources Conservation Service (NRCS) **(Appendix C8)**	April 5, 2023	The NRCS responded to the agency notification letter that they have a major responsibility with the Farmland Protection Policy Act (FPPA) in documenting conversion of farmland (*i.e.*, prime, statewide importance and local importance) to non-agriculture use when federal funding is utilized. Since the Project does not have a source of federal funding, therefore, FPPA does not apply, and no further action is needed.

TABLE 7.0-1
Summary of Agency and Organization Correspondence

Agency, Group, or Organization	Correspondence Date	Summary of Correspondence[1]
North Dakota Department of Water Resources (NDDWR) **(Appendix C9)**	August 30, 2019	The NDDWR responded to the agency notification letter that the project does not require a conditional or temporary permit for water appropriation, however, if surface water or groundwater will be diverted for construction of the Project, a water permit will be required per N.D.C.C. 61-04-02. If a NDDWR observation well must be removed, the Project is requested to contact the Water Appropriations Division. There are no floodplains identified and/or mapped at the Project location. North Dakota has no formal 'permitting' authority as a state entity in National Flood Insurance Program identified floodplain areas. The permitting is always done by the local entity, please work closely with the County Floodplain Administrator.
	April 23, 2023	The NDDWR responded to the agency notification letter that there is a Federal Emergency Management Agency National Flood Insurance Program mapped where the project is to take place. The NDDWR requests to be notified regarding any potential impacts to water resources. The NDDWR indicated the project does not require a conditional or temporary permit for water appropriation. The NDDWR states if an observation well must be removed, please contact the Water Appropriation Division.
United States Department of Defense (DoD)	NA	See NTIA response.
United States Army Corps of Engineers (USACE) **(Appendix C10)**	August 19, 2019	The USACE responded to the agency notification letter that a Section 10 permit would be required for work impacting navigable waters. A section 404 permit would be required for discharge of dredge or fill material in waters of the United States. The USACE has determined that the Project may need a Clean Water Act Section 404 permit.
	April 17, 2023	The USACE responded to the agency notification letter that their office has reviewed the information you provided regarding the proposed project and determined that a USACE Section 404 permit may be required for your Project.
Oliver County	July 28, 2022	Oliver Wind IV presented a Project update to Oliver County Planning & Zoning.
Mercer County **(Appendix C11)**	December 9, 2022	Oliver Wind IV presented a Project update to the Mercer County Commission.
	March 16, 2023	Oliver Wind IV presented a Project update to Mercer County Planning & Zoning.
	September 15, 2023	Oliver Wind IV coordinated with Mercer County regarding FEMA floodplain maps.
North Dakota Transmission Authority	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Pipeline Authority	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
North Dakota Department of Environmental Quality (NDDEQ) **(Appendix C12)**	August 20, 2019	The NDDEQ responded to the agency notification letter that environmental impacts from construction of the Project will be minor and can be controlled by proper construction methods. Fugitive dust emissions should be minimized during construction. Aggregate for road construction should not contain erionite. Care is to be taken during construction activity near any water of the state to minimize adverse effects on a water body. The Project may be located over defined glacial aquifers, defined sensitive glacial drift aquifers, or within wellhead or source water protection areas. Noise levels can be minimized by ensuring that construction equipment is equipped with recommended muffler in good working order and ensuring that construction activities are not conducted early morning or late evenings. All solid waste materials must be managed and transported in accordance with the state's solid and hazardous waste rules. The NDDEQ owns no land and does not have projects scheduled in the Project area. The NDDEQ believes that the proposed activities are consistent with the State Implementation Plan for the Control of Air Pollution for the State of North Dakota.

TABLE 7.0-1
Summary of Agency and Organization Correspondence

Agency, Group, or Organization	Correspondence Date	Summary of Correspondence[1]
	April 19, 2023	The NDDEQ responded to the agency notification letter that care is to be taken during construction activity near any water of the state to minimize adverse effects on a water body. Disturbing one or more acres requires a permit to discharge stormwater runoff. The Project may be located over defined glacial aquifers, defined sensitive glacial drift aquifers, or within wellhead or source water protection areas. All solid waste materials must be managed and transported in accordance with the state's solid and hazardous waste rules. The NDDEQ owns no land and does not have projects scheduled in the Project area.
North Dakota Geological Survey (NDGS) **(Appendix C13)**	August 21, 2019	The NDGS responded to the agency notification letter that it appears that there are some locations in the northeast portions of the Project that contain areas mapped as landslide or features that suggest slope instability. There are also several areas within the Project boundary that contain mineable coal resources as depicted on the NDGS coal maps. A review of the Public Service Commission's Abandoned Mine Land (AML) locations data also shows several AML locations northeast of Center, ND.
	April 6, 2023	The NDGS responded to the agency notification letter that the project area is located just south of an area where several sand mining operations are currently located. The project area does contain a few localized landslide features associated with local drainages and the hilly topography in this area. Areas of landslides should be avoided when selecting locations for towers or transmission line support structures.
North Dakota Forest Service	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
Bureau of Land Management	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
Military Aviation and Installation Assurance Siting Clearinghouse (Clearinghouse) **(Appendix C14)**	November 21, 2019	The Military Aviation and Installation Assurance Siting Clearinghouse coordinated within the U.S. DoD an informal review of the Project. The results indicated that the Project will have minimal impact on military operations conducted in the area.
91st Missile Maintenance Squadron	NA	See Minot Air Force Base response.
Minot Air Force Base (AFB) **(Appendix C15)**	April 6, 2023	The Minot AFB responded stating that the 91st Missile Wing does not have any operations in these counties however the 5th Bomb Wing on Minot AFB does have flying routes in this area. The Minot AFB also asked if the Project has been pushed to the DoD Clearing House for a review.
	May 18, 2023	Merjent responded to the Minot AFB stating that the wind turbine locations have undergone a review and have been approved by both the DoD Siting Clearinghouse and the Federal Aviation Administration (FAA). The DoD had no concerns, and the FAA has issued Determinations of No Hazard. Proposed wind turbine and transmission line pole locations were provided.
Grand Forks Air Force Base	NA	The agency did not provide a response to the 2019 or 2023 notification letters.
National Telecommunications and Information Administration (NTIA) **(Appendix C16)**	April 1, 2022	Oliver Wind IV submitted a letter and attachments to the NTIA.
	May 19, 2022	The NTIA had minor issues with turbine placement in this area. The NTIA found the project is within the notification zone of the Bismarck, ND NEXRAD radar. However, there will be low impact and only the lowest elevation angle will be contaminated. The agency requested further contact with the developer only if the project area changes or the turbine heights increase by 10 meters or more.
National Park Service (NPS) - Knife River Indian Villages (KRIV) National Historic Site (NHS) **(Appendix C17)**	October 18, 2019	Oliver Wind IV reengaged with the NPS regarding the Project and stated that once the cultural resources studies are complete and the locations of all of the project facilities are locked in, Oliver Wind IV would like to discuss with the NPS regarding a visual analysis previously requested.
	July 6, 2023	On a telephone call between Oliver Wind IV and the NPS about the Project, NPS staff expressed concerns about potential visual impacts of the Project on the setting of the KRIV National Historic Site (NHS) both from within the KRIV NHS and Fort Clark State Historic Site (SHS). NPS staff mentioned that there is a draft Cultural Landscape Report for the KRIV.

TABLE 7.0-1
Summary of Agency and Organization Correspondence

Agency, Group, or Organization	Correspondence Date	Summary of Correspondence[1]
	July 18, 2023	Oliver Wind IV follows up on the call with notes and requests additional information including: a copy of the draft Cultural Landscape Report, a copy of the KRIV management plan or similar type of comprehensive/planning document if there is one, a copy of the KRIV National Historic Landmark (NHL) nomination form with regard to the proposed NHL at the KRIV, and confirmation that Jim Schilling at NPS Midwestern Regional office is the appropriate NPS staff to contact with regard to Fort Clark SHS.
	August 8, 2023	NPS responded by providing a link to the Big Hidatsa Village NHL nomination form and the 1989 National Register nomination form for KRIV. NPS specified that these documents contain sensitive information and are for Oliver Wind IV's reference only. The NPS stated their concern about the proposed energy project is not just specific to impacts to archaeological sites, but to a cultural landscape that is significant to the Mandan Hidatsa and Arikara. The NPS shared important viewsheds from within KRIV.
	August 8, 2023	Oliver Wind IV responded to the NPS that they did reach out to Andrew Clark at North Dakota State Historic Preservation Office about the draft NHL nomination for Fort Clark.
	September 2023	As of September 2023, Oliver Wind IV is actively coordinating with the NPS regarding visual concerns. Oliver Wind IV is completing a viewshed analysis and photostatic simulations using key viewpoints. Selection of viewpoints was coordinated with NPS staff.
North Dakota Game and Fish Department (NDGFD) and United States Fish and Wildlife Service (USFWS) **(Appendix C18)**	July 18, 2018	Oliver Wind IV initiated a meeting with NDGFD and USFWS that allowed Oliver Wind IV to present an update on the Project. Oliver Wind IV introduced the Project and presented an overview of studies completed by the previous developer and studies to be conducted by Oliver Wind IV. Oliver Wind IV 's intent is to avoid siting infrastructure on unbroken grasslands to the extent possible, considering other exclusion/avoidance areas and constraints. Oliver Wind IV provided a map of the desktop unbroken grassland analysis. NDGFD requested updates to the reports for whooping crane and avian species, intending to use Neal Niemuth's models for these birds. NDGFD also shared a large map of NDGFD lek data and highlighted that the Red Butte Project area is not fully covered by this data due to limitations in lek census blocks. The meeting included a discussion about the feasibility of the transmission line spanning Wildlife Management Areas (WMA) and the presentation of new North Dakota Century Code rules.
	August 28, 2019	Oliver Wind IV initiated a meeting with NDGFD as an opportunity to provide a status update on the Project. Oliver Wind IV shared a map of the latest project layout, highlighting a substantial reduction in project size and potential turbines due to coal lease and grassland issues. Turbine micrositing is complete, and field surveys are underway. All turbines and substation locations are situated outside of unbroken grasslands. The evaluation of transmission routing considers challenges such as coal leases, cultural resources, grouse leks, and landowner preferences. Regarding offsets, Oliver Wind IV is awaiting the post-micrositing array to conduct an initial evaluation, expecting wetlands to be of low concern due to minimal numbers and low use by breeding waterfowl. In general, NDGFD acknowledges avian displacement as the primary ecological service to be offset, although it is used as a proxy for other wildlife effects. NDGFD recognizes certain factors but expresses concerns about the acreages rather than dollar values in the offset ask. NDGFD appreciates Oliver Wind IV's efforts to avoid and minimize impacts and is amenable to having Oliver Wind IV review and structure the NDGFD letter to the Commission addressing these efforts. Overall, NDGFD welcomes the frequent updates from Oliver Wind IV and values the opportunity to discuss project progress.

TABLE 7.0-1
Summary of Agency and Organization Correspondence

Agency, Group, or Organization	Correspondence Date	Summary of Correspondence[1]
	September 12, 2019	The NDGFD responded to the agency notification letter that based on initial review, the Project appears to fall within an area with low to moderate risk to our native wildlife; however, valuable habitat for these species does exist within the Project Area and careful consideration should be made when siting turbines, roads, and associated infrastructure. Disturbance, fragmentation, and loss of native prairie have adversely impacted a wide variety of species and these negative impacts will only continue to compound as more development takes place on the landscape. Though the Project Area only includes a small number of wetlands, the resources they provide are still of value to many of our native species. The NDGFD recommends Oliver Wind IV contact USFWS's Habitat and Population Evaluation Team office to request the Local Siting Decision Support Tool to evaluate Project impacts on wetland resources. As Oliver Wind IV moves forward with this Project, the NDGFD requests to remain informed.
	October 17, 2019	The USFWS responded to the agency notification letter that the USFWS primary recommendation on all wind energy facilities in North Dakota is to avoid impacting all grasslands, particularly native prairie, focusing instead on areas that are currently disturbed (*e.g.*, cropland). We recommend seeking an alternate area with less intact habitat for this project. If the Project is to proceed at this location, then we recommend avoidance to the maximum extent possible of grasslands, particularly native prairie. The Project Area is within the whooping crane migration corridor and whooping cranes have been reported near the Project. Preconstruction surveys at Project revealed the presence of NLEB both on-site and in adjacent habitats during summer. Dakota skipper surveys were not conducted despite the presence of suitable reproductive habitat for the species within the Project Area and historic records of the species in Oliver County. At least 11 bald eagle nests have been identified in the Project Area.
	July 14, 2022	Oliver Wind IV initiated a meeting with NDGFD and USFWS that allowed Oliver Wind IV to present an update on the Project including that the transmission line is now routed north of NDGFD WMA. Oliver Wind IV presented an overview of survey results and ongoing studies encompassing the entire 400 MW study area that was formerly identified as part of the larger, prior Red Butte Wind Project. WEST will follow up with NDGFD for any new nest/lek data, while USFWS requested bat reports. Oliver Wind IV clarified that the bat reports are not yet finalized, and genetic samples are being collected for NLEB. Oliver Wind IV inquired about USFWS obtaining a permit for genetic sampling for the Project, surprising both NDGFD and USFWS with the capture of NLEB. Oliver Wind IV possesses the wind best management practices document as requested by NDGFD. NDGFD asked Oliver Wind IV to share turbine locations and site plans, with NDGFD planning to run the impact analysis internally. Oliver Wind IV agreed to send once finalized.
	March 15, 2023	Oliver Wind IV initiated a meeting with NDGFD on March 15, 2023 with the objective of the meeting to update the proposed development schedule of the original Red Butte Wind Project, providing timelines and expectations for submission to the Commission. Oliver Wind IV presented updated project information, describing that the former Red Butte Wind Project was being split into two parts: Oliver Wind IV (~200 MW) and Red Butte Wind (~200 MW). Oliver Wind IV is on track to submit a Commission application around August 2023, with a commercial operation date in Q4 2024. The turbines proposed for Oliver Wind IV are GE 2.82MW with a tip height of 500 feet. An estimated 18 miles of new overhead transmission line will connect to a new Basin Electric substation near Leland Olds. The layout scenarios have considered numerous constraints, and all unbroken grasslands are being avoided for turbine placement. Oliver Wind IV provided an overview of wildlife survey results. Turbines are also positioned to be 0.5 miles away from sharp-tailed grouse leks. Most field surveys for the entire development area have been completed, and additional Dakota skipper surveys will be done for the finalized construction layout in summer 2023. The development of a WCS is also planned for spring and summer. NDGFD inquired if a two-mile avoidance of nesting habitat was used in turbine layouts and asked about the number of turbines sited within broken grasslands. NDGFD expressed a preference for turbines in croplands and within two miles of leks instead of on grasslands, proposing post-construction monitoring of known leks and construction timing restrictions as alternative options.

TABLE 7.0-1
Summary of Agency and Organization Correspondence

Agency, Group, or Organization	Correspondence Date	Summary of Correspondence[1]
	May 11, 2023	The USFWS requested shapefiles of the study area used in the notification letter. Merjent responded with the requested shapefiles.
	June 23, 2023	Oliver Wind IV initiated a meeting with USFWS on June 23, 2023 with the objective of the meeting to update the proposed development schedule of the original Red Butte Wind Project, providing timelines and expectations for submission to the Commission. Oliver Wind IV presented updated project information, describing that the former Red Butte Wind Project was being split into two parts: Oliver Wind IV (~200 MW) and Red Butte Wind (~200 MW). Oliver Wind IV is on track to submit a Commission application around August 2023, with a commercial operation date in Q4 2024. An estimated 18 miles of new overhead transmission line will connect to a new Basin Electric substation near Leland Olds. Oliver Wind IV provided an overview of wildlife survey results. The layout scenarios have considered numerous constraints, and all unbroken grasslands are being avoided for turbine placement. Turbines are also positioned to be 0.5 miles away from sharp-tailed grouse leks and 2 miles from eagle nests. Most field surveys for the entire development area have been completed, and additional Dakota skipper surveys will be done for the finalized construction layout in summer 2023. The development of a Wildlife Conservation Strategy is also planned for spring and summer. The whooping crane habitat model was updated using the requested Niemuth models. USFWS recommended marking the transmission line with bird diverters, which Oliver Wind IV confirmed was already planned. Oliver Wind IV stated that impacts to wetlands are being avoided and if impacts are necessary, will be less than 0.1 acre (non-reporting NWP). Oliver Wind IV confirmed that the project does not fall within the range of the offset model for wetlands. USFWS stated they would like to review the WCS. Oliver Wind IV agreed to the NLEB timing restrictions for tree clearing and will continue coordination if tree clearing cannot occur prior to April 1.
Federal Aviation Administration (FAA)	June 23, 2022/August 18, 2023	FAA issued Determinations of No Hazard for preliminary turbine array. FAA issued extension of Determinations of No Hazard for preliminary turbine array.
	July 12, 2023	ADLS and meteorological tower locations were submitted for FAA review.
	August 22, 2023	FAA issued Determinations of No Hazard for the wind turbines.
	August 30, 2023	A single revised turbine location submitted for FAA review.
	September 18, 2023	FAA issued Determination of No Hazard for transmission line structures.

[1] Wording in response letters may reference Red Butte Wind instead of Oliver Wind IV.

8.0 POTENTIAL PERMITS/APPROVALS

Table 8.0-1 outlines the federal, state, and county permits or approvals that have been identified as potentially required for the construction and operation of the Project. Permits dependent on the final Project layout will be applied for after receiving Commission approval, but prior to construction.

TABLE 8.0-1
Potential Permits and Approvals Required for Construction and Operation

Agency	Type of Approval	Status*	Need
Federal Approvals			
Federal Aviation Administration (FAA)	Form 7460-1, Notice of Proposed Construction	2	Notice and approval are required for structures over 200 feet in height. FAA approval of lighting and marking of turbines is required.
Federal Communications Commission	National Environmental Policy Act Review: Categorical Exclusion	3	Review to determine if an Environmental Assessment will be required for the Aircraft Detection Lighting System.
U.S. Environmental Protection Agency	Spill Prevention, Control, and Countermeasure Plan	3	Required if more than 1,320 gallons of oil storage is located on-site.
U.S. Fish and Wildlife Service (USFWS)	Special Use Permit	N/A	Not required as no USFWS easements are present.
United States Army Corps of Engineers (USACE)	Nationwide Permit (NWP) 51	3	The Project will comply with all conditions of NWP 51. Impacts to wetlands are less than 0.1 acre and will not require submission of a pre-construction notification to the USACE.
	Section 404 Permit	N/A	
	Section 10 permit	N/A	
State of North Dakota			
North Dakota Department of Environmental Quality	National Pollutant Discharge Elimination System Permit: General Construction Storm Water	3	Required for disturbance of over one acre of land and a stormwater pollution prevention plan must be prepared.
North Dakota Department of Transportation	Road Approach/Access Permit	3	Required for construction of access roads from State Highways.
	Utility Permit/Risk Management Documents	3	Required for utility crossings on State Highway right-of-way.
North Dakota Department of Trust Lands	Rights-of-Way Easement and special access request	N/A	No temporary or permanent rights on school trust land properties is required.
North Dakota Department of Water Resources	Drainage Permit	N/A	Not required as the Project will not be required to drain a pond, slough, lake or sheetwater, or any series thereof, that has a watershed area (*i.e.*, drainage area) of 80 acres or more.
	Conditional or Temporary Permit for water appropriation	N/A	No water appropriation required.
	Water Permit	3	Required if drilling a well.
North Dakota Highway Patrol	Overheight/Overweight Permit	3	Required for hauling construction equipment and materials on State Highways.
North Dakota Public Service Commission	Certificate of Site Compatibility	2	Required for construction of generation facility over 0.5 megawatt in size.
North Dakota Public Service Commission	Certificate of Corridor Compatibility and Transmission Facility Route Permit	2	Required for construction of transmission facility over 115-kilvolt.
State Historical Society of North Dakota (SHSND)	Review of Effect Determinations	3	Reports for the Class III Cultural Resources Inventory will be submitted to SHSND for review when complete.
Local Permits			
Oliver County	Conditional Use Permit	2	Required for construction of a wind energy facility and transmission line.
	Utility Occupancy Permit	3	Required to place collection lines and telecommunication lines within county right-of-way.
	Road Use Agreement	3	Required for road use, access roads, intersections, road maintenance and repair of county roads.

TABLE 8.0-1
Potential Permits and Approvals Required for Construction and Operation

Agency	Type of Approval	Status*	Need
	Building Permit	3	Required to build aboveground facilities such as the operations and maintenance facility.
Mercer County	Conditional Use Permit	2	Required for construction of a transmission line.
Southwest Water Authority	Pipeline Crossing Permit	3	Required for crossing the Southwest Pipeline Project.

*Status Explanation: 1 Completed and approved, 2 Applied and/or decision pending, 3 Will apply for prior to construction as applicable

9.0 QUALIFICATIONS OF CONTRIBUTORS

The qualifications of each significant contributor involved in the facility site location study and this application are provided below in Table 9.0-1.

TABLE 9.0-1
Qualifications of Contributors

Name and Project Role	Education and Professional Experience
Clay Cameron Director Wind Development NextEra	Mr. Cameron has over 25 years of experience in project management, including development, construction, budgeting, financial reporting, and federal, state, and local permitting and compliance. His responsibilities include financial feasibility analysis, cost and schedule management, and coordination of functional project teams and customer relationships. He has 15 years of experience in the utility industry including roles of increasing responsibility in community development, engineering & construction, and project development. He studied business management at Louisiana State University, and holds a State of Florida General Contractor license.
Sarah Montone Wind Development NextEra	Ms. Montone has seven years of experience in project management, including development, audit, and vehicle line planning. She has two years of utility industry project development experience. She has a Bachelor of Science and a Master of Business Administration from the University of Detroit Mercy.
Dina Brown Environmental Services Project Manager NextEra	Ms. Brown has over 25 years of environmental experience in the planning, permitting, management and closure of energy industry projects. She has had direct responsibility for permitting and compliance with the Clean Water Act, National Environmental Policy Act, Resource Conservation and Recovery Act, Endangered Species Act, National Historic Preservation Act, Clean Air Act, as well as numerous state regulatory programs. Her primary responsibility is the permitting and licensing of projects on private and public lands in compliance with federal and state environmental laws. She has a Master of Science in Forest Science from Oregon State University and a Bachelor of Science in Civil/Environmental Engineering from Texas A&M University. She is a Certified Professional Soil Scientist.
Ron Burris Tribal Relations Project Manager NextEra	Mr. Burris is the Tribal Relations project manager for NextEra's North Dakota projects with primary responsibility for ensuring proactive outreach, collaboration, and relationship development with Tribes who have ancestral connections to the area of North Dakota. He has 19 years of total project management experience as an officer in the United States Navy, a project engineering manager for NextEra Energy, and has been the Tribal Relations lead for North Dakota for the past five years. Mr. Burris has a B.S. in Systems Engineering from the US Naval Academy and is a designated Naval Aviator.
Tracy Davis Managing Attorney NextEra	Ms. Davis has over 19 years of experience practicing energy regulatory law and has served as in-house counsel for NextEra for the past ten years. Her responsibilities include representation of NextEra subsidiaries and affiliates before state regulatory commissions, including the North Dakota Public Service Commission. She has a Bachelor of Arts and a Doctor of Jurisprudence from the University of Texas at Austin.
Lindsey Churchill, PhD, PWS Project Manager Merjent, Inc.	Dr. Churchill has 15 years of environmental permitting experience in wetland and natural resources. Her responsibilities included project management, application preparation, and oversight of surveys. She has a PhD in Natural Resources Management from North Dakota State University, a Master of Science in Natural Resources Management from NDSU, and Bachelor of Science in biology and mathematics from University of Jamestown. She is registered as a Professional Wetland Scientist and a USACE certified wetland delineator.
Dirk Churchill Environmental Specialist Merjent, Inc	Mr. Churchill has 11 years of experience in environmental assessment, permitting, and compliance services. His responsibilities included application preparation and leading wetland surveys. He has a Bachelor of Science in Natural Resources from North Dakota State University. He is a USACE-certified wetland delineator.
Jim Heideman GIS Analyst Merjent, Inc.	Jim Heideman is a GIS Specialist with 11 years of experience in environmental consulting, focusing on cultural resource management and environmental permitting. He has been the GIS lead scopes with the role of creating/managing spatial data, publishing and hosting ArcGIS Online services, post-processing and analyzing spatial data, and preparing technical report figures.
Melinda McCarthy, MA, RPA Archaeologist Burns & McDonnell	Ms. McCarthy has 14 years of cultural resources and historic preservation experience. Her responsibilities included leading the cultural resources archaeology and architecture surveys, GIS, and tribal outreach. She has a Bachelor of Arts in Anthropology with an emphasis in Archeology and a Master of Arts in history with a specialization in historic preservation, both from Southeast Missouri State University. She is permitted as a Principal Investigator through the North Dakota State Historic Preservation Office (NDSHPO) in North Dakota.

10.0 LITERATURE CITED

Anderson, F.J. 2012. Sand and Gravel Resources Show Record Production in North Dakota. North Dakota Department of Mineral Resources Geo News. Volume 39, No. 2.

Angulo, I., D. de la Vega, I. Cascón, J. Cañizo, Y. Wu, D. Guerra, and P. Angueira. 2014. Impact analysis of wind farms on telecommunication services. Renewable and Sustainable Energy Reviews 32: 84-99.

APLIC (Avian Power Line Interaction Committee). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C.

BNI (BNI Coal Ltd.). 2023. BNI Coal Ltd. LBA Tracts Federal Coal Lease-by-Application Serial Number: NDM-105513 Supplemental Environmental Assessment. Dated January 2023 to the US Department of the Interior Office of Surface Mining Reclamation and Enforcement. Accessed July 26, 2023. Available online at: https://www.osmre.gov/sites/default/files/inline-files/Supplemental_Environmental_Assessment-BNI_Coal_LBA_Tracts.pdf.

Bryce, S., Omernik J., Pater D., Ulmer M., Schaar J., Freeouf J., Johnson R, Kuck P., and Azevedo S. 1996. Ecoregions of North Dakota and South Dakota. U.S. Geological Survey. Accessed July 26, 2023. Available online at: https://store.usgs.gov/assets/MOD/StoreFiles/Ecoregion/21629_nd_sd_front.pdf.

Commission (North Dakota Public Service Commission). 2015. Jurisdiction: Coal Mining, List of Companies. © Copyright 2015. Accessed July 26, 2023. Available online at: https://psc.nd.gov/jurisdiction/coalmining/companies.php.

Commission. 2022. Abandoned Mine Lands - ND Public Service Commission. Last Modified: March 9, 2022. Accessed July 26, 2023. Available online at: https://ndgov.maps.arcgis.com/home/webmap/viewer.html?webmap=0c4eb5ce19a84a069c1d04b449c39d43.

Commission. 2023. North Dakota Active Wind & Solar Projects. Last updated Feb. 2023. Accessed July 26, 2023. Available online at: https://psc.nd.gov/docs/consinfo/siting/ND-wind-projects.pdf.

Derby, C. E., M. M. Welsch, and T. D. Thorn. 2018. Whooping crane and sandhill crane monitoring at five wind energy facilities. Proceedings of the North American Crane Workshop 14:26-34. Accessed July 28, 2023. Available online at: https://www.nacwg.org/publications/cranes_sandhill_whooping_2018-3.pdf.

DWC (Dakota Westmoreland Corporation). 2020. Response to second completeness review letter - Renewal Number 6, Permit KRSB-8802. Filed July 13, 2020 to the North Dakota Public Service Commission Case RC-20-209. Accessed August 3, 2023. Available online at: https://www.psc.nd.gov/database/documents/20-0209/006-010.pdf.

EnergyND. 2023. Wind – ND Wind Manufactures. Accessed July 27, 2023. Available online at: https://web.archive.org/web/20220824052410/energynd.com/resources/wind/.

Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Erickson, W.P., M.M. Wolfe, K.J. Bay, D.H. Johnson, and J.L. Gehring. 2014. A comprehensive analysis of small-passerine fatalities from collisions with turbines at wind energy facilities. PLoS ONE 9(9): e107491. doi 10.1371/journal.pone.0107491.

Huling, C.M., M.M. McCarthy, K.I. Perry, R.N. Pace, L. Harrington, R.M. Roberts, M. Bieber, M.L. Bender, and A.D. Cassidy-Neumiller. 2021. "Red Butte Wind Energy Center: Class III Cultural Resource Inventory Results for the 2019 and 2020 Field Seasons in Oliver County, North Dakota". Report on file with the State Historical Society of North Dakota, Archaeology and Historic Preservation Division in Bismarck, ND.

King, T.F. 2012. Cultural Resource Laws and Practice: An Introductory Guide: 4th Edition. AltaMira Press, Walnut Creek, California.

Google Earth. 2023. Oliver County, North Dakota. Oliver Wind IV Energy Center Project Area. Accessed July 2023. Available online at: https://www.google.com/earth/.

Gullickson, G. 1999. Bats of North Dakota. North Dakota Watchable Wildlife Program, Bismarck, North Dakota.

Loss, S.R., T. Will, and P.P. Marra. 2013. Estimates of bird collision mortality at wind facilities in the contiguous United States. Biological Conservation 168: 201-209.

McCarthy, M.M. 2021. "A Class II/III Architectural Survey – Red Butte Wind Energy Center in Oliver County, North Dakota". Report on file with the State Historical Society of North Dakota, Archaeology and Historic Preservation Division in Bismarck, ND.

NDDOT (North Dakota Department of Transportation). 2023. NDDOT's Transportation Information Map. Accessed July 26, 2023. Available online at: https://gis.dot.nd.gov/external/ge_html/?viewer=ext_transinfo.

NDGIS (North Dakota GIS Hub Data Portal). 2023. North Dakota GIS Hub Data Portal. Accessed July 26, 2023. Available online at: https://gishubdata-ndgov.hub.arcgis.com/.

NDGFD (North Dakota Game and Fish Department). 2015. North Dakota State Wildlife Action Plan. Published July 1, 2015. Accessed July 26, 2023. Available online at: https://gf.nd.gov/sites/default/files/publications/swap-2015_0.pdf.

NDGFD. 2021. A Desktop Approach to Avoid and Minimize Development Impacts to Grassland Habitat and Wildlife in North Dakota. Accessed September 13, 2023. Available online at: ndgf-desktop-approach-grasslands-2021.pdf.

NDGS (North Dakota Geological Survey). 2007. Lignite Reserves - Quadrangles: Center, Hannover NE, Hannover NW, Medicine Butte NE, Medicine Butte SE, Otter Creek Red Butte, Red Butte NW, and Red Butte SW. Accessed August 3, 2023. Available online at: https://www.dmr.nd.gov/ndgs/SurfaceMap/SurfaceMap.asp?source=landslide24k.

NDLMI (Job Service North Dakota Labor Market Information Center). 2023. Oliver County Area Profile. Accessed July 24, 2023. Available online at: https://www.ndlmi.com/admin/gsipub/htmlarea/uploads/lmi_apolivercounty.pdf.

NDOGD (North Dakota Oil and Gas Division). 2023. North Dakota Oil and Gas Division Map Viewer. Accessed July 26, 2023. Available online at:

https://gis.dmr.nd.gov/dmrpublicportal/apps/webappviewer/index.html?id=a2b071015113437aa8d5a842e32bb49f.

NDTA (North Dakota Transmission Authority). 2022. Power Forecast Study 2021 Update. Updated by Barr Engineering Co. Dated January 2022. Available online at: https://www.ndic.nd.gov/sites/www/files/documents/Transmission-Authority/Publications/ta-Power-Forecast-Study-Update-21.pdf.

NDDWR (North Dakota Department of Water Resources). 2023. Mapservice. Accessed July 24, 2023. Available online at: http://mapservice.swc.nd.gov/.

NDDWR, NDRAM (North Dakota Risk Assessment MapService). 2023. Flood - Base Level Engineering: Oliver County, ND. Accessed July 24, 2023. https://ndram.swc.nd.gov/.

NIEHS (National Institute of Environmental Health Sciences). 1999. NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields Prepared in Response to the 1992 Energy Policy Act (PL 102-486, Section 2118). NIH Publication No. 99-4493.

Office of the Governor. 2021. Burgum hosts Energy Secretary Granholm, stresses all-of-the-above energy policy and carbon opportunities. Dated October 14, 2021. Accessed July 27, 2023. Available online at: https://www.governor.nd.gov/news/burgum-hosts-energy-secretary-granholm-stresses-all-above-energy-policy-and-carbon.

Oliver County. 2016. Oliver County, North Dakota Revised Zoning Ordinances – Revised 2016. Accessed July 26, 2023. Available online at: https://olivercountynd.org/vertical/sites/%7B6E6CB90D-6F4C-4198-8B57-AAF2D42615E1%7D/uploads/1_Oliver_County_PZ_Cover__Index.pdf

Pearse, A. T., M. Rabbe, M. T. Bidwell, L. M. Juliusson, L. Craig-Moore, D. A. Brandt, and W. Harrell. 2018. Map of Whooping Crane Migration Corridor. U.S. Geological Survey (USGS) ScienceBase-Catalog, USGS Data Release Products. Access July 28, 2023. Available online at: https://www.sciencebase.gov/catalog/item/5a314a72e4b08e6a89d707e0.

Project Tundra. 2023. Project Tundra. Access July 27, 2023. Available online at: https://www.projecttundrand.com/.

SHSND (State Historical Society of North Dakota). 2020. “North Dakota SHPO Guidelines Manual for Cultural Resource Inventory Projects”. State Historical Society of North Dakota, Archaeology and Historic Preservation Division. Electronic Document. Accessed August 12, 2023. Available online at: https://www.history.nd.gov/hp/PDFinfo/North-Dakota-SHPO-Guidelines-Manual-for-Cultural-Resource-Inventory-Projects.pdf

U.S. Census Bureau. 2020. DEC Redistricting Data, Oliver County, North Dakota. Accessed July 2023.Available online at: https://data.census.gov/table?q=housing&g=050XX00US38065&tid=DECENNIALPL2020.H1.

USACE (U.S. Army Corps of Engineers). 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

USDA (U.S. Department of Agriculture). 2023. Web Soil Survey. USDA (U.S. Department of Agriculture)/NRCS (Natural Resources Conservation Service). Accessed July 27, 2023. Available online at: http://websoilsurvey.sc.egov.usda.gov.

USDA, FSA (Farm Service Agency). 2023. Conservation Reserve Program. What is the Conservation Reserve Program (CRP)? Assessed July 27, 2023. Available online at: https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/

USDA, NASS (National Agricultural Statistics Service). 2017. Census of Agriculture North Dakota. County Summary Highlights: 2017. Accessed July 27, 2023. Available online at: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/North_Dakota/st38_2_0001_0001.pdf.

USDHS (U.S. Department of Homeland Security), FEMA (Federal Emergency Management Agency). 2023. FEMA Flood Map Service Center: Oliver County, ND. Accessed July 24, 2023. Available online at: https://msc.fema.gov/portal/search?AddressQuery=oliver%20county%20north%20dakota

USFWS (U.S. Fish and Wildlife Service). 2012. U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines. Accessed July 25, 2023. Available online at: https://www.fws.gov/sites/default/files/documents/land-based-wind-energy-guidelines.pdf

USFWS. 2013. Eagle Conservation Plan Guidance Module I – Land Based Wind Energy. Accessed July 25, 2023. Available online at: https://www.fws.gov/sites/default/files/documents/eagle-conservation-plan-guidance.pdf

USFWS. 2016. Eagle Permits; Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests; Final Rule. 50 CFR 13 and 22. Department of the Interior Fish and Wildlife Service. 81 Federal Register (FR) 242: 91494-91554. December 16, 2016.

USFWS. 2021a. U.S. Fish and Wildlife Service (USFWS), Region 6, Recommended Protocol for Conducting Pre-construction Eagle Nest Surveys at Wind Energy Projects. Revised March 31, 2021. USFWS, Region 6, Migratory Bird Management Office, Mountain-Prairie Region. Accessed July 27, 2023. Available online: https://www.fws.gov/sites/default/files/documents/usfws-r6-eagle-nest-survey%20protocol-recommendations-wind-energy-projects-v3-2021.pdf.

USFWS. 2021b. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Rufa Red Knot (*Calidris canutus rufa*). A Proposed Rule by the Fish and Wildlife Service on July 15, 2021. Publication Date: July 15, 2021. Available online at: https://www.federalregister.gov/documents/2021/07/15/2021-14406/endangered-and-threatened-wildlife-and-plants-designation-of-critical-habitat-for-rufa-red-knot

USFWS. 2022a. Rufa Red Knot (*Calidris canutus rufa*) | U.S. Fish and Wildlife Service. Accessed July 28, 2023. Available online at: https://www.fws.gov/species/rufa-red-knot-calidris-canutus-rufa

USFWS. 2022b. Whooping Crane (*Grus americana*) | U.S. Fish and Wildlife Service. Accessed July 28, 2023. Available online at: https://www.fws.gov/species/whooping-crane-grus-americana

USFWS. 2022c. 2022 Dakota Skipper (Hesperia dacotae) North Dakota Survey Protocol. Accessed July 28, 2023. Available online at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd1037927.pdf

USFWS. 2023a. FWSInterest (Feature Server). Last edit June 15, 2023. Accessed July 26, 2023. Available online at: https://www.arcgis.com/home/webmap/viewer.html?useExisting=1

USFWS. 2023b. National Wetlands Inventory. Accessed July 27, 2023. Available online at: https://www.fws.gov/wetlands/data/mapper.html

USFWS. 2023c. IpaC. Accessed Jul7 26, 2023. Available online at: https://ipac.ecosphere.fws.gov/

USFWS. 2023d. ECOS Environmental Conservation Online System – Piping Plover (*Charadrius melodus*). Accessed July 28, 2023. Last updated May 26, 2023. Available online at: https://ecos.fws.gov/ecp/species/6039#crithab

USFWS. 2023e. Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines. U.S. Fish and Wildlife Service, Region 3, Bloomington, MN. 76 pp.

USGS (U.S. Geological Survey). 2023. National Hydrography Dataset. Accessed July 27, 2023. Available online at: http://nhd.usgs.gov/data.html.

Zillow. 2023. Oliver County ND Real Estate & Homes for Sale. Accessed July 27, 2023. Available online at: https://www.zillow.com/oliver-county-nd/.

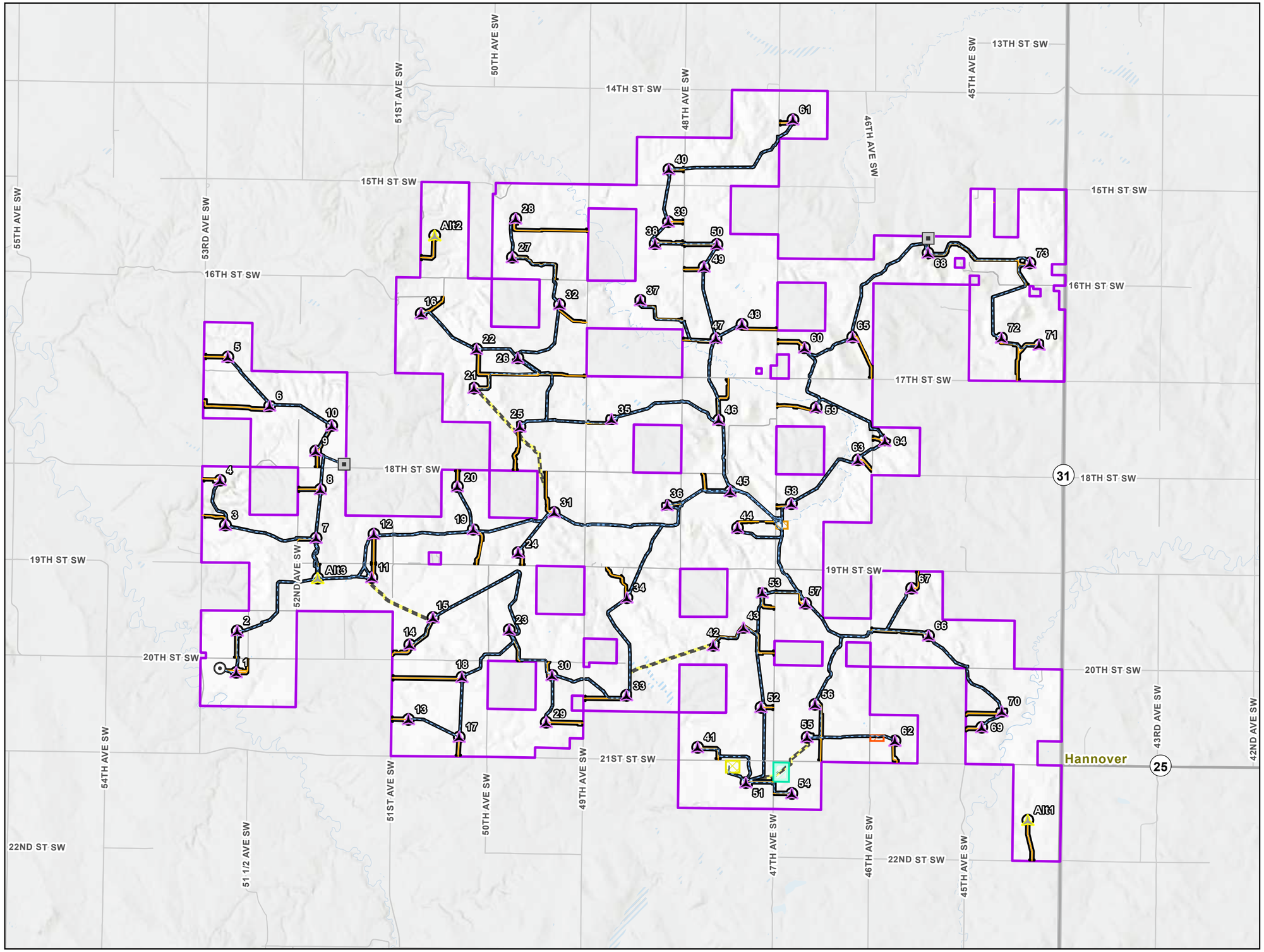
11.0 ACRONYMS AND ABBREVIATIONS

ADLS	aircraft detection lighting system
AFB	Air Force Base
AML	Abandoned Mine Land
APLIC	Avian Power Line Interaction Committee
Basin Electric	Basin Electric Cooperative
BGEPA	Bald and Golden Eagle Protection Act
BMPs	Best Management Practices
BNI	BNI Coal, Ltd.
CFR	Code of Federal Regulation
Certificate	Certificate of Site Compatibility
Clearinghouse	Military Aviation and Installation Assurance Siting Clearinghouse
CO_2	carbon dioxide
Commission or PSC	North Dakota Public Service Commission
CRP	Conservation Reserve Program
dBA	decibel, A-weighted
DoD	U.S. Department of Defense
DWC	Dakota Westmoreland Corporation
ECPG	Eagle Conservation Plan Guidance
EMF	electromagnetic fields
EPC	engineering, procurement, and construction
ESA	Endangered Species Act of 1973
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FPPA	Farmland Protection Policy Act
FSA	Farm Service Agency
GE	General Electric
ICBM	intercontinental ballistic missile
IPaC	Information for Planning and Conservation
KRIV	Knife River Indian Villages
kV	kilovolt
LNTE	Low-Noise Trailing-Edges
LOS	Leland Olds Station
MBTA	Migratory Bird Treaty Act
MET tower	meteorological evaluation tower
mph	miles per hour
MW	megawatt
N.D. Admin. Code	North Dakota Administrative Code
N.D.C.C.	North Dakota Century Code
NASA	National Aeronautics and Space Administration
NASS	National Agricultural Statistics Service

NDAC	North Dakota Aeronautics Commission
NDCRS	North Dakota Cultural Resources Survey
NDDEQ	North Dakota Department of Environmental Quality
NDDOT	North Dakota Department of Transportation
NDDTL	North Dakota Department of Trust Lands
NDDWR	North Dakota Department of Water Resources
NDGFD	North Dakota Game and Fish Department
NDGIS	North Dakota GIS Hub Data Portal
NDGS	North Dakota Geological Survey
NDLMI	Job Service North Dakota Labor Market Information Center
NDOGD	North Dakota Oil and Gas Division
NDRAM	North Dakota Risk Assessment MapService
NDSHPO	North Dakota State Historic Preservation Office
NDTA	North Dakota Transmission Authority
NextEra	NextEra Energy Resources, LLC
NHD	National Hydrography Dataset
NHL	National Historic Landmark
NHS	National Historic Site
NIEHS	National Institute of Environmental Health Sciences
NLEB	northern long-eared bat
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
Oliver Wind IV	Oliver Wind IV, LLC
O&M	operations and maintenance
Phase I ESA	Phase I Environmental Site Assessment
PLOTS	Private Land Open to Sportsmen
PPA	power purchase agreement
Project	Oliver Wind IV Energy Center
Project Transmission Line	Planned 19.5-mile-long 345-kilovolt transmission line
SCADA	Supervisory Control and Data Acquisitions
SHS	State Historic Site
SHSND	State Historical Society of North Dakota
Siting Act	Energy Conversion and Transmission Facility Siting Act
SODAR	sonic detection and ranging
SPCC	Spill Prevention, Control, and Countermeasures
SPP	Southwest Power Pool
SRCSTT	Sites of Religious and/or Cultural Significance to Tribes
SSURGO	Soil Survey Geographic Database
SWPPP	Storm Water Pollution Prevention Plan
T&E	threatened and endangered

TCS	Traditional Cultural Surveyors
THPO	Tribal Historic Preservation Officer
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDHS	U.S. Department of Homeland Security
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCS	Wildlife Conservation Strategy
WEG	Wind Energy Guidelines
WEST	Western EcoSystems Technology, Inc.
WMA	Wildlife Management Area
WRRS	Wildlife Response and Reporting System
2016 Final Eagle Rule	Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests

Figures



0 0.5 1 Miles

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N W E S

- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

Figure 1: Project Area and Facilities Layout/ Site Plan (Street)

Oliver Wind IV Energy Center

Oliver County, North Dakota

merjent

For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

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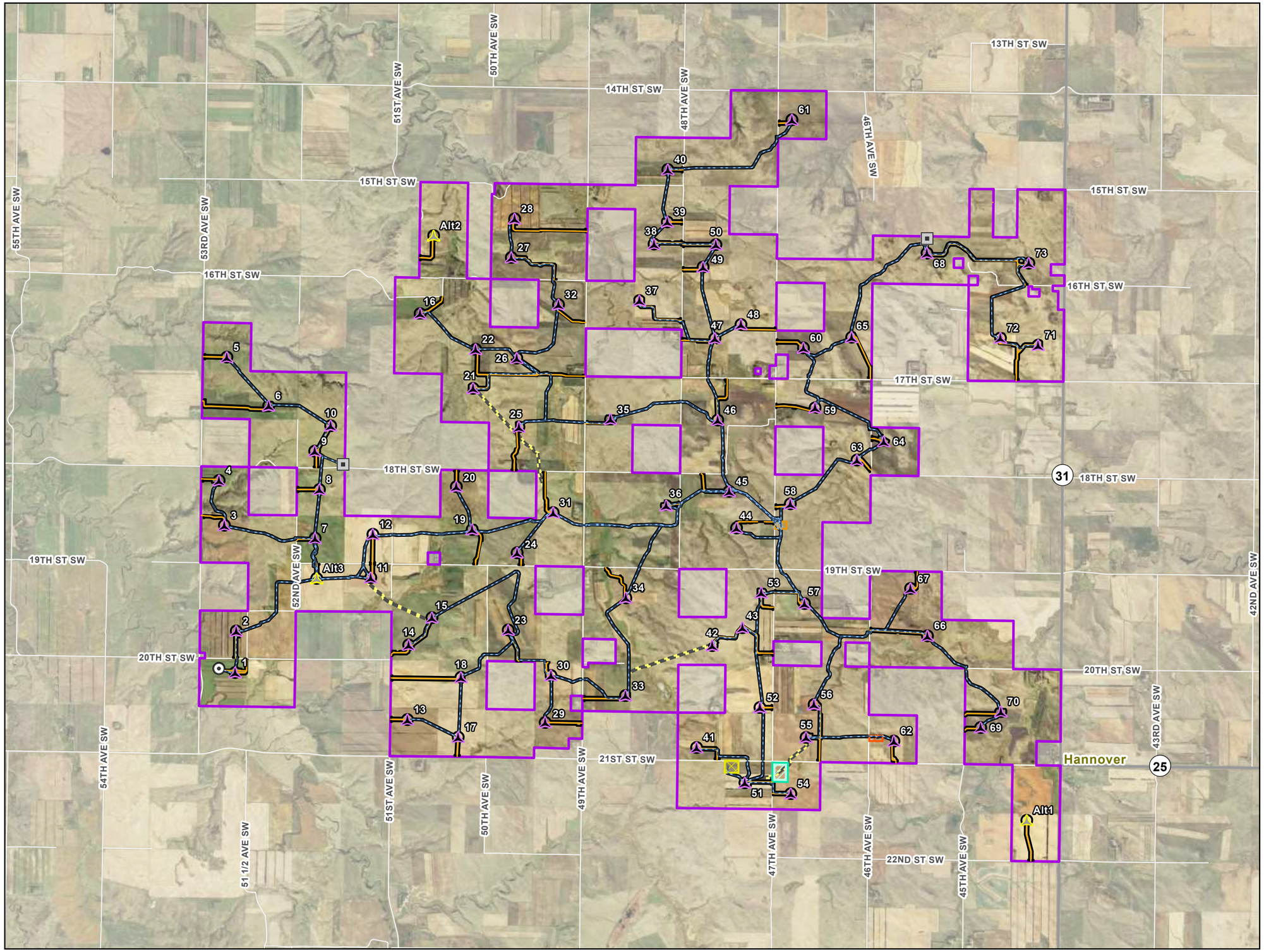

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N W E S

- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

Figure 2: Project Area and Facilities Layout/ Site Plan (Aerial)

Oliver Wind IV Energy Center

Oliver County, North Dakota

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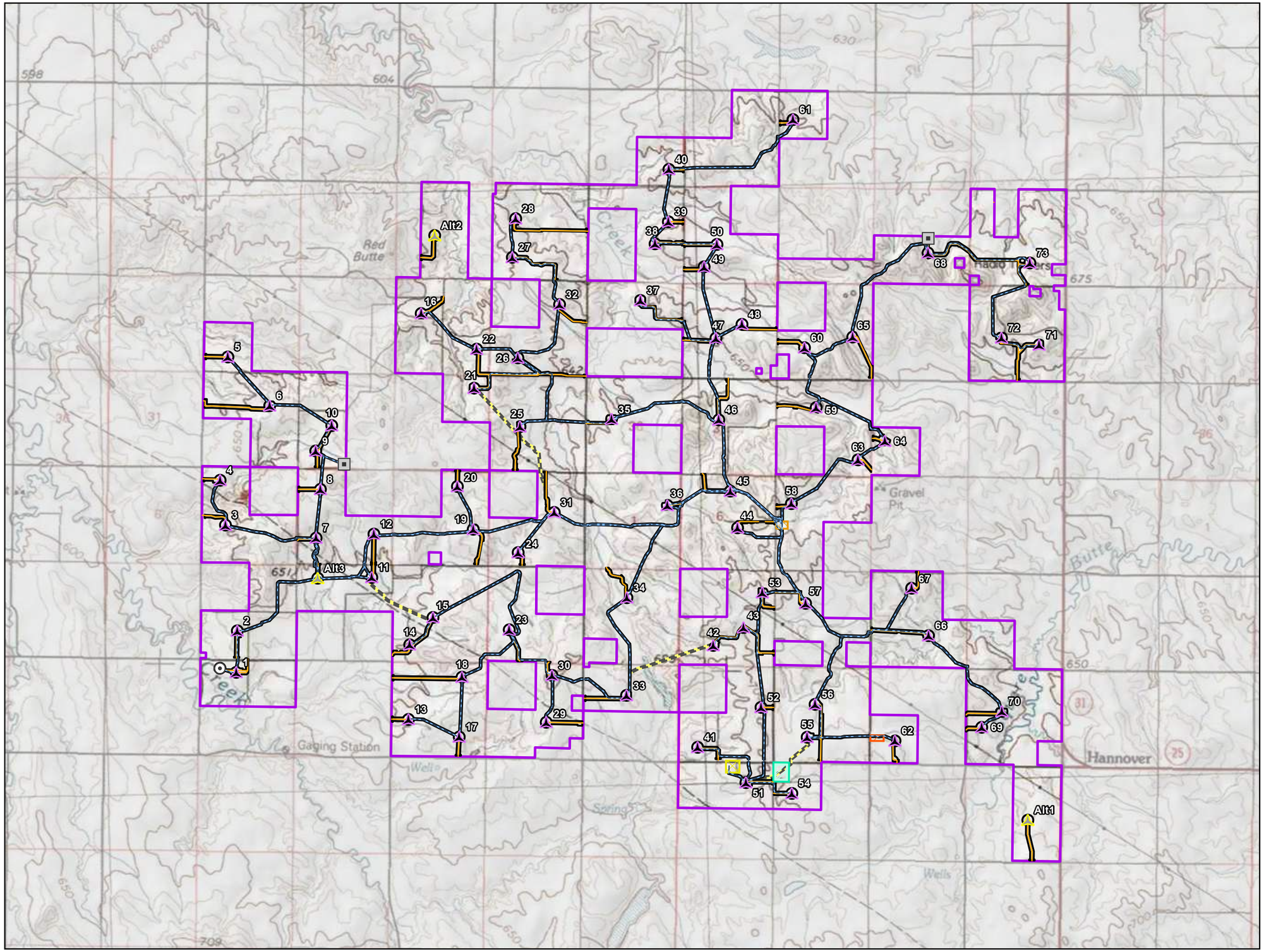
Contractor Will Bore All Wetlands And Roads



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- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

Figure 3:
Project Area and Facilities Layout/ Site Plan (Topographic)
Oliver Wind IV Energy Center
Oliver County, North Dakota

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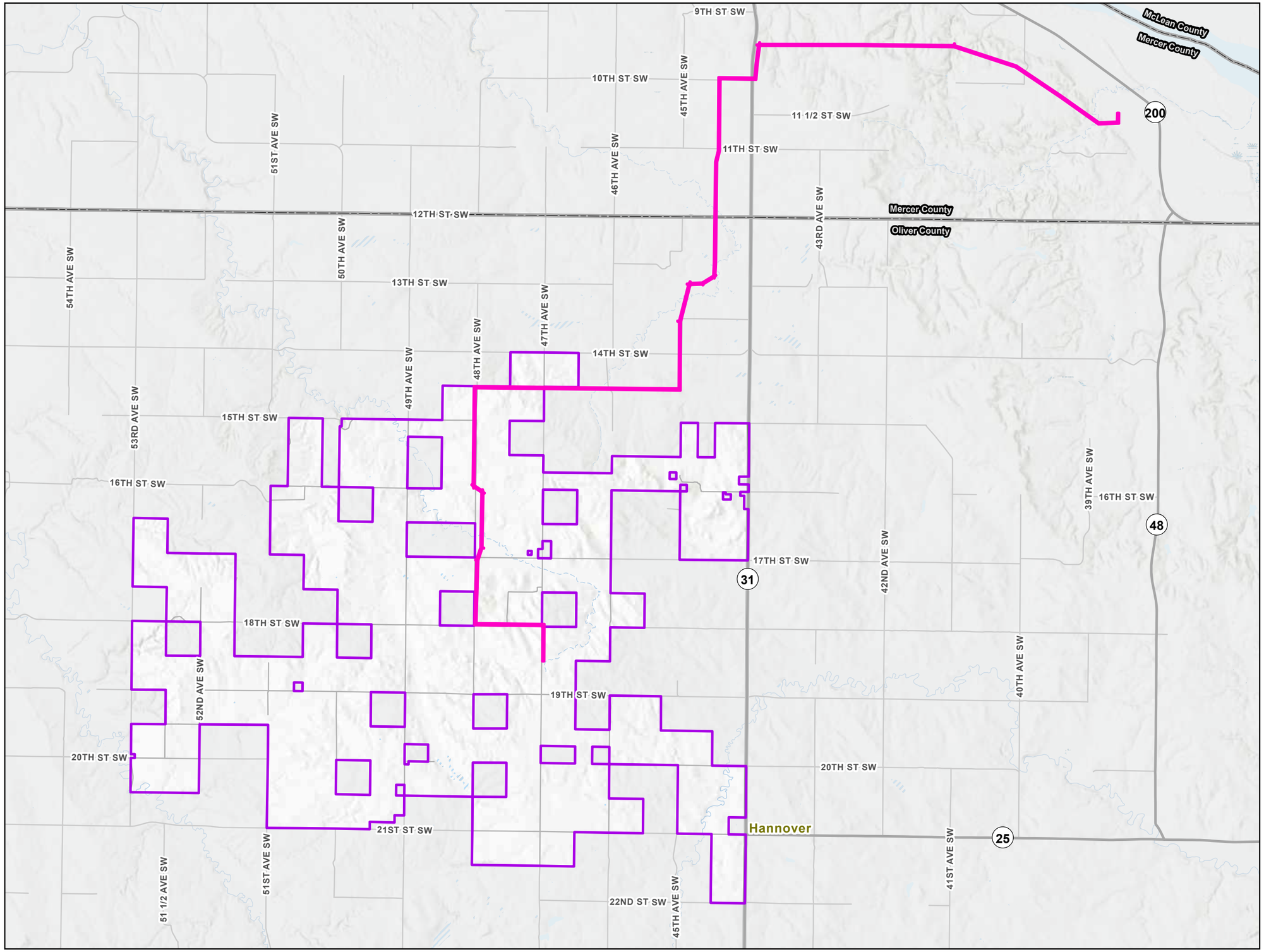
Contractor Will Bore All Wetlands And Roads



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Project Area

Proposed Transmission Line Corridor

County Boundary

Figure 4: Project Area and Project Transmission Line

Oliver Wind IV Energy Center

Oliver and Mercer Counties, North Dakota

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Contractor Will Bore All Wetlands And Roads

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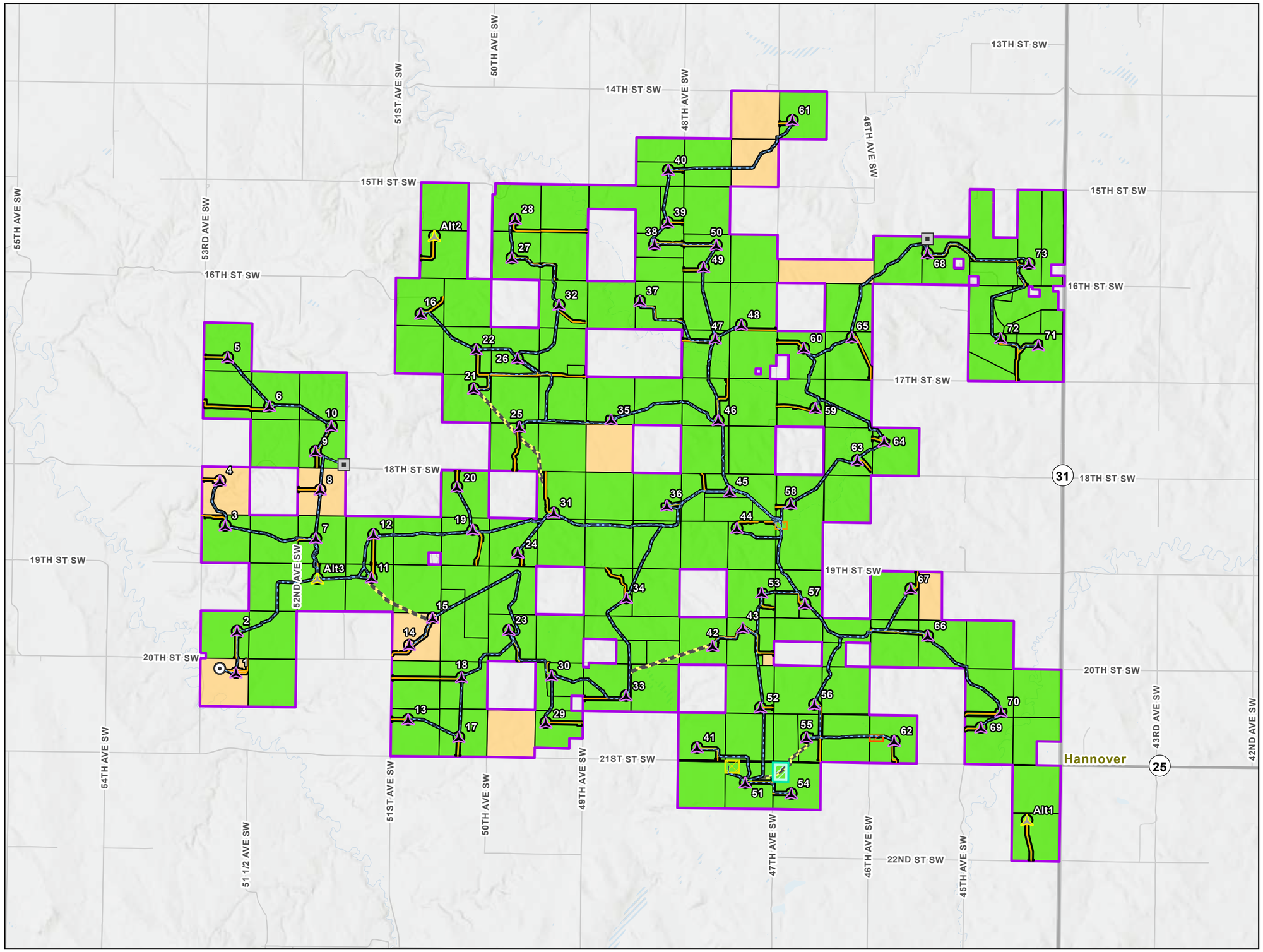

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N W E S

- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road
- Participating Landowner
- Landowner Participation Anticipated

Figure 5: Participating Landowners

Oliver Wind IV Energy Center

Oliver County, North Dakota

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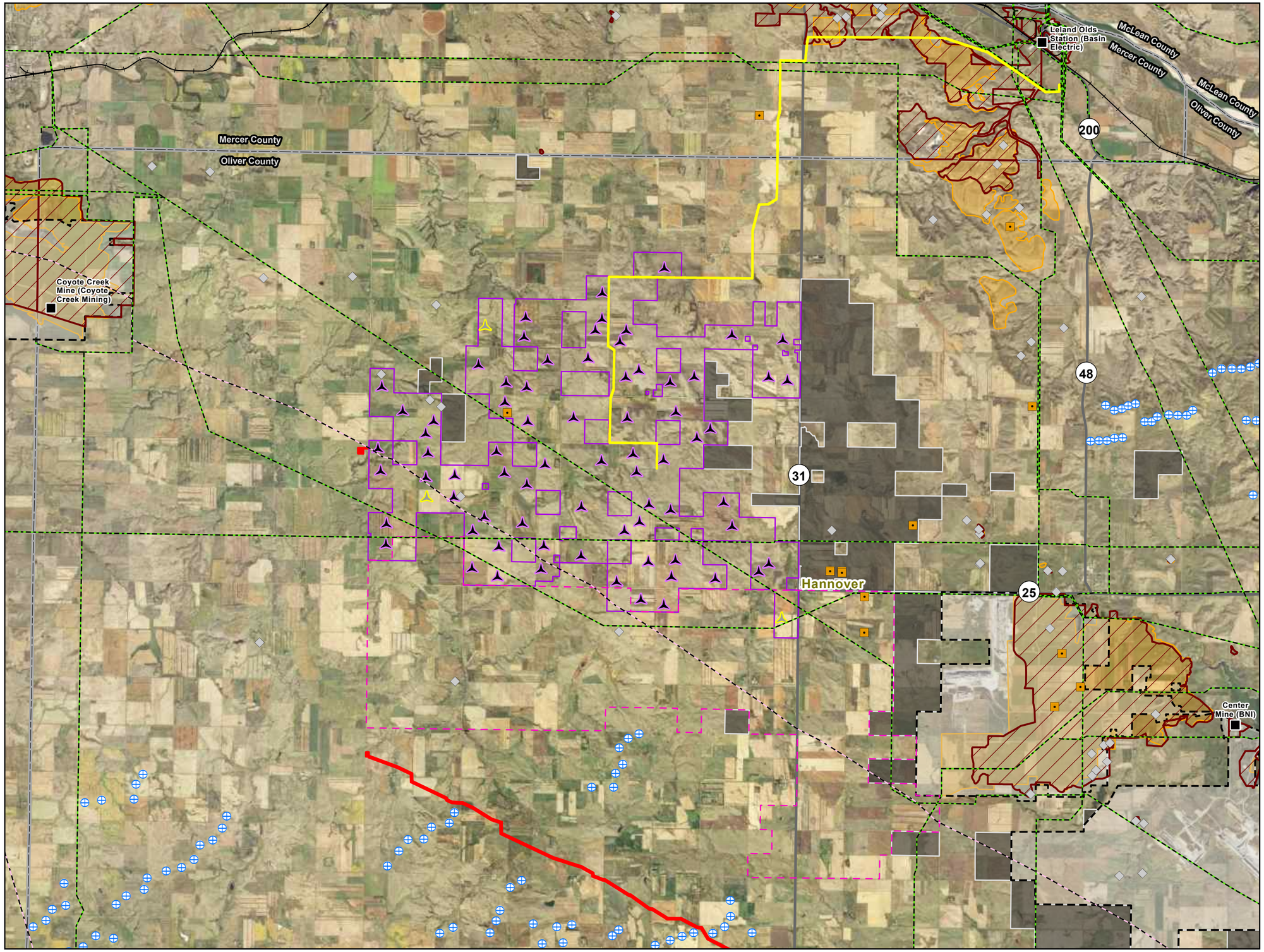
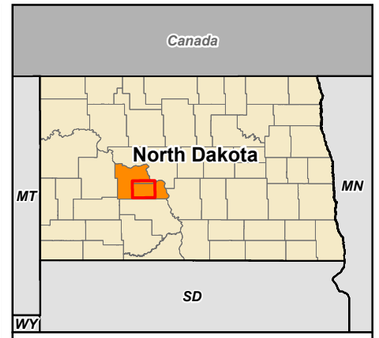
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads





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Existing Development
- Wind Turbine
- Energy Facility
- Exploration Well
- Abandoned Mine
- Transmission Line
- Oil & Gas Pipeline
- Railroad
- Coal Mine Permit Boundary
- Coal Lease*
- Previously Mined Land (NDGS 2007)
- Previously Mined Land (USDA 2023)

*Only coal leases adjacent to the Project are displayed on the map

Proposed Development
- Oliver Wind IV Primary Turbine
- Oliver Wind IV Alternative Turbine
- Oliver Wind IV Transmission Line
- Oliver Wind IV Project Area
- Red Butte Study Area
- Proposed Carbon Caputure Infrastructure

Figure 6:
Present and Future Natural Resources Development
Oliver Wind IV Energy Center
Oliver County, North Dakota

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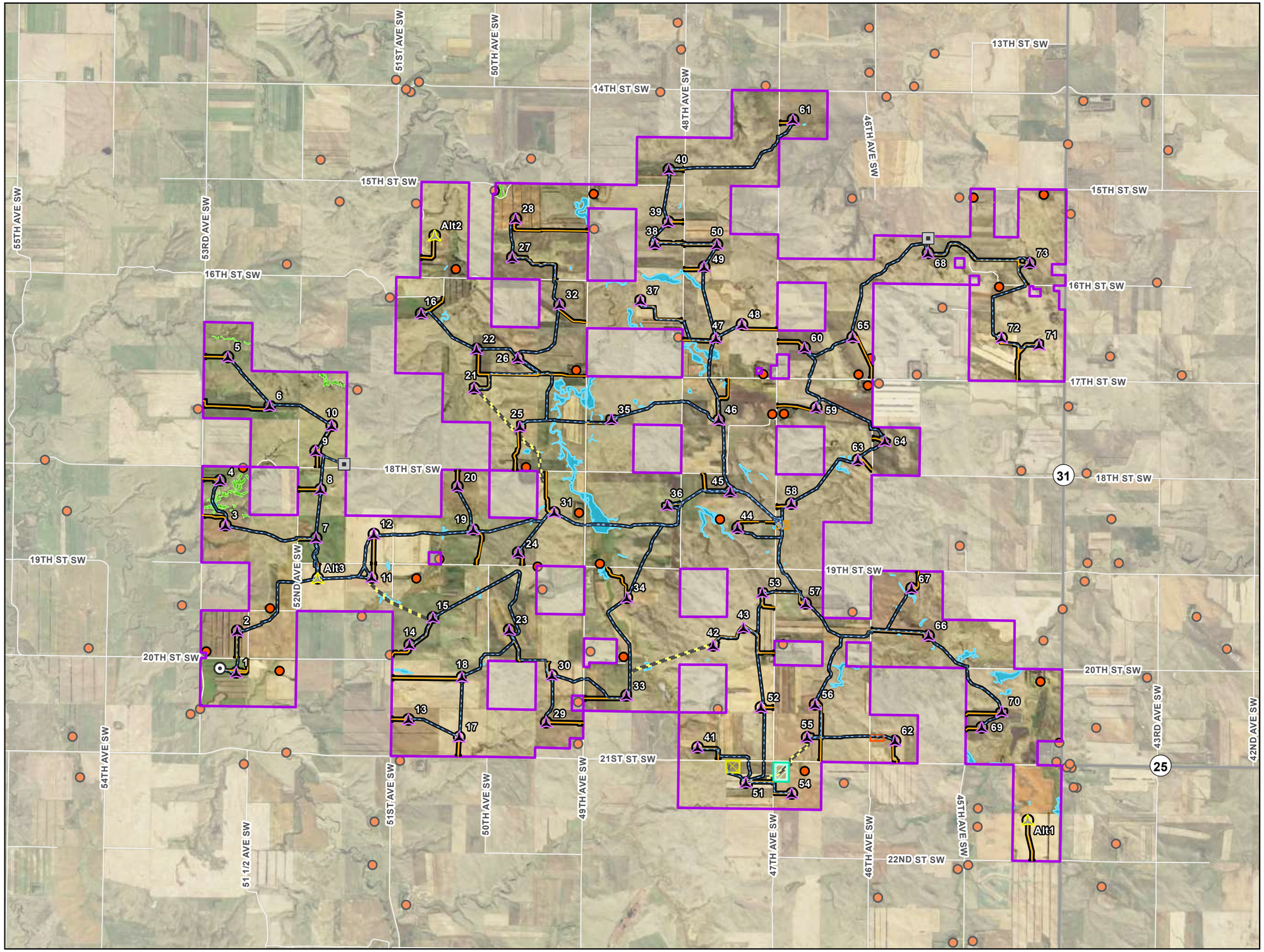
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Source: ArcGIS Online; Red Butte Study Area; Oliver Wind IV Project Area; Proposed Carbon Caputure Infrastructure
Date: (8/1/2025)
Z:\Clients\NextEra\Projects\Oliver_Wind_IV\Mapping\GIS_App\OliverWind_DIV_Wind_Proj_Application.aprx



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N
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S

- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

Avoidance Area*

- Historic Resource
- Delineated Wetland and Other Water
- Woodland (Desktop Delineated)

*Known archaeological sites are not depicted due to confidentiality

Figure 7: Exclusion and Avoidance Areas

Oliver Wind IV Energy Center

Oliver County, North Dakota

Date: (4/15/2025) Source: K:\Clients\NA_Private\Enel_Green_Power\Oliver_OIV_Wind_PSC_Application.aprx

For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Figure 8

Wind Turbine Design Features

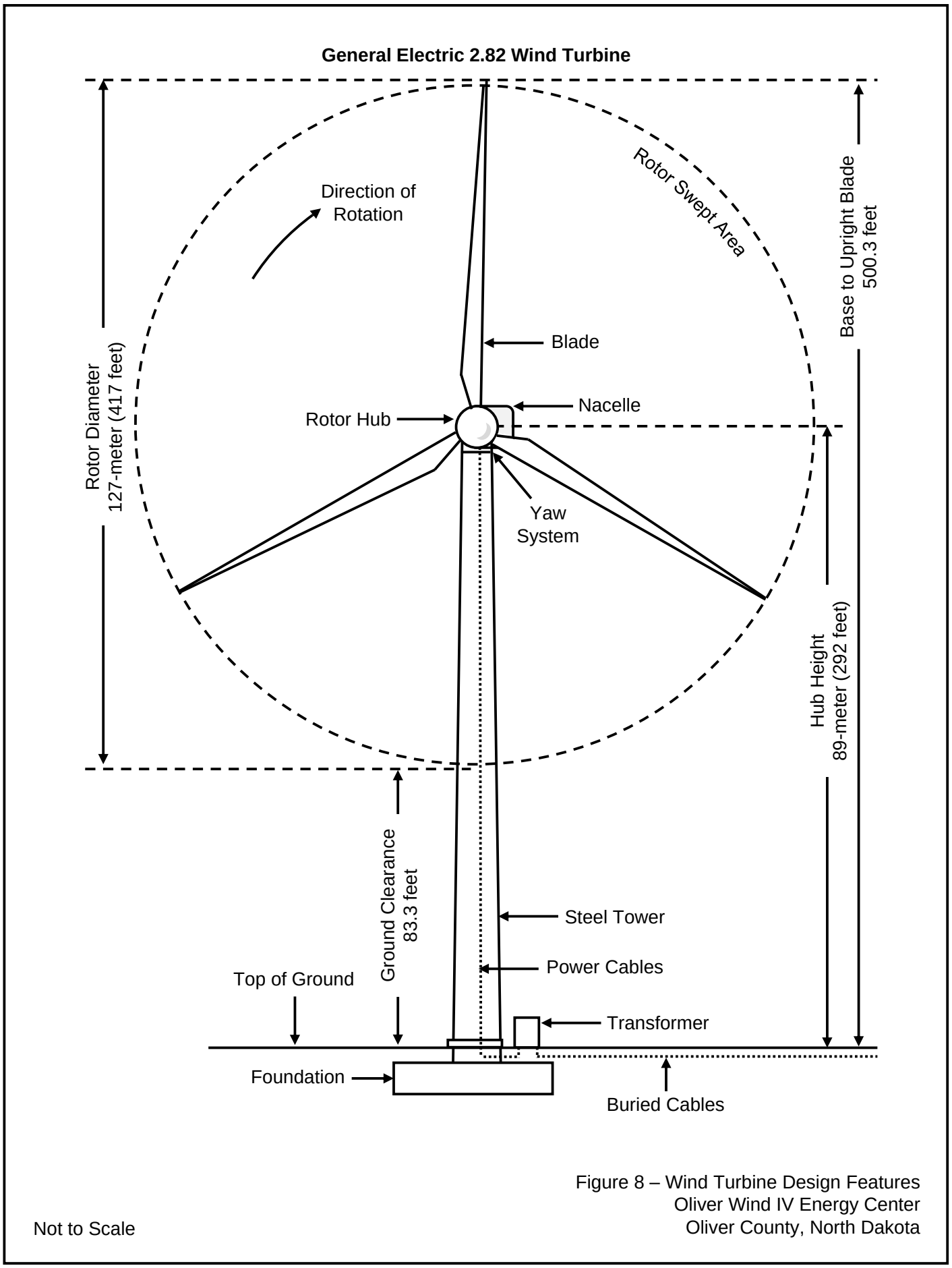


Figure 8 – Wind Turbine Design Features
Oliver Wind IV Energy Center
Oliver County, North Dakota

Not to Scale

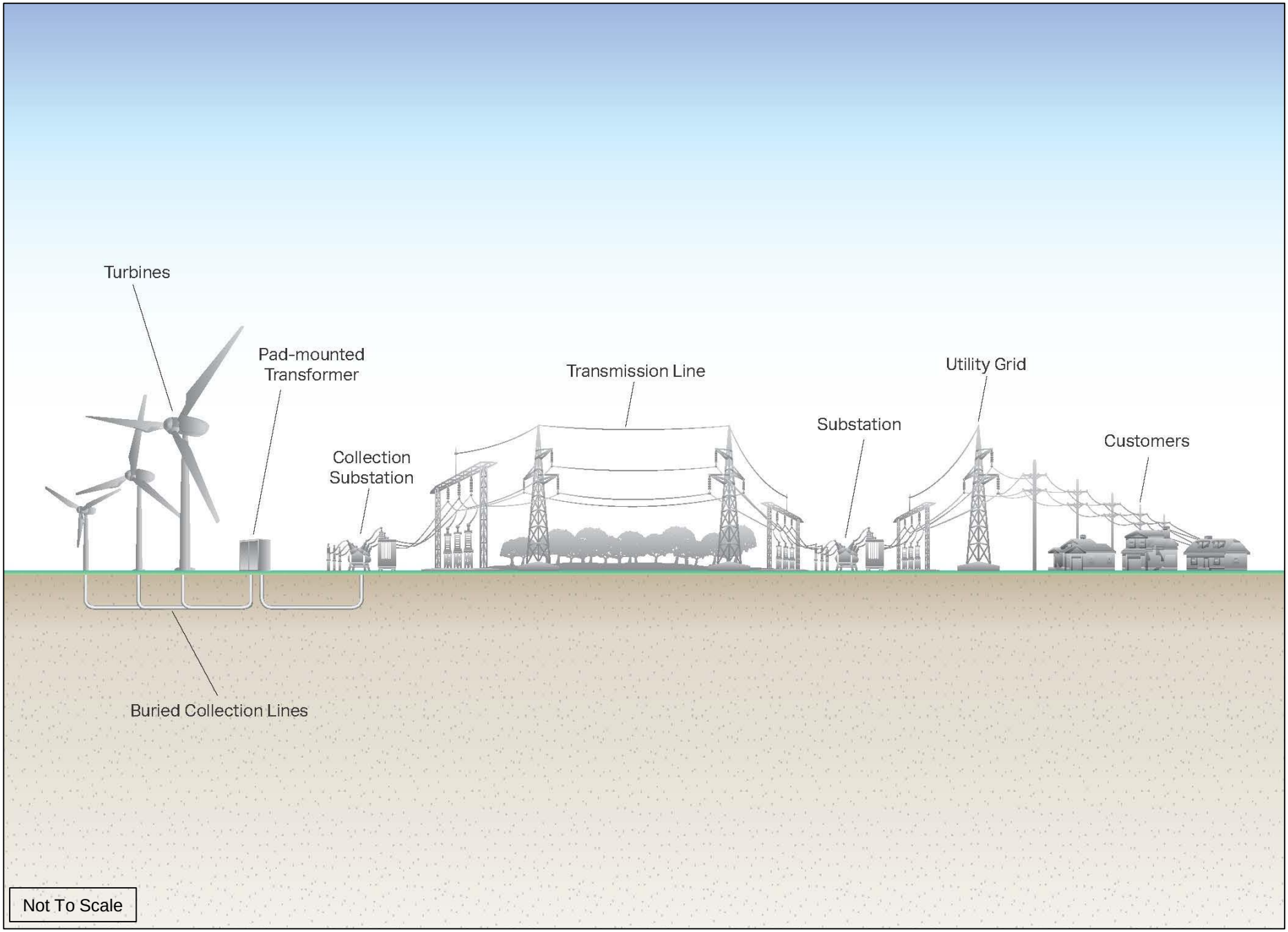


Figure 9
Path of Energy Diagram

Oliver Wind IV Energy Center
Oliver County, North Dakota

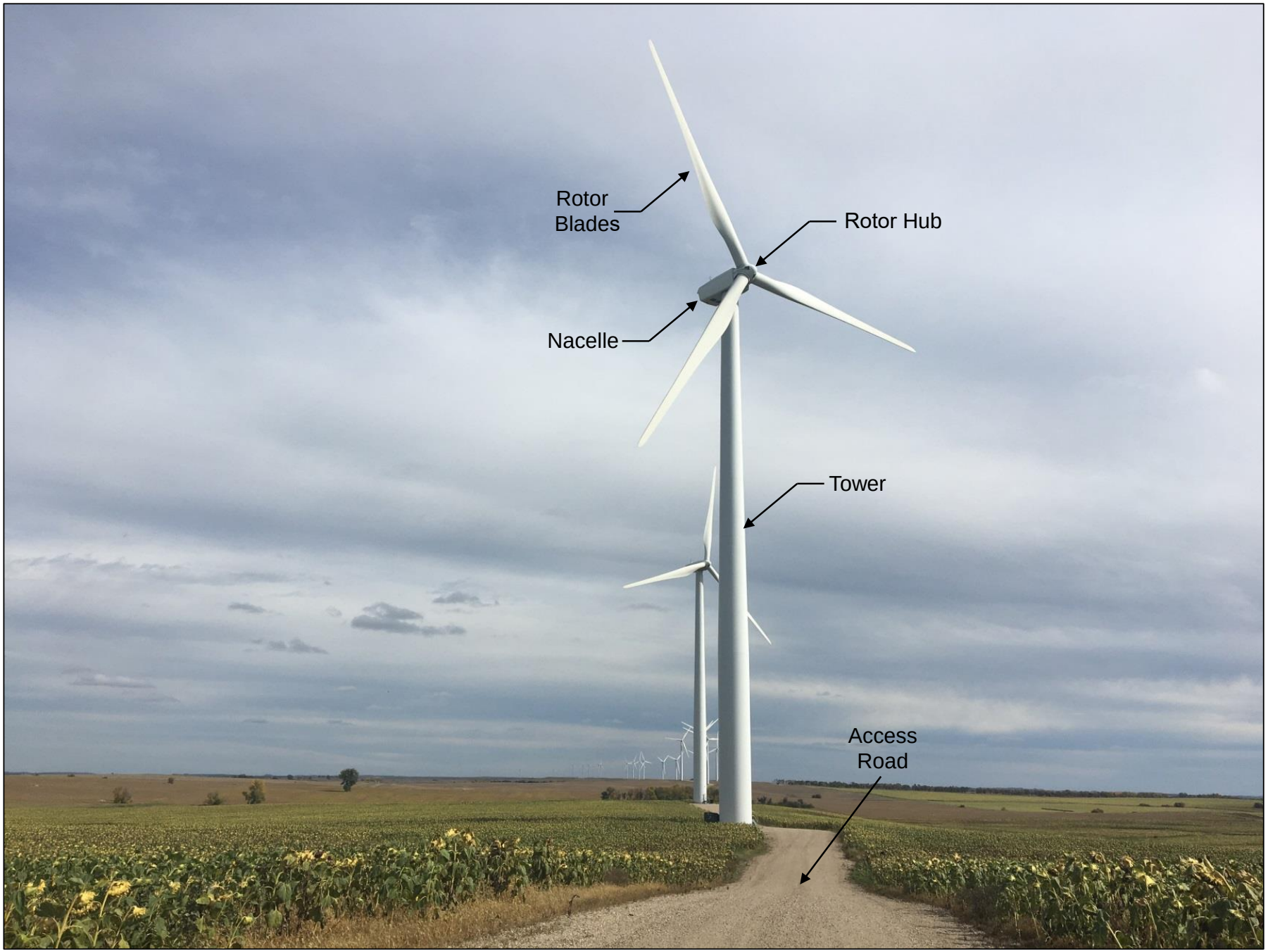
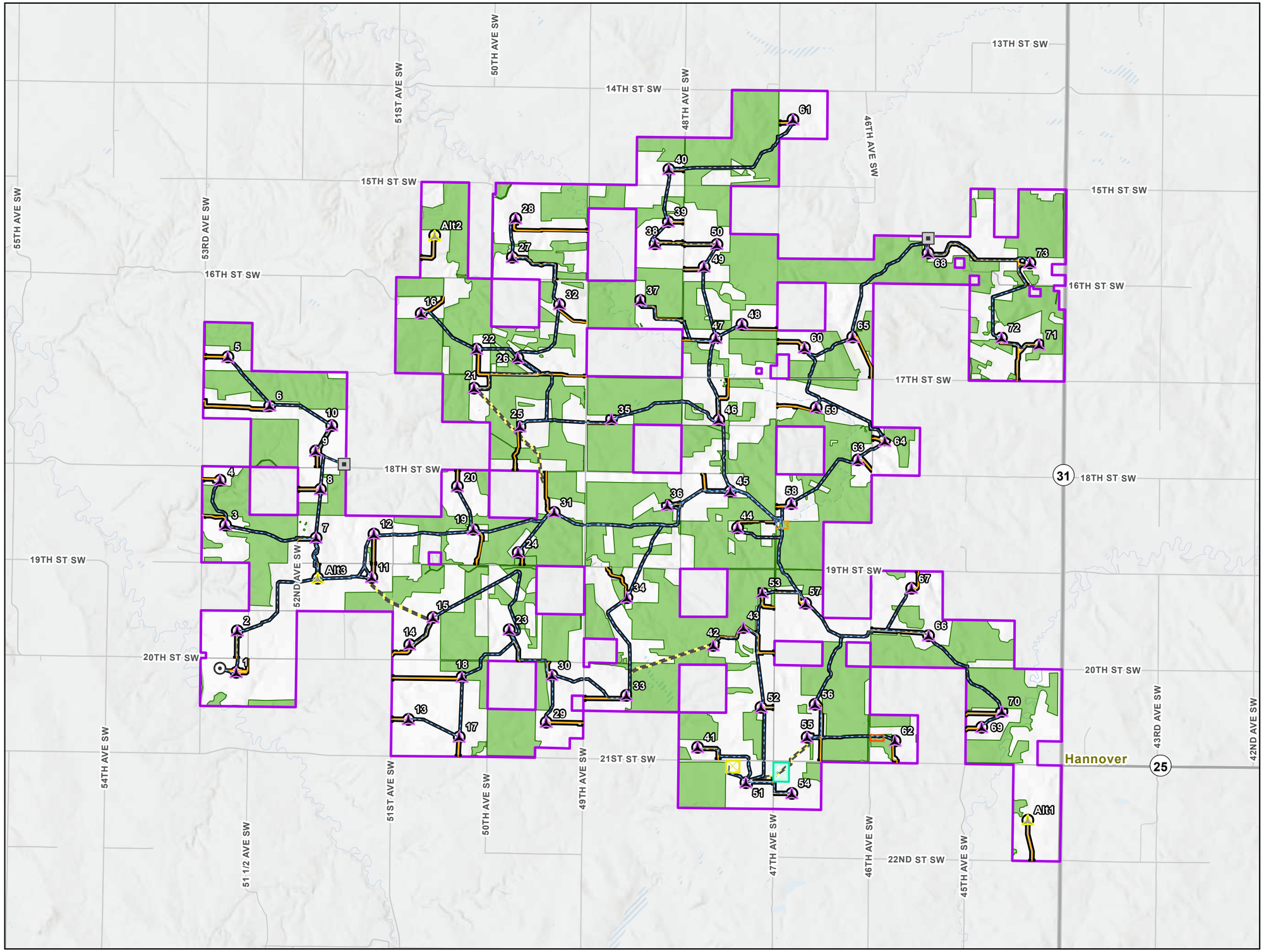


Figure 10
Typical Wind Energy Center Layout

Oliver Wind IV Energy Center
Oliver County, North Dakota



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N W E S

- Project Area
- Unbroken Grassland
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

Figure 11: Unbroken Grassland

Oliver Wind IV Energy Center

Oliver County, North Dakota

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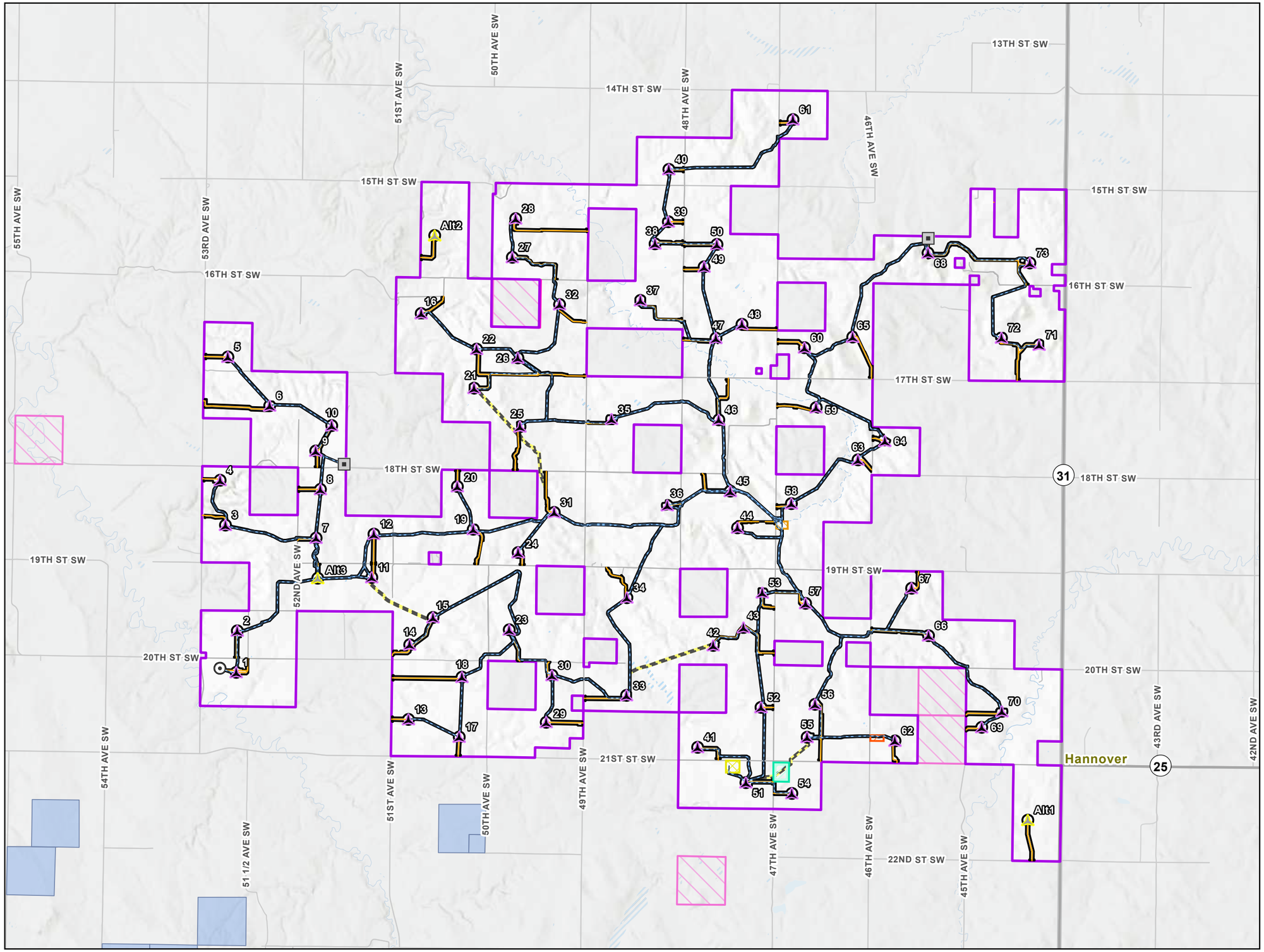
Contractor Will Bore All Wetlands And Roads

Date: (4/15/2025) Source: C:\Clients\1_Private\Enel_Green_Power\Projects\PSC_App\OMNI\Files_ONV_Wind_PSC_Application.aprx



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N W E S

- Project Area
- State Trust Land
- Private Land Open to Sportsmen Agreement
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

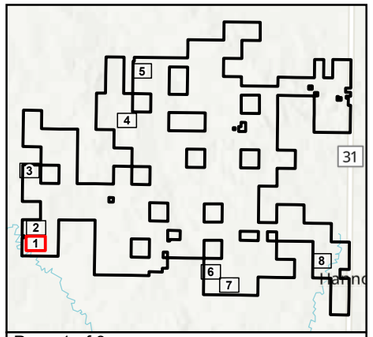
Figure 12: Public Lands, Easements, and Agreements

Oliver Wind IV Energy Center

Oliver County, North Dakota

Source: Z:\Clients\NextEra\Oliver_Wind\Permitting\PSC_App\GIS\MXDs\Fig_01_Wind_PSC_Application.aprx
Date: (9/15/2025)

For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads



Page 1 of 8

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- Project Area
- Construction Easement
- Primary Turbine
- MET Tower
- Collection Line
- Access Road

Figure 13:
Tree and Shrub Clearance Request
Oliver Wind IV Energy Center
Oliver County, North Dakota

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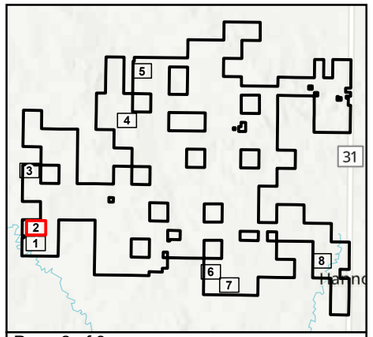
Contractor Will Bore All Wetlands And Roads

Date: (8/15/2025) Source: Z:\Clients\M_P\MidAmerican_Solar\ACOE\Permitting\PCN_App\GIS\Mxds\Fig_OIV_Wind_PCN_Application.mxd



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- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road

Figure 13:
Tree and Shrub Clearance Request
Oliver Wind IV Energy Center
Oliver County, North Dakota

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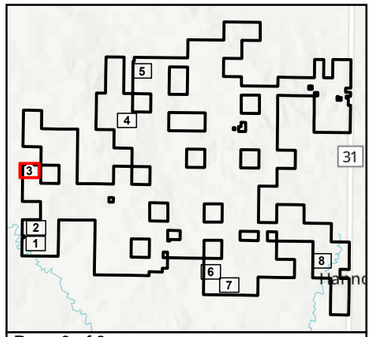
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Date: (9/10/2021) Source: Z:\Clients\MS_PN\Maps\Post_Construction\Permitting\PSC_App\OliverWindIV_Wind_PSC_Application.aprx



Page 3 of 8

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- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road

Figure 13:
Tree and Shrub Clearance Request
Oliver Wind IV Energy Center
Oliver County, North Dakota

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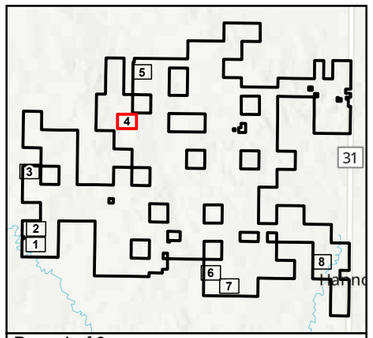
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Date: (8/15/2025) Source: Z:\Clients\M_P\NextEraRed_Butte\ArcGIS\Permitting\PSC_App\OLIVER\NextEra_OLIV_Wind_PSC_Application.aprx



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- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road

Figure 13:
Tree and Shrub Clearance Request
Oliver Wind IV Energy Center
Oliver County, North Dakota

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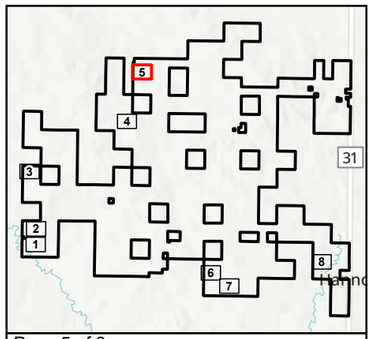
Contractor Will Bore All Wetlands And Roads

Date: (9/16/2021) Source: Z:\Clients\NJ_PN\Maps\Post_Submittal\SDR_Permitting\PSC_App\OliverNextEra_OIV_Wind_PSC_Application.aprx



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Project Area
Construction Easement
Primary Turbine
Collection Line
Access Road

Figure 13:
Tree and Shrub Clearance Request
Oliver Wind IV Energy Center
Oliver County, North Dakota

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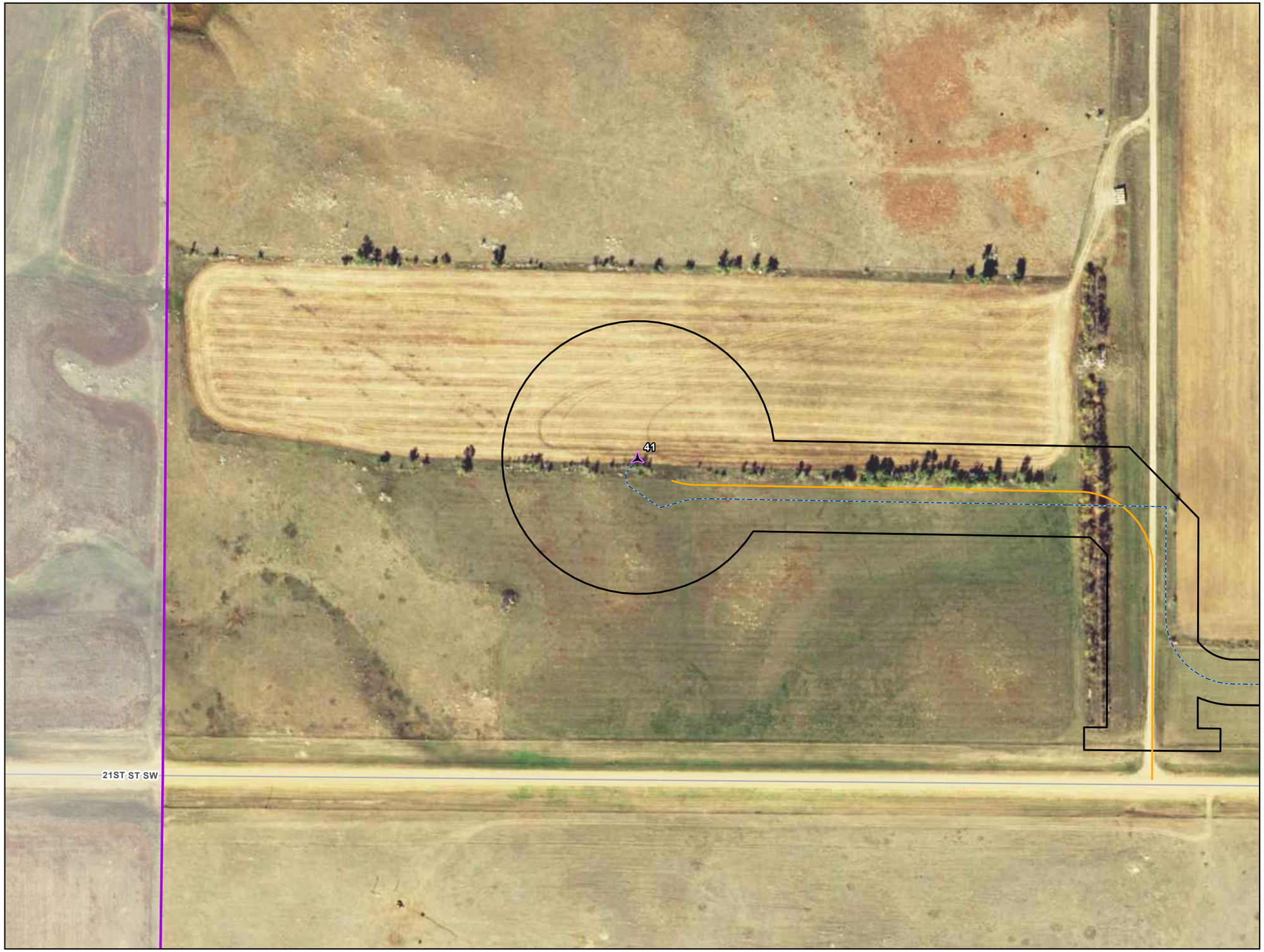
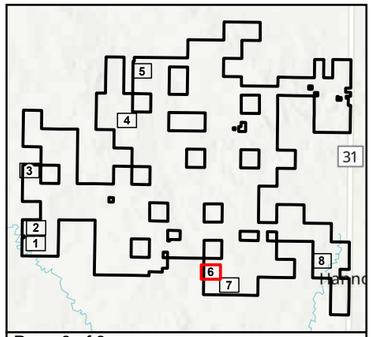
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Date: (9/15/2023) Source: J:\Clients\NJ_Private\Wind_Solar\ACEP\Permitting\PSC_App\OliverWind\GIS_PSC_Wind_PSC_Application.aprx





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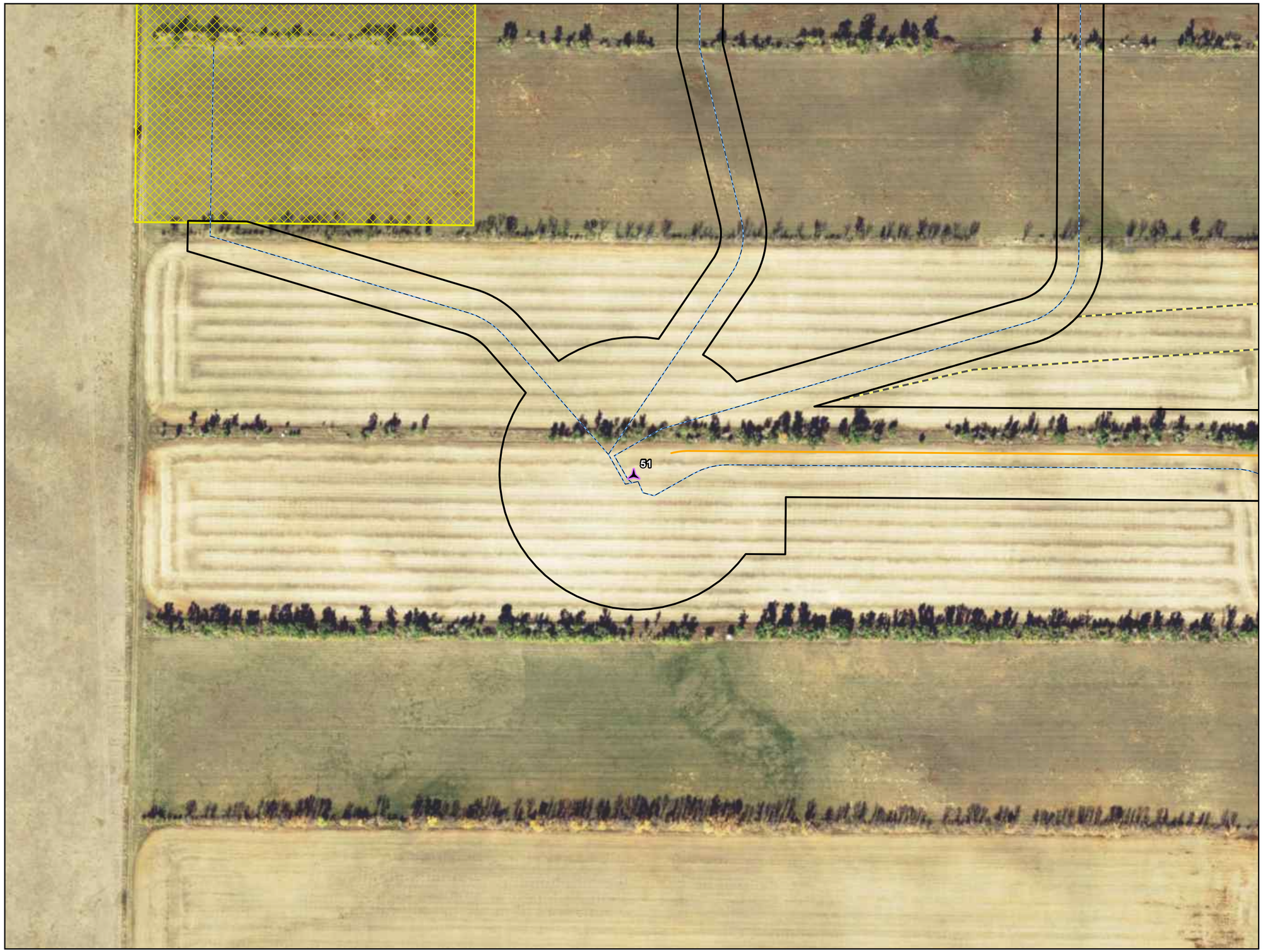
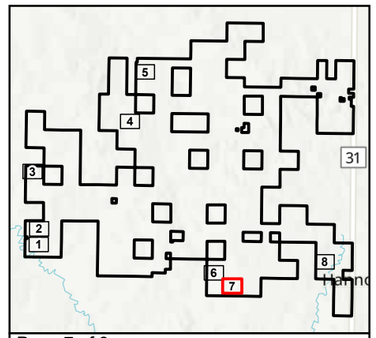
Project Area
Construction Easement
Primary Turbine
Collection Line
Access Road

Figure 13:
Tree and Shrub Clearance Request
Oliver Wind IV Energy Center
Oliver County, North Dakota

For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Date: (4/15/2025) Source: Z:\Clients\NJ_PNE\Projects_Data\GIS\Permitting\PSC_App\OliverWind_OIV_Wind_PSC_Application.aprx





Page 7 of 8

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N
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- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Primary Turbine
- Collection Line
- Access Road

Figure 13:
Tree and Shrub Clearance Request
Oliver Wind IV Energy Center
Oliver County, North Dakota

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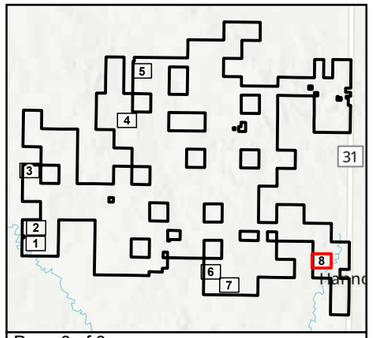
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Date: (9/5/2023) Source: Z:\Client\M_P\NextEra_Butler\GIS\Permitting\PSC_App\OliverIV\NextEra_OIV_Wind_PSC_Application.aprx



Page 8 of 8

0 100 200 Feet

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N
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- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road

Figure 13:
Tree and Shrub Clearance Request
Oliver Wind IV Energy Center
Oliver County, North Dakota

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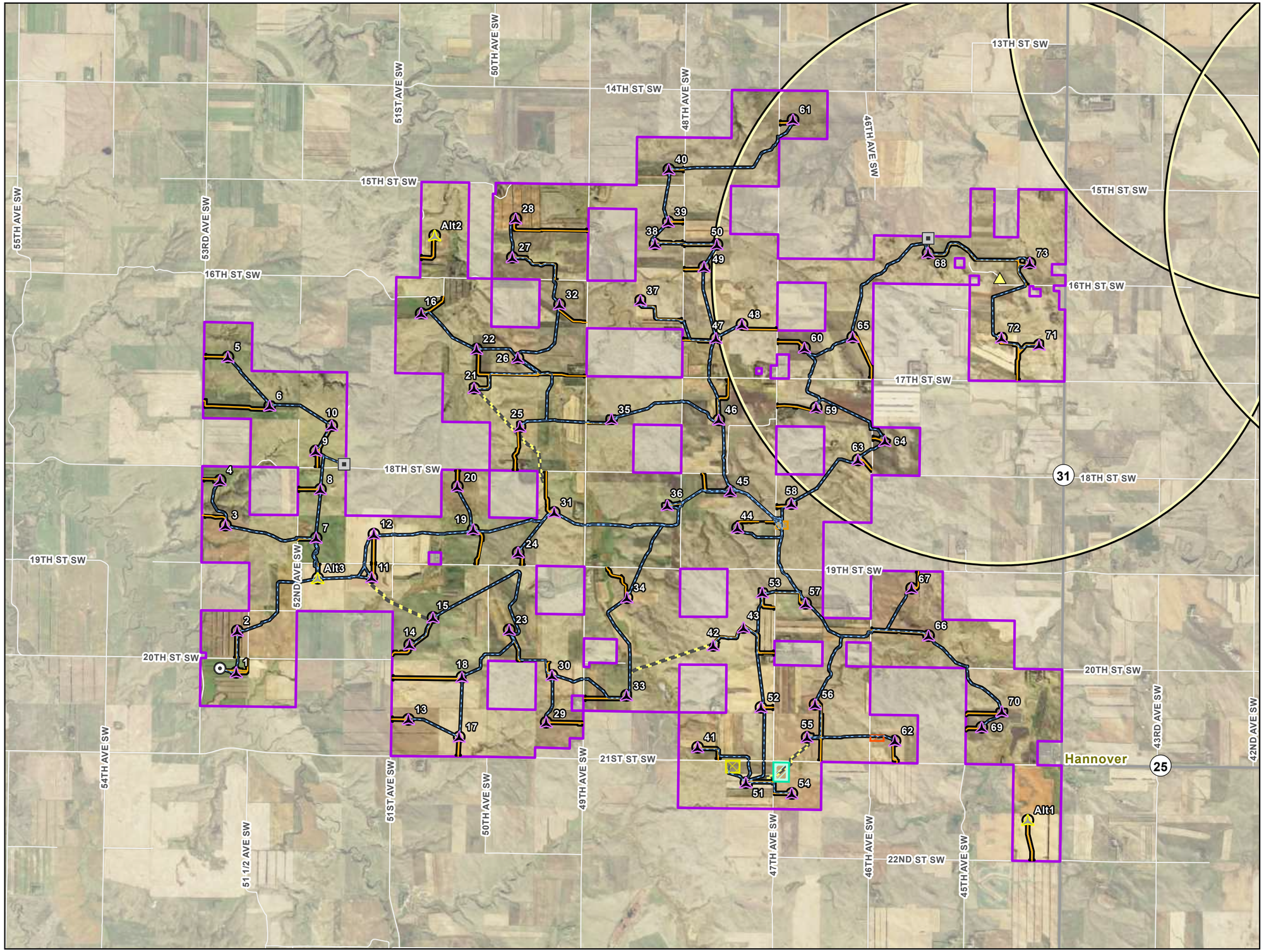
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Date: (01/02/2025) Source: Z:\Clients\M_P\Oliver Wind\Mapfiles\Buttonwood\Permitting\PSC_App\OLIVNextEra_OIV_Wind_PSC_Application.aprx



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N
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- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road
- NLEB Positive Location
- NLEB Conservation Buffer (3 mi)

Figure 14: Northern Long-Eared Bat Conservation Buffer and Tree Removal

Oliver Wind IV Energy Center
Oliver County, North Dakota

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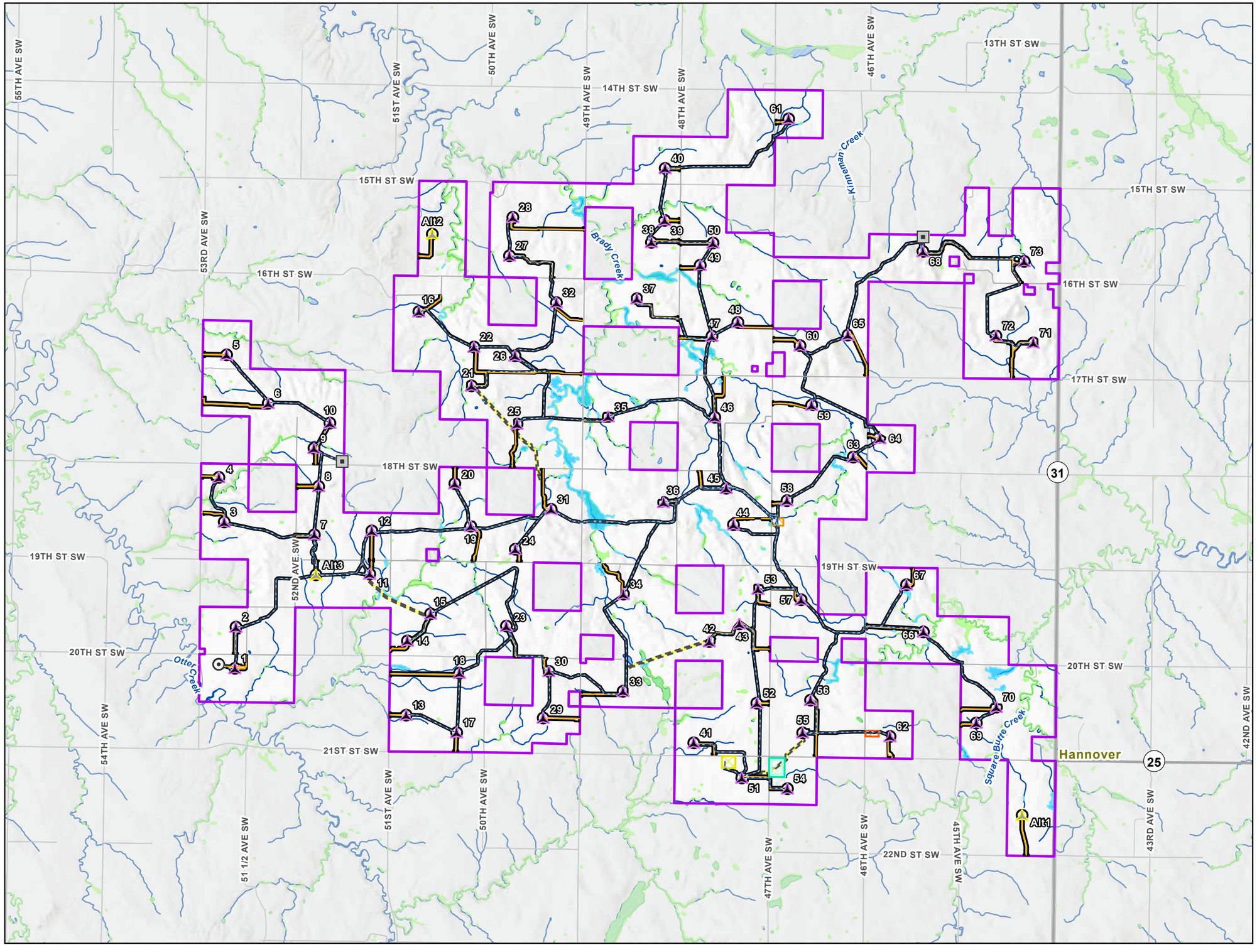
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Date: (9/15/2023) Source: Z:\Clients\NextEra_Energy_Resources\Projects\Oliver_Wind_IV\GIS\Maps\PSC_Application.aprx



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N
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- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road
- NHD Waterway
- NHD Waterbody
- NWI Wetland
- Delineated Wetland and Other Water

Figure 15: Surface Water and National Wetlands Inventory

Oliver Wind IV Energy Center
Oliver County, North Dakota

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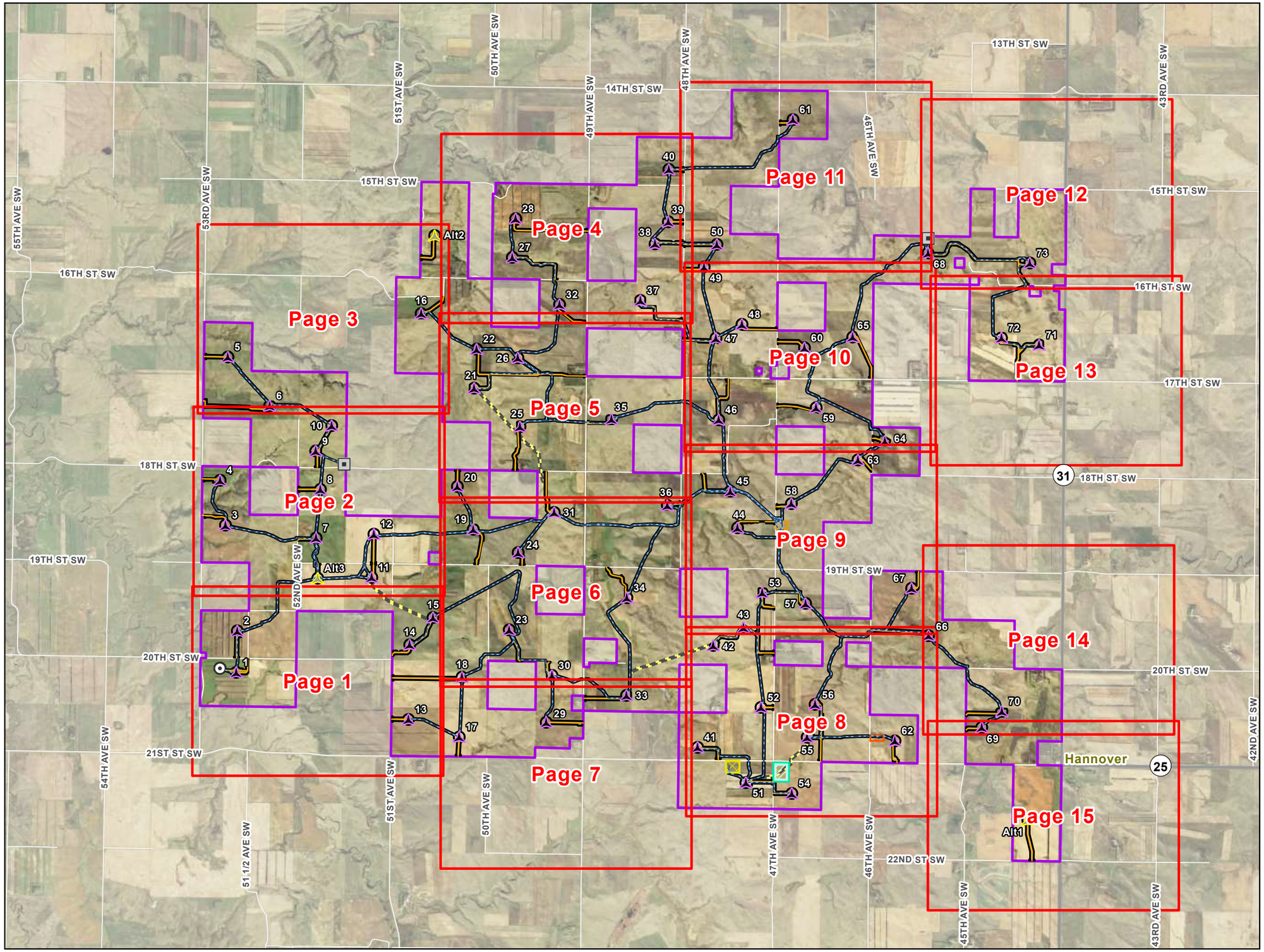
For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads

Date: (4/1/2022) Source: Z:\Current_Projects\Oliver\GIS\Permitting\PSC_App\DWM\Fig_OW_Wind_PSC_Application.aprx



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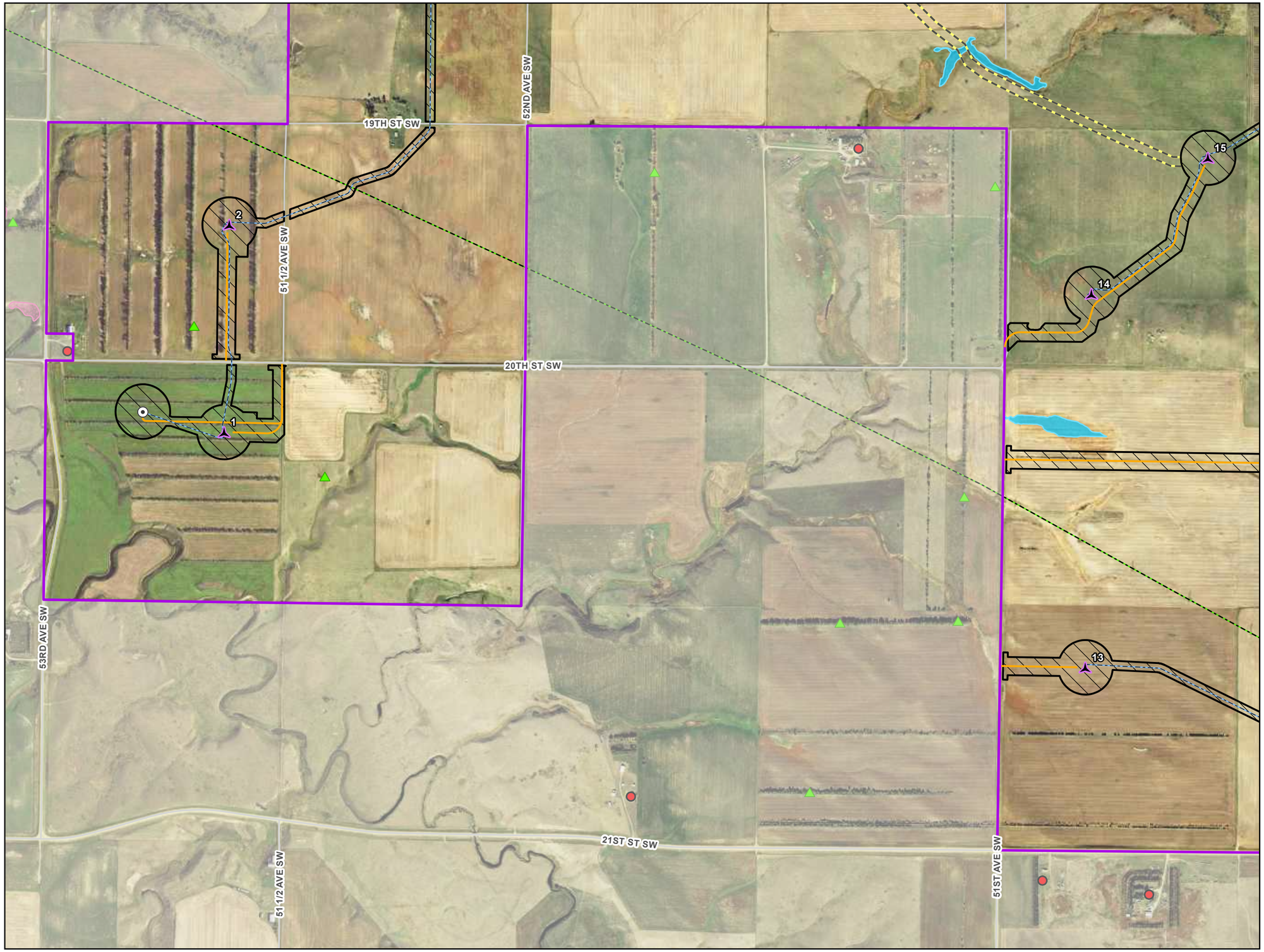
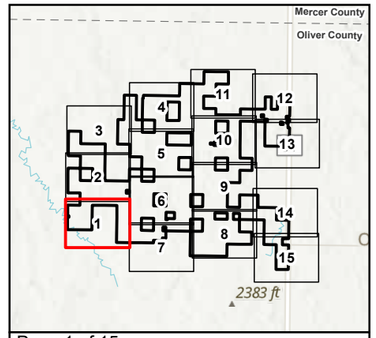
- Project Area
- Map Series Page Extent
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

Figure 16:
Site Plan Detail Index Map
Oliver Wind IV Energy Center
Oliver County, North Dakota

Source: ArcGIS_Project\Exhibit_Builder\ArcGIS Permitting\PSC_App\OMWestern_OIV_Wind_PSC_Application.aprx
Date: (9/15/2023)

For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads





Page 1 of 15

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N W E S

Site Plan

- Project Area
- Construction Easement
- Crane Path
- Primary Turbine
- MET Tower
- Collection Line
- Access Road

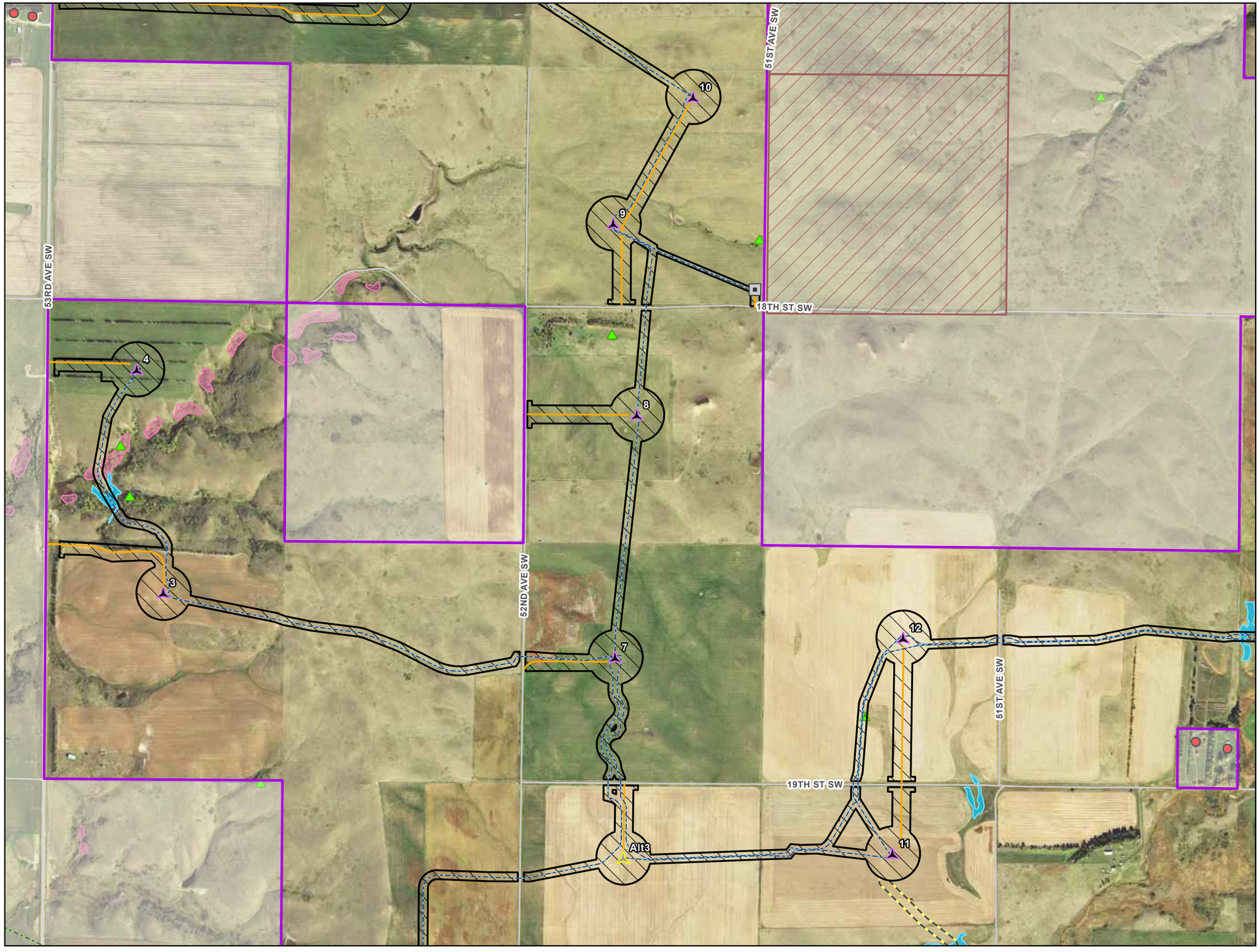
Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

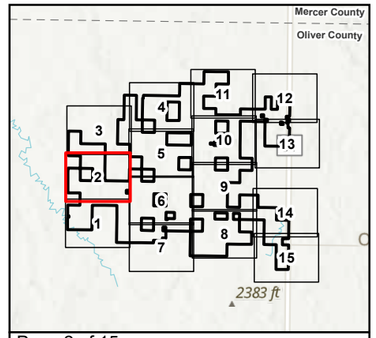
- Occupied Residence
- Raptor Nest
- Delineated Wetland and Other Water
- Landslide Deposit
- Transmission Line
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

For Environmental Review Purposes Only

Date: (9/18/2025) Source: Z:\Clients\Enel_North_America\Oliver_Wind_IV\GIS\Permitting\PSC_App\OliverWind_PSC_Application.aprx





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Site Plan

- Project Area
- Construction Easement
- Crane Path
- Primary Turbine
- Alternative Turbine
- ADLS Radar Tower
- Collection Line
- Access Road

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Delineated Wetland and Other Water
- Coal Lease
- Landslide Deposit
- Transmission Line
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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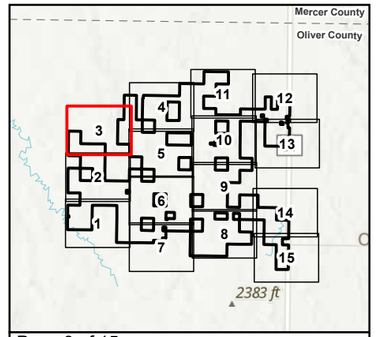
For Environmental Review Purposes Only

Date: (9/30/2021) Source: Z:\Clients\M_P\Noble\Oliver_Butler\GIS\Permitting\PSC_App\OWNextEra_OIV_Wind_PSC_Application.aprx



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Site Plan

- Project Area
- Construction Easement
- Primary Turbine
- Alternative Turbine
- Collection Line
- Access Road

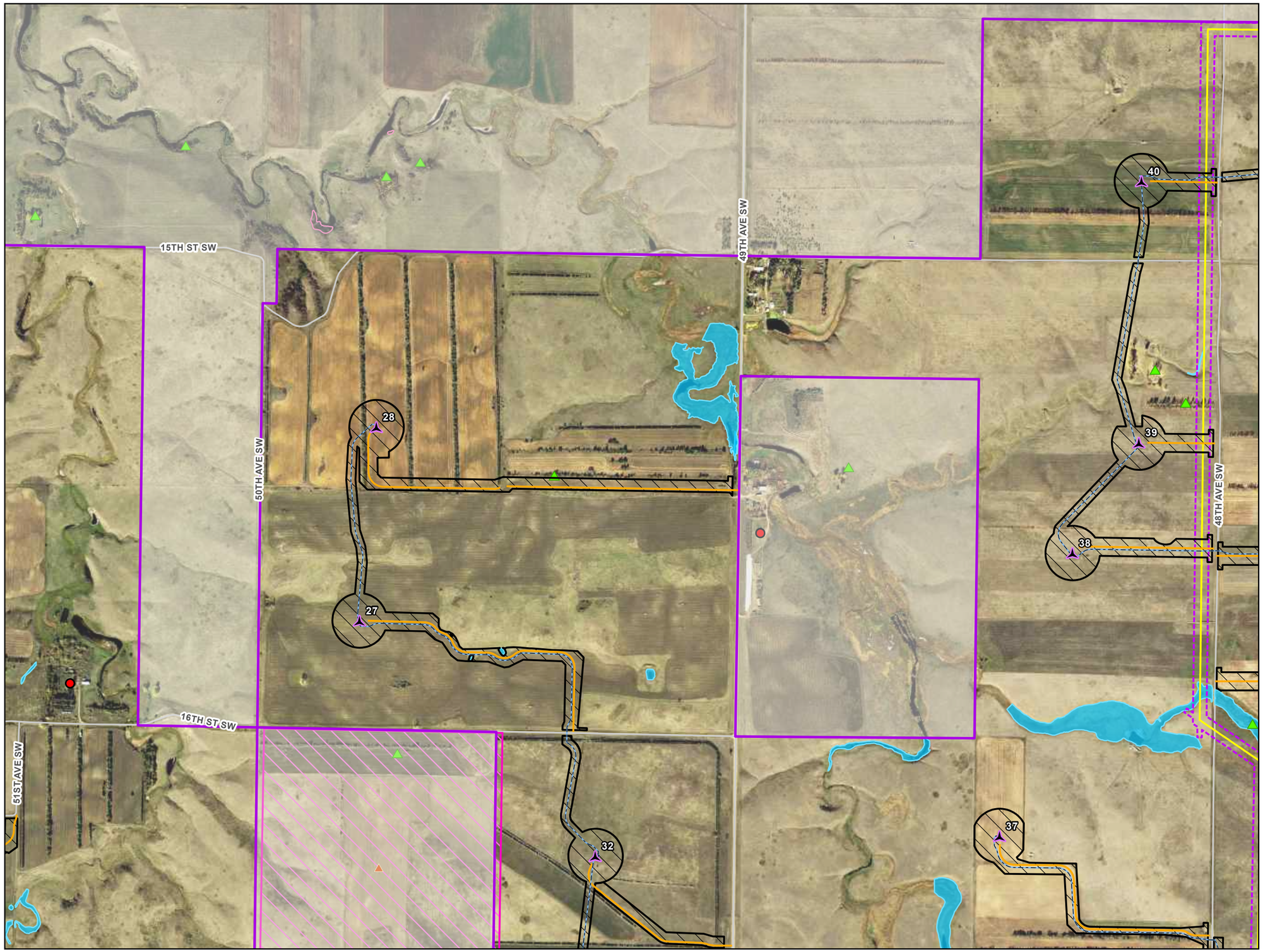
Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

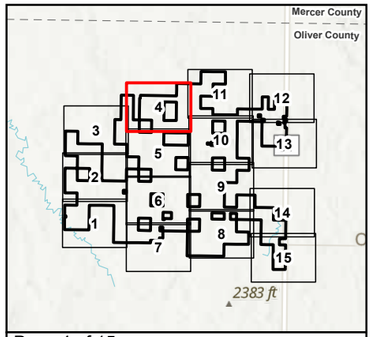
- Occupied Residence
- Raptor Nest
- Delineated Wetland and Other Water
- Coal Lease
- Landslide Deposit
- Transmission Line
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

For Environmental Review Purposes Only

Date: (9/18/2025) Source: Z:\Clients\M_P\Nextera\Oliver Wind IV\GIS\Permitting\PSC_App\OliverWindIV_PSC_Application.aprx





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Site Plan

- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road
- Transmission Line Route
- Transmission Line Corridor

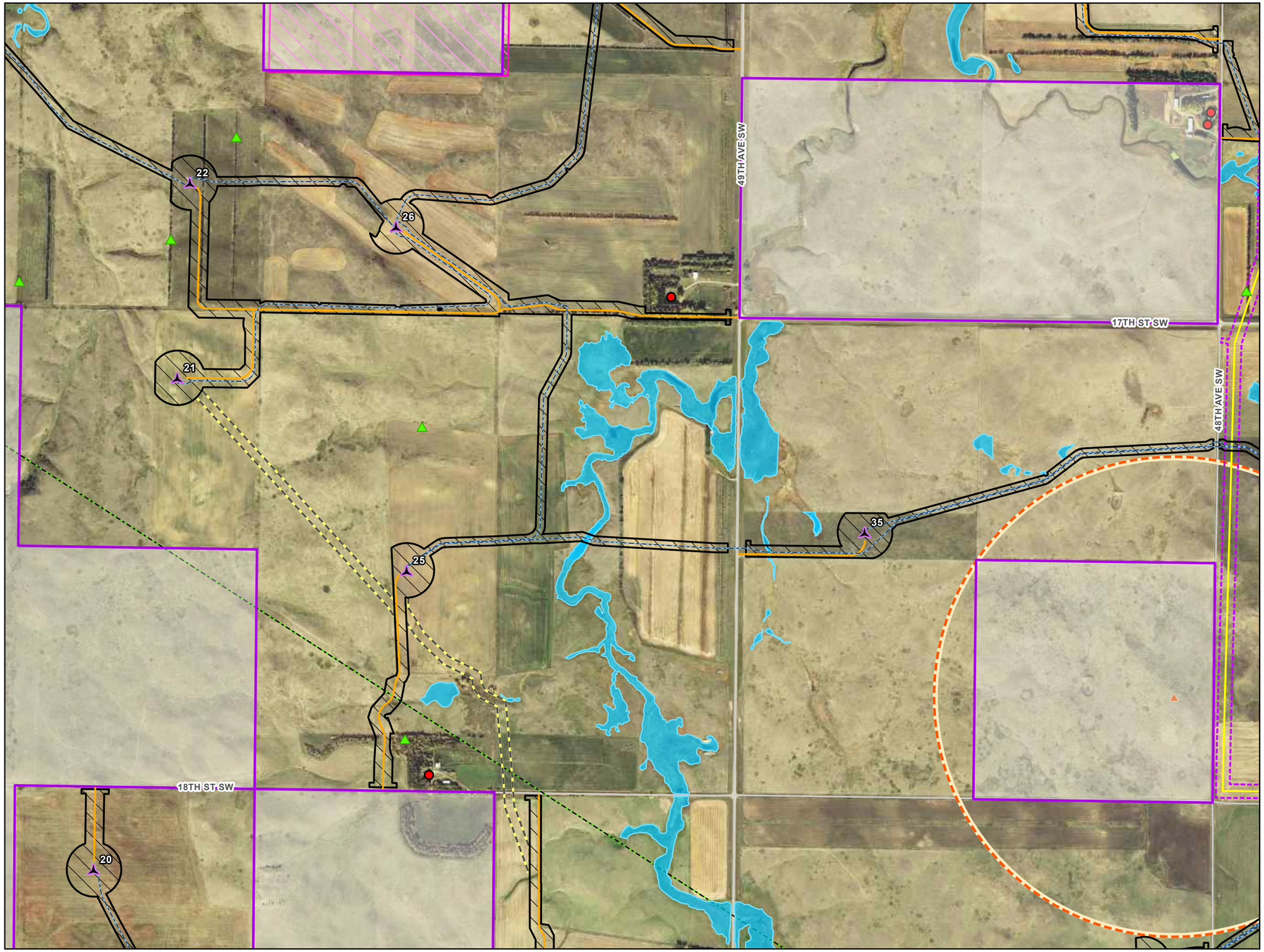
Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

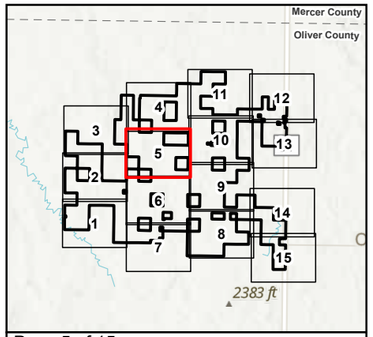
- Occupied Residence
- Raptor Nest
- Confirmed Sharp-tailed Grouse Lek
- Delineated Wetland and Other Water
- State Trust Land
- Landslide Deposit
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

Date: (8/18/2025) Source: Z:\Clients\M_P\Nextera\Red_Butte\ArcGIS\Planning\PSC_App\OIV Nextera_OIV_Wind_PSC_Application.aprx

For Environmental Review Purposes Only





Page 5 of 15

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Site Plan

- Project Area
- Construction Easement
- Crane Path
- Primary Turbine
- Collection Line
- Access Road
- Transmission Line Route
- Transmission Line Corridor

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Confirmed Sharp-tailed Grouse Lek
- Sharp-tailed Grouse Lek 0.5-mile Buffer
- Delineated Wetland and Other Water
- State Trust Land
- Transmission Line
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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For Environmental Review Purposes Only

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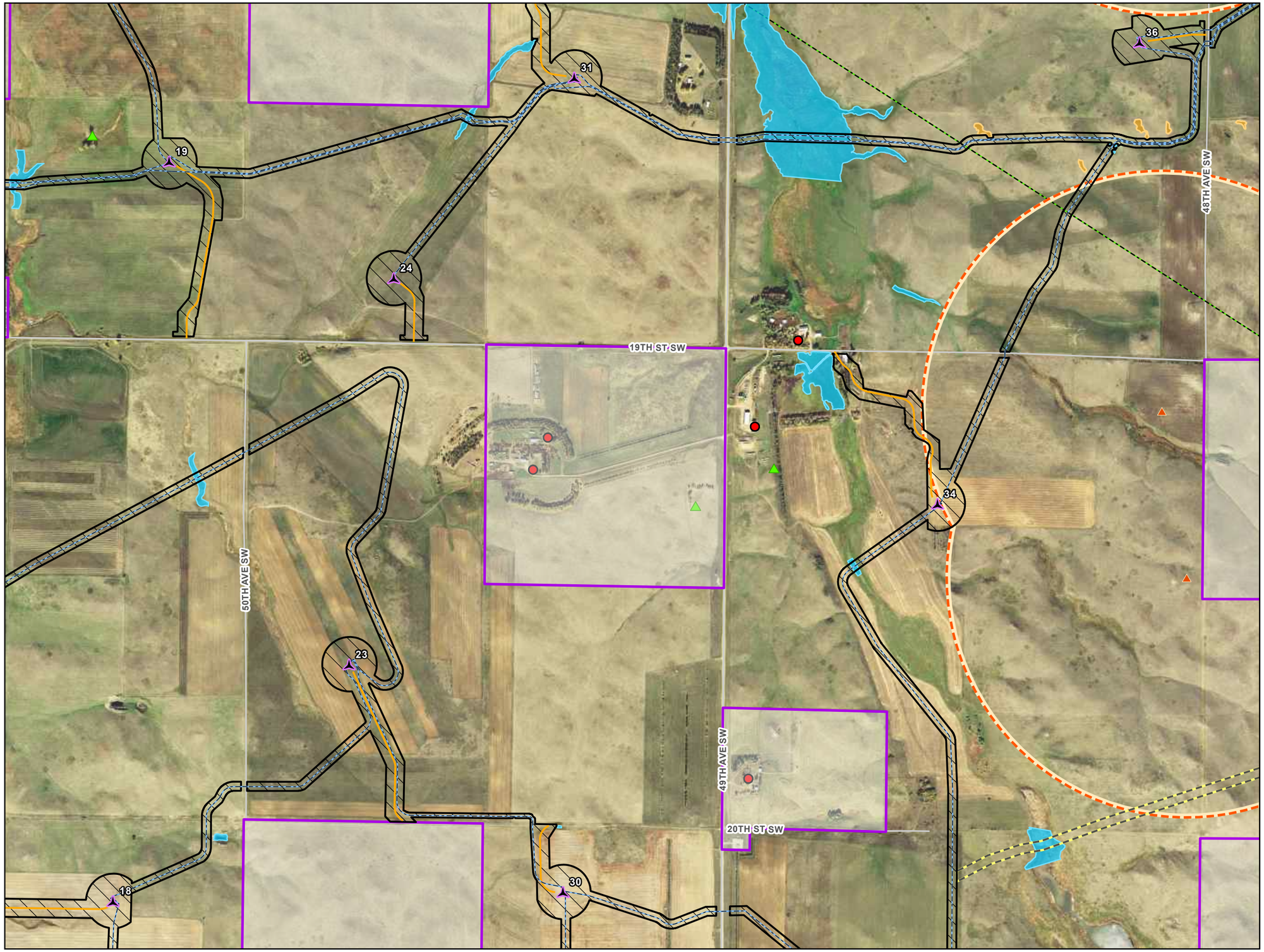

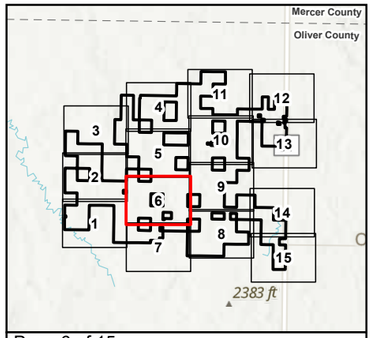

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Site Plan

- Project Area
- Construction Easement
- Crane Path
- Primary Turbine
- Collection Line
- Access Road

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Confirmed Sharp-tailed Grouse Lek
- Sharp-tailed Grouse Lek 0.5-mile Buffer
- Dakota Skipper Larvae Habitat
- Delineated Wetland and Other Water
- Transmission Line
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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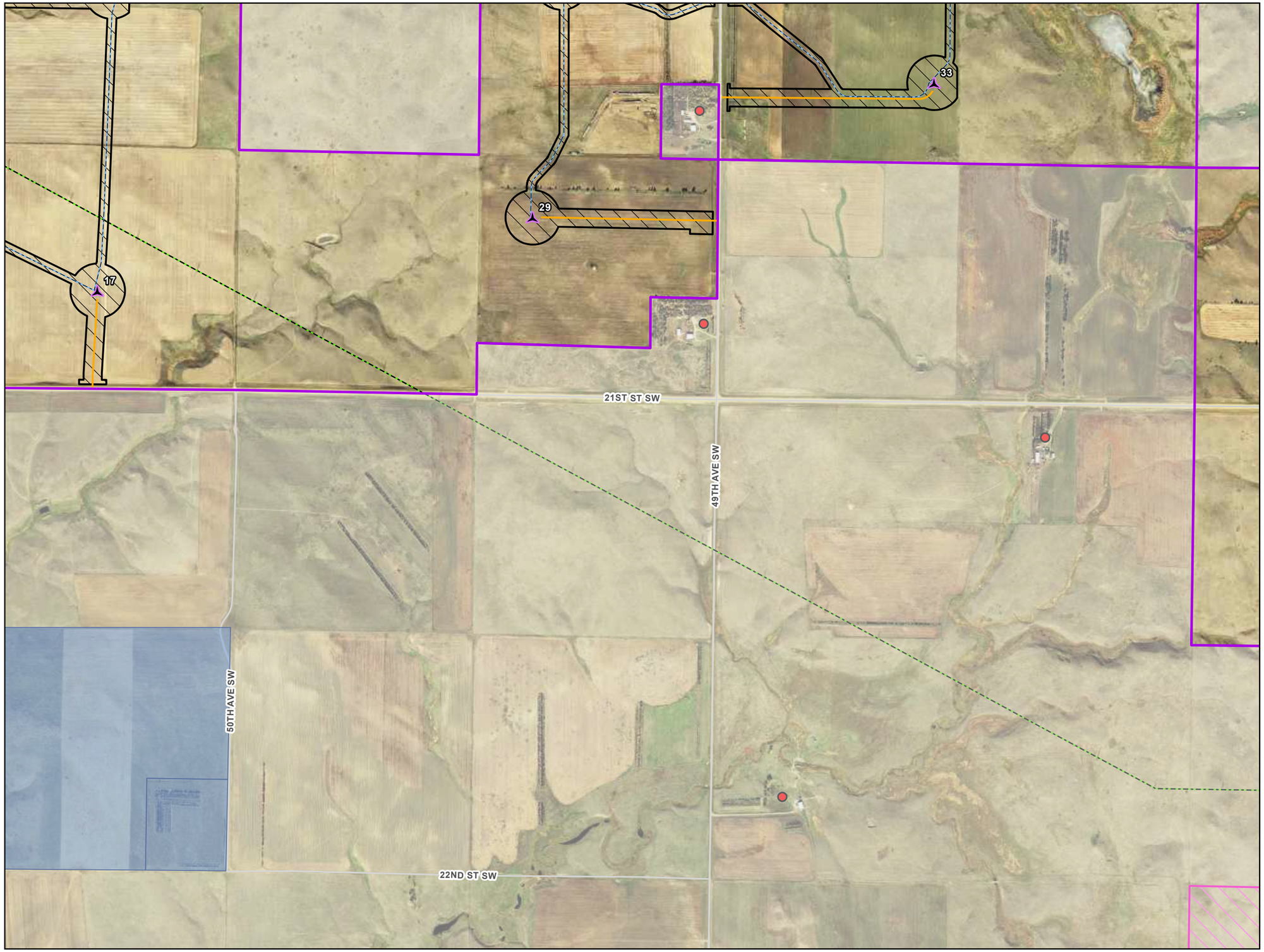

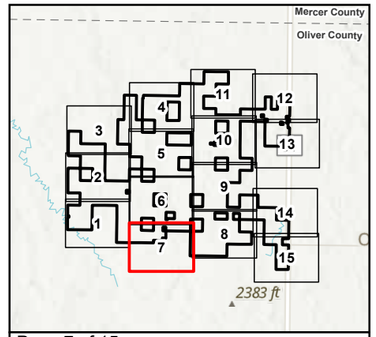

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Site Plan

- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- State Trust Land
- Private Land Open to Sportsmen Agreement
- Transmission Line
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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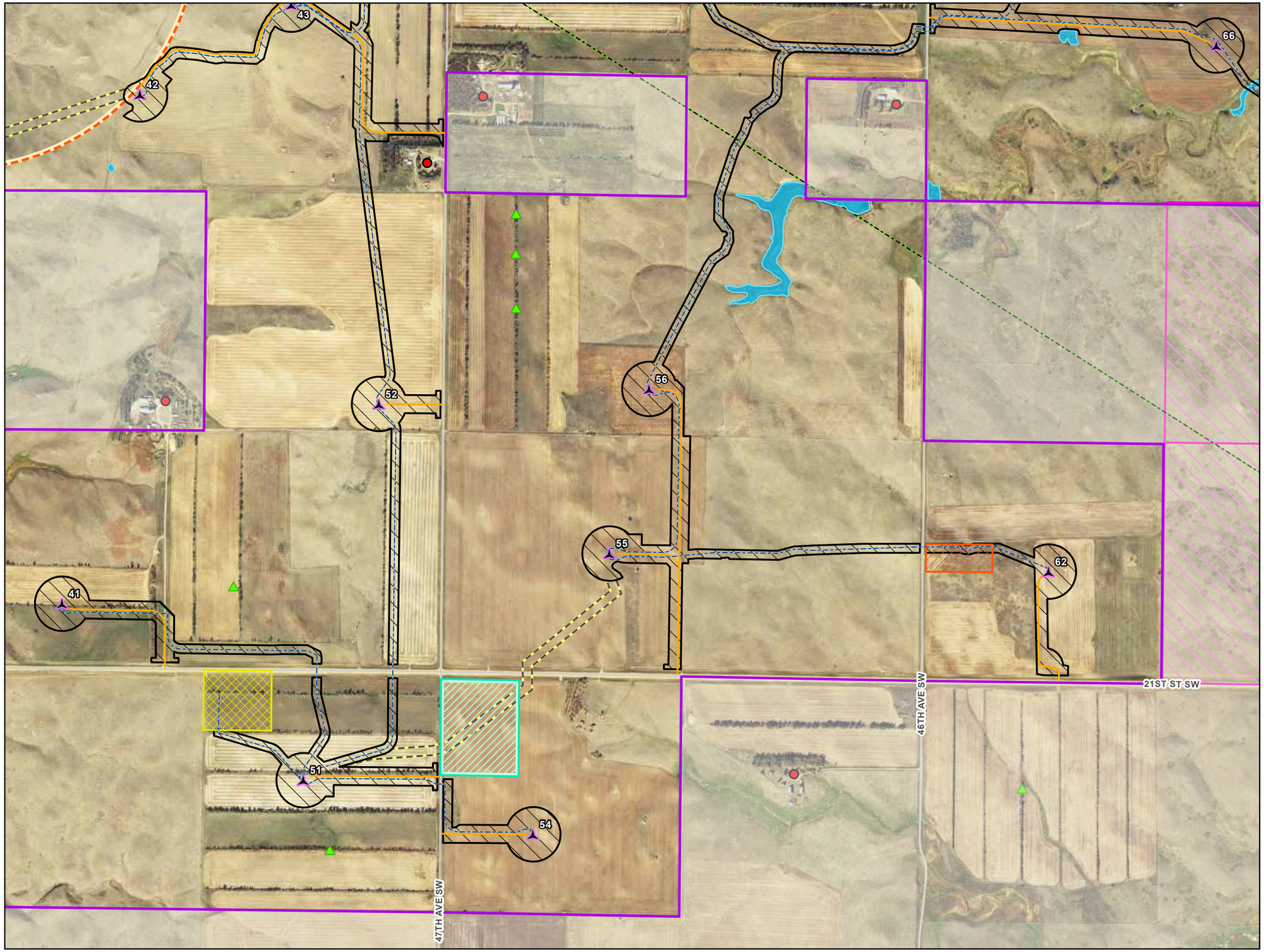

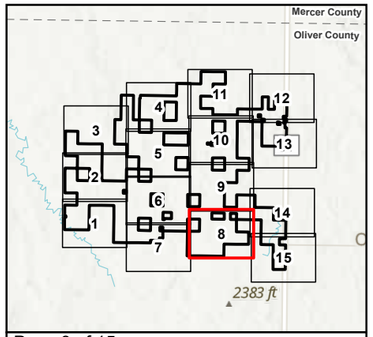

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Site Plan

- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Collection Line
- Access Road

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Sharp-tailed Grouse Lek 0.5-mile Buffer
- Delineated Wetland and Other Water
- State Trust Land
- Landslide Deposit
- Transmission Line
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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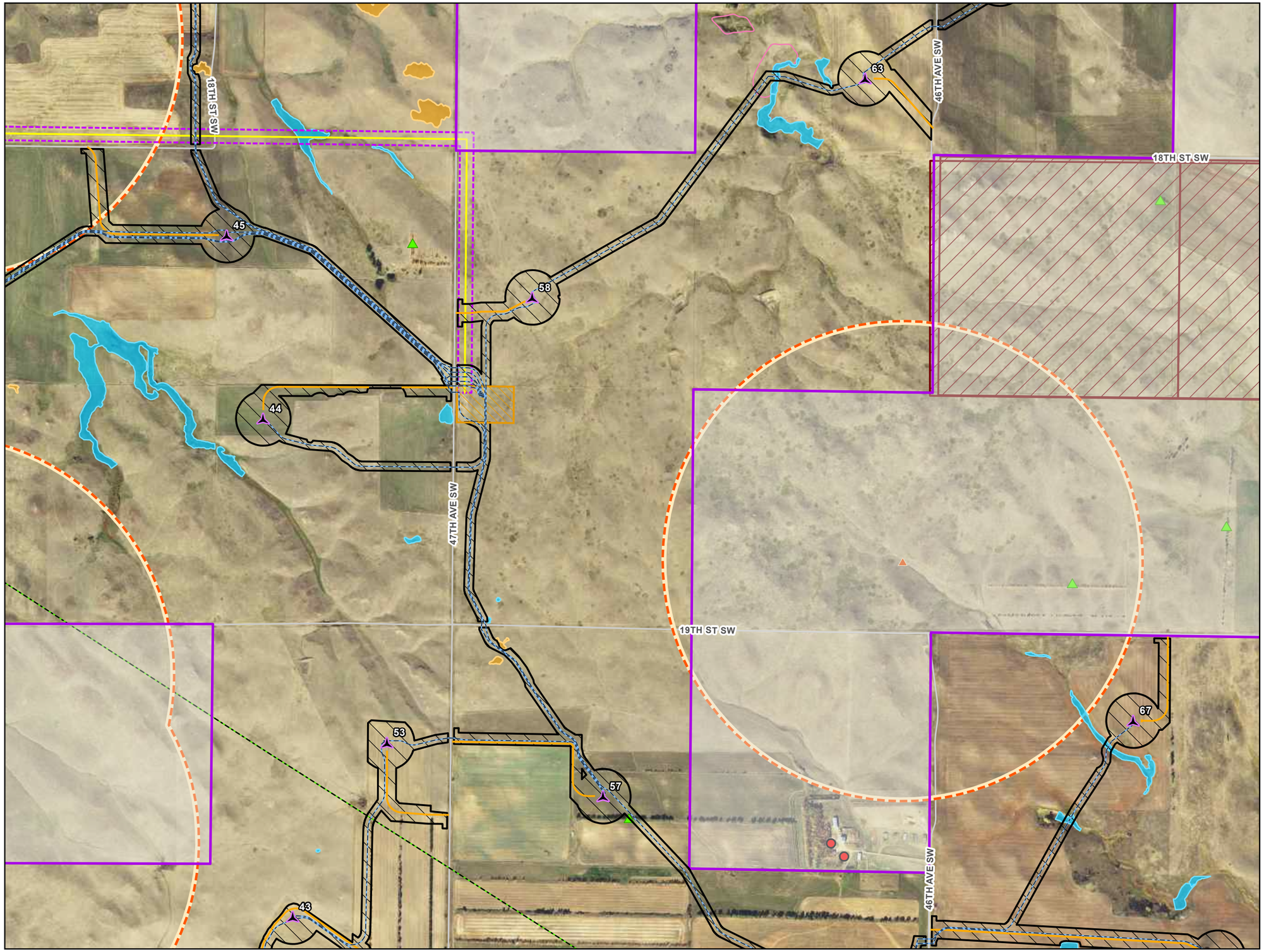

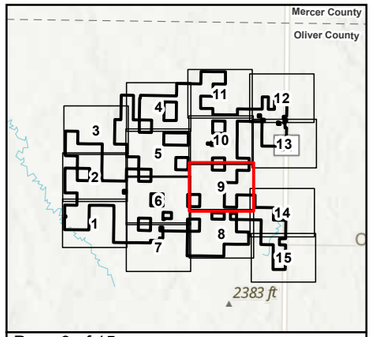

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Site Plan

- Project Area
- Construction Easement
- Collection Substation
- Primary Turbine
- Collection Line
- Access Road
- Transmission Line Route
- Transmission Line Corridor

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Confirmed Sharp-tailed Grouse Lek
- Sharp-tailed Grouse Lek 0.5-mile Buffer
- Dakota Skipper Larvae Habitat
- Delineated Wetland and Other Water
- Coal Lease
- Landslide Deposit
- Transmission Line
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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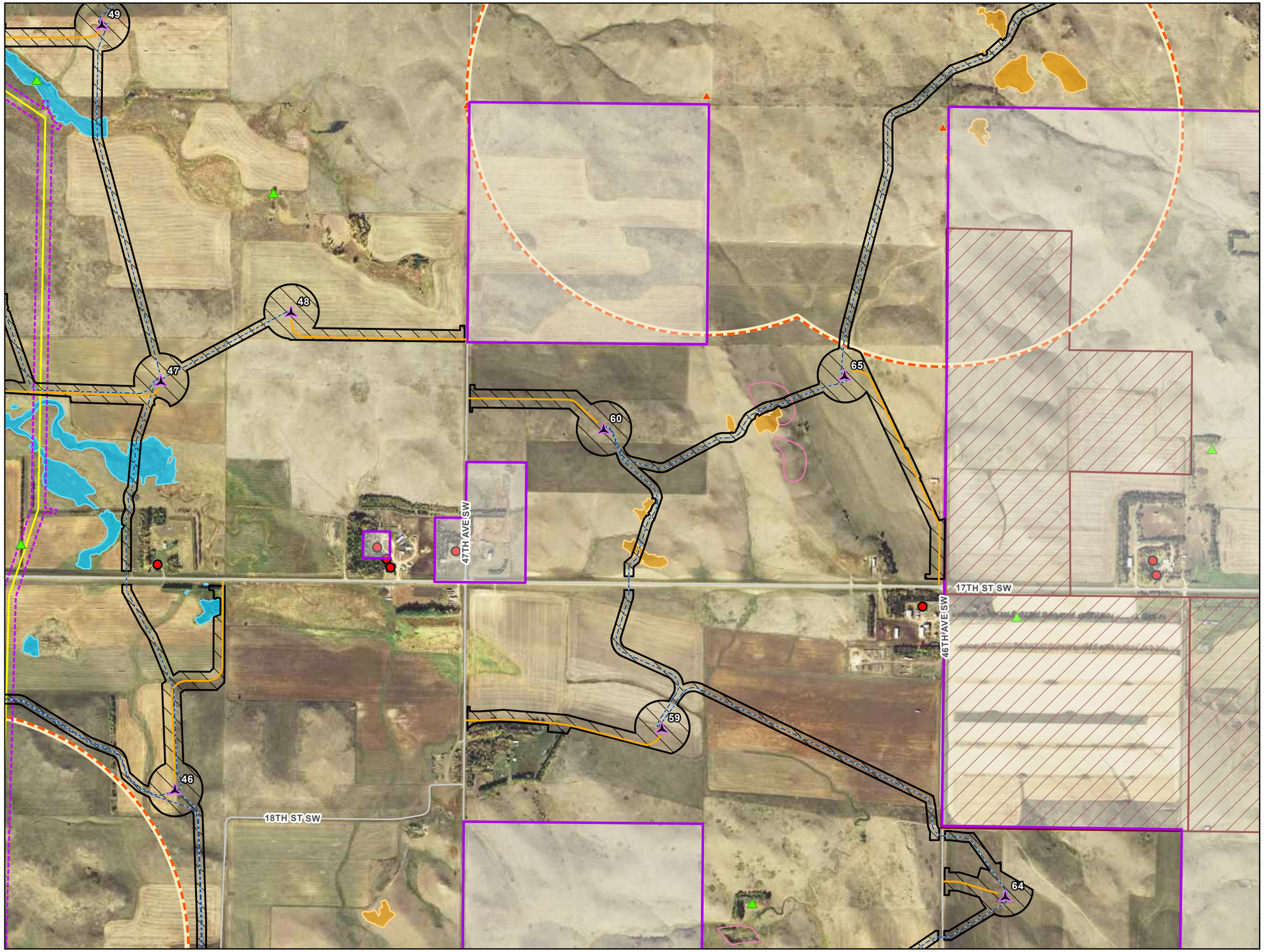

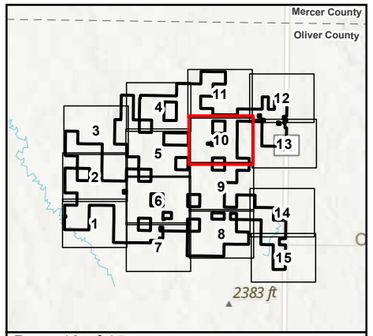

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Site Plan

- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road
- Transmission Line Route
- Transmission Line Corridor

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Confirmed Sharp-tailed Grouse Lek
- Sharp-tailed Grouse Lek 0.5-mile Buffer
- Dakota Skipper Larvae Habitat
- Delineated Wetland and Other Water
- Coal Lease
- Landslide Deposit
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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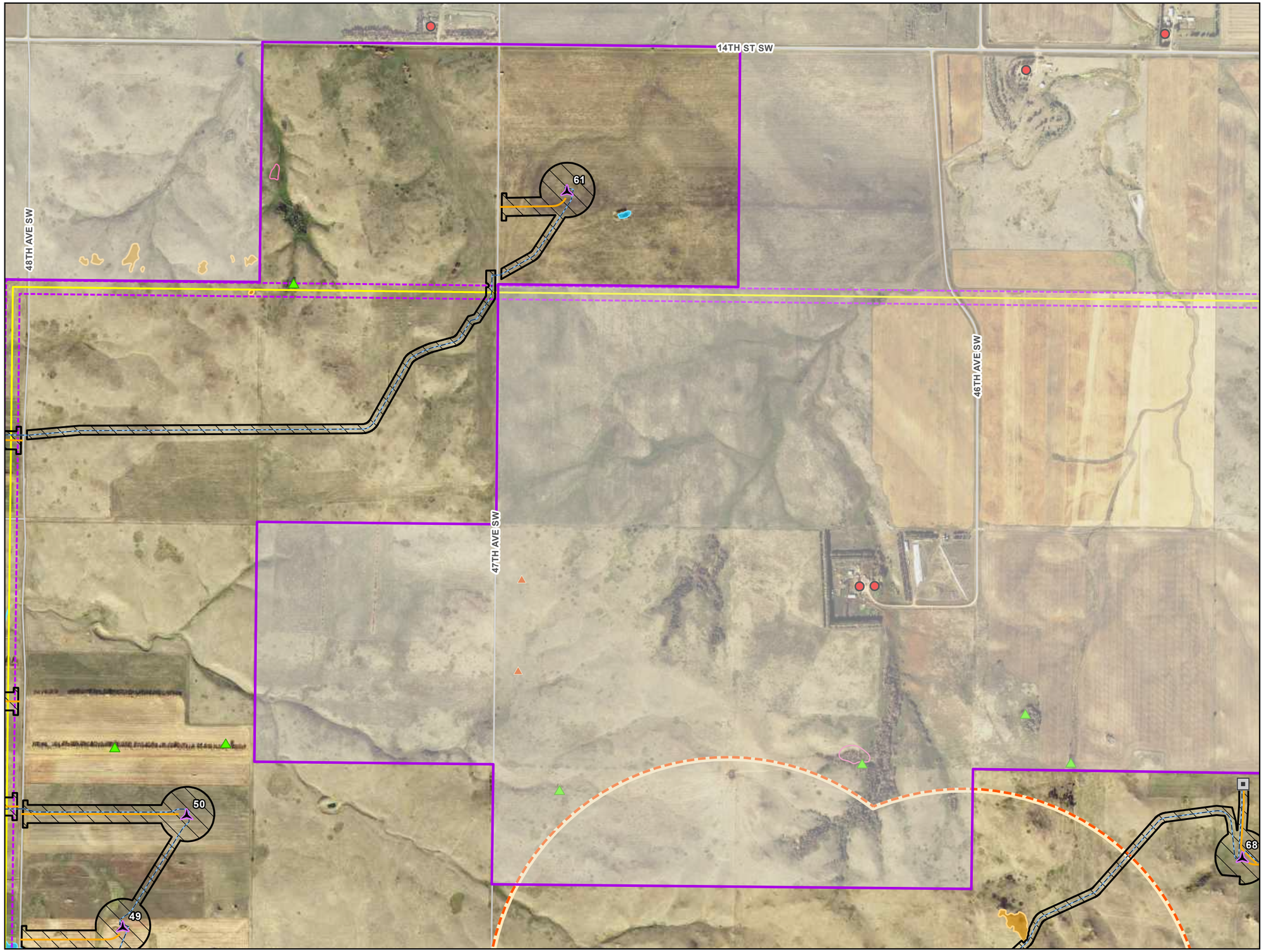

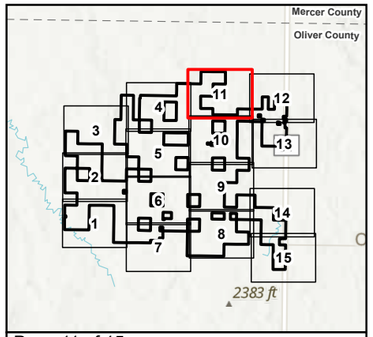

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Site Plan

- Project Area
- Construction Easement
- Primary Turbine
- ADLS Radar Tower
- Collection Line
- Access Road
- Transmission Line Route
- Transmission Line Corridor

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Confirmed Sharp-tailed Grouse Lek
- Sharp-tailed Grouse Lek 0.5-mile Buffer
- Dakota Skipper Larvae Habitat
- Delineated Wetland and Other Water
- Landslide Deposit
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

For Environmental Review Purposes Only

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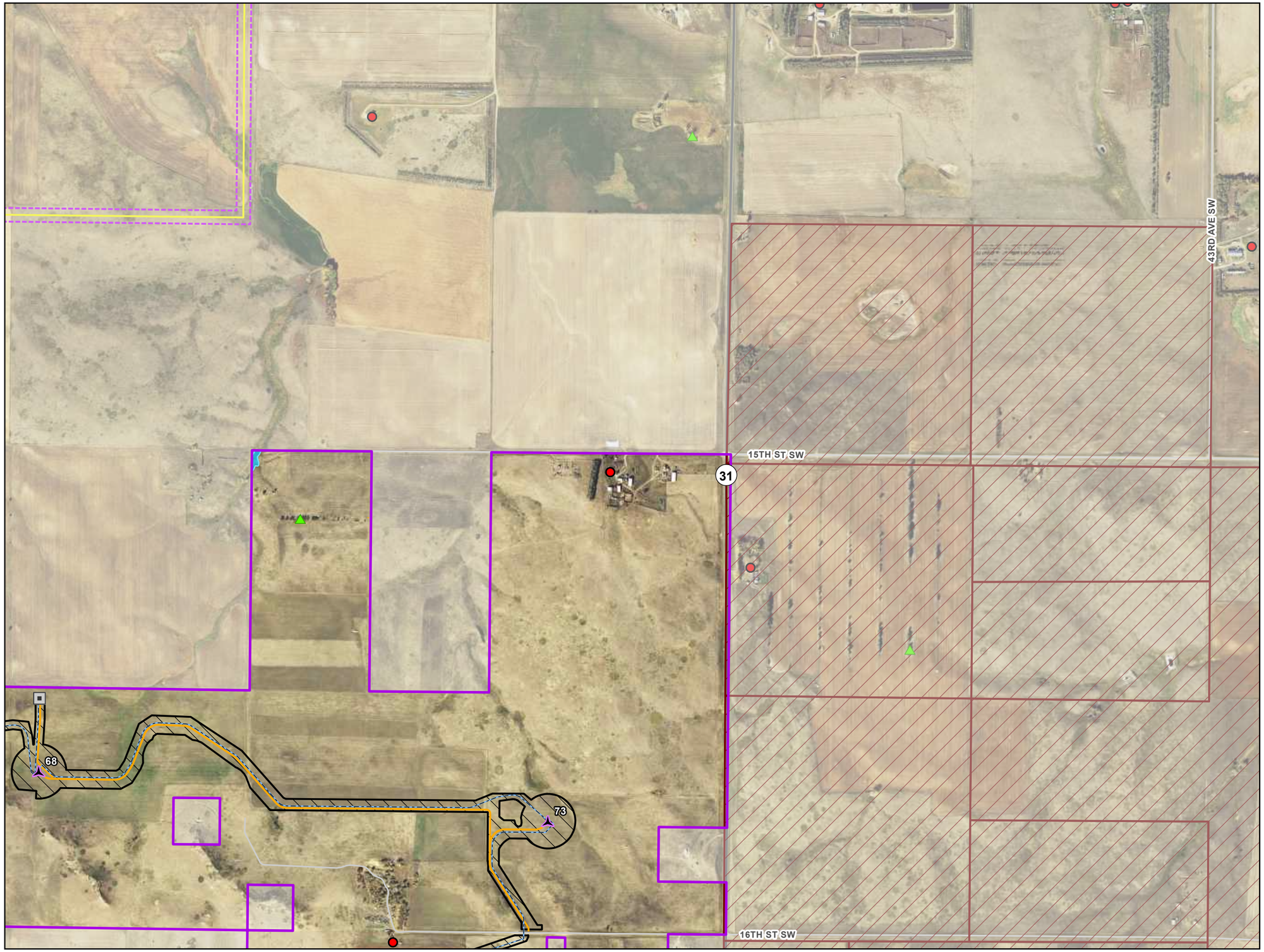

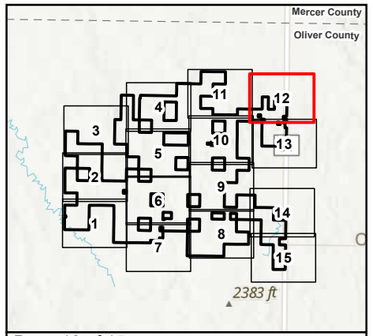

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Site Plan

- Project Area
- Construction Easement
- Primary Turbine
- ADLS Radar Tower
- Collection Line
- Access Road
- Transmission Line Route
- Transmission Line Corridor

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Delineated Wetland and Other Water
- Coal Lease
- State/Federal Highway
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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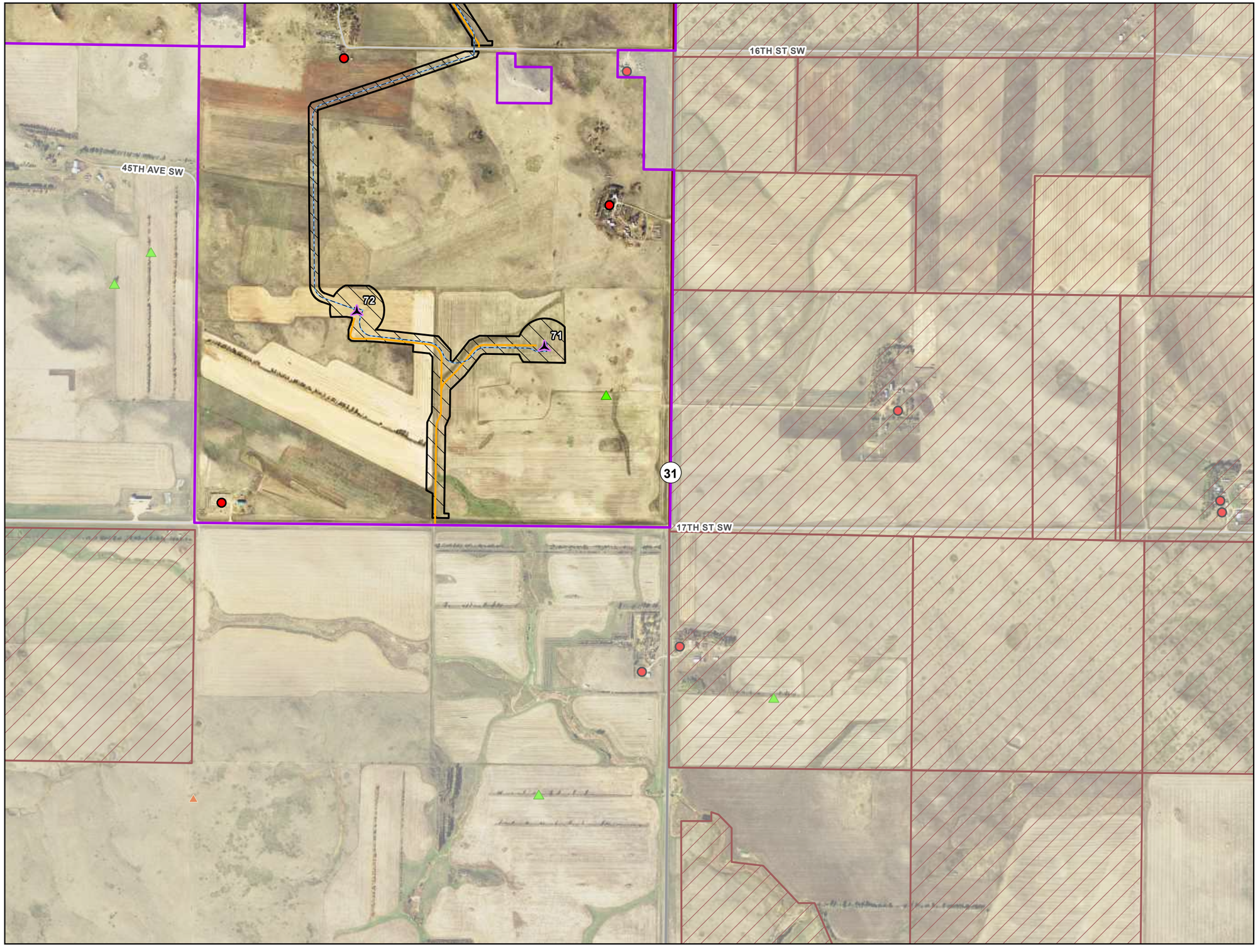

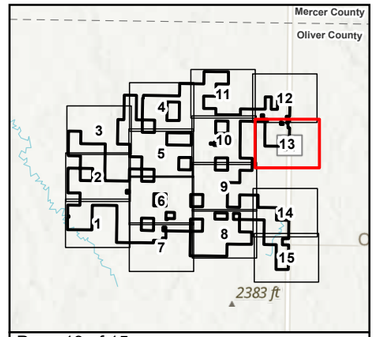

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Site Plan

- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Confirmed Sharp-tailed Grouse Lek
- Coal Lease
- State/Federal Highway
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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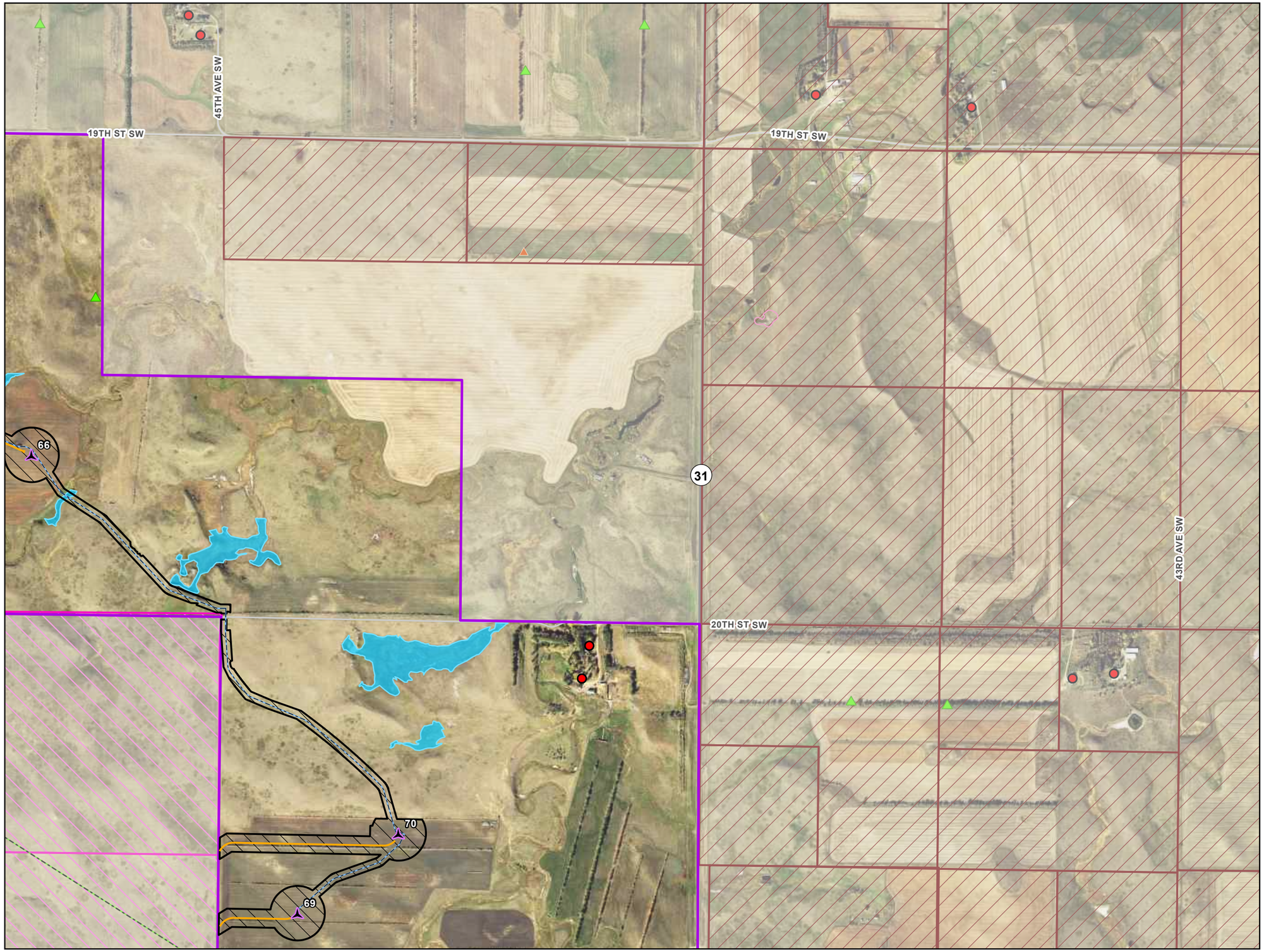

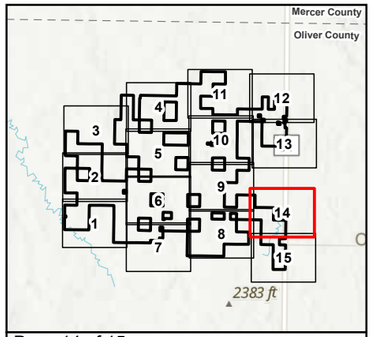

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Site Plan

- Project Area
- Construction Easement
- Primary Turbine
- Collection Line
- Access Road

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Confirmed Sharp-tailed Grouse Lek
- Delineated Wetland and Other Water
- Coal Lease
- State Trust Land
- Landslide Deposit
- Transmission Line
- State/Federal Highway
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

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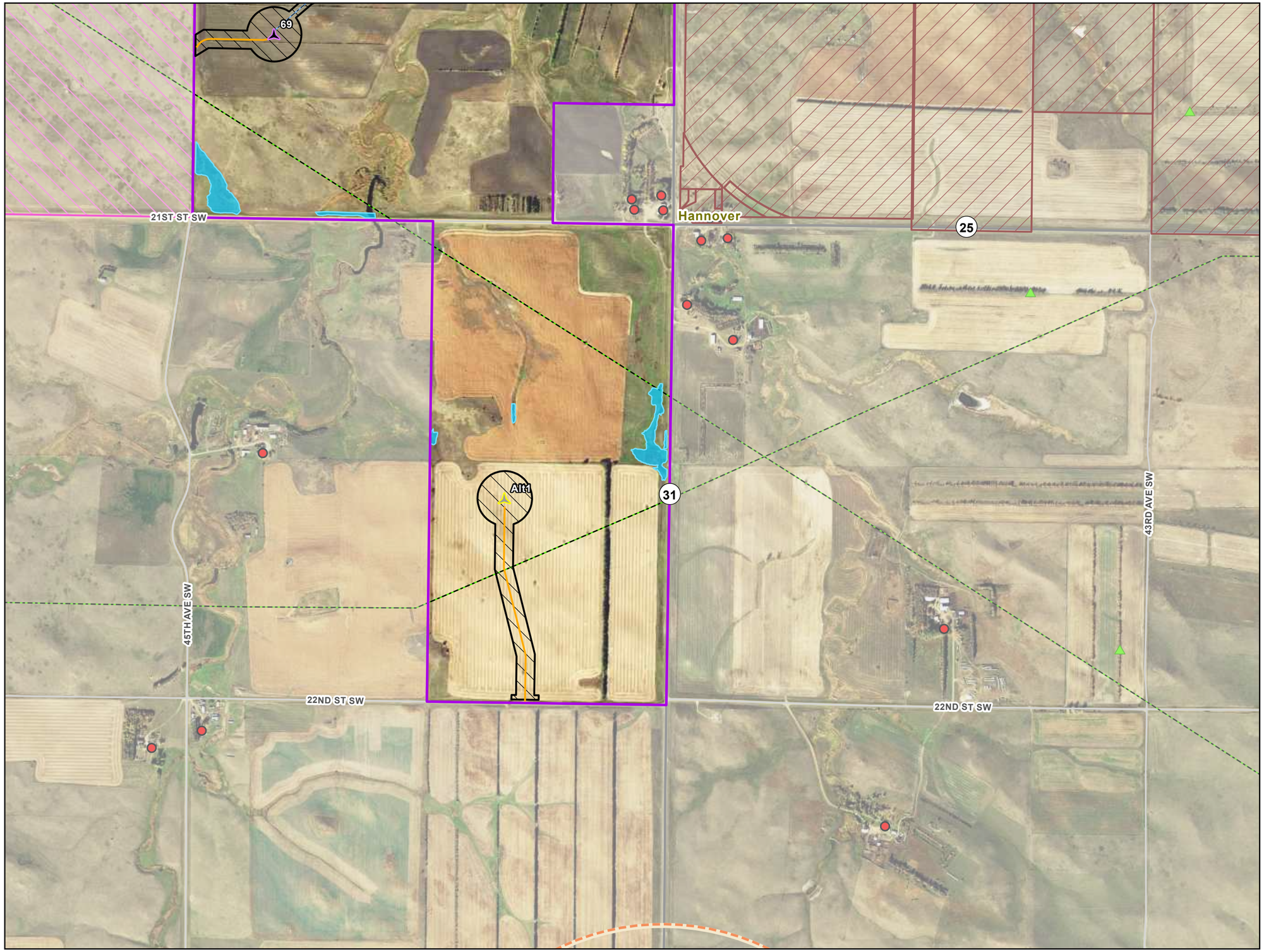

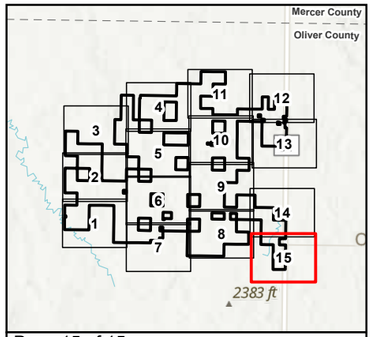

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Site Plan
- Project Area
- Construction Easement
- Primary Turbine
- Alternative Turbine
- Collection Line
- Access Road

Contractor will bore all wetlands, Dakota skipper habitat, and roads.
Known archaeological sites are not depicted due to confidentiality.

- Occupied Residence
- Raptor Nest
- Sharp-tailed Grouse Lek 0.5-mile Buffer
- Delineated Wetland and Other Water
- Coal Lease
- State Trust Land
- Transmission Line
- State/Federal Highway
- County Road

Figure 16:
Site Plan Detail
Oliver Wind IV Energy Center
Oliver County, North Dakota

For Environmental Review Purposes Only

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Appendix A

NextEra Energy, Inc.'s 2022 Environmental, Social and Governance Report

NEXTera ENERGY

2022

ENVIRONMENTAL, SOCIAL AND GOVERNANCE REPORT

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Cover photo: The Wheatridge Renewable Energy Facility, which went online in Lexington, Ore., in March 2022, combines wind, solar and battery energy storage technology in one location. The wind component encompasses up to 300 megawatts of wind capacity produced by approximately 120 wind turbines.

Photo left: Catch a quick glimpse of employee Jeff Elms as he appears between the solar panels during an equipment check at the Blythe and McCoy Energy Centers in Blythe, Calif.

Oliver IV Wind 000125

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VISION AND STRATEGY: A LETTER FROM OUR CHAIRMAN, PRESIDENT AND CEO

To all our stakeholders:

It is the honor of my professional life to lead the best team in our industry at NextEra Energy. Our team has a clear vision: We will help lead the decarbonization of the U.S. economy. This vision is bold – even unprecedented. Yet, it's consistent with our decades-long record of performance for all our stakeholders, including our accomplishments and goals related to environmental, social and governance (ESG) that we share with you in this report.

I joined this company nearly 20 years ago, and right away was given the opportunity to work on a game-changing step we took at that time to move forward to a clean energy future. That transaction was the conversion of a gas turbine contract with General Electric, still one of our largest suppliers today, to a contract for wind turbines. We made that decision because we saw something others didn't see, that renewables would soon become the low-cost generation source of choice.

Our first-mover advantage in wind at what is now NextEra Energy Resources was soon expanded to solar. We started first with solar-thermal technology, but then photovoltaic technology came along and was a game-changer for us and for our entire economy, and our solar business began to take off. Over the years, NextEra Energy Resources became the largest generator of wind and solar energy in the world.

> WE PLAN TO DECARBONIZE OURSELVES, STARTING AT FPL, WITH THE MOST AMBITIOUS GOAL SET BY ANY U.S. UTILITY OR POWER PROVIDER TO DATE, AND THE SECTOR'S ONLY ONE TO NOT REQUIRE CARBON OFFSETS. OUR GOAL IS TO ACHIEVE REAL ZERO™ BY NO LATER THAN 2045 … ZERO CARBON EMISSIONS, 100% CLEAN ENERGY, AT NO INCREMENTAL COST TO OUR CUSTOMERS.

Over this same period, Florida Power & Light Company (FPL) led its own transformation. FPL was already one of the best utilities in the nation. But the FPL team was not satisfied 20 years ago, and still is not satisfied today, and we have chosen to be a first mover in the utility space time and time again. FPL voluntarily reduced our reliance on foreign oil by 99% starting in 2001. We were also one of the very first utilities to fully deploy smart meters across our service area and to launch a comprehensive storm hardening program to help us restore power faster after major storms and to help us improve everyday reliability. And FPL was also the first utility to really go after renewables as a way to reduce customer bills relative to alternatives.

John Ketchum – NextEra Energy's chairman, president and CEO.

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Both FPL and NextEra Energy Resources continue to be industry leaders. Several years ago, both businesses invested in battery storage, which is the holy grail of renewables because it can help make wind and solar energy a nearly firm energy product. Today, our vision is focused on deploying even more renewables and storage, which in the future we expect to be supplemented by green hydrogen as a way to convert gas turbines to generate emissions-free baseload generation. We have built both FPL and NextEra Energy Resources through a series of toe-in-the-water investments that over time have added up to something big, a scalable platform, built from the ground up, and centered on the best opportunity set and team in the industry.

WE PLAN TO BECOME THE PREFERRED U.S. PARTNER FOR RENEWABLE ENERGY INFRASTRUCTURE SOLUTIONS OF FORTUNE 1000 CUSTOMERS THAT ARE TRYING TO ACHIEVE THEIR OWN SUSTAINABILITY GOALS.

Our vision to help decarbonize the U.S. economy is based upon that scalable platform and everything else that has made our company successful over at least the last 20 years. We plan to achieve our vision in four ways, simultaneously:

» We plan to decarbonize ourselves, starting at FPL, and starting with the most ambitious goal set by any U.S. utility or power provider to date, and the sector's only one to not require carbon offsets. Our goal is to achieve Real Zero, meaning we will be carbon emissions free by no later than 2045. Described in our Zero Carbon Blueprint™, Real Zero means exactly that: zero carbon emissions, 100% clean energy, at no incremental cost to our customers.

» We plan to partner with our peer companies to help decarbonize the rest of the U.S. power sector, continuing the work that NextEra Energy Resources has done with investor-owned utilities, municipalities and cooperatives over the last 20 years. We believe that, as we work toward our own Real Zero goal, we will further develop the capabilities that can help other power companies meet their own goals.

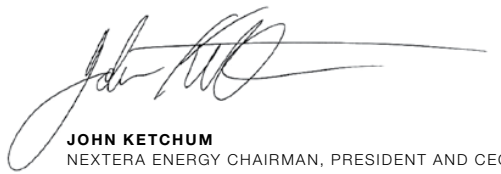
» We plan to partner with companies outside the power sector to help lead the decarbonization of the rest of the U.S. economy. We aim to become the preferred U.S. partner for renewable energy infrastructure solutions of Fortune 1000 customers that are trying to achieve their own sustainability goals, especially in sectors with high electric use or high emissions.

» We plan to continue to build the nation's leading competitive transmission business to help provide the backbone for the significant renewables expansion that we believe is coming.

Many other elements of our ESG strategy are discussed throughout this report, such as the measurable progress we have made on racial equity at our company, especially over the last two years. We have also committed to additional disclosures on various metrics related to diversity, equity and inclusion. I am proud of our team's efforts and am honored to have joined a board of directors that has such a strong commitment to corporate governance and ethics and which provides oversight of every facet of NextEra Energy's strategy that is reflected in this document.

Our company has made many ambitious goals. Some, such as reliable and affordable electric service, date from the founding of our company nearly a century ago. Others, such as our new Real Zero goal, keep us focused on what we can achieve in the decades ahead. Reaching each of our goals is the imperative of the most talented team in our industry. Over the last 20 years, and especially over the last six months, I have become even more grateful for all my colleagues who come to work every day focused on delivering even more value to our customers and who challenge themselves to make our company even better.

On behalf of our more than 15,000-member team, thank you for your interest in learning more about NextEra Energy and all our ESG accomplishments and goals.



JOHN KETCHUM
NEXTERA ENERGY CHAIRMAN, PRESIDENT AND CEO

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NEXTERA ENERGY'S BLUEPRINT TO REACH REAL ZERO BY ELIMINATING CARBON EMISSIONS BY NO LATER THAN 2045

Today, we see a pathway to a completely carbon-emissions-free power sector by no later than 2050, with a combination of zero-carbon-emissions resources and short-term and long-term energy storage. We believe that the transition to affordable renewable energy isn't an option; it's the solution. Years before many Fortune 500 companies considered transitioning away from fossil fuels to renewable energy, we were building solar and wind projects, and closing oil- and coal-fired power plants. We're now poised to build on our decades of innovation, as we work to fulfill our long-standing vision to be the largest and cleanest energy provider in the world.

> OUR GOAL IS TO BE COMPLETELY CARBON EMISSIONS FREE BY NO LATER THAN 2045. OUR GOAL INCLUDES MEANINGFUL MILESTONES IN FIVE-YEAR INCREMENTS.

The road to decarbonizing the U.S. economy requires every industry to assess its role and set goals that will lead to the greatest possible impact. As the largest U.S. utility company, we know our sector can lead the way. Today, we're setting an ambitious goal for our company that should catalyze progress for our sector and for the U.S. economy. Our goal is to be completely carbon emissions free by no later than 2045.* Our goal includes meaningful milestones in five-year increments that would allow us to reach Real Zero emissions by no later than 2045.

NextEra Energy has been working to reduce our carbon dioxide (CO_2)-emissions rate for decades, and as of 2021 has achieved a 58% reduction, compared to a 2005 adjusted baseline. While we've had emissions-rate-reduction goals since 2018 and worked to reduce emissions years before setting goals, we've always said that we did not want to commit to a full decarbonization goal until we could see the full path. That time is now.

*Greenhouse gas (GHG) emissions are reported in our annual GHG inventory as metric tons carbon dioxide equivalent (CO_2e), and include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Employees from left, Devon Wing, Will Rosenboom and Stefan Hansen are among the first to work at the company's Wheatridge Renewable Energy Facility where solar, wind and battery energy storage merge into a winning combination to reach Real Zero.

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NEXTERA ENERGY'S REAL ZERO GOAL

Our Real Zero goal is the most ambitious target set by an energy producer, and the sector's only one to not require carbon offsets for success. We've been an industry leader for at least 30 years, and our size, scale and expertise position us to lead the energy sector to Real Zero. Our Real Zero goal aligns with our view that our nation must be energy independent and that America's energy can and should be carbon emissions free, and affordable.

NextEra Energy's ability to produce power with zero-carbon emissions means our energy customers can meet their emissions goals. We can help make any such goal achievable, affordable and on a faster pace.

For our current and future customers, whatever your emissions-reduction goals, NextEra Energy would be prepared to be your partner of choice, using our unmatched expertise to accelerate your success.

We're in this to lead our industry and drive change. And we want to bring the U.S. economy with us on this journey.

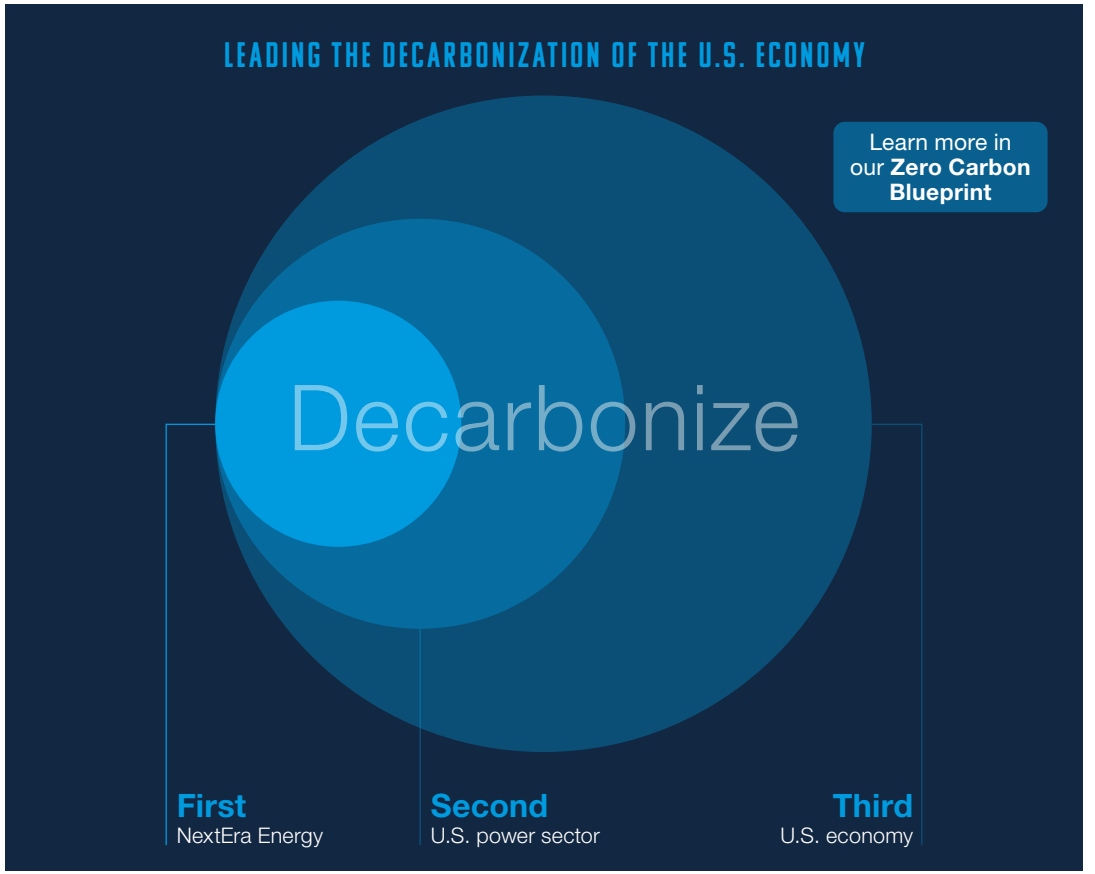
Producing electricity at Real Zero would be a game-changer – for our customers, the U.S. electric power sector and the entire U.S. economy.

NextEra Energy's Real Zero goal would catalyze the decarbonization of the U.S. economy along three parallel paths.

First, we intend to decarbonize our own business, beginning with our goal to reach Real Zero emissions, without the need for carbon offsets, by no later than 2045. We've been prudently investing in decarbonizing our own operations for decades and this is an extension of our core values.

Second, we plan to help decarbonize more of the U.S. power sector – investor-owned utilities (IOUs), municipalities and cooperatives – through continued investments and innovation in wind, solar, storage and green hydrogen projects.

Third, we expect to help lead the decarbonization of the U.S. economy – by working to become the preferred partner for customers to help them reduce or eliminate carbon emissions in their operations. We would also use our experts and data analytics to help our commercial and industrial customers reach their own net zero or strive to achieve Real Zero goals.



Strategy and measurable milestones

We plan to decarbonize our company and achieve our Real Zero goal by doubling down on our core businesses at FPL and NextEra Energy Resources. We would continue to smartly invest capital at FPL, and increase our investments in renewable energy, storage and innovation. We're also setting clear, interim emissions-reduction milestones to hold ourselves accountable and demonstrate measurable progress to our stakeholders. Value, affordability, reliability and resiliency for our customers remain our priority.

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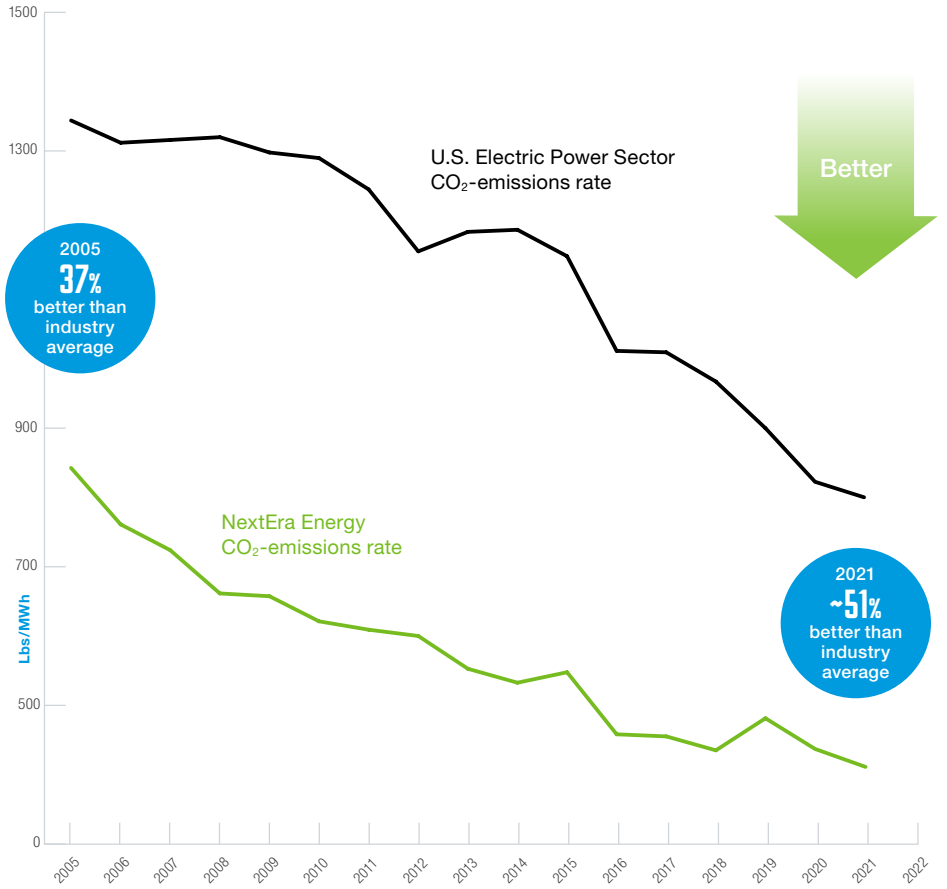
OUR CO_2-EMISSIONS RATE IS SIGNIFICANTLY BETTER THAN THE INDUSTRY AVERAGE DUE TO OUR CLEAN ENERGY INVESTMENTS AND ACTIONS

Others in our sector are today reaching carbon-emissions-reduction levels we achieved 15 years ago.



2005	Continued the transition away from foreign oil and added 2,214 megawatts (MW) of natural gas and added 434 MW of wind.
2006	Acquired 615 MW of nuclear and added 824 MW of wind.
2007	Acquired 1,024 MW of nuclear, added 1,150 MW of natural gas and 1,060 MW of wind.
2008	Added 25 MW of solar, 2,500 MW of natural gas and 1,061 MW of wind.
2009	Added 1,169 MW of wind.
2010	Added 91 MW of solar and 683 MW of wind.
2011	Completed 176-MW nuclear addition, added 1,250 MW of natural gas, 378 MW of wind, 5 MW of solar.
2012	Completed 514-MW nuclear addition, added 1,523 MW of wind and 40 MW of solar.
2013	Modernized 1,200 MW of natural gas, added 1,364 MW of wind and 20 MW of solar.
2014	Modernized 1,250 MW of natural gas, added 374 MW of wind and 623 MW of solar.
2015	Added 522 MW of wind and 47 MW of solar.
2016	Modernized 1,277 MW of natural gas, divested 3,828 MW of natural gas, added 621 MW of wind and 1,012 MW of solar.
2017	Retired and demolished 250 MW of coal, repowered 1,597 MW of wind, added 354 MW of wind and 497 MW of solar.
2018	Retired and demolished 636 MW of coal and 2,530 MW of natural gas and oil, repowered 928 MW of wind, added 1,405 MW of wind and 924 MW of solar, and completed a 26-MW nuclear addition.
2019	Acquired Gulf Power (which added 1,750 MW of natural gas), repowered 1,091 MW of wind, and added 1,025 MW of wind and 830 MW of solar.
2020	Retired 615 MW of nuclear and 330 MW of coal, converted 924 MW of coal to natural gas, completed a 23-MW nuclear addition, repowered 1,432 MW of wind, and added 1,993 MW of solar, 2,679 MW of wind and 26 MW of energy storage.
2021	Added approximately 2,007 MW of wind, 1,547 MW of solar, 1,017 MW of battery energy storage, and repowered 435 MW of wind generating capacity.

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ABOUT THIS REPORT

We set big goals, deliver measurable results and hold ourselves to high standards. In recent years, investors and other stakeholders have shown increased interest in understanding our goals, results and standards within the framework of environmental, social and governance (ESG) reporting. We're confident that our smart capital investments in renewable energy will be beneficial for our customers, the environment and the U.S. economy, and will support reaching our Real Zero goal.

This report is designed to highlight our core ESG strategy and disclosures, based on feedback from the investment community and other stakeholders.

NextEra Energy reports ESG disclosures through multiple resources, including this report, to provide stakeholders with an understanding of our long-term strategy focused on providing clean, reliable and affordable energy solutions across North America, our track record of delivering results for our customers and shareholders, and our vision for a zero-carbon-emissions future.

This report is aligned with the Sustainability Accounting Standards Board (SASB) framework under the Electric Utilities and Power Generators Standard and the Task Force on Climate-Related Financial Disclosures (TCFD).

We also continue to report ESG disclosures through the Edison Electric Institute (EEI) ESG/Sustainability template and the United Nations Sustainable Development Goals (SDGs), and our report includes a **Third-Party Emissions Statement**. Additional metrics also can be found on the ESG Resources page on our **Investor Relations website.**

A sunset at the Ponderosa Wind Energy Center in Ponderosa, Okla., sends a warm glow over the renewable energy facility.

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CONFRONTING CLIMATE CHANGE

At NextEra Energy, we began our journey to Real Zero in the 1980s when we invested in our first solar and wind projects. Today, we pledge to do what we can to accelerate our journey and lead the decarbonization of the entire U.S. economy.

As highlighted in this report, we envision an ambitious expansion of our existing storage and renewables portfolios and the adoption of emerging technologies to fulfill our goal of achieving Real Zero carbon emissions at NextEra Energy, as well as our endeavor to lead the decarbonization of the U.S. economy. While those technologies and wind will support broader decarbonization, additional solar, battery energy storage, green hydrogen and renewable natural gas, as well as continued use of our existing nuclear fleet, represent key steps in the drive toward decarbonization of our own operations.

Serving customers while tackling today's challenges comes with the fundamental responsibility to also look beyond the horizon to ensure we're ready to serve customers tomorrow. This is especially true in Florida, where FPL serves a rapidly growing state on the front lines of climate change and frequent severe weather. Our approach to climate change, which is in line with the TCFD framework, is summarized below and discussed throughout this report. A TCFD reference index is also included as **Appendix B** to this report.

Governance

NextEra Energy, as a renewable energy leader, has made climate-related issues core to our overall business strategy. The entire NextEra Energy board of directors, led by our executive chairman has oversight of climate-related risks and opportunities, including their impacts on our strategy. The board understands the impacts of climate change on our future growth, as well as how we prepare our business to adapt to the effects of climate change.

At every scheduled board of directors meeting, the board performs a review of our performance against business objectives and key risks and opportunities for the company.

The board also holds an annual strategy session devoted to discussing, debating and validating management's overall strategy. Oversight of climate-related issues includes discussion of physical risks from climate change, such as hurricanes, climate- and emissions-related government policies, incentives and regulations, emissions-reduction initiatives, renewable energy, trends and business plans, and emerging clean energy technologies, among others.

Our executive management team is responsible for day-to-day management of climate-related risks and opportunities, as well as their potential effects on the management and operations of individual business units.

Crew members team up to install new wind generating equipment during construction of the Borderlands Wind Energy Center in Quemado, N.M.

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The Cotton Creek Solar Energy Center was commissioned in Northwest Florida in March 2022.

Through the board's oversight and management's execution of our strategy, our carbon-emissions rate in 2005 was already 37% better than the U.S. electric power sector and, in 2021, was nearly 51% better than the U.S. electric power sector. Over the same period, our total generating capacity increased 72% to meet growing customer demand. These results demonstrate that, even with dramatic growth in our core business, we've reduced our already industry-leading, carbon-emissions rate much faster than the industry average – leading the way to Real Zero, we believe.

Strategy

Climate-related risks and opportunities influence our strategy across all of our businesses over the short term (less than five years), medium term (five to 10 years) and long term (greater than 10 years). As we respond to our customers' demands for emissions-free and renewable energy, climate-related risks and opportunities have influenced our financial plan for capital expenditures, acquisitions and revenues.

Customer demands also have influenced our capital plan in executing our significant renewable energy deployment and transmission line development business plans, including our grid hardening initiatives. At FPL, climate-related risks and opportunities have influenced our operational strategy, including our short- and medium-term strategy for daily operations and infrastructure planning in our integrated resource plan. This strategy is reflected in our modernization of FPL's generation fleet by first replacing old, inefficient oil, natural gas and coal plants with state-of-the-art natural gas units. We reduced our use of oil to generate electricity from 41 million barrels in 2001, the most in the country, to only 100,000 barrels of low-sulphur diesel, a fuel used as emergency backup, in 2021. In 2020, we converted the Gulf Clean Energy Center, formerly Plant Crist, to natural gas, cutting its CO_2-emissions rate by 40%. With the 2020 retirement of FPL's Indiantown Cogeneration facility, 2021 was the first time in nearly 70 years that there were no coal-fired power plants in our Florida system. The phase-out of these coal facilities is expected to generate hundreds of millions of dollars of savings for customers, while eliminating millions of tons of CO_2 emissions annually.

CLIMATE-RELATED RISKS AND OPPORTUNITIES INFLUENCE OUR STRATEGY ACROSS ALL OF OUR BUSINESSES OVER THE SHORT TERM, MEDIUM TERM AND LONG TERM.

The next leg of FPL's generation modernization efforts is focused on deploying solar, which is now the most cost-effective generation resource in most parts of our service area. At the end of 2021, FPL had approximately 3,164 MW of solar generation capacity on its system, making it the largest producer of solar energy-generated electricity in Florida. By the end of 2031, FPL projects that it will have approximately 12,626 MW of photovoltaic (PV) solar generation. Company projections show that the cleanest energy sources, such as low-emissions natural gas, zero-carbon-emissions nuclear and solar, will provide approximately 99% of all energy produced in FPL's system in 2031, putting the company well on its way to attaining Real Zero. Our decarbonization goals also includes converting current natural gas generation to green hydrogen or renewable natural gas in the future.

NextEra Energy has built and operates more solar power facilities than any other utility in the nation, and we have even more on the way as we work to reach our Real Zero goal and continue to build a more resilient and sustainable energy future. We believe all forms of solar play a role in a zero-carbon-emissions future and we support customers who choose to put solar panels on their roofs. In Florida, we are concerned about the growing and unnecessary state-mandated, subsidized bill credit for the very small fraction of customers who choose to buy or lease expensive rooftop solar systems, yet the credit is funded by all FPL customers, including those who can't or choose not to place solar systems on their homes.

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Climate-related opportunities influence our strategy over the short-, medium- and long-term horizons. NextEra Energy Resources, our diversified, clean energy business, emphasizes the development, construction and operation of long-term contracted assets. We continue to tailor solutions for commercial, utility and public power customers who want to access their own clean, reliable, renewable energy. We offer a combination of energy solutions that cannot be found elsewhere in the marketplace from one company. These solutions include universal and small-scale solar energy, wind energy and energy storage behind and in front of the meter.

Our focus at NextEra Energy Resources is to develop long-term contracted, low-cost wind and solar generation assets, increasingly paired with battery energy storage. We have been in the renewable development business for decades. From these early beginnings, we have become the world's largest generator of renewable energy from the wind and the sun and a world leader in battery energy storage.

An example is the Wheatridge Renewable Energy Facility, which went online in March 2022. This innovative project combines wind, solar and battery energy storage technology in one location. The wind component encompasses up to 300 MW of wind capacity produced by approximately 120 wind turbines. Along with the broader public shift toward calls for action to fight climate change, over the past few years there has been an increased focus on sustainability on the part of many of our stakeholders. While we expect this trend to amplify demand among our traditional customers and in our core renewable energy business, we also believe that it is opening significant new markets and business opportunities for NextEra Energy Resources. With NextEra Energy's leadership and Real Zero goal, NextEra Energy Resources plans to help customers achieve their emissions-reduction goals and eventually attain Real Zero themselves. We anticipate our development program to be further enhanced by an ability to attract new, non-traditional customers, particularly in the commercial and industrial sector, as improving renewable economics are increasingly aligned with corporate objectives to procure energy from clean generation sources.

Employee Jana Lehn surveys solar panels at the Wheatridge Renewable Energy Facility in Lexington, Ore. The operation combines solar with wind and battery storage.

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CLIMATE-RELATED RISKS THAT MAY IMPACT OUR BUSINESS

Climate change risk type	Application to our businesses
Current/emerging regulation	Our operations are subject to complex and comprehensive federal, state and other regulations. Current and emerging regulations are addressed in risk management and business planning. As an example, under a Florida law enacted in 2019, FPL must file a long-term Storm Protection Plan that details how it plans to continue to build a stronger, smarter and more storm-resilient grid in the years ahead. The Storm Protection Plan and subsequent Florida Public Service Commission (FPSC) rules regarding cost recovery mechanism are examples of current regulation that address risks related to climate change and severe weather events and impact how FPL receives cost recovery for its storm hardening activities.
Technology	Technology developments are reviewed as part of our corporate risk assessment and strategic planning processes. We are always focused on innovation and exploring new technologies. Being innovative and having a strong commitment to continuous improvement is at the heart of who we are as a company. From state-of-the-art renewable energy solutions and leading-edge battery storage systems to smart grid technology and drones equipped with artificial intelligence, we're making significant investments in innovative, advanced technologies to do what's right on behalf of our customers, shareholders and other stakeholders. Transition risks related to changes in the price and availability of technology are some of the risks related to climate change that we consider in our analyses. Based on our ongoing analysis of the long-term potential of low-cost renewables, we remain confident that wind, solar and battery storage will help reduce costs for customers and help achieve future CO_2-emissions reductions on our path to Real Zero by no later than 2045.
Legal	While FPL's generation portfolio emits greenhouse gases at a lower rate than most of the U.S. electric generation sector, its results of operations could be impacted to the extent that new federal or state laws or regulations impose any new greenhouse gas emissions limits or a price on CO_2 emissions. To address this potential risk, FPL's integrated resource planning and annual Ten-Year Site Plan filing with the FPSC have included CO_2 cost projections since 2007. On the other hand, we believe that any such new laws or regulations likely would increase the demand for NextEra Energy Resources' clean energy products and services.
Market	Investments by FPL are guided by a well-established integrated resource planning process to determine the amount and timing of future generation needed to meet projected growth in energy load and demand. Market climate-related risks are incorporated into this planning process and different options are evaluated taking into account system economics, forecasted electric power demand, demand-side management, fuel prices, potential future climate policies and the integration of low-cost, clean and reliable generation, including solar and energy storage solutions. We also look at the impact of federal and state energy efficiency codes and standards. To the extent market forces drive demand for renewable energy, we believe that should only increase the opportunities available for NextEra Energy Resources.
Acute/chronic physical	Physical risks tied to climate change are reviewed as part of our risk management process. Changes in global climate could produce unusual variations in temperature and weather patterns, resulting in more intense, frequent and extreme weather events, abnormal levels of precipitation and, particularly relevant to FPL, changes in sea level. FPL operates in the east and lower west coasts of Florida and in Northwest Florida, areas that historically have been prone to severe weather events, such as hurricanes. Throughout our history of managing the impacts of hurricanes and natural disasters in Florida, we have remained focused on safety, execution and the importance of providing an essential service to our customers during these events. Our continued investments and preparation at FPL have resulted in building a stronger, smarter and more resilient energy grid that has improved reliability in good weather and bad and enables faster power restoration following extreme weather events. Since 2006, FPL has made significant investments in strengthening the energy grid to make it more resilient to severe weather. The deployment of innovative technology to help prevent outages and shorten restoration times when outages occur has enabled FPL to lower operating costs and improve reliability and resiliency.

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Risk management

As discussed in more detail in the risks and opportunities section of this report, our approach to risk management starts with a strategic focus on preparedness and a disciplined capital allocation process. Preparedness, crisis planning and risk management are part of our culture. Our president and CEO, who also serves as our chief risk officer, and executive management are responsible for executing our long-term strategy, while also monitoring climate-change opportunities and risks related to our strategy. Our corporate risk management committee provides oversight and support for our risk management activities.

For the purposes of our risk management process, we do not view climate change as a discrete risk, but rather a potential stress multiplier to existing risks and opportunities that we monitor very closely and have worked to mitigate for a very long time. For example, system disruption from a weather event is a long-standing risk that we have integrated into our risk assessment process, and potential climate change projections for more frequent storms would be a multiplier for this risk category but not necessarily broken out as an incremental impact being added separately. We also recognize that climate change may affect different parts of our business in different ways.

Metrics and targets

The business metrics we use to assess climate-related risks and opportunities include our progress against each business unit's goals. At FPL, these include our service reliability metrics, our power plant availability metrics and our progress toward our goal to install 30 million solar panels by 2030. We now expect to reach our solar panel installation goal by 2025. One of the main climate-change related risks facing FPL is more frequent storms, and our reliability metrics help us measure our progress in providing a stronger and more resilient energy grid. At NextEra Energy Resources, this includes our progress on completing the development of our wind, solar and storage projects on schedule and on budget, as well as adding significant new wind and solar opportunities to our backlog to support future growth. Implementing our renewables development strategy has led to significant carbon-emission reductions for our company and our customers. Our smart, long-term investments, including in wind and solar, have helped us achieve a laudable reduction in our CO_2-emissions rate, achieving a 58% reduction from an adjusted 2005 baseline. As we implement Real Zero, our goal is to eliminate scope 1 and scope 2 carbon emissions from our operations by no later than 2045, beginning with a 70% reduction in our CO_2 rate by 2025.* Read more about our Real Zero goal and our plan to achieve it in our **Zero Carbon Blueprint**.

Our scope 1, 2 and 3 emissions data is verified by an independent third party and available in **Appendix E** (Emissions Data and Third-Party Emissions Assurance Statement) of this report. We also participate in the CDP (formerly known as the Carbon Disclosure Project) survey. Our 2021 response is available on our **Investor Relations website**.

Crews construct what today is the FPL Miami-Dade Solar Center in Florida.

* We are striving to achieve our goal of Real Zero emissions by no later than 2045 so long as there is no incremental cost to customers relative to alternatives, our efforts to do so are supported by cost-effective technology advancements and constructive government policies and incentives and our investments are acceptable to our regulators Throughout this report, we reference our adjusted 2005 baseline for our emissions-reduction goal. The 2005 baseline is adjusted to account for acquisitions and divestitures during the goal period. Certain facilities within the NextEra Energy wind and solar generation portfolio produce Renewable Energy Credits and other environmental attributes which are typically sold along with the energy from the plants under long-term contracts, or may be sold separately from wind and solar generation not sold under long-term contracts. The purchasing party is solely entitled to the reporting rights and ownership of the environmental attributes. Visit "Reports and Filings" on the investor page of NextEraEnergy.com for more information.

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NEXTERA ENERGY'S ESG JOURNEY

1952: FPL holds its first storm drill.

1978: FPL begins demand-side management program.

1979: FPL starts exploring alternative fuels, including solar power.

1984: FPL Group (renamed NextEra Energy in 2010) incorporated; appoints first female director; we have had at least one female director on our board continuously since our incorporation.

1984: FPL Group provides the right for a majority of shareholders to call a special meeting; in 2015, the threshold was lowered to 20%.

1984: FPL Group invests in our first Florida solar project in Miami.

1989: FPL Group is the first non-Japanese company to win Deming Prize recognizing outstanding performance in quality control.

1989: FPL Group invests in our first wind project outside of Florida.

1994: FPL launches Care to Share program, providing crisis assistance to customers who are unable to pay their electric bills.

1997: FPL Energy (renamed NextEra Energy Resources in 2010) is formed to focus on clean energy technologies and fuels.

1998: FPL Energy builds our first wind farm in Oregon.

2001: FPL Group incorporates sustainability metrics into executive officer compensation goals.

2001: FPL begins fleet modernization by switching from oil to natural gas and increasing fuel efficiency.

2006: FPL begins hardening program to strengthen the energy grid.

2007: FPL Group commits to more than $2 billion investment in clean energy to reduce CO_2 emissions at the Clinton Global Initiative Forum.

2008: FPL builds the nation's largest PV solar project.

2008: FPL Group begins ZeroToday! employee safety campaign.

2009: FPL Group becomes the largest producer of wind and solar power in the U.S.

2010: FPL builds the world's first solar hybrid facility.

2010: FPL Group, Inc., is renamed NextEra Energy, Inc. and FPL Energy renamed NextEra Energy Resources.

2012: NextEra Energy Resources celebrates commissioning 10,000th MW of wind energy.

2012: NextEra Energy Resources launches first battery storage demonstration project.

2016: FPL launches innovative energy storage pilot project related to scaling renewable energy and storage.

2018: NextEra Energy announces goal to reduce CO_2-emissions rate 65% by 2021 from a 2001 adjusted baseline.

2018: FPL launches Storm Secure Underground Program, a pilot to place neighborhood overhead power lines underground to improve resiliency during severe weather and enhance day-to-day reliability.

2019: NextEra Energy acquires Gulf Power Company and begins plans to reduce emissions, increase clean energy and lower costs.

2019: FPL announces plan to install 30 million solar panels by 2030.

2019: NextEra Energy announces updated goal to reduce CO_2-emissions rate by 67% by 2025 from a 2005 adjusted baseline.

2020: FPL launches FPL SolarTogether, the largest community solar program in the U.S.

2020: FPL announces plan for first green hydrogen pilot project.

2020: FPL and Gulf Power Company end coal-fired power generation in Florida.

2021: FPL and Gulf Power Company legally combine.

2021: NextEra Energy Resources announces plan for first green hydrogen pilot project.

2021: FPL completes and commissions the world's largest integrated solar-powered battery.

2022: FPL installs 50% of 30 million solar panels ahead of schedule. Completion is now expected by 2025.

2022: NextEra Energy sets goal to achieve Real Zero carbon emissions by no later than 2045.

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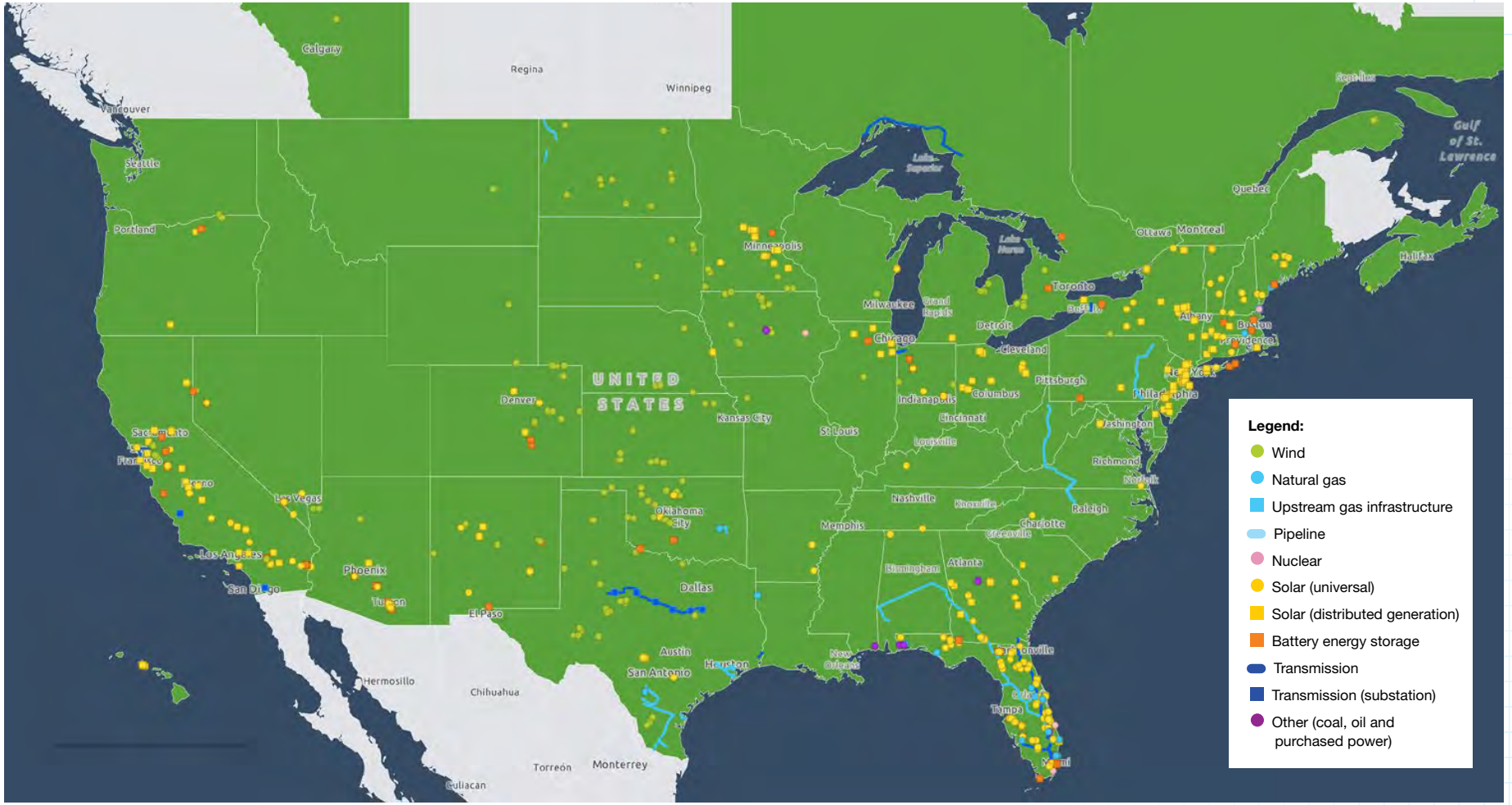
OUR PORTFOLIO



Map represents areas where NextEra Energy has a presence, operations or development projects. Locations with more than one facility are illustrated with a single dot. Data as of December 2021.

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COMPANY SNAPSHOT*

~61,800 MW
net generating capacity

~$110 B
infrastructure capital deployed since 2012

~15,000
employees

~$141 B
in total assets

~89,180 MILES
of transmission and distribution

$17.1 B
operating revenues

49 STATES AND 4 CANADIAN PROVINCES
with a presence, operations or development projects

~51%
below the national average CO_2-emissions rate

85%
improvement in NextEra Energy overall company safety performance since 2003

~$16 B
invested in American energy infrastructure

23%
total shareholder return, outperforming the S&P 500 Utilities Index

45%
improvement in FPL's reliability over the last decade

*Data as of year-end 2021 if not otherwise shown.

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BUILDING THE WORLD'S LEADING CLEAN ENERGY PROVIDER

NextEra Energy is shaping the future of energy through innovation and investments in clean energy for the benefit of our customers throughout the U.S. and Canada. Through FPL and NextEra Energy Resources, we are investing in North America's energy infrastructure sustainably and responsibly.

Solar panels and batteries work together at the Manatee Solar Energy Center in Parrish, Fla., to form one of the world's biggest solar-charged battery storage systems.

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FLORIDA POWER & LIGHT COMPANY

FPL is the largest energy company in the U.S. as measured by retail electricity produced and sold, serving approximately 5.8 million customer accounts or more than 12 million people across Florida – from Miami to Pensacola.

Our core philosophy, known as the virtuous circle, starts with providing customers a best-in-class value proposition of low bills, high reliability, clean energy solutions and excellent customer service. By delivering on these key commitments, we can drive high customer satisfaction, which leads to a constructive regulatory environment and the ability to have important conversations with regulators and elected officials at all levels about investments in new technologies. A constructive regulatory environment, in turn, attracts investment, which enables us to invest in projects that grow clean energy capacity, keep costs low for customers and improve reliability. From 2012 to 2021, FPL deployed approximately $51 billion in smart capital investments in Florida to continue to improve its customer value proposition.

FPL'S GENERATION FLEET IS NOW ONE OF THE CLEANEST AND MOST EFFICIENT IN THE COUNTRY, SAVING CUSTOMERS MORE THAN $12 BILLION IN FUEL COSTS AND AVOIDING MORE THAN 175 MILLION TONS OF CO_2 EMISSIONS SINCE 2001.

To help pay for these investments with minimal impact to customer bills, FPL has focused on lowering its operating costs for more than 30 years. FPL has improved its operating costs from almost 10% worse than the industry average in 1988 to 65% better than the industry average by 2020. Relative to an average utility's operation and maintenance (O&M) costs per retail megawatt hour (MWh), FPL saves its customers nearly $2.6 billion a year through its best-in-class cost profile. The result of these smart capital investments and continued focus on cost reduction is a typical 1,000-kilowatt hour (kWh) FPL residential customer bill that was approximately 28% lower than the national average as of year-end 2021 and among the lowest in the U.S.* Additionally, based on the 20 largest investor-owned utilities in the country ranked by number of customers, FPL has the lowest residential bill, which is well below the average.*

Efficient generation and clean energy solutions

FPL has been making smart, consistent, long-term investments in cleaner, state-of-the-art energy centers and replacing old inefficient oil, natural gas and coal plants with modern natural gas units, reducing its oil use to nearly zero since 2001.

*Data does not include Gulf Power.

The Blue Springs Solar Energy Center is one of the newer solar installations in the FPL fleet. The facility, located in Northwest Florida's Jackson County, was commissioned in 2022.

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LEADING COAL PHASE-OUT STRATEGY

Coal plant retirements by FPL in Florida:

2016
Cedar Bay
250 MW

2018
St. John's River Power Park
254 MW (Units 1 and 2 ownership portion)

375 MW (Units 1 and 2 bought purchased power agreement portion)

2020
Indiantown Cogen
330 MW

Plant Crist
924 MW (Units 4-7)

FPL has closed all of its coal plants in Florida.

Coal plant retirements outside of Florida:

2021
Plant Scherer
634 MW
(Unit 4 ownership share)

2024
Plant Daniel
502 MW
(Units 1 and 2 ownership share scheduled to retire by January 2024)

2028
Plant Scherer
215 MW
(Unit 3 ownership share scheduled to retire by 2028)

FPL's generation fleet is now one of the cleanest and most efficient in the country, saving customers more than $12 billion in fuel costs and avoiding more than 175 million tons of CO_2 emissions since 2001.

In recent years, FPL acquired coal plants from which we were previously contractually obligated to purchase power and subsequently began to close and demolish these plants. FPL has permanently closed approximately 2,133 MW of coal generation, including joint ownership interests, since 2015. The Indiantown Cogeneration Plant was closed at the end of 2020, and the Gulf Clean Energy Center, formerly Plant Crist, was converted to natural gas, cutting its CO_2-emissions-rate by 40%. With the conversion of the Gulf Clean Energy Center and the retirement of Indiantown Cogeneration Plant, 2021 marked the first time in nearly 70 years that FPL had no coal-fired power plants in Florida. At the end of 2021, FPL formally retired its portion of a coal unit located in Georgia. FPL has announced plans for retirements of two of its three remaining coal units outside of Florida by January 2024. FPL also owns a 25% interest in an 860-MW coal unit at a multi-unit power plant in Georgia. This unit in which we own an interest is slated to close around or before 2028.

The distinct red and white stacks of FPL's Cape Canaveral Power Plant in Florida are demolished to make way for a more modern, efficient, less-carbon emitting facility to serve Florida customers.

FPL has invested in natural gas generation to reduce dependence on oil and coal. Its highly efficient natural gas power generation fleet has helped drive these coal retirements, reduced costs for its customers and lowered its CO_2-emissions rate. Its natural gas units emit approximately one-third the CO_2 of similarly sized coal units, while maintaining affordability and reliability. In the future, we plan to adapt FPL's natural gas power generation fleet to use zero-carbon-emissions green hydrogen. In fact, FPL received approval to develop Florida's first green hydrogen plant, which is expected to come online in 2023 at our Okeechobee Clean Energy Center. Early investments in modernizations, such as green hydrogen, are an important part of our Real Zero journey and pave the way for cost-effective conversion of our existing natural gas-fired plants to green hydrogen.

In addition, we are bringing the benefits of solar energy to the Sunshine State. Solar is now the most cost-effective generation resource in most parts of FPL's service area. FPL leads all utilities in the nation with the most universal solar capacity and is currently Florida's largest generator of solar power. In 2019, FPL announced its groundbreaking 30-by-30 plan, representing one of the largest solar expansions in the world. By April 2022, FPL passed the 50% mark toward completing the plan with 50 solar energy centers in operation. FPL now expects to install 30 million solar panels across the state of Florida by 2025 – five years ahead of schedule.

FPL is giving customers additional opportunities to invest in solar through the FPL SolarTogether™ program – the largest community solar program in the U.S. The program was initially launched in 2020 to provide customers the opportunity to offset their energy capacity with power from 20 universal solar energy centers totaling nearly 1,500 MW of capacity.

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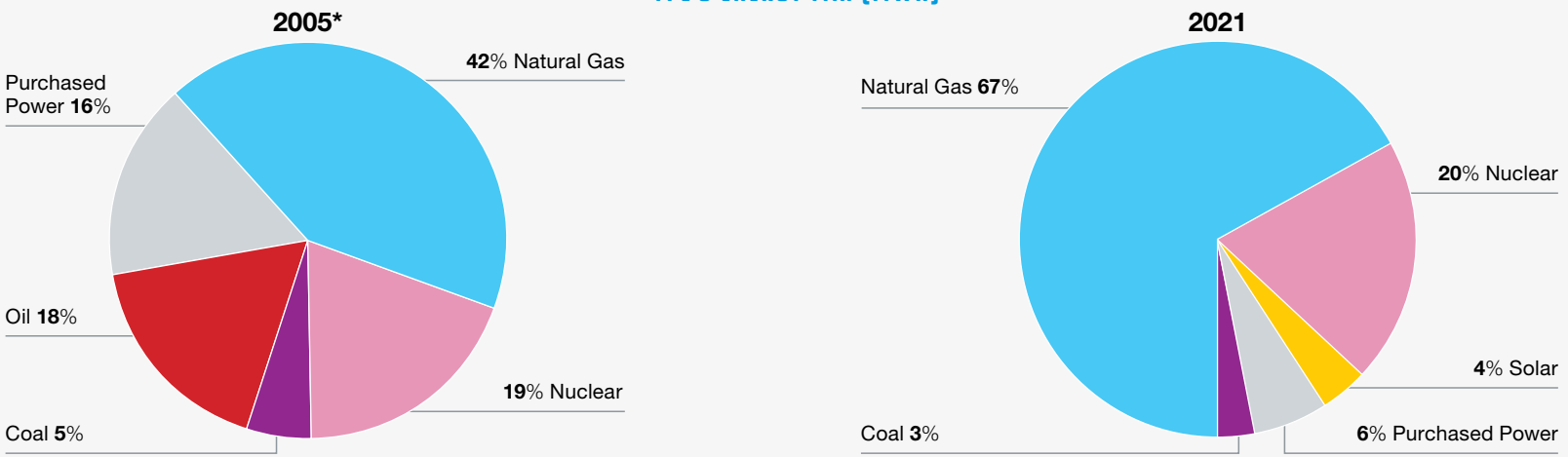
FPL'S ENERGY MIX (MWH)



Due to the overwhelming popularity of SolarTogether, a program extension – which would include 24 more solar energy centers and 1,788 MW of additional capacity – was approved in 2021. SolarTogether also includes an allocated portion of solar capacity for low-income customers, which is the largest low-income solar offering in the country.

We are increasingly combining solar with low-cost battery energy storage. At the end of 2021, FPL commissioned the world's largest solar-powered battery – a 409-MW project adjacent to our Manatee solar facility in Manatee County, Florida. FPL's **Ten-Year Site Plan**, filed in April 2022, includes a significant increase in battery energy storage deployment with approximately 1,800 MW of new battery energy storage by 2031.

We are excited about green hydrogen technology, which will be key to unlocking 100% carbon-free electricity through long battery energy storage created with solar power. Green hydrogen is a versatile clean fuel and important to NextEra Energy's Real Zero goal. Green hydrogen is made by using zero-carbon-emissions electricity to run an electrolyzer, which splits water into hydrogen and oxygen, while producing no greenhouse gas emissions. Green hydrogen holds the promise of addressing hard-to-decarbonize sectors that are important drivers of economic growth in the U.S., such as manufacturing and heavy-duty transportation.

*Data does not include Gulf Power.

FPL is in the midst of executing on an approved pilot program to assess how our combustion turbines operate with a hydrogen fuel mix and learn how a hydrogen fuel production and battery energy storage facility can be effectively used on site with combustion turbine units.

The pilot program is the latest example of how FPL always looks beyond the horizon and eagerly makes disciplined, long-term investments to build a more modern, stronger and cleaner energy grid that all of us – including future generations – can depend on.

The future FPL Cavendish NextGen Hydrogen Hub will leverage solar energy to power the electrolysis process that produces green, or zero-carbon-emissions, hydrogen from water. Once produced, the green hydrogen will be blended with natural gas and used to power an existing combustion turbine at the co-located FPL Okeechobee Clean Energy Center – creating cleaner energy that will help power FPL customers across the grid. Expected learning from this pilot include lessons from design, procurement, construction, commissioning, operations and maintenance during a variety of operational scenarios on the grid. As we execute our Real Zero goal, we project that FPL's CO_2-emissions rate will be approximately 64% lower in 2030 than the industry average was in 2005.

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These electric vehicle fast chargers located at the Turnpike Plaza in Pompano, Fla., are among those available in FPL's EVolution program.

We believe in the future of electric vehicles (EVs). Beyond our generation transformation, we are excited about the potential for the electrification of transportation. In 2019, FPL launched an innovative program designed to boost Florida's electric vehicle charging infrastructure, support EV adoption and increase range confidence. FPL EVolution will bring more than 1,000 charging ports to more than 200 locations across the FPL service area by the end of 2025, and is positioned to be one of the largest fast-charging networks in the state. The program includes more than 800 miles of strategically located, fast-charging stations, where EV drivers will be able to plug in every 25 miles along major highways, such as I-95, the Florida Turnpike and east-west corridors. With the addition of FPL EVolution Fleet and FPL EVolution Home, we also are meeting EV drivers' needs at home, at work and on the road.

On top of investments in EV charging, we partnered with the city of West Palm Beach to purchase five electric school buses for use by the city's parks and recreation department. This project is the first of its kind in Florida – and it's just the beginning. FPL also is leading by example when it comes to driving EVs. We are committed to converting 60% of our light-duty vehicle fleet to electric or plug-in hybrid by 2030, demonstrating our pledge to help Florida become a leader in sustainable transportation and our Real Zero goal to be zero-emitting by no later than 2045.

Building America's smartest and strongest energy grid – reliability and customer service

Another example of FPL's strategy is our extensive effort to harden the energy grid and deploy smart grid technology. In 2004-2005, FPL's service area was hit by seven major hurricanes over 18 months, including Hurricane Wilma, which caused extensive damage throughout FPL's service area, requiring a total restoration time of more than two weeks. Since 2006, we have made significant investments to strengthen the energy grid to improve reliability for customers. By the end of 2021, we had hardened or undergrounded more than 65% of all main distribution power lines. We also have replaced wood transmission structures so that 94% of these are now concrete or steel.

FPL was one of the early adopters of smart grid devices and today has approximately 6 million smart meters and intelligent devices on our grid. Each day we collect about 1 billion data points from these devices and use predictive analytics and algorithms that we developed and patented to identify potential problems so we can fix them before our customers are interrupted and crews are dispatched. Not having to dispatch a vehicle helps reduce our carbon footprint and reduces O&M costs. These intelligent devices can automatically redirect power, self-heal and eliminate or minimize customers affected, resulting in more than 10 million outages avoided over the last decade.

We delivered our best-ever service reliability performance in 2021, continuing a trend in which we've improved reliability by nearly 45% since 2011. Customers in Northwest Florida have seen an improvement of nearly 60% in reliability since becoming part of the FPL family in 2019. For the sixth time in seven years, FPL in 2021 was awarded the ReliabilityOne® National Reliability Award, presented by PA Consulting, to the award recipient that has demonstrated sustained leadership, innovation and achievement in the area of electric reliability.

FPL expects to continue to invest in building the nation's strongest and smartest energy grid. Under a Florida law enacted in 2019, we have filed a long-term Storm Protection Plan that details how we will continue to build a stronger, smarter and more storm-resilient grid in the years ahead. The plan is a continuation of our successful storm hardening and preparedness program and includes additional hardening of overhead transmission and distribution facilities, as well as significant undergrounding of distribution lines. The undergrounding of neighborhood lines, or distribution laterals, will further enhance the network's overall reliability and resiliency.

In addition, we intend to make further smart grid investments over the coming years and will continue to use emerging technology to find new, innovative ways to deliver cleaner, more reliable energy to customers. FPL also focuses on providing best-in-class customer service. The company received the top ranking in the southern U.S. among large electric providers, according to J.D. Power's 2021 Electric Utility Residential Customer Satisfaction Study℠ and 2021 Electric Utility Business Customer Satisfaction Study℠. All our capital investments have improved our customer value proposition, and we have the team and technology to respond to customer concerns quickly and transparently through several communication channels and web-based applications.

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Our focus on enhancing the customer value proposition has helped reduce customer complaints and earn award-winning customer satisfaction. Our survey data indicates that three-quarters of residential customers rate their overall experience with us as excellent. Complaints recorded as logged in the FPSC Consumer Activity Report have dropped from 346 in 2010 to 102 in 2021 – a 71% reduction. During the same period, the number of customers we serve increased by 15%.

Modernizing Northwest Florida with innovative infrastructure and first-class reliability

We are committed to giving our customers in Northwest Florida the best electric service they have ever had. In the three years since welcoming Gulf Power into the NextEra Energy family, we have realized outstanding results toward this goal. On Jan. 1, 2021, Gulf Power merged into FPL with separate retail rates. Following unanimous regulatory approval of a comprehensive four-year-rate agreement, FPL began serving Northwest Florida under unified rates in 2022.

FPL EXPECTS TO CONTINUE TO INVEST IN BUILDING THE NATION'S STRONGEST AND SMARTEST ENERGY GRID.

NextEra Energy acquired Gulf Power in January 2019 and immediately began identifying investments to improve reliability and expand clean energy, while working to reduce costs for customers. Currently, FPL has 19 solar farms in operation or in development across Northwest Florida (not including solar on military installations) – and even more in the works. We completed the Gulf Clean Energy Center coal-to-natural gas conversion and accelerated shut down of its coal units. We also are constructing the North Florida Resiliency Connection (NFRC), a new transmission line that will connect the Northwest Florida and FPL systems. It is expected to be completed in 2022.

The results of the work of our dedicated team and smart investments over the past years have been remarkable compared to industry standards. Due to our smart capital investments, Northwest Florida customers achieved a 24% improvement in CO_2-emissions rate over the last three years. Under our Real Zero goal we will continue to reduce carbon emissions. The investments we are making in Northwest Florida are the same types of investments that have made FPL's energy grid the strongest and most reliable in the nation.

Our service reliability in Northwest Florida has improved by nearly 60% since 2019. The improvements include a pilot program to replace select overhead power lines with underground lines in neighborhoods chosen based on past hurricane outages, vegetation-related service interruptions and other reliability data.

A STRONGER AND SMARTER ENERGY GRID HELPS PREVENT OUTAGES AND RESTORE POWER QUICKER*

deployed
~6 MILLION SMART METERS

installed more than
200,000 INTELLIGENT DEVICES**

collect daily
~1 BILLION DATA POINTS

perform annually
26,000 MILES
of vegetation management

hardened
94%
of transmission structures which are now concrete or steel

* Data as of year-end 2021 unless otherwise shown.
**Milestone reached May 20, 2022.

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NEXTERA ENERGY RESOURCES

NextEra Energy Resources, LLC (together with its subsidiaries) is a clean energy leader, with approximately 24,600 MW of total net generating capacity in the U.S. and Canada, as of year-end 2021, and a total generating capacity of approximately 30,000 MW for the facilities it operates and in which it has ownership interests as of year-end 2021. NextEra Energy Resources has invested capital in nearly every part of the energy and electricity value chain. Yet, the heart of the business is building and growing the world's leading portfolio of wind, solar and battery energy storage assets. Our strategy is focused on developing low-cost and long-term contracted wind and solar generation assets, which are increasingly paired with battery energy storage. NextEra Energy Resources invested in our first wind and solar projects in the 1980s.

From these early beginnings, NextEra Energy Resources has become the world's largest generator of renewable energy from the wind and sun and a world leader in battery energy storage. Since 2012, NextEra Energy Resources has invested nearly $40 billion in wind, solar and battery energy storage to advance our industry-leading position.

With renewable operations in 38 states as of year-end 2021, we are helping states and companies across the U.S. meet renewable portfolio standards and carbon-emissions-reduction goals through the development of zero-emissions renewable energy solutions, while lowering customer bills and creating value for NextEra Energy shareholders. With approximately 50% of U.S. origination market share for wind, 15% of U.S. origination market share for universal solar and 35% of U.S. universal storage origination market share in 2021, NextEra Energy Resources has been a driving force in emissions reductions across the U.S. power sector for three decades.*

FROM 2022 THROUGH 2025, NEXTERA ENERGY RESOURCES EXPECTS TO CONSTRUCT APPROXIMATELY 28 TO 37 GIGAWATTS OF LONG-TERM CONTRACTED RENEWABLES PROJECTS, REPRESENTING ONE OF THE LARGEST-EVER DEPLOYMENTS OF WIND, SOLAR AND BATTERY PROJECTS OVER A FOUR-YEAR PERIOD.

To grow the world's largest competitive clean energy company, we are focused on leveraging our competitive advantages to capitalize on what we believe is the best renewables environment in our history. By executing our strategy, we will lead and partner with the rest of the energy industry to continue to drive North America's clean energy future forward.

* Universal solar means utility-scale projects having at least 10 MW in nameplate generating capacity.

~$40 B
Invested nearly $40 billion in wind, solar and battery energy storage since 2012

~25 GW
Owned or operated about 25 gigawatts (GW) of wind and solar as of year-end 2021

~3,800 MW
Commissioned ~3,800 MW of renewable energy projects and storage in 2021

Employee Chris Farmer heads out to check the turbines at the Golden West Wind Energy Center in Callahan, Colo.

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Wind turbines are visible as the sun shines through the clouds at sunset at the Heartland Divide Wind Energy Center in Audubon, Iowa.

Executing our strategy

NextEra Energy Resources' renewable energy business has been built almost entirely from the ground up, and along the way we have honed several competitive advantages. These start with our development skills – outstanding customer relationships, regulatory and permitting knowledge, the ability to design integrated renewable products, and our history of construction execution and brand recognition.

Another key competitive advantage is scale. NextEra Energy Resources is among the leaders in bringing new renewable energy projects online every year. Our scale allows us to leverage long-term, strategic relationships with our suppliers and lenders to realize sustained cost advantages. With the largest portfolio of development sites and interconnection queue positions in the industry, we believe we are uniquely positioned to execute better than any other company in our sector even in challenging market conditions. Our team's skill set includes a deep understanding of our data and the ability to leverage that data to improve our offerings to customers.

NextEra Energy Resources collects billions of data points every day from its operating wind and solar portfolio and uses that data to make smart decisions to optimize project development, maximize revenues and reduce operational costs. Using advanced analytics, we developed the first-of-its-kind intelligent wind and solar site-design optimization tool.

By processing large proprietary data sets – from weather and resource data, land constraints and equipment characteristics – this tool evaluates thousands of potential layouts to find the optimal design that maximizes value for each site. With digital work plans and the ability to view real-time performance of the fleet, we leverage digital tools to streamline, simplify and automate labor-intensive processes, while optimizing work planning across our portfolio. These efforts have allowed NextEra Energy Resources to reduce our wind O&M costs per MWh by approximately 34% since 2016, with the expectation of another 10% reduction by 2023. For solar, we aim to reduce NextEra Energy Resources' O&M costs per MWh by approximately 44% from 2016 to 2023.

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Renewables' market potential

Over the past 10 years, renewable energy has shifted from a business solely driven by compliance to one that is driven by both compliance and economics. Today, new renewable energy resources are cheaper than the operating costs of many older, inefficient fossil generation units. With continued technology improvements and cost declines, we believe that by the latter part of this decade, after U.S. federal tax credits phase down, new near-firm (with battery energy storage) wind will be a $25 to $32 per MWh product and new near-firm (with battery energy storage) solar will be a $30 to $37 per MWh product, continuing to be the low-cost generation alternatives.

NEXTERA ENERGY RESOURCES IS KEY TO NEXTERA ENERGY'S LEADERSHIP IN THE DECARBONIZATION OF THE POWER SECTOR AND OTHER PARTS OF THE U.S. ECONOMY.

Market estimates now anticipate the renewable energy market to grow at roughly 15% per year through the next decade and that the wind and solar share of the nation's generation mix could grow from less than 13% in 2021 to about 60% in 2035. We have conducted a scenario analysis to model the U.S. energy grid to determine how the U.S. electric sector can achieve a 100% carbon-free electricity grid on a long-term horizon by 2050. Based on our analysis, we believe there is an opportunity to build approximately 3,600 GW, or more than 100 GW per year, of renewable energy and storage through 2050. Additionally, decarbonizing the electricity sector of the economy results in excess carbon-free energy that may be converted to green hydrogen to decarbonize other sectors of the economy. This creates an estimated $4 trillion investment opportunity in renewable energy plus storage through 2050.

Positioned to decarbonize the U.S. economy

NextEra Energy Resources is key to NextEra Energy's leadership in the decarbonization of the power sector and other parts of the U.S. economy. With our meaningful competitive advantages, we are well positioned to capitalize on this opportunity through better development and operational and customer solutions.

NextEra Energy Resources' focus on leading the power sector's transition to low-cost renewables is reflected in our development expectations. From 2022 through 2025, NextEra Energy Resources expects to construct approximately 28 to 37 GW of long-term contracted renewables projects, representing one of the largest-ever deployments of wind, solar and battery projects over a four-year period. In 2021, we had a record year of success, commissioning approximately 3,800 MW of renewable energy projects during the year and adding about 7,200 net MW of renewables and storage to our backlog.

Employee Francisco Castellanos checks on the battery energy storage facilities Blythe and McCoy Energy Centers in Blythe, Calif.

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An artist's rendering of the Okeechobee Clean Energy Center in Florida includes the Cavendish NextGen Hydrogen Hub.

Our renewables backlog, as of year-end 2021, was approximately 16,600 MW, which is roughly the size our entire renewables generation portfolio was at the end of 2017 and nearly 25% larger than our backlog at year-end 2020. In 2021, we added approximately 2,008 MW of new wind generating capacity and 728 MW of solar generating capacity, repowered 435 MW of wind generating capacity and increased our backlog of contracted renewable development projects. We are well on our way to meeting our current development expectations for new signed contracts.

Green hydrogen presents a particularly compelling new market for NextEra Energy Resources, where we have explored a number of pilot programs. A clean energy technology company with which we have partnered has developed proprietary processes to decarbonize industrial production of hydrogen at economic prices and recently won conditional approval for an approximately $1 billion Department of Energy loan to expand its methane pyrolysis process facilities in Nebraska that produce clean hydrogen and low-emissions carbon black, which is primarily used in manufacturing tires, plastics, inks and toners, and other products. Our agreement with this company provides NextEra Energy Resources the opportunity to be its preferred renewable energy supplier for the manufacturing facility. Similarly, we also have partnered with a liquid fuels company with a proprietary process to produce zero-emissions synthetic fuels by combining green hydrogen with concentrated CO_2 streams captured from industrial processes. Our strategic partnership with this company includes the opportunity for NextEra Energy Resources to provide up to 3,000 MW of renewable energy under a preferential energy supply agreement.

In addition to assisting customers with the transition to sustainable and zero-carbon-emissions transportation, we are helping our customers optimize their energy use and reach their own carbon-reduction goals. Our NextEra 360 software platform leverages data from NextEra Energy Resources' world-leading renewable fleet. The software is part of our broader suite of sustainability solutions that help our customers navigate the sustainability journey to achieve their own Real Zero.

In addition, we are helping to change the landscape of water resource management through NextEra Distributed Water's on-site reclamation and reuse services. The company's ecologically engineered, district-scale water recycling systems, called Water Hubs, reduce water supply risk, have the potential to save millions of dollars in utility costs and improve environmental stewardship.

As we execute our Real Zero goal and develop additional renewable energy opportunities over the coming years, we expect to deliver benefits for customers and many other stakeholders. Older, inefficient and higher-cost generation units will be replaced with clean low-cost wind and solar, reducing customer costs, emissions, water use and waste. The billions of dollars of investments we plan to make will support local communities and create attractive construction and operations job opportunities. Finally, shareholders will benefit through execution of a sustainable business strategy that also delivers attractive long-term growth.

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ENVIRONMENTAL

Being a good steward of the environment means making the right choices. NextEra Energy has been an industry leader in protecting the environment for many decades, and we continue to demonstrate that commitment with our Real Zero goal. We invest in low- and zero-carbon-emissions generation. We support environmental conservation and research. We conserve and enhance biodiversity on land for which we are responsible. We engage with environmental and government agencies and local stakeholders. We follow our environmental policy that includes our strategies to prevent pollution, minimize waste, and conserve natural resources and habitats where we operate.

FPL has a long history of protecting sea turtles, not only at our generating facilities like the St. Lucie Nuclear Power Plant, but also through our sea turtle lighting program in the coastal areas within our service territory.

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ENVIRONMENTAL

Managing and mitigating environmental risk

Environmental risk identification, mitigation and management are key drivers for ensuring safe and sustainable operations. More than 150 corporate environmental professionals and numerous others embedded in our operating business units keep these environmental drivers top of mind, all of whom are key members of the teams that develop and operate our projects over the long term. These include experts in air emissions, water use and quality, remediation, wildlife and habitat, oil and hazardous substances, archaeology and cultural resources, and environmental policy, all critical to the responsible development and ongoing operation and compliance of our facilities. Whether it is a modernization of an existing generation facility, a clean energy development project, a transmission or distribution infrastructure project or development of corporate facilities, our environmental services team is part of the entire life cycle of the project to ensure that we identify, mitigate and manage any potential impacts to the environment.

We also work closely with a wide range of environmental organizations to ensure responsible development and operations and to complete environmental stewardship projects that go beyond compliance. We also invest philanthropic dollars for environmental education, conservation and research. We employ a multifaceted, proactive approach to managing environmental protection and stewardship and achieving our goal of zero significant environmental events every year. Our programs include employee and contractor training, daily site inspections, remote satellite and drone monitoring, routine self-assessments, compliance tracking systems, environmental construction monitoring, environmental audits, quarterly business unit reviews with our Corporate Environmental Governance Council and quarterly due diligence reporting to executive management and the NextEra Energy board of directors.

Climate change, decarbonization and Real Zero carbon emissions reductions

We believe our industry can best confront climate change by investing in clean power generation that produces zero or low emissions. This has been part of the strategy across all of our businesses for a long period of time and is a key element of our Real Zero goal. Our portfolio has one of the lowest emissions profiles of any utility in North America. In 2021, sulfur dioxide (SO_2), nitrogen oxides (NOx) and CO_2 rates were 98%, 74% and 51% lower, respectively, than the U.S. electric power sector average. We have also set a clear goal to reduce carbon emissions further with Real Zero and are making excellent progress toward that achievement. Our near-term goal is to reduce our CO_2-emissions rate 70% by 2025 from an adjusted 2005 baseline, while our long-term goal is to achieve Real Zero carbon emissions by no later than 2045. From 2005 to 2021, NextEra Energy reduced its CO_2-emissions rate by 58%.*

FPL biologist Mary Jo Hernandez uses a test strip to measure water pH as part of routine monitoring around the Turkey Point Clean Energy Center in Florida.

*We are striving to achieve our goal of Real Zero emissions by no later than 2045 so long as there is no incremental cost to customers relative to alternatives, our efforts to do so are supported by cost-effective technology advancements and constructive government policies and incentives and our investments are acceptable to our regulators. Throughout this report, we reference our adjusted 2005 baseline for our emissions reduction goal. The 2005 baseline is adjusted to account for acquisitions and divestitures during the goal period. Certain facilities within the NextEra Energy wind and solar generation portfolio produce Renewable Energy Credits and other environmental attributes which are typically sold along with the energy from the plants under long-term contracts, or may be sold separately from wind and solar generation not sold under long-term contracts. The purchasing party is solely entitled to the reporting rights and ownership of the environmental attributes. Visit "Reports and Filings" on the investor page of NextEraEnergy.com for more information. Throughout this report, we reference our adjusted 2005 baseline for our emissions reduction goal. The 2005 baseline is adjusted to account for acquisitions and divestitures during the goal period.

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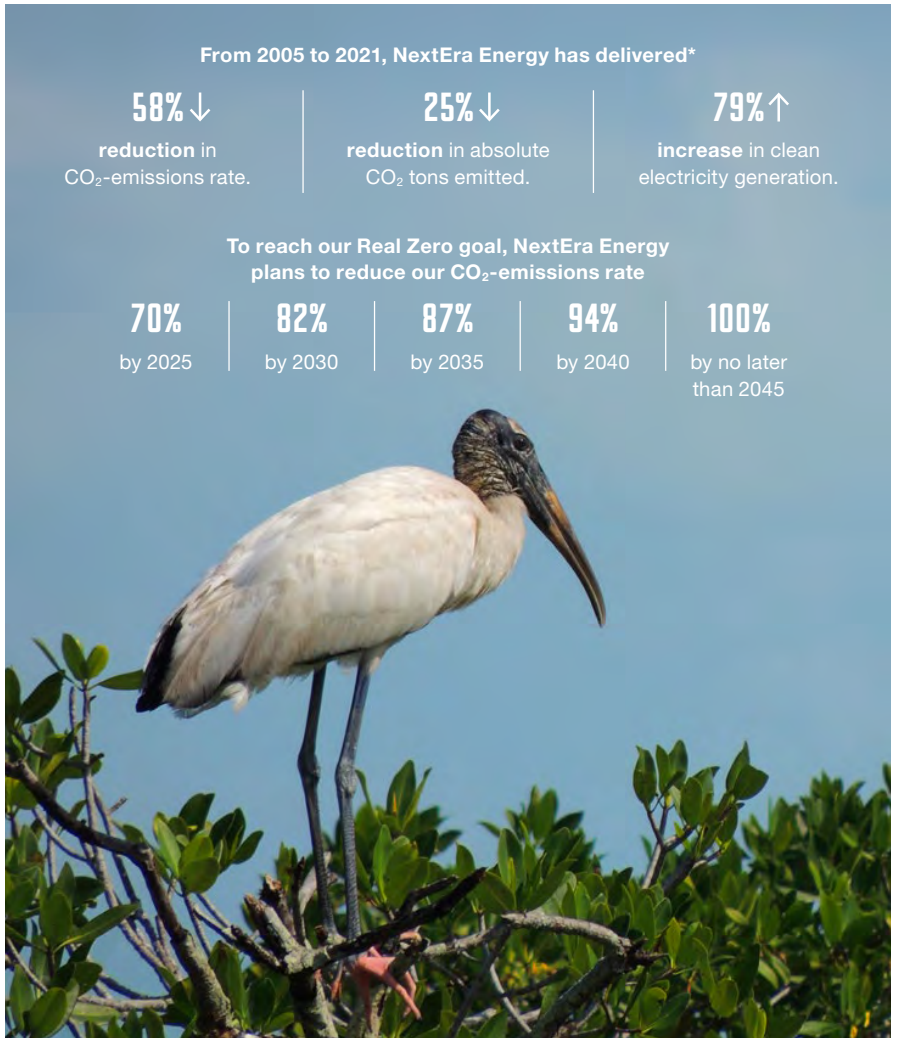

This wood stork is one of many birds that frequent the natural areas surrounding the Turkey Point Clean Energy Center in Florida.

Through Real Zero, our goal is to expand our innovative solutions, such as FPL SolarTogether, energy efficiency programs, NextEra Energy Resources' wind and solar projects, and other offerings, to help customers, states and businesses across the country reduce their emissions and meet their clean energy goals. Real Zero also includes the continued safe operation of our nuclear fleet to generate zero-carbon-emissions electricity, a core component of our environmental strategy.

Verifying our emissions data

Our 2021 scope 1, scope 2 and partial scope 3 emissions inventory received independent third-party verification. The verification activities were conducted in alignment with the principles of ISO 14064-3:2006(E) Specifications with Guidance for the Validation and Verification of Greenhouse Gas Assertions. Our verified scope 1, 2 and 3 emissions data and additional information can be found in Appendix E (Emissions data and third-party emissions assurance statement) of this report.

> WE ALSO WORK CLOSELY WITH A WIDE RANGE OF ENVIRONMENTAL ORGANIZATIONS TO ENSURE RESPONSIBLE DEVELOPMENT AND OPERATIONS AND TO COMPLETE ENVIRONMENTAL STEWARDSHIP PROJECTS THAT GO BEYOND COMPLIANCE. WE ALSO INVEST PHILANTHROPIC DOLLARS FOR ENVIRONMENTAL EDUCATION, CONSERVATION AND RESEARCH.

Water availability

Water is a vital natural resource. We continue to take measures to reduce our water consumption, including investing in both water-free power generation from wind and PV solar, and in more efficient generation at our facilities that use steam turbines. To ensure sustainable access to water, we are active stewards of sourcing, using and managing this critical resource in the communities in which we operate. We embed water conservation management strategies into our business planning and operational practices to lower costs and mitigate risks posed by water availability. We reduce consumption through efficiency, technology and operational improvements.

Our investments in water-free wind and PV solar energy, which currently comprise more than a third of our company's generating capacity, avoided the use of more than 20 billion gallons of water in 2021. Nearly 74% of the water NextEra Energy generating facilities withdrew in 2021 came from saltwater sources, which are non-potable and not subject to drought.

*Based on a 2005 baseline adjusted for acquisitions and divestitures during the emissions-reduction goal period.

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Importantly, 98% of water withdrawn for use at our natural gas plants is withdrawn via a once-through cooling system and then returned to its original source. The remainder is reused or consumed through evaporation or deep-well injection.

Only one of 25 of our generation facilities that use water is located in a region of high or extremely high water stress in the U.S. In 2021, we used 7.1 billion gallons of reclaimed water for cooling purposes. Doing so offsets the demand for higher-quality water and reduces water supply risk. We continue to find innovative ways at our generation facilities to use the lowest-quality water sources, including reclaimed water, which reduce impacts to higher-quality sources like groundwater. At FPL's Sanford Plant, we are transitioning from using groundwater to surface water, which assists the St. Johns River Water Management District in protecting the Volusia Blue Spring. Additionally, at FPL's Okeechobee Clean Energy Center, we are deepening a groundwater well to use lesser quality water from the Avion Park Production Zone, instead of sourcing water from the Upper Floridan Aquifer.

In June 2020, the Miami-Dade County Commission approved FPL's proposed development of an advanced reclaimed water project to reuse treated wastewater from the county at FPL's Turkey Point Clean Energy Center. The state-of-the-art FPL Miami-Dade Clean Water Recovery Center (CWRC) will further treat and reuse up to 15 million gallons of reclaimed water per day from the South District Wastewater Treatment Plant in Miami-Dade County. FPL will use 100% of that reclaimed water to cool a natural gas plant at Turkey Point.

A win-win for FPL customers, Miami-Dade County and the Sunshine State, the CWRC will increase resiliency at the Turkey Point Clean Energy Center, provide a cost-effective way to reuse and recycle treated wastewater that would otherwise be discarded, and conserve Floridan Aquifer groundwater at the Turkey Point site. The CWRC also will help Miami-Dade County meet regulations of the Ocean Outfall Act, which set a state requirement for Miami-Dade County to reuse 60% of its wastewater.

Reducing waste

We believe the best way to deliver environmental value by minimizing our waste footprint begins with reducing the amount of waste we generate in the first place. Then, we look for opportunities to reuse and recycle materials to minimize the waste that we send to local landfills.

From modernizing many of our facilities and reducing the amount of oil-ash generated to banning the use of chlorinated solvents at all facilities and continuing to phase out polychlorinated biphenyl (PCB) equipment, we are reducing the amount of waste generated.

Environmental water conservation measures are underway at the Okeechobee Clean Energy Center in Florida to deepen a groundwater well which will allow the company to reduce its potable ground water use at this site.

We have greatly reduced the amount of hazardous waste we generate to maintain the status of a Very Small Quantity Generator, the lowest possible federal regulatory classification. NextEra Energy provides documented training to employees to ensure that hazardous waste, when generated, is properly identified, stored, disposed or recycled. All aspects of waste management are validated through facility environmental audits that include records review, site inspection and personnel interviews. In addition, all waste management vendors receive an environmental audit from either internal audit personnel or through CHWMEG, a nonprofit trade association, and its global Facility Review Program. Active engagement with industry groups, like Cross-Cutting Issues Group and the Electric Power Research Institute, also helps ensure understanding of evolving standards and compliance obligations.

We also seek opportunities to identify and implement reuse and recycling programs that result in environmental and economic benefits. In 2021, our corporate recycling and services facility reconditioned and redirected $4.7 million worth of equipment back into inventory. In addition, our investment recovery team engages a seven-step process for asset disposition when assets reach the end-of-use stage: reuse, recondition, return, resell, reclaim, recycle and remove. In 2021, FPL was awarded the Trailblazer Award from the Florida Recycling Partnership Foundation for the investment recovery operation.

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Another example of how NextEra Energy is working to reduce waste and streamline costs comes from our supply chain business unit. FPL replaces poles as needed due to aging, storms and grid hardening efforts. These poles include both wood and reinforced concrete. Historically, wood poles were cut into manageable pieces and collected for landfill disposal. Concrete poles would be transported to a crusher, with FPL covering transit costs. The team identified a source to recycle wood and concrete poles and reduce landfill costs, saving $400,000 in cost avoidance and keeping 20.5 million pounds of debris out of the landfill. Our partner provides one-stop support for all poles. About 75% of the wood poles are now redeployed to landscapers or other end re-users so only 25% go to landfill, while all concrete poles are crushed and used as aggregate.

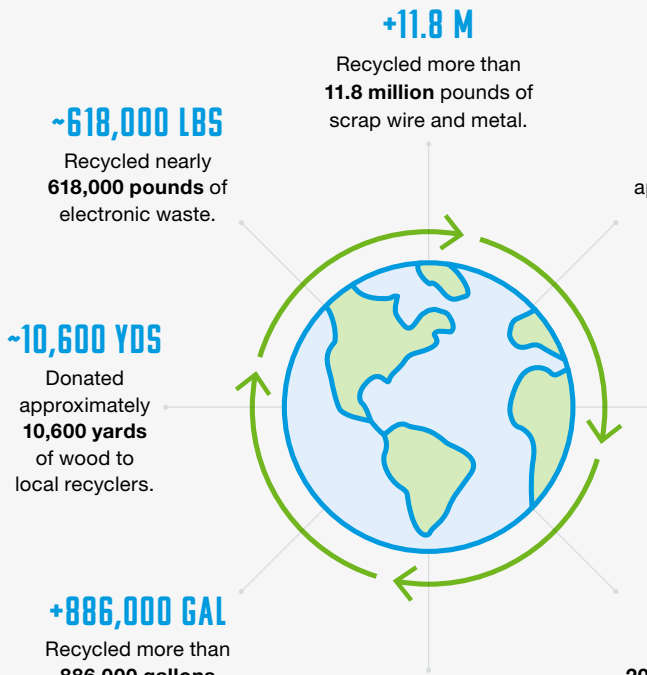
WE EMPLOY A MULTIFACETED, PROACTIVE APPROACH TO MANAGING ENVIRONMENTAL PROTECTION AND STEWARDSHIP AND ACHIEVING OUR GOAL OF ZERO SIGNIFICANT ENVIRONMENTAL EVENTS EVERY YEAR.

While our solar and wind fleet are still early in their operating lives, we are working with our vendors on recycling plans. We have proactively worked with solar vendors on plans to first reuse solar infrastructure components when a site is decommissioned and, in the event they cannot be reused, to recycle them. We have recently employed the same collaboration with wind vendors for waste management as we decommission or repower wind sites. Many of our wind vendors have made significant strides in recycling.

This was recently demonstrated by GE Renewable Energy's announcement that it has entered into long-term contracts to recycle blades removed from its U.S.-based turbines during upgrades or repowering. The recycled blades are used as a raw material for cement. In 2021, 580 blades from five projects were identified for recycling, including 393 that were removed in 2020 and recycled in 2021 and an additional 287 blades that were removed in 2021 to be recycled in 2022.

Preserving and protecting habitat and wildlife

Environmental stewardship includes habitat and wildlife protection. Before we build any operating facility, we study the local ecosystem so that we can better understand what it takes to be a partner in its preservation and to be a good neighbor to all the species that live there. We carefully consider the presence of any threatened or endangered species, as well as significant wildlife corridors, wetlands or other ecologically important areas.



Data from year-end 2021.

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We seek to minimize and mitigate the impact of our development before we begin a project and, once a project is operating, we continue to monitor potential impacts to biodiversity. The Land-Based Wind Energy Guidelines, Avian Protection Plan Guidelines and Manatee Protection Plans are among numerous policies and programs aimed at protecting threatened and endangered species that we follow across our operations. In addition to following all federal and state regulations, we make important contributions to scientific research to protect numerous vulnerable species and habitats and to better understand how to reduce impacts. Several examples of our wildlife and habitat restoration projects are featured below.

Solar stewardship

At our Florida solar energy centers, we work with Audubon Florida and other local organizations to craft site-specific enhancement and preservation plans focused on providing habitat opportunities for birds, pollinators and other wildlife. This is accomplished through a variety of prescriptive methodologies, including but not limited to: restoring hydrology to wetlands, increasing biodiversity through the use of appropriate native plant species, applying integrated approaches to minimize the prevalence of invasive species, incorporating pollinator species into ground covers and installing of artificial perches, nest boxes and platforms for wildlife use.

For example, to avoid disrupting the delicate Florida ecosystem, sites within panther habitat include wildlife-friendly fencing. This special fencing is designed so that both panther prey species and panthers themselves can pass through or over the fence. At our FPL Hammock Solar Energy Center, which has been operating since 2018, we conducted a study with 20 cameras set along the perimeter fence and throughout the site to ensure that animals were able to access and use the site successfully and safely. In 2021, the company standardized the use of wildlife-friendly fencing at all future solar sites in Florida to further allow for wildlife use.

Outside of Florida, we follow a similar process. NextEra Energy Resources evaluates opportunities to implement additional voluntary stewardship actions on a project-by-project basis. Voluntary stewardship supplements the development process and takes further steps to preserve and enhance existing natural resources.

Two caracara and a red-shouldered hawk scout for prey at our Blue Heron Solar Energy Center in Hendry County, Fla.

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These additional actions can work to address local stakeholder concerns, build upon required regulatory actions and the stewardship components of the project development process, and address stewardship goals, such as preserving or enhancing biodiversity.

Monarch butterfly and pollinators

To demonstrate our commitment to protect pollinators and their habitats, FPL is one of the first electric utilities to have enrolled in the voluntary Monarch Candidate Conservation Agreement with Assurances. By enrolling, FPL has committed to implement measures to create conservation benefits for the monarch butterfly. These measures can also benefit other pollinators.

In addition to direct habitat conservation measures, it is also important to contribute to our scientific understanding of pollinator preservation. NextEra Energy is engaged in a research partnership with the University of Illinois Chicago's Energy Resources Center (UIC-ERC) to answer key questions at the intersection of insect pollinator conservation and solar power. The study, entitled "Evaluation of Economic, Ecological, and Performance Impacts of Co-Located Pollinator Plantings at Large-Scale Solar Installations," will examine the economic, ecological and performance impacts of pollinator habitats co-located at five large-scale solar PV facilities in the Midwest and Mid-Atlantic regions, one of which is a subsidiary of NextEra Energy.

Wildlife and habitat research

NextEra Energy Resources participates in the Renewable Energy Wildlife Research Fund (REWRF), which is housed within the Renewable Energy Wildlife Institute, an independent, nonprofit organization that works to solve renewable energy, wildlife, and related natural resource challenges through sound science and collaboration. The REWRF is currently funding innovative research projects related to bats, eagles and grouse, and will be expanding into solar research topics to better understand the potential impacts on species and habitat. REWRF will also explore potential benefits to ecosystem services that solar energy can provide (pollination, soil preservation, water quality, etc.). All research is conducted by independent third parties and will be peer reviewed and publicly released.

Manatees

For decades, FPL has worked closely with state and federal agencies to ensure manatees are protected. In 2016, FPL opened Manatee Lagoon, an eco-discovery center, to help educate the public and inspire communities to preserve and protect Florida's environment and wildlife for future generations. At FPL's Cape Canaveral Clean Energy Center, the U.S. Fish and Wildlife Service (USFWS) and the Florida Fish and Wildlife Conservation Commission (FWC) created

Manatees munch on romaine lettuce at FPL's Cape Canaveral Clean Energy Center in Florida. The supplements were provided for manatees in response to the 2021 Unusual Mortality Event. Photo courtesy of the Florida Fish and Wildlife Conservation Commission.

a temporary field response station to support the Florida manatee in response to the 2021 Unusual Mortality Event (UME) declared following an abnormal number of manatee deaths in Florida. The energy center, located in the northern Indian River Lagoon, is a critical stop-off point, where manatees congregate as they migrate south during the winter. We eagerly worked with the FWC to assist in the effort and pledged to contribute more than $700,000 over the next three years to help with manatee rescue and rehabilitation, education and habitat restoration.

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Mike Lloret, a wildlife biologist with FPL, holds several American crocodile hatchlings. The reptiles have found an ideal home in the habitat surrounding FPL's Turkey Point Clean Energy Center in Florida.

Researchers determined the cause of the manatee UME is starvation attributed to a lack of seagrass, a primary food source, in the Indian River Lagoon. Supporting research to restore and recover seagrass can positively benefit the health of Florida manatees. With this knowledge, the NextEra Energy Foundation provided grants to the Florida Atlantic University (FAU) Foundation for the FAU Harbor Branch Experimental Seagrass Nursery and to the Florida Oceanographic Society to support seagrass research and on-site seagrass nursery operations.

Additionally, in partnership with the Fish & Wildlife Foundation of Florida, FPL funded a new manatee rescue transport truck for FWC. This truck was added to the FWC fleet to expand rescue efforts and transport sick or injured manatees to rehabilitation facilities throughout Florida.

American crocodiles

On the brink of extirpation from the U.S. in the late 1970s due to habitat loss, the American crocodile has made a dramatic comeback in the habitat surrounding FPL's Turkey Point Clean Energy Center. In the 1980s, FPL initiated a crocodile management program at the plant.

This plant has a 5,900-acre, manmade cooling canal system and surrounding land that offers ideal nesting conditions for the American crocodile. Our crocodile management program includes protecting these nesting areas, completing population surveys, conducting capture and spatial distribution surveys, and regulating plant activity at night and during nesting season. In 2021, FPL biologists captured, tagged and released a record setting 565 hatchlings. Our strategy to prepare historical nesting locations before the season and improve the water quality of the cooling canal system led to 27 successful nests in 2021, the second-highest year on record, behind 28 successful nests in 2008.

Avian protection programs

We have taken the initiative to protect bird species through several innovative programs. When siting projects, we are dedicated to avoiding and minimizing impacts to both terrestrial and avian species and their habitat. For NextEra Energy Resources' wind facilities, we follow industry and agency guidelines, which include voluntarily collecting and providing eagle nesting and avian point count survey data results, as well as post-construction mortality monitoring results, to the USFWS. Our practice also is to site our turbines at least 2 miles away from every known eagle nest, unless otherwise approved by USFWS. In addition to our siting practices, we use IdentiFlight®, a developing automated technology used to detect, identify and protect eagles at wind farms by using high performance optical systems paired with machine vision software. Golden Hills Wind, LLC has been conducting a pilot project using this technology to minimize effects to golden eagles at the site.

By detecting an eagle as far as 1 kilometer out from an operating wind turbine, in real time, the IdentiFlight system maximizes the protection for eagles compared to other non-automated systems. The pilot project, at the two-year mark, is demonstrating very promising results. In addition to our project specific work, we have funded several research projects related to eagle population assessments and eagle conservation. NextEra Energy Resources also has recently reached a voluntary agreement with the federal government pursuant to which it will spend up to approximately $27 million to minimize additional eagle deaths and injuries at approximately 50 of its existing wind facilities. NextEra Energy Resources continues to minimize our interactions with bald and golden eagles through our siting practices, research and conservation. See our **statement** for additional details.

Since 2007, FPL has invested more than $130 million to construct and retrofit more than 150,000 poles to make them more bird-friendly, reducing avian risk and improving service reliability to our customers. To identify and proactively address high-risk distribution structures, FPL created the energy industry's first avian risk assessment model. In 2014, FPL updated the avian risk assessment model to further enhance avian assessment for eagles and wood storks and protection processes.

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Sierra Franco is a two-time participant in the NextEra Energy Internship Program. This year, Franco is interning with environmental services after being an intern with power delivery in 2021.

SOCIAL

Our three core values are at the forefront of everything we do:
We are committed to excellence.
We do the right thing.
We treat people with respect.

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SOCIAL

Our culture and people

Our culture and people are our most important resource and a key competitive advantage. We have a culture that is centered on our people, setting big goals and focusing on execution, and continuous improvement and accountability in everything we do. Integrity and ethical behavior are at the very foundation of who we are, what we do and how we do it. We expect all employees and contractors of our company to act with the highest standards of personal and professional integrity and to comply with all applicable laws, regulations and company policies.

At NextEra Energy, we have three principal codes of conduct that embody these values and help ensure they are upheld: our Code of Business Conduct and Ethics, our Code of Ethics for Senior Executive and Financial Officers and our Supplier Code of Conduct and Ethics. Each year, all non-bargaining employees are required to review our Code of Business Conduct and Ethics and certify compliance via a required annual code of conduct training session. Every year NextEra Energy hosts several events for employees to showcase innovation and advances in technology. Our annual NextEra Energy Quality, Safety and Innovation Expo provides an opportunity for employees to learn about the latest innovations in technology, safety and practices that power our company.

Human rights

We are committed to maintaining a culture that supports human rights. This commitment to human rights is consistent with our company's core values and cuts across all operations. Our Code of Business Conduct and Ethics reminds our employees and those doing business on our behalf of their moral, ethical and legal responsibility to protect the rights of all people. Further, one of our core values is "Treat People with Respect." This means all people. We are subject to federal and state labor laws, which address freedom of association and collective bargaining, child labor, and forced and compulsory labor.

Our commitment to human rights extends to our international suppliers. We work closely with our solar panel and energy storage suppliers to protect that our equipment, including components, are produced without forced labor. First, our new contracts require that our solar supplies, including components, be manufactured outside of the Xinjiang Uyghur Autonomous Region of China and without the use of forced labor. Second, our new contracts include a commitment from our suppliers' to maintain a strict forced labor compliance program that documents the supply chain from raw materials to finished products. Finally, we hired an independent third party to review our solar suppliers' manufacturing and supply chain traceability documents to help confirm that our products were being manufactured outside of Xinjiang and without forced labor.

Employees Phuong Geer and Ray Lozano participate in Power to Care week by sprucing up the Citrus Health Center in Pembroke Pines, Fla. Volunteers cleaned, painted and planted flowers and gave back to the community.

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Arlo Smith works on a storm hardening project in Northwest Florida.

Company operations do not interfere with employees' freedom of association and collective bargaining. We are committed to continued compliance with those laws and the rights of Indigenous people. We support compliance with federal and state laws by continuous monitoring and auditing of our internal processes, such as hiring and promotion practices.

Additionally, we actively encourage all employees to speak up if they believe our Code of Business Conduct and Ethics or labor laws have been violated. All such reports are taken seriously and investigated. We expect the same standards from our suppliers and all other entities with whom we conduct business.

Safety

There is nothing more important in our company than the safety of our employees and our customers. Our commitment to safety is a hallmark of our culture and a reflection of our focus on execution. Our vision for corporate safety is to establish and promote a safety culture based on the principle that zero injuries is the only acceptable target. We've made safety a part of every employee's annual goals to reach this target. We're proud of our decades-long record of safe operations. Since 2003, we have seen an 85% improvement in safety performance as of year-end 2021. Our safety performance ranks in the top decile for our industry.

To ensure we maintain a safe working environment, we leverage safety committees, as well as an Executive Safety Council that reviews and addresses our work-related injury risks. Numerous NextEra Energy locations participate in the Voluntary Protection Program (VPP) of the Occupational Safety and Health Administration (OSHA). Currently, 28 of our work locations have received an inspection from OSHA and recognition as a VPP Star Site. We are also committed to using suppliers with a demonstrated commitment to safety. In general, suppliers who have a presence on company premises of 30 or more cumulative person-days within 12 months are required to comply with the requirements of NextEra Energy's Supplier Safe and Secure Workplace Policy. We maintain specific guidelines for the implementation of safety goals and invoke them as requirements within contractual agreements with our suppliers.

The safety of our customers is equally important. We provide resources and continue to leverage our Safety 6 program to educate the public on how to prevent safety incidents near power lines. We encourage anyone working outdoors to follow these rules:

1. **Work at a safe distance.**
2. **Stay calm, stay away.**
3. **Don't mix ladders and lines.**
4. **Call 811 before you dig.**
5. **Look up and live.**
6. **Respect that downed lines can be deadly.**

Attracting and retaining talent

We believe that achieving success begins with people. We are focused on attracting and retaining a diverse, highly skilled and multi-generational workforce that can help us drive innovative and creative solutions to meet the continually evolving needs of our customers. We are focused on attracting and retaining the talent needed to support our culture of innovation and continuous improvement. As a world leader in clean energy, we attract highly skilled talent from across different specializations, including engineering, computer, math and data science, finance, legal and technology professionals, such as cyber security, biologists, chemists, and countless field and technical industry specialists, who are eager to be a part of providing a more safe and sustainable energy future for the U.S. In 2021, our talent acquisition team attended career fairs and college recruiting events across the country to identify top candidates and partner with key organizations, such as Women in Technology International, the National Black MBA Association, the American Indian Science and Engineering Society, Society of Hispanic Professional Engineers, MBA Vets and several other professional diversity recruiting organizations with a focus on attracting a diverse talent pool. We recruit from universities across the country, including Historically Black Colleges and Universities, to identify candidates for our summer intern program and early-career rotational programs.

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From left, employees Catalina Arango and Lissette Carrasco share an award received during the 2022 Women in Data Science (WiDS) South Florida conference, hosted and sponsored by NextEra Energy. Arango served as co-ambassador for the event with Lissette Carrasco as WiDS ambassador. Hosting the event was one of many ways the company supports employee professional development.

In 2021, our NEXT summer intern program welcomed 163 interns from universities across the country, of which more than 78% were women and minority interns. Beginning in 2020, we adapted this important program to include virtual and in-person options to ensure it would continue during the coronavirus (COVID-19) pandemic.

We have a robust talent management process that includes an annual performance review with two check-ins throughout the year and an employee development and goal-setting plan that focuses equally on employee and leader feedback to develop skills, opportunities and further advancement within the organization.

Our senior management team hosts talent meetings across business units to identify, assess and position employees to further develop skills needed to become future leaders. We also regularly conduct employee engagement surveys to identify ways to improve our business and increase employee engagement. We take these survey results seriously and use them to create action plans, facilitated by our corporate engagement team, to address top focus areas. In 2022, 90% of NextEra Energy employees, excluding FPL bargaining employees, completed the survey, matching both the 2018 and 2020 participation rate. Our overall engagement score for 2022 was 62%. Employees ranked their immediate supervisor, safety, performance, and diversity and inclusion among their most positive work experiences.

Critical to our success is the health and well-being of our employees. We support them with programs that drive high performance, development and engagement, while also providing work-life balance. Some of the programs we offer employees include on-site fitness centers and medical services, paid parental leave, mental health services, financial well-being programs, career development programs and tuition reimbursement for higher education. We offer more than 1,500 courses through NextEra University, an internal continuous education platform available to all employees, that includes training related to leadership, technical and commercial skills, Six Sigma and project management. In 2021, our employees completed more than 1.2 million hours of continuing education.

Diversity, equity and inclusion

We highly value diversity of thought, style, technical and functional capabilities and leadership. When talented employees from varied backgrounds are engaged and contributing to our business success, we all benefit. NextEra Energy is committed to maintaining an inclusive work environment that is free from discrimination and harassment on the basis of race, color, age, sex, pregnancy (including lactation, childbirth or related medical conditions), national origin, religion, marital status, sexual orientation, gender identity, gender expression, genetic informations, citizenship status, physical or mental disability or protected veteran status, or any other characteristic protected by applicable federal, state or local law.

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From left, Justice Rowe, Emmanuel Francois, Nicholas Braswell, David Cohen and Malcom Richardson joined NextEra Energy in 2021, through the summer intern program, which is part of the company's diversity and inclusion strategy. Rowe, Francois, Cohn and Richardson remain part of the NextEra Energy family.

Our Executive Diversity & Inclusion (D&I) Council advises and drives our corporate D&I strategy and partners with business units to promote diversity talent development and recruiting. We also have a Corporate D&I Council, whose members are business unit champions, who help drive their respective unit's D&I strategies. The Corporate D&I Council shares best practices, sponsors our annual D&I Summit, and advises and mentors our employee resource groups (ERGs).

D&I metrics are reviewed quarterly by the Executive D&I Council, as well as by all senior leaders who are members of the company's operating committee. The Corporate D&I Council meets monthly and reviews organizational diversity metrics on a quarterly basis. Business unit leaders review a diversity scorecard quarterly to develop annual D&I plans, track progress and implement strategies. In 2022, we established a diversity and inclusion goal for leaders to promote diversity and foster an inclusive culture.

Our board of directors reviews our D&I and talent management strategy at least annually, including human capital and diversity metrics. The board also focuses on diversity in our talent pipeline and reviews the diversity metrics of our internship program. Our diverse board members also speak to employee resource groups and other employee forums.

As of year-end 2021, women represented 24% of our workforce and minorities represented 39% of our workforce. We also actively focus on increasing diversity of company management. Women represented 26% of our management team and minorities represented 28% of our management team, as of year-end 2021.

2021 WORKFORCE AND MANAGEMENT DEMOGRAPHICS

Women and minorities in the workforce	
Women	24%
Minorities	39%
Minority and women interns	78%

Women and minorities in management	
Women	26%
Minorities	28%

Ethnic diversity in the workforce	
White	61%
Hispanic/Latino	22%
Black or African American	10%
Asian	5%
All other minorities*	2%

Ethnic diversity in management	
White	72%
Hispanic/Latino	14%
Asian	7%
Black or African American	5%
All other minorities*	2%

*All other minorities include: Native Hawaiian or Other Pacific Islander, two or more races, and Native American or Alaskan Native.

RACIAL EQUITY PILLARS

» Hiring, retention and promotion of Black employees:
  – Partner with 50+ professional organizations to increase pipeline of Black talent, including Management Leadership for Tomorrow, National Black MBA Association, National Association of Black Accountants, HBCU Connect, etc.
  – Implement rotational development program and mentoring/sponsorship program for Black employees.
» Programs that make a difference in Black communities:
  – Support 30+ community and youth outreach organizations over a period of one to 10 years.
  – Increase total funding by $6 million annually.
  – Funded $30 million to the NextEra Energy Foundation to support these efforts.
  – Contributed more than $3.1 million in 2021.
» Supplier diversity and venture investment:
  – Staff company-wide supplier diversity program to triple our spending with Black-owned businesses by 2022.
  – Committed more than $145 million in 2021 to venture capital, private and real estate to advance diversity, equity and inclusion.

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Asian Professionals in Energy Exchange (APEX) is one of NextEra Energy's employee resource groups. Each year APEX hosts Diwali to give their colleagues the opportunity to learn about traditional Indian music, dance, cuisine and creative crafts.

Our past three years of recently filed EEO-1 reports are posted beginning this year on the investor relations section of our website under **ESG Resources**. In 2021, NextEra Energy was named to Forbes magazine's list of "America's Best Employers for Diversity." In addition, the company was selected by Winds of Change magazine as one of the "Top 50 Workplaces for Indigenous STEM Professionals" for our strong support of diversity and an inclusive work climate.

Programs that make a difference

As part of our commitment to advancing social justice, racial equity and related issues, our racial equity working team of nearly 100 employees continues to develop specific actions our company can take to make a positive contribution toward racial equity, including supporting programs that make a difference in Black communities in STEM education, workforce development, equitable justice, community development and economic mobility for Black communities nationwide. With strategic partners like the American Association of Blacks in Energy, 100 Black Men of America, United Negro College Fund, and Center for Policing Equity, our outcomes included:

- **3,200 lives directly affected.**
- **11 new workforce development programs.**
- **10 new scholarship programs.**
- **Seven new permanent endowments.**
- **53 strategic alignments with organizations advancing racial equity for the Black community.**

We have embedded this focus on racial equity into our business practices and implemented platforms that deliver conscious, intentional and transformational change.

Employee resource groups (ERGs)

Our 12 ERGs are at the heart of our D&I and engagement efforts. These voluntary, employee-led groups are made up of employees and allies who partner together to develop personal and professional skills, drive cultural competency and demonstrate advocacy.

Additionally, the ERGs help influence our D&I strategy and serve as key advisers to help evolve and grow our inclusive culture. Our ERGs are active throughout the year hosting events to help employees learn and discover the uniqueness we all bring to the workplace. Our ERGs celebrate Black History Month, Women's History Month, Asian Pacific Heritage Month, Pride Month, Hispanic Heritage Month, Disability Employment Awareness Month and Veterans Day.

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Employees participate in NextEra Energy's Power to Care Day by planting sea oats near Pompano Beach, Fla. The annual event allows employees to volunteer their time together to give back to the community.

Supplier diversity

For more than 40 years, our company has promoted the use of diverse suppliers through our supplier diversity program. We actively pursue opportunities and cultivate relationships with small, disadvantaged, women-owned, HUBZone, veteran- and service-disabled veteran-owned, and minority-owned business enterprises. We define diverse suppliers as companies that are certified as owned, operated and controlled by minorities or women, and those designated by U.S. government agencies as small and disadvantaged businesses. The integrated supply chain group and supplier diversity team work with our business units, as well as with other internal and external stakeholders to strengthen relationships with the suppliers and grow our spend with them. These businesses continue to provide innovative and cost-effective solutions that deliver value to our company and customers.

In 2021, we sourced more than $750 million with small businesses, $500 million with minority-owned businesses and $200 million with women-owned businesses. Given the important role diverse businesses play in positively impacting our communities, NextEra Energy is committed to supplier diversity and economic inclusion. While COVID-19 challenged us last year, we centered on innovative ways to reach out and engage diverse suppliers from across the nation. We supported virtual conferences, networking, community, and development events with our advocacy partners like the Florida State Minority Supplier Development Council and others.

As a founding member of the council, we proudly support its mission to link corporations and government with minority business enterprises to foster business development and expansion. We stand committed to advancing supplier diversity, growing small and diverse businesses, and favorably impacting communities where we work, live and serve.

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Our Communities

With operations across North America, we recognize the importance of building relationships and are passionate about supporting the communities where we live and work. Since the founding of our company in 1925, we have striven to improve community engagement and foster strong ties to the communities we serve. As part of the Power to Care volunteer program, NextEra Energy employees contributed more than 39,000 hours in 2021 to their local communities through company-sponsored projects and personal volunteer time.

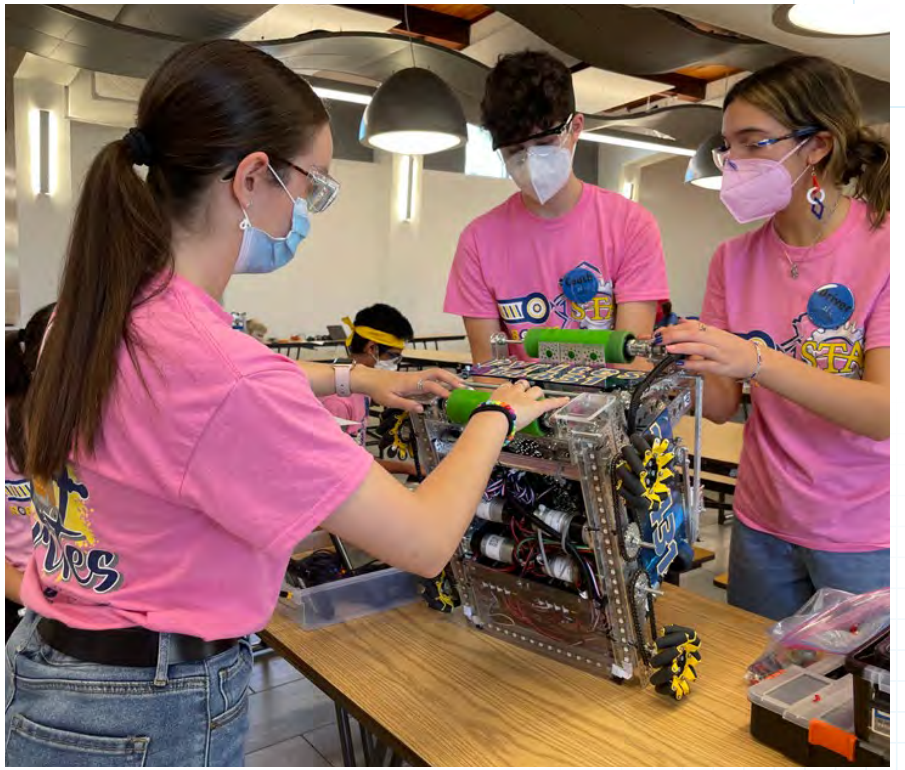
Some of the impacts our employees made in 2021 include:

- The 2021 Power to Care campaign was reimagined due to COVID-19, featuring service projects that could be done safely and remotely at any time during the two-week campaign, and employees enterprise-wide were invited to participate.
- More than 680 volunteers across 10 states participated in over 1,070 different service projects, all to give back to the communities we serve.
- In partnership with Operation Gratitude, more than 2,400 paracord survival bracelets were made and more than 1,000 letters of appreciation and encouragement were written to military service members and frontline workers.
- More than 500 employees and their families honored Earth Day by picking up litter in their local communities.
- More than 180 volunteers recorded themselves reading a book in partnership with Reading Is Fundamental's "Until Every Child Reads" initiative. These are featured on the organization's virtual library for children to access.

In 2021, our company and our employees also contributed more than $20 million to support wide-ranging initiatives and causes that benefit the well-being of our communities. Our 2021 giving included NextEra Energy employees raising more than $4.75 million for the United Way and other nonprofit organizations. And through the company's Dollars for Doers program, which awards grants in recognition of employee volunteer time, nearly $100,000 in grants were distributed to nonprofit organizations in 2021.

Academic support

NextEra Energy recognizes that building a culturally diverse and inclusive workplace is the right thing to do. Different perspectives help us serve our customers better and grow our business. The diversity of thought and experience offered by an employee base that reflects all the communities we serve gives us a competitive advantage – internationally, nationally and directly within the communities in which we live, work and raise a family. We have devoted a significant level of resources to ensure that our efforts within the education arena support students from all demographics and income strata because the energy needs of today's world lead to a need



Students on St. Thomas Aquinas High School's robotics team, the Pyrites, work on building their robot at their school in Fort Lauderdale, Fla. The team competes with their robot in challenges and is sponsored by FPL.

for a broader skill base and creativity. Our support of hundreds of education programs spans national, state and local organizations, nonprofits and 43 counties and 35 school districts in Florida alone. Our education and programs that make a difference teams focus on efforts that serve diverse and underserved communities, with a particular focus on science, technology, engineering and math (STEM). STEM programs help to develop students for future success while building a highly skilled workforce for NextEra Energy and other companies. Students are introduced to a world of possibilities and set on an educational track to acquire the capabilities to pursue careers in science and engineering. And we believe that, in many cases, these programs break down barriers and provide more opportunities.

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Amite High Magnet School Principal Dr. Travis Ford is all smiles after receiving a $50,000 classroom makeover grant. The magnet school in Amite City, La., is one of the schools to receive the grant, which is part of a $2 million commitment from the NextEra Energy Foundation to advance STEM curriculum.

NextEra Energy has long been committed to supporting and promoting robotics teams across its service area, offering financial support to fund teams and to help exceptional students who plan to take their STEM skills, as well as leadership and communication talents, to the college level. FPL has sponsored the South Florida FIRST Robotics competition and supported more than 500 teams over the past decade. Each year a $20,000 college scholarship is awarded to an outstanding alumnus of the FIRST robotics program.

Through the NextEra Energy Foundation, NextEra Energy Resources and FPL recently awarded their inaugural Classroom Makeover Grants. Each year through 2024, 10 schools – 40 in all – will be selected to receive a $50,000 grant. The grants are intended to provide transformational learning experiences for Black students in classroom settings. All recipient schools are comprised of 25% or more Black students, bringing potential together with opportunity so all children can succeed. The Classroom Makeover Grant program directly addresses needs in infrastructure, technology and resources like software, equipment and books.

NEXTERA ENERGY OFFERS SCHOLARSHIPS FOR BLACK STUDENTS IN THE SOUTHEASTERN CONSORTIUM OF MINORITIES IN ENGINEERING AND HAS COMMITTED $1.8 MILLION OVER THE NEXT FOUR YEARS TO MAKE SURE OUR FUTURE WORKFORCE IS REPRESENTATIVE OF THE COMMUNITIES WE SERVE.

Educators everywhere faced challenges at the highest levels due to COVID-19. Among the many lessons learned, leveraging technology and looking for innovative ways to reach and teach students at all ages topped the list. FPL's energy curriculum portal provides a robust virtual curriculum for fourth, fifth and sixth grades that covers energy standards in science, English language arts and math. The free, open-source online curriculum is designed to ensure that students have a deeper understanding about the importance of energy and all of its forms and is available at energycurriculum.com.

As early as 22 years ago, FPL incorporated experiential learning and has offered a traveling science show at no charge to elementary schools offering important energy conservation lessons. Since 2000, the show has reached more than 1 million students and more than 80% of those students attend Title 1 schools. NextEra Energy offers scholarships for Black students in the Southeastern Consortium of Minorities in Engineering (SECME) and has committed $1.8 million over the next four years to make sure our future workforce is representative of the communities we serve.

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FPL Chairman, President and CEO Eric Silagy chats with Girl Scout entrepreneurs about cookies and more during the commissioning of the Cotton Creek Solar Energy Center in Escambia County in Northwest Florida.

FPL also partners with scout troops for badge work, workshops and virtual programming in support of STEM, including the NextEra Energy Renewable Energy Patch and the FPL Florida Solar Patch. We partner with Girl Scouts by funding a STEM program manager and providing STEM scholarships. Through the Urban League, FPL sponsors a STEM progression program that begins in eighth grade and guides youth through their high school years. Our partnership with the Student ACES program gives students a chance to work in the growing solar industry field and receive mentorship to help them begin a promising career.

We believe supporting education is the key to a brighter future and it is a cornerstone of our commitment to our customers, our employees and our children in the communities we serve. We strive to help develop our next generation of leaders and create opportunities for all students so they can dream of a brighter future and achieve it.

NextEra Energy also works with universities, community colleges and school districts both in and outside of Florida. Some of NextEra Energy academic partners are researching which vegetation, including pollinators, are optimal within and outside the controlled, fenced area of a solar facility.

Agrivoltaic/Solar Energy Research & Training Centers offer multidisciplinary approach to advancing coexistence of agriculture and renewable energy. Disciplines include but are not limited to, engineering, agricultural science, entomology, horticulture, renewable energy, biology and craft/technical. This effort will result in renewable energy development that is environmentally prudent, sustainable and commercially practical.

To ensure safe and accessible laboratories, NextEra Energy supports development of solar research fields. The facilities are collaborative with universities, community colleges and area school districts. As part of comprehensive training programs, students, with mentoring from NextEra Energy experts, install the PV panels. The solar energy labs advance training and research in electrical engineering, mechanical engineering, civil engineering, environmental science, agricultural science, computer science, networking/cybersecurity, artificial intelligence, meteorological studies, supervisory controls and data acquisition, cybersecurity, photovoltaic panel installation and numerous other craft/technical disciplines. On of our collaborations is with the University of Arizona and Diné College, the oldest tribal college & university in the country, NextEra Energy is supporting the development of a solar training and research lab.

At the University of Nevada, Reno, students in 2021 received a firsthand look at what it takes to operate their own solar energy center. In addition, we awarded a $75,000 grant to the university's Nevada Institute for Sustainability to teach the next generation of renewables engineers. Thanks to the donation, the university now offers a minor in sustainability, online graduate certificate programs for working professionals, and new programs for current and future students who are interested in becoming part of the growing renewable industry.

Affordable energy

Providing affordable electricity for customers is critical to supporting local economies. The typical FPL residential customer bill is significantly below the national average and among the lowest in Florida.* For many years, we have worked closely with our customers experiencing hardship regarding any issues about their service or paying their bill, offering several programs designed to support customers.

FPL's Care to Share program has provided payment support to customers in time of crisis, raising about $26 million since 1994 to help nearly 100,000 Florida families in need pay their electric bills. For decades, FPL has worked with hundreds of agencies to facilitate payment assistance for qualified customers. In Northwest Florida, we support our neighbors in need of assistance with their energy bills through Project SHARE, which is administered by the Salvation Army.

FPL also has developed programs and tools designed to educate our customers about energy efficiency and help them reduce electricity use. Programs like our FPL Energy Analyzer on our mobile app and the FPL Business Energy Manager empower customers and enable them to analyze, track and better understand their energy usage, in addition to providing customers a personalized plan with energy-saving tips and recommendations, including programs and rebates that may be available.

*Data does not include Gulf Power.

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NextEra Energy Resources in 2021 broke ground on the Grand Casino Hinckley 3-MW Solar Facility, the company's first solar project developed in collaboration with the Mille Lacs Band of Ojibwe and its tribal government body. Solar energy generated at the site will power the Band's Grand Casino in Hinckley, Minn., and other customers served by the local utility.

FPL's demand-side management efforts through 2021 have resulted in a cumulative summer peak reduction of nearly 5,500 MW and an estimated cumulative energy savings of approximately 95,489 gigawatt hour (GWh). This has eliminated the need to construct the equivalent of approximately 66 new 100-MW generating units.

We also support our customers during major disruptive events. In 2017, FPL voluntarily suspended electrical disconnections for several months following Hurricane Irma. In addition, we support our customers during major disruptive events, such as the COVID-19 pandemic. During the height of the pandemic, FPL's Main Street Recovery Credit Program offered eligible small businesses a monthly 10% credit on the energy charge portion of their bill. For low-income residential customers, NextEra Energy committed $15 million to fund a discount program, where eligible customers who received federal assistance through the Low-Income Discount Program (LIHEAP) or the Emergency Home Energy Assistance for the Elderly Program (EHEAP) received a $20 credit on their monthly bill from December 2020 through December 2021.

COVID-19

Since early 2020, the NextEra Energy team has constantly risen to meet the challenges of the COVID-19 global pandemic. We feel great compassion for those who have lost loved ones to this disease, those who have contracted the COVID-19 virus and those who have experienced economic hardship. We've worked tirelessly to demonstrate our commitment to the communities where we live, work and play by providing innovative solutions to help our customers, while keeping our employees safe during this unprecedented time. Our corporate pandemic team continues to prioritize the safety of our team and our communities, while we continue to deliver on our commitments to customers during this pandemic and beyond. Electricity is critical to responding to the virus so first responders can help those in need, businesses can continue to operate, governments can continue to function and our customers can go about their daily lives to the greatest extent possible during this challenging time.

Tribal/Indigenous relations

Our communities include Native American tribes and Canadian Indigenous communities that may have an interest in our projects. That interest may be due to tribal lands in proximity to the project location or because the tribe historically resided in the region. Our tribal/Indigenous relations staff supports all NextEra Energy Resources and FPL projects, including wind, solar, battery energy storage, electric transmission and natural gas infrastructure. We work proactively with tribes to avoid and resolve issues, support tribal economic and community needs, educate internal personnel and consultants, and help support tribes' energy development interests.

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Issue avoidance and resolution is achieved by early, direct tribal outreach on all projects under development, both for projects on private land where tribal outreach is voluntary and on projects with a regulatory requirement for tribal outreach. Multiple opportunities for project participation are available to tribes throughout a project's development, including site visits, cultural surveys, construction monitoring and special studies. Staff coordination is conducted with respect and sensitivity to each tribe's cultural concerns or needs.

Tribal community support is provided by working with tribes to identify national, regional and local tribal community needs. For example, in 2021, NextEra Energy created a scholarship program for Native American youth, administered by the American Indian Graduate Center. Fifteen scholarships are awarded annually to qualified students in energy, environmental and cultural resource disciplines.

Internal education for our development, environmental and construction teams is vital to our efforts to build strong collaborative relationships with tribes. By learning about Native American and Indigenous practices, traditions, cultural awareness and sensitivities, our tribal/Indigenous relations staff provide training for developers, subject matter experts/support staff and construction personnel. This helps ensure that all members of our project teams act in a responsible, respectful manner on every project. Strong relationships with tribes also open lines of communication that may identify opportunities and support business development on tribal lands. In 2021, NextEra Energy broke ground on the Grand Casino Hinckley 3-MW Solar Facility, the company's first project developed in collaboration with the Mille Lacs Band of Ojibwe and its tribal government body. Solar energy generated at the site will power the Band's Grand Casino in Hinckley, Minn., and other customers served by the local utility.

Veterans and military members

We are proud that nearly 2,000 NextEra Energy employees – 13% of our workforce – are veterans of our nation's armed forces. The Veterans at NextEra Energy (VETNEXT) is one of the company's largest and most engaged employee resource groups. In 2021, NextEra Energy received the U.S. Department of Labor's HIRE Vets Platinum Medallion award for the third year in a row for our excellence in hiring and retaining veterans.

Additionally, we are honored to be named for the second year by Forbes and Statista to the 2021 list of America's Best Employers for Veterans. This award was chosen based on an independent survey from a sample of 5,000 U.S. veterans and awarded to 150 companies for their efforts to recruit, employ and retain veterans. For more than a decade, FPL has been celebrating local heroes, with holiday hero surprises. Employee volunteers decorate the hero's homes' exterior with thousands of LED lights, solar-powered decorations and energy-efficient décor as a thank you for service to our community and nation.

Volunteer Air Force personnel stationed at Vance Airforce Base in Enid, Okla. offer their thanks to NextEra Energy Resources for our support of their Thanksgiving meal program, which served 200 meals to officers and enlisted personnel and their families in 2021.

In 2021, two veterans and three healthcare workers and their families were surprised in Miami, Melbourne, St. Augustine, Gulf Breeze and Panama City. NextEra Energy Resources also supports our military during the holidays. At Vance Airforce Base in Oklahoma, the company sponsored a Thanksgiving meal project. The programs are among many ways NextEra Energy supports veterans and our armed forces in areas we serve, such as Northwest Florida, a key area for the U.S. Navy and Air Force. We are committed to being the best partner we can be by focusing on communication, cooperation and collaboration to form consensus.

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Economic development

NextEra Energy is one of the largest infrastructure companies and among the largest capital investors in the U.S., and our investments create significant economic benefits. In 2021, NextEra Energy paid $2.6 billion in various state and local taxes and business fees that support local governments, police, fire, schools and other local organizations within the communities where we operate. In Florida, we were one of the top taxpayers in 2021, paying $1.9 billion in various taxes and fees, including property taxes, sales and use taxes, gross receipts taxes and franchise fees. In property taxes alone, FPL paid more than $628 million to Florida governments in 2021, up from $607 million in 2020.

Economic analysis indicates that NextEra Energy's capital investments in 2020 have created more than 84,000 jobs across the nation when including both direct and indirect economic activity. Florida's low-tax, pro-business policies, combined with a variety of incentives designed to spur economic growth, make it an attractive place to do business.

NEXTERA ENERGY PAID $1.9 BILLION IN VARIOUS STATE AND LOCAL TAXES AND BUSINESS FEES THAT SUPPORT LOCAL GOVERNMENTS, POLICE, FIRE, SCHOOLS AND OTHER LOCAL ORGANIZATIONS WITHIN THE COMMUNITIES WHERE WE OPERATE.

We are doing our part to energize economic opportunity across FPL's service area through FPL's Office of Economic Development. Created in 2011, this one-stop resource for new and expanding businesses that are considering expansion in Florida has brought in dozens of new businesses from out of state, promoting Florida's economic growth. We're also committed to supporting local suppliers. In 2021, we spent more than $2.7 billion with suppliers in Florida, where our headquarters are located.

Powering Florida Resource Center

Launched in 2012, the Powering Florida Resource Center provides site selection experts with direct access to information about the state's workforce, real estate, utility rates, and potential discounts and incentives. In addition, it provides local economic development organizations in Florida with tailored data about their communities to help them better market their strengths and target potential businesses. Powering Florida works hand-in-hand with state and local organizations to keep Florida high on the list for growing businesses. A new resource center will re-launch later this year.

NextEra Energy welcomes entrepreneurs to its 35 Mules innovation hub, where they have the opportunity to develop their business ideas that support the energy and water industries. The inaugural class celebrated graduation in December 2021.

35 Mules innovation hub

Our 35 Mules in-house innovation hub helps entrepreneurs develop their game-changing ideas in energy, water and energy-adjacent industries into Florida-based businesses, further supporting the state's economic growth and stimulating the business environment. FPL launched the hub in February 2020 and received 70 applications from around the world. FPL chose six companies to join 35 Mules for its first cohort. The 13 founders had a dedicated workspace on FPL's Juno Beach campus for 15 months. During their time in the program, the startups raised $15 million in grant funding and venture capital, met with more than 150 NextEra Energy subject-matter experts, and received more than 200 hours of formal training in legal, marketing, human resources, customer discovery and more.

In March 2022, FPL welcomed its second cohort – 14 entrepreneurs in seven startup companies – into its program. These startups are in various industries, including maritime, industrial professional services, raw materials, asset and vegetation risk management, consumer electronics, cleantech, aviation and aerospace, and information technology. The program's unique name comes from FPL's humble beginnings in 1925, when a very unlikely patchwork of enterprises combined to form the precursor to NextEra Energy, including an ice plant, a sponge boat and 35 mules.

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GOVERNANCE

Our proven track record of delivering strong financial and operational performance begins with our foundation of sound corporate governance and oversight. Our board of directors is led both by our executive chairman and a lead independent director. The board has a broad range of skills and industry knowledge, as well as diversity with respect to age, gender, race, ethnicity and specialized experience.

Together, the board has brought diverse perspectives to lead NextEra Energy to successful results and create long-term value for our shareholders and stakeholders. For more details, please refer to the NextEra Energy 2022 Proxy Statement on the investor relations section of NextEra Energy's website. Page 8 of the proxy statement includes a summary of director qualifications and experience.

NextEra Energy Chairman, President and CEO John Ketchum and NextEra Energy Resources President and CEO Rebecca Kujawa talk with employees during a 2022 quarterly meeting.

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GOVERNANCE

Sustainability governance

Our approach to sustainability engages all levels of the company from the board of directors to our employees. Sustainable business practices are embedded throughout the company as we execute our long-term strategy.

Board of directors – With sustainability core to our business, the board's oversight of the development and execution of NextEra Energy's strategy includes providing oversight of issues which could impact the long-term sustainability of our company. Additionally, through annual in-depth strategy sessions and regular updates on each business, the board effectively oversees opportunities and risks, including those related to our ESG responsibilities.

Board committees – Each board committee oversees different areas of opportunities and risks related to sustainability and communicates key findings to the full board.

Chief executive officer – Our chairman, president and CEO has ultimate responsibility for the company's sustainability performance and long-term success.

Executive leadership – As our leaders execute our long-term growth plan and key initiatives, they implement our sustainability vision. Leaders are responsible for achieving specific goals tied to sustainability as we deliver long-term value.

Sustainability executive steering committee and sustainability council – Composed of key business unit representatives across the organization, the council focuses on proactively addressing sustainability issues and policies and driving strategic initiatives across the company. The council reports to, and receives feedback from, the executive steering committee quarterly. In 2021, we updated the executive steering committee charter by adding another layer of senior executive oversight. Twice a year, the executive steering committee chair reports to the sustainability lead team, made up of the executive vice president of finance and CFO, executive vice president and general counsel and the executive vice president of human resources and corporate services.

Employees – By delivering on their goals and objectives, our employees are key to driving our company's sustainability efforts and delivering value to all stakeholders.

GOVERNANCE HIGHLIGHTS*

- **11 of 12 directors** are independent.
- Balance of new and experienced directors, with **tenure of current directors averaging nine years**.
- **Two of the four** new independent directors added since 2018 **were women or ethnically diverse**.
- **Added nine new independent directors** in the last 10 years and have a **specified retirement age** for directors.
- **Four of 12 directors are women or ethnically diverse** and average age of directors is 65.

COMPENSATION ALIGNED WITH SUSTAINABILITY

Senior executive compensation is tied directly to performance that drives long-term shareholder value. Our senior executive compensation program includes goals tied to sustainability, a variety of which have been included as compensation metrics since 2001. Current senior executive compensation metrics include:

Environment	Social	Governance / Operations
Renewable energy – To maintain our position as the world's leading renewables developer, compensation is tied to completing the development and construction of our wind, solar and storage projects on schedule and on budget, as well as adding significant new wind, solar and storage opportunities to our backlog to support future growth. Implementing our renewables development strategy has led to significant emissions reductions for our company and our customers.	**Customer value proposition** – To emphasize the delivery of a sustainable outstanding customer value proposition, compensation metrics include O&M costs per retail MWh, capital expenditures, service reliability and customer satisfaction scores. These metrics are intended to drive the delivery of low bills, high reliability, clean energy solutions and outstanding customer service.	**Operational performance** – Intended to support efficient and reliable delivery of clean energy to our customers, these metrics include availability metrics across the generation fleets and reliability metrics for the transmission and distribution grid.
Environmental events – To support our commitment to the environment, metrics include achieving zero significant environmental violations across all of our businesses.	**Safety** – Safety is a company priority. We include the number of OSHA recordable incidents in our compensation metrics to emphasize our focus on a zero accident workplace.	**Nuclear safety and reliability** – To prioritize the highest levels of nuclear safety and reliability, compensation metrics include the nuclear fleet's performance against industry-wide operating performance measures, as measured by a third party.

*As of August 2022.

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BOARD OF DIRECTORS' ESG OVERSIGHT

Audit Committee
- Oversees compliance with legal and regulatory requirements and Code of Business Conduct and Ethics.
- Oversees external and internal auditors.
- Oversees preparation of financial statements in accordance with Generally accepted accounting principles (GAAP) standards.
- Reviews and discusses with management the company's major financial risk exposures.
- Ensures that major risks identified are reviewed by the board or a board committee.

Governance and Nominating Committee
- Oversees board composition, refreshment and diversity.
- Political engagement oversight.
- Makes recommendations to the board on the business of the Annual Meeting of Shareholders.
- Oversees evaluation of the board.

Finance and Investment Committee
- Oversees capital spending and financing plans.
- Reviews financing strategies, financial policies and the use of financial instruments, including derivatives.
- Reviews energy trading and marketing operations.
- Recommends annual dividend policy.

Nuclear Committee
- Oversees safety, reliability and quality of nuclear operations.
- Reviews long-term strategies and plans related to nuclear operations.

Compensation Committee
- Approves compensation program, including incentive compensation goals tied to sustainability and other ESG-related goals.
- Approves selection of corporate peer group for compensation benchmarking.
- Assesses risks related to employee compensation programs.

NextEra Energy board of directors, as of August 2022, row 1, from left: Sherry Barrat, lead director, James Camaren, Kenneth Dunn, and Naren Gursahaney. Row 2, from left: Kirk Hachigian, John Ketchum, Amy Lane and David Porges. Row 3, from left: Rudy Schupp, John Skolds, John A. Stall and Darryl Wilson.

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Public policy advocacy

Since every aspect of our business is impacted by policy decisions at every level of government, it is particularly important for us to be involved in the political process. Our political engagement strategy helps support constructive political and regulatory environments throughout the U.S., which, in turn, should create long-term shareholder value. In Florida, a constructive regulatory environment is a key foundation to our regulated utility strategy of further improving our best-in-class customer value proposition through smart capital investments. At NextEra Energy Resources, local, state and federal regulations govern every aspect of our renewable energy development business.

Sound political engagement has supported NextEra Energy in becoming the world's leading generator of energy from the wind and sun. Without active political engagement, we believe that overall renewable development within the U.S. would have been significantly lower than current levels. Additionally, we believe that without active political engagement, we would be less successful in advancing our corporate strategies and creating long-term shareholder value.

The company believes our lobbying efforts are consistent with its corporate objective of being the world's leading clean energy company, which necessarily involves an evolving balance of considerations, including achieving our emissions-reduction targets. To the extent consistent with our objective, we aim for our lobbying and participation in trade associations to align with pursuing strategies that are consistent with the goal to keep global warming to less than 1.5 degrees Celsius over pre-industrial levels.

Our board's governance and nominating committee, composed entirely of independent directors, oversees our Political Engagement Policy. Among other requirements, the policy establishes clear accountability for all political engagement and for governance and nominating committee review, and public website disclosure, of all federal and state lobbying expenditures, significant trade association dues, and contributions made by the NextEra Energy PAC, among other pertinent information.

The policy also requires our general counsel to receive, and to report to the governance and nominating committee the status of, annual compliance certifications from our leaders having political engagement accountabilities. It also requires the vice president, government affairs – federal, annually to review significant trade association memberships to ensure that participation aligns with our strategy. Any policy positions taken by a trade association that may be in conflict with our core strategy and objectives will be reviewed with the chairman, president and CEO. For more information, please access our **Corporate Political Engagement Policy** on the investor relations section of our website.

Engaging our shareholders

We engage with shareholders on a regular basis and provide information through multiple channels. Our shareholder engagement efforts allow us to better understand our shareholders' priorities and perspectives and enable us to effectively address the issues that matter the most to our shareholders.

In 2021, we reached out to our 50 largest shareholders and offered to engage on ESG-related topics as well as any other topics of interest. We also reached out to shareholders not among our 50 largest who expressed an interest in engagement with us. We received positive feedback from and held engagements with shareholders representing over 35% of our shares outstanding. Our 2021 ESG report, diversity and inclusion strategy, emissions-reduction initiatives and renewable energy strategy were the main topics of these engagements.

Engaging our stakeholders

A stakeholder can be defined as an individual, group or institution that has a vested interest in how our company operates and manages economic, environmental and/or social issues and risks. At NextEra Energy, our stakeholders include employees, customers, government/agency officials, investors, shareholders, suppliers, consultants, environmental groups, members of the media, our business partners and nonprofit organizations that help the communities we serve.

We engage our stakeholders through various methods, including:

- Outreach meetings.
- Web, FPL Mobile App and email.
- Speaking engagements.
- Executive contact program.
- Social media.
- Customer care center.
- Open houses.
- Employee and customer surveys.
- Customer account satisfaction tracking.
- Materiality analysis.
- ESG reporting analysis.
- Direct mail.
- Government relations.
- Analyst meetings.
- Shareholder meetings.

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RISKS AND OPPORTUNITIES

Our approach to risk management starts with a strategic focus on preparedness and a disciplined capital allocation process. Preparedness, crisis planning and risk management are part of our culture. Our chairman, president and CEO, who also serves as our chief risk officer, and executive management are responsible for executing our long-term strategy while also monitoring opportunities and risks related to our strategy.

NextEra Energy's GridLiance West Transmission operates transmission assets in Clark County, Nev.

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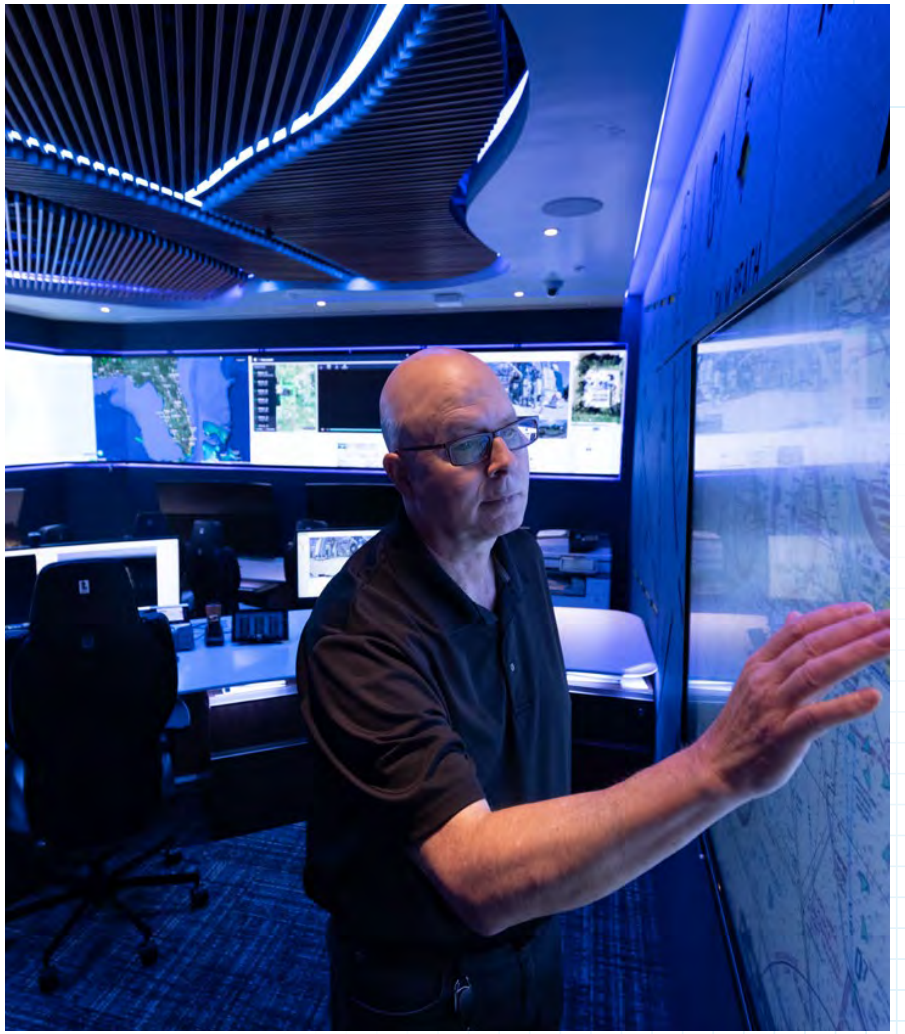
RISKS AND OPPORTUNITIES

Our corporate risk management committee provides oversight and support for our risk management activities. The committee consists of officers and key personnel from across the company. The committee meets four times per year and discusses risks and related mitigation activities, and performs detailed reviews of risks, as appropriate. Risks are assessed based on impact, probability and speed of onset. Representatives of the committee then meet twice a year with the risk lead team, which is comprised of the chairman, president and CEO, CFO and general counsel, to review and provide feedback on the results of the committee's work. The risk assessment activities and results are reported to the audit committee of the board of directors annually.

The corporate risk management committee has established relationships within the risk community and continuously works to ensure our risk program stays current and relevant. In 2021, the committee participated in enterprise risk management roundtables with companies both within and outside the utility industry. We also have an exposure management committee, which has policy oversight of the risk profiles of our energy marketing and trading and power marketing businesses. This committee meets monthly and is chaired by the CFO. The exposure management committee reviews all market, credit and operational issues associated with energy trading and reports to the finance and investment committee of the board of directors at least annually. It also reports to the audit committee on all matters of internal control and financial reporting associated with this business.

FPL IS BUILDING A STRONGER, SMARTER AND MORE RESILIENT ENERGY GRID THAT IMPROVES RELIABILITY IN GOOD WEATHER AND BAD, AND ENABLES FASTER POWER RESTORATION FOLLOWING EXTREME WEATHER EVENTS.

We employ a robust risk management process to all of our investment decisions. Our investment decisions are rooted in realistic assumptions, with appropriate sensitivity analyses, as needed, to ensure a data-driven decision-making process. Across all of our businesses there is a robust due diligence and project approval process intended to ensure that all significant risks have been identified and mitigated to the greatest extent possible. All significant investment decisions are reviewed and approved by NextEra Energy's operating committee, which is comprised of all senior executives and other executives from the various functional departments of each of our businesses. Investments of greater dollar value require additional authorizations, up to and including approval by the board's finance and investment committee and the full NextEra Energy board of directors, depending on the nature and amount of the investment.



Employee Phil Langworthy monitors our operating systems from the Power Delivery Diagnostic Center, which we do around the clock to keep the lights on for customers. The smartgrid technology allows for increased reliability for customers.

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Investments at our regulated utilities are guided through a well-established integrated resource planning process to determine the amount and timing of future generation needed to meet projected growth in energy load and demand. Our carbon footprint and potential climate-related risks are incorporated into this planning process. Different options are evaluated taking into account system economics, forecasted electric power demand, demand-side management, fuel prices, potential future climate policies, and the integration of low-cost, clean and reliable generation, including solar and battery energy storage solutions. Our capital allocation process at FPL is centered on enhancing the overall customer value proposition to deliver long-term customer benefits and the support of regulators for our investment decisions.

Review of NextEra Energy Resources' investment decisions begins with thorough due diligence by subject matter experts from nearly 20 key functional areas. These subject matter experts, who bring deep experience and expertise, help identify and assess the commercial, financial and operational feasibility of new project investment opportunities. We also have processes in place to ensure we are continuously learning from unforeseen challenges to improve future capital allocation decisions.

FPL and NextEra Energy Resources hold annual strategy sessions with business unit leadership across each organization to identify and review long-term goals, risks and opportunities. The results of these annual strategy sessions are reviewed with the board of directors to ensure key risks are identified and managed, and opportunities to enhance customer and shareholder value creation are pursued.

For the purposes of our risk management process, we do not view climate change as a discrete risk, but rather a potential stress multiplier to existing risks and opportunities already under consideration. For example, system disruption from a weather event is a long-standing risk that we have integrated into our risk-assessment process, and potential climate change projections for more frequent storms would be a multiplier for this risk category but not necessarily broken out as an incremental, separate impact. We also recognize that climate change may affect different parts of our business in different ways. We provide more details on our approach to managing environmental risks and our strategy under **Environment** in this report.

Preparing for storms, flooding and sea-level rise

Physical risks are reviewed as part of our corporate risk management process, including the risks of more frequent and severe storms, flooding and sea-level rise as a result of climate change. Our experience and history of managing hurricanes and natural disasters in Florida provides us with the skills and capabilities to remain focused on safety, execution and the importance of providing an essential service to our customers during these events.

FPL is building a stronger, smarter and more resilient energy grid that improves reliability in good weather and bad, and enables faster power restoration following extreme weather events. Since 2006, FPL has made significant investments in strengthening the energy grid to make it more resilient to severe weather. The deployment of innovative technology to help prevent outages and shorten restoration times when outages occur has enabled FPL to lower operating costs and improve reliability and resiliency. Specific investments in the FPL system include:

- Hardening or undergrounding power lines to better withstand higher winds to enhance service reliability and resiliency.
- Upgrading transmission line structures, replacing wood structures with concrete or steel, maintaining vegetation along more than 26,000 miles of power lines each year and inspecting all 1.4 million power poles within an eight-year cycle.
- Installing more than 200,000 intelligent devices that prevent power outages and shorten restoration times by automatically redirecting power, self-healing and minimizing customers affected, resulting in more than 10 million outages avoided over the last decade.
- Using drones equipped with artificial intelligence, machine learning and geospatial data so flights are fully autonomous, as well as developing in-house image recognition software to spot faulty equipment and prevent outages.

FPL crews work to restore power following a storm in West Palm Beach, Fla. Our emergency preparation efforts to strengthen the grid against storms and train for quick storm response increases reliability for our customers.

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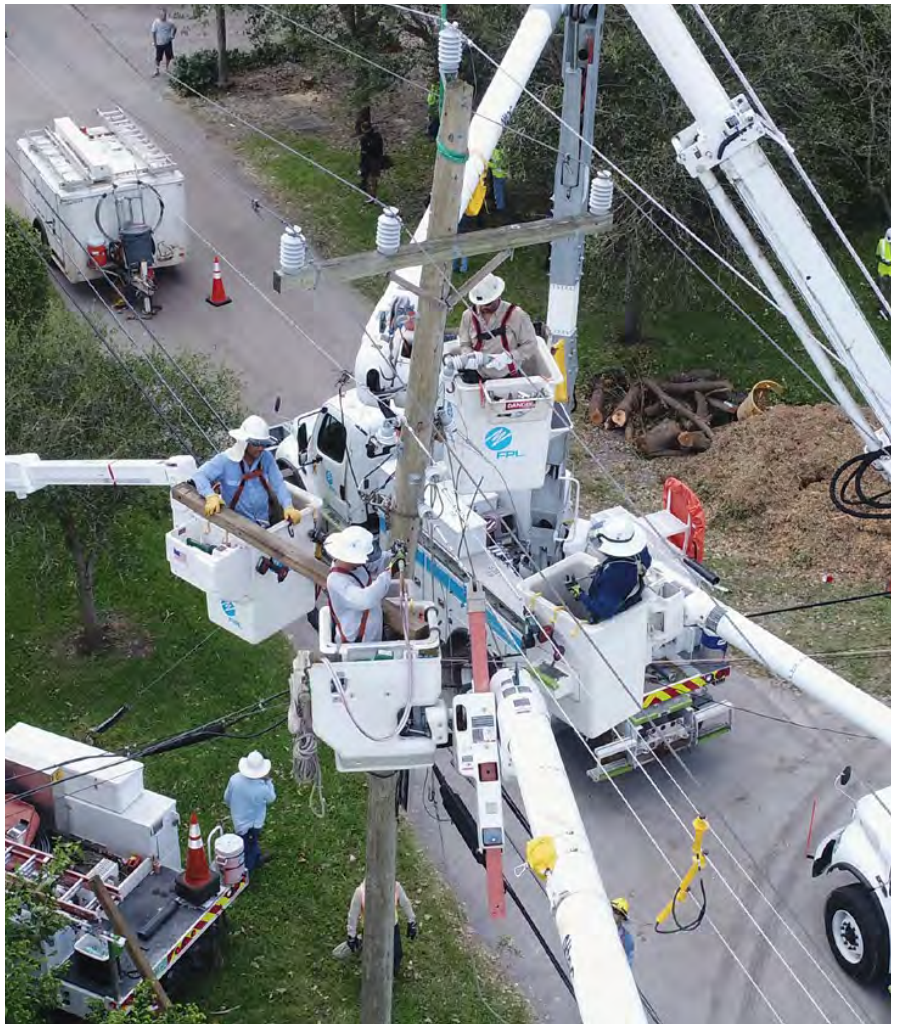

FPL line workers work to repair damaged power lines in South Miami-Dade County, Fla., after Hurricane Irma, one of the Atlantic's strongest and costliest hurricanes.

Based on analysis of sea-level rise and flooding that FPL has completed in collaboration with many different government organizations, we have determined that near-term risk to our operations and facilities is low. Our Florida nuclear facilities are elevated 20 feet above sea level to protect against flooding and extreme storm surge. We expect to continue to make additional resiliency and reliability investments over the coming decades to mitigate any potential impacts to our system. Mitigation actions taken to date include:

- Installing pumps, flood control structures, monitoring sensors and raised equipment in high-risk flood zones.
- Designing our substation yards to meet the Federal Emergency Management Agency (FEMA) 100-year flood elevations.
- Deploying mobile substations and transformers, along with other equipment, that can be used to respond to flood or storm events.
- Hardening underground structures and using above-ground equipment in high-risk flood zones.
- Deploying innovative technology at locations more susceptible to storm surge, such as a temporary AquaDam we installed at one of FPL's coastal substations in North Florida.

OUR EXPERIENCE AND HISTORY OF MANAGING HURRICANES AND NATURAL DISASTERS IN FLORIDA PROVIDES US WITH THE SKILLS AND CAPABILITIES TO REMAIN FOCUSED ON SAFETY, EXECUTION AND THE IMPORTANCE OF PROVIDING AN ESSENTIAL SERVICE TO OUR CUSTOMERS DURING EXTREME WEATHER EVENTS.

A good example of how our storm hardening investments have created value for our customers is to compare the last two major hurricanes that hit FPL's service area: Hurricane Wilma in 2005 and Hurricane Irma in 2017. Although Irma was a more powerful storm, with nearly 50% greater damage potential than Wilma, FPL was able to reduce the average number of outage days per customer by 60%. Hurricane Irma was the largest hurricane event FPL has ever faced with more than 4.4 million, or nearly 90% of customers, losing power compared to roughly 3.2 million, or 75% of customers, due to Hurricane Wilma. As a result of our storm hardening investments, FPL improved restoration times, sustained less equipment damage, lost fewer poles and brought our generation facilities back faster than ever. These investments also avoided significant economic loss in FPL's service area and across Florida.

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Employee Sophia Eccleston joins other FPL team members participating in the company's annual storm drill in advance of the 2022 hurricane season.

Emergency preparedness

Preparedness and crisis management are part of what we do as a company. For nearly 70 years, we have conducted annual drills to prepare for all types of emergencies. It is this type of preparation to handle the unexpected that we believe will enable us to continue to deliver for our customers over the long-term, no matter what may come our way.

We are continuously monitoring and preparing for the unexpected and have teams in place that regularly test our systems, operations and people to ensure they are prepared to manage any emergency – whether it's a storm, cyber event, oil spill, capacity shortfall or even a global pandemic.

FPL conducts an annual week-long storm drill, which tests the response of employees to a hypothetical hurricane. These drills, which traditionally include local first responders, as well as state and federal officials, provide opportunities to demonstrate how we continuously improve and are ready to respond together with local and state partners to return life to normal for millions of Floridians in their greatest time of need. Every year, our drills are a commitment to push ourselves and improve upon our procedures when responding to a natural disaster. During the simulated exercises, FPL employees are evaluated on response and restoration efforts related to operations, logistics, communications and customer service, among other areas.

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The FPL Distribution Control Center is a state-of-the-art, Category 5-rated building that enhances FPL's ability to respond to natural disasters, as well as efficiently monitor thousands of smart devices and other equipment around the clock to prevent outages before they occur and to quickly respond and restore power when they do occur. FPL has improved its storm preparation and response capabilities by:

» Hardening, or strengthening, nearly all main power lines serving critical community facilities and services, such as police and fire stations, hospitals and 911 centers. In addition to being more storm-resilient, main power lines that have been hardened perform 50% better in day-to-day operations than those that are not hardened, which means fewer outages.

» Improving communication systems and capitalizing on smart grid technology to ensure efficient and accurate restoration information delivered to customers.

» Providing customers the ability to directly report a downed power line using smartphone technology, which speeds efforts to restore power.

We also participate in mutual assistance programs with other electric companies from across the nation, which allows us to bring in additional resources to quickly support our crews responding to major outage events. EEI honored FPL in 2021 with its Emergency Response Award for the company's efforts to help other utilities and customers recover after Hurricane Ida.

NUCLEAR SAFETY IS PARAMOUNT TO OUR BUSINESS OPERATIONS AND WE HAVE ROBUST SAFETY MEASURES ACROSS OUR NUCLEAR FLEET.

Nuclear safety

Our nuclear fleet is a critical part of our generation mix and one of the most cost-effective fleets in the industry, driven by a focus on innovation, lowering costs and commitment to excellence. Our nuclear fleet is a source of safe, reliable, clean and cost-effective baseload energy for customers and a key component of our Real Zero goal to provide emissions-free generation. Our operating nuclear units avoided the generation of more than 23.5 million tons of CO_2 in 2021, equivalent to removing about 4.6 million cars from the road annually. Nuclear safety is paramount to our business operations and we have robust safety measures across our nuclear fleet. The U.S. Nuclear Regulatory Commission (NRC) maintains and tracks a set of performance indicators as objective measures of nuclear safety performance for commercial U.S. nuclear plants.

Employee Andrew Watry is a nuclear chemist at Point Beach Nuclear Power Plant in Two Rivers, Wis.

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These indicators monitor the performance of initiating events, safety systems, fission product barrier integrity, emergency preparedness, occupational and public radiation safety and physical protection (security).

Our plants are designed to withstand physical attacks, as well as earthquakes and other natural events stronger than ever recorded in their respective regions. Site design at all of our nuclear sites provides extra protection against flooding and extreme storm surge, including all sites being elevated at least 20 feet above sea level. In collaboration with the nuclear industry, we created regional response centers that house pre-built equipment, located away from nuclear sites, that can be brought into any of our nuclear plants in response to a natural disaster at a site. We have made significant upgrades to our nuclear facilities, including:

» Installed high-capacity pumps to provide additional backup cooling water for safety systems.

» Pre-staged additional backup equipment in reinforced buildings on-site.

» Confirmed the ability of our plants to withstand extreme natural events, such as earthquakes, flooding and fires.

» Empowered our plant operators to shut down the plant within a matter of seconds, if necessary.

» Require one full week of training every six weeks for plant operators to prove their ability to safely operate the plant in a variety of worst-case scenarios that include earthquakes, severe storms, flooding, loss of power and loss of reactor core cooling.

Cybersecurity

We take security seriously at NextEra Energy – both at our facilities and online. We have a comprehensive cybersecurity monitoring program for all of our computer and data networks and are actively involved in cybersecurity-related matters, including establishing a cybersecurity culture at NextEra Energy and educating our employees about the importance of being cyber aware.

In 2021, all employees were required to complete a cybersecurity and data privacy training course focused on building techniques for maintaining cyber awareness at work, at home and while traveling.

We have made it a priority to protect our power networks and customer data from all forms of intrusion, including cyber incidents, that could threaten to disrupt operations or cause harm to customers. The safe, secure delivery of electrical service is paramount. Our comprehensive, defense-in-depth approach imposes security at every layer and our standards for cybersecurity exceed those set by the industry.

Ben Miron, who oversees the company's cybersecurity efforts, addresses employees during an annual cybersecurity summit.

NextEra Energy's audit committee receives regular reports on the key risks facing the company from a representative of the corporate risk committee and also receives frequent reports from the company's internal auditor about the results of reviews of cybersecurity and information security governance. The board of directors of the company annually receives a cybersecurity report from the company's chief information officer and its vice president, IT infrastructure and cybersecurity.

Various leading third parties periodically assess the company's alignment with the U.S. Department of Energy's Cyber Capability Maturity Model (C2M2) standard, which is the predominate cybersecurity framework for the U.S. electric utility industry. NextEra Energy has a comprehensive cybersecurity training program in which all employees receive education and training on prevention of cybersecurity problems and on privacy and data protection.

FPL performs annual internal cybersecurity drills with the participation of federal agencies (the U.S. Department of Homeland Security, U.S. Secret Service and the Federal Bureau of Investigation) to ensure readiness of the organization. FPL also participates with other electric utilities across the country in the North American Electric Reliability Corporation's (NERC) biennial GridEx exercise and in industry forums, such as Electricity Subsector Coordinating Council and NERC activities, to ensure lessons learned are applied.

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AWARDS AND RECOGNITIONS

» In 2022, NextEra Energy was again ranked No. 1 in the electric and gas utilities industry on Fortune's list of "Most Admired Companies" for the 15th time in 16 years. NextEra Energy is one of only two Florida-based companies to rank No. 1 in its industry across all sectors. NextEra Energy ranked No. 1 for eight of the nine rated attributes, including innovation, people management, use of corporate assets, quality of management, financial soundness, long-term investment value, quality of products/services and global competitiveness.

» In 2022 and 2021, NextEra Energy was named to Newsweek's list of America's Most Responsible Companies. NextEra Energy is the only Florida-based energy company on the list two years in a row. The award recognizes companies for their ESG efforts, among other attributes.

» In 2022, NextEra Energy was recognized by Forbes magazine as one of America's Best Employers for the sixth year.

» In 2022, NextEra Energy received the Business Group on Health's Best Employers Award for Excellence in Health & Well-Being for advancing employee well-being through comprehensive, innovative benefits and initiatives. NextEra Energy was specifically recognized for its focus on diversity and inclusion.

» In 2021, NextEra Energy received the U.S. Department of Labor's HIRE Vets Platinum Medallion award for our excellence in hiring and retaining veterans. The company has received the award every year since 2018.

» In 2021, NextEra Energy was recognized on Fortune's list of companies that "Change the World." NextEra Energy is the only U.S. gas and electric utility to be recognized. This is the second time that NextEra Energy has been recognized on Fortune's "Change the World" list. The annual list recognizes companies that have had a positive social impact through activities that are part of their core business strategy.

» In 2021, NextEra Energy was named to the first-ever list of TIME's 100 Most Influential Companies. The list highlights 100 businesses making an extraordinary impact around the world.

» In 2021, NextEra Energy was recognized by Institutional Investor for the best CEO and the best investor relations team in the utilities industry for the last six years in a row and the best CFO for the last three years.

» In 2021, FPL won the ReliabilityOne® National Reliability Excellence Award for the sixth time in the last seven years, presented by PA Consulting to the award recipient that has demonstrated sustained leadership, innovation and achievement in the area of electric reliability.

» FPL received the top ranking in the Southern U.S. among large electric providers, according to J.D. Power's 2021 Electric Utility Residential Customer Satisfaction Study℠ and 2021 Electric Utility Business Customer Satisfaction Study℠.

» NextEra Energy was assessed in 2021 as having best-in-class preparedness, according to S&P Global Ratings' ESG evaluation, reflecting our ability to identify long-term risks and develop and implement plans to transform these challenges into new opportunities, distinguishing the company from its peers amid the disruptive forces facing the industry. NextEra Energy's final ESG evaluation score, 86, is one of the highest rankings to be given by S&P Global Ratings to any corporate entity within the electric power industry.

» NextEra Energy received the third annual S&P Global Platts Energy Transition Award, for our leadership in environmental, social and governance, in 2020, the last year the special award was given by the organization.

» FPL was named a 2021 Business Customer Champion by Escalent, a top human behavior and analytics firm. FPL Escalent also named FPL among the 2021 Most Trusted Utility Brands. FPL ranked as the second most trusted electric provider in Florida. This is the eighth consecutive year the company was recognized by Escalent as being one of the nation's top-performing utilities.

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CONCLUSION

We have been making long-term strategic investments to build a business that is resilient and able to deliver for customers and shareholders. NextEra Energy's Real Zero goal is the next step in this journey and it lays out a clear path to reach zero-carbon emissions by no later than 2045. We believe that our ambition to reach Real Zero can and will be a game-changer, not only for customers, but also for the U.S. electric power sector and the entire U.S. economy.

We are committed to a carbon-free-emissions future and delivering outstanding value for our customers, supporting our communities and empowering our teams, all while generating significant shareholder value creation and doing the right thing for the environment.

The Cool Springs Solar Energy Center was commissioned at Bainbridge, Ga., in 2021.

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APPENDIX A

Sustainability Accounting Standards Board (SASB) Metrics

SASB topic	SASB accounting metric	2020	2021	Comments
Greenhouse Gas Emissions and Energy Resource Planning	1. Gross global scope 1 emissions 2. Percentage covered under emissions-limiting regulations and 3. Percentage covered under emissions-reporting regulations	1. 43,247,571 metric tons CO_2e 2. 0.07% 3. 100%	1. 42,353,376 metric tons CO_2e 2. 0.15% 3. 100%	NextEra Energy conducts business under regulatory regimes that require CO_2 rather than CO_2e reporting. The SASB metric reported here is CO_2e which includes emissions from power generation.
	GHG emissions associated with power deliveries	2,172,160 metric tons CO_2e	1,736, 579 metric tons CO_2e	The 2020 and 2021 numbers represent additional CO_2e for power purchased for customer load in Northwest Florida.
	Discussion of long-term and short-term strategy or plan to manage scope 1 emissions, emissions reduction target, and analysis of performance against those targets	Discussion within report	Discussion within report	See discussion in the following sections of this report: NextEra Energy's blueprint to reach Real Zero no later than 2045 and Confronting Climate Change Our strategy: A letter from our chairman, president and CEO Building the world's leading clean energy solutions provider Environment-Climate Change, decarbonization and Real Zero carbon-emissions reductions
	1. Number of customers served in markets with renewable portfolio standards and 2. Percentage fulfillment of RPS target by market	See comments	See comments	FPL serves approximately 5.8 million customer accounts in Florida. Florida does not have a state-level renewable portfolio standard (RPS) requirement. NextEra Energy Resources is a wholesale power generator for customers across the U.S. that includes utilities, retail electricity providers, power cooperatives, municipal electric providers and large industrial companies. NextEra Energy Resources operates in 38 states with mandatory renewable portfolio standards and an additional five states with voluntary renewable energy standards or targets.
Air Quality	Air emissions of the following pollutants: 1. NOx (excluding N_2O) 2. SOx 3. particulate matter (PM 10) 4. lead (Pb) 5. mercury (Hg) Percentage of each in or near areas of dense population	1. 8,453 metric tons 2. 1,183 metric tons 3. 959 metric tons 4. 0.36 metric tons 5. 0.03 metric tons	1. 10,525 metric tons 2. 840 metric tons 3. 964 metric tons 4. 0.61 metric tons 5. 0.05 metric tons	2021 SASB data set includes emissions from power generation. With the exception of cooling towers, auxiliary equipment is not included in the 2021 data set, as this represents less than 0.1% of emissions and is considered de minimis. All power plants are near areas of dense population based on the definitions of "near" and "dense." SOx is reported as SO_2. NOx and SO_2 numbers differ from other reported areas due reporting in metric tons versus short tons.

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Sustainability Accounting Standards Board (SASB) Metrics

SASB topic	SASB accounting metric	2020	2021	Comments
Water Management	1. Total water withdrawn 2. Total water consumed, percentage of each in regions of high or extremely high baseline water stress	1. 7,681,333, thousand cubic meters; 0.001% 2. 118,814 thousand cubic meters; 0.07%	1. 7,339,262 thousand cubic meters; 0.001% 2. 117,079 thousand cubic meters; 0.08%	In 2021, NextEra Energy operated or had ownership share of 25 power generating sites across the U.S. that use water, but only one site is located in regions of high or extremely high water stress. Nearly 74% of the water we withdrew in 2021 came from saltwater sources. Water metrics reported reflect use for plant operations and use associated with decommissioning or closure of generating facilities. Water numbers differ from other reported areas due to the use of thousand cubic meters vs. billions gallons.
	Number of incidents of non-compliance associated with water quality and/ or quantity permits, standards, and regulations	0	1	In 2021, the Cape Canaveral Energy Center exceeded its permitted allowable *Once Through Cooling Water Chlorine Dioxide Injection* limit, resulting in an Environmental Reportable Event. Procedures were put into place after the event to ensure future compliance.
	Description of water management risks and discussion of strategy and practices to mitigate those risks	Description within report and on the sustainability website	Description within report and on the sustainability website	See discussion in the following sections of this report: Environment - Water Availability
Coal Ash Management	Amount of coal combustion residuals (CCR) generated, percentage recycled	169,771 metric tons; 93% recycled	144,706 metric tons 91% recycled	In 2021, NextEra Energy did not operate any facilities that generated CCR but has a co-owner share of two that do.
	Total number of CCR impoundments, broken down by hazard potential classification and structural integrity assessment	4	4	NextEra Energy has interest in four CCR impoundments, with two of these impoundments undergoing closure. While there are three surface impoundments that are regulated under the federal CCR regulation found at 40 CFR 257.50-107, there are four impoundments that meet the broader definition in 40 CFR 257.2 referenced within the SASB standards. Each has been ranked using the EPA hazard potential classification. There are one Low Hazard, two Significant Hazard and one High Hazard. All four had the highest structural integrity assessment rating of Satisfactory in 2021.

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Sustainability Accounting Standards Board (SASB) Metrics

SASB topic	SASB accounting metric	2020	2021	Comments
Energy Affordability	Average retail electric rate for 1. residential, 2. commercial and 3. industrial customers	FPL Retail electric rates: 1. Residential $0.1044/kWh 2. Commercial $0.0805/kWh 3. Industrial $0.0569/kWh Gulf Power Retail electric rates: 1. Residential $0.1357/kWh 2. Commercial $0.1057/kWh 3. Industrial $0.0722/kWh	FPL Retail electric rates: 1. Residential $0.1122/kWh 2. Commercial $0.0880/kWh 3. Industrial $0.0636/kWh Gulf Power Retail electric rates: 1. Residential $0.1395/kWh 2. Commercial $0.1085/kWh 3. Industrial $0.0831/kWh	
	Typical monthly electric bill for residential customers for 1. 500 kWh and 2. 1,000 kWh of electricity delivered per month	FPL: 1. 500 kWh $52.50 2. 1,000 kWh $94.38 Gulf Power: 1. 500 kWh $80.06 2. 1,000 kWh $140.43	FPL: 1. 500 kWh $55.79 2. 1,000 kWh $101.70 Gulf Power: 1. 500 kWh $79.81 2. 1,000 kWh $139.89	
	Discussion of impact of external factors on customer affordability of electricity, including the economic conditions of the service territory	Discussion within report	Discussion within report	See discussion in the following sections of this report and the sustainability website: Florida Power & Light Company Affordable Energy Economic Development

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Sustainability Accounting Standards Board (SASB) Metrics

SASB topic	SASB accounting metric	2020	2021	Comments
Workforce Health and Safety	1. Total recordable incident rate (TRIR), 2. fatality rate and 3. near miss frequency rate (NMFR)	1. 0.39 2. 0.00 3. N/A	1. 0.33 2. 0.00 3. N/A	NextEra Energy does not track NMFR in a comparable manner as SASB guidelines. OSHA recordable rate (TRIR) is the metric used in senior leadership compensation goals; goal for senior leadership is top decile performance.
End-Use Efficiency and Demand	Percentage of electric utility revenues from rate structures that 1. are decoupled and 2. contain a lost revenue adjustment mechanism (LRAM)	Not applicable	Not applicable	
	Percentage of electric load served by smart grid technology	99%	99%	
	Customer electricity savings from efficiency measures, by market	Discussion within report	Discussion within report	See discussion in the following sections of this report: Florida Power & Light Company Affordable Energy
Nuclear Safety and Emergency Management	Total number of nuclear power units, broken down by U.S. Nuclear Regulatory Commission (NRC) Action	All eight nuclear power units are 'licensee response' classification under U.S. Nuclear Regulatory Commission Action	All eight nuclear power units are 'licensee response' classification under U.S. Nuclear Regulatory Commission Action	U.S. Nuclear Regulatory Commission Action Matrix Includes Duane Arnold nuclear power unit, which is in the process of decommissioning
	Description of efforts to manage nuclear safety and emergency preparedness	Description within report	Discussion within report	See discussion in the following section of this report: Nuclear safety
	Number of incidents of non-compliance with physical and/or cybersecurity standards or regulations	Description within report	Description within report	See discussion in the following section of this report: Cybersecurity

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Sustainability Accounting Standards Board (SASB) Metrics

SASB topic	SASB accounting metric	2020	2021	Comments
Grid Resiliency	1. System Average Interruption Duration Index (SAIDI) 2. System Average Interruption Frequency Index (SAIFI) 3. Customer Average Interruption Duration Index (CAIDI), inclusive of major event days	FPL: 1. SAIDI: 48.5 2. SAIFI: 0.87 3. CAIDI: 56.26 Gulf Power: 1. SAIDI: 50.26 2. SAIFI: 0.81 3. CAIDI: 61.71	FPL: 1. SAIDI: 45.6 2. SAIFI: 0.82 3. CAIDI: 55.29 Gulf Power: 1. SAIDI: 42.8 2. SAIFI: 0.63 3. CAIDI: 94.34	Metric is exclusive of major event days and is based on how reported to Florida Public Service Commission for all of power delivery (transmission and distribution).

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APPENDIX B

Task Force on Climate-Related Financial Disclosures

Section	Recommended Disclosure	NextEra Energy Response
Governance	Describe the board's oversight of climate-related risks and opportunities.	Confronting climate change - Governance Sustainability governance Our approach to risk management
	Describe management's role in assessing and managing climate-related risks and opportunities.	Confronting climate change - Governance Sustainability governance Our approach to risk management
Strategy	Describe the climate-related risks and opportunities identified over the short, medium and long term.	Confronting climate change - Strategy Risks and opportunities Florida Power & Light Company NextEra Energy Resources
	Describe the impact of climate-related risks and opportunities on the businesses, strategy and financial planning.	Confronting climate change - Strategy Our approach to risk management
	Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2 degree Celsius or lower scenario.	Confronting climate change - Strategy Our approach to risk management 2022 FPL Ten-Year Site Plan
Risk Management	Describe the processes for identifying and assessing climate-related risks.	Confronting climate change - Risk management Risks and opportunities
	Describe the processes for managing climate-related risks.	Confronting climate change - Risk management Risks and opportunities
	Describe how processes for identifying, assessing and managing climate-related risks are integrated into the overall risk management process.	Confronting climate change - Risk management Risks and opportunities
Metrics and Targets	Disclose the metrics used to assess climate-related risks and opportunities in line with strategy and risk management processes.	Confronting climate change - Metrics and targets Environment Environment - Climate change and reducing emissions
	Disclose scope 1, 2 and, if appropriate, 3 GHG emissions and related risks.	Sustainability Accounting Standards Board (SASB) Metrics 3rd-Party Verification Statement
	Describe the targets used to manage climate-related risks and opportunities and performance against targets.	Environment - Climate change and reducing emissions

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APPENDIX C

EEI ESG/Sustainability Quantitative Metrics

Parent Company: NextEra Energy, Inc. (NextEra Energy)

Principal Operating Companies: Florida Power & Light Company (FPL) and NextEra Energy Resources, LLC and Gulf Power Company (2019 - 2021 data only)

	2005	2019	2020	2021
Owned Net Generation Capacity (MW)[1]				
Coal	915	2,554	1,351	717
Natural gas[2]	22,515	23,973	24,533	26,030
Nuclear	4,015	6,202	5,794	5,795
Oil	1,316	944	1,473	964
Renewable Energy Resources:	4,069	18,007	21,581	23,068
Hydroelectric	361	0	0	0
Landfill gas	0	3	3	3
Solar	148	3,894	5,505	6,548
Wind	3,192	14,110	16,073	16,517
Other	368	0	0	0
Owned Net Generation (MWh)				
Coal	6,065,258	6,923,744	4,417,826	4,439,180
Natural gas	59,752,003	99,230,129	103,070,751	99,680,103
Nuclear	29,745,644	51,118,396	49,869,793	46,943,053
Oil	23,828,305	222,347	160,427	293,419
Renewable Energy Resources:	9,385,224	49,890,065	58,688,356	69,932,925
Hydroelectric	1,811,409	0	0	0
Landfill gas	0	22,547	21,615	21,259
Solar	275,393	7,059,936	9,417,857	15,232,598
Wind	7,298,422	42,807,582	49,248,884	54,679,068
Capital Expenditures and Energy Efficiency (EE)[3]				
Annual Capital Expenditures (billions)[4]	$2.5	$12.3	$14.6	$15.9
Incremental Annual Electricity Savings from EE Measures (MWh)	Form EIA-861	Form EIA-861	Form EIA-861	Form EIA-861
Incremental Annual Investment in Electric EE Programs (thousands)	Form EIA-861	Form EIA-861	Form EIA-861	Form EIA-861
Retail Electric Customers				
Commercial	469,973	571,3812	576,672	641,831
Industrial	20,392	12,084	11,990	13,368
Residential	3,828,374	4,501,472	4,567,743	5,065,615

1) Solar capacity numbers for 2019, 2020 and 2021 include 75 MW of non-incremental thermal solar. 2019 coal and landfill capacity and generation increased due to the acquisition of Gulf Power. 2019 Natural Gas capacity increased due to the addition of Okeechobee Clean Energy Center (state-of-the art natural gas combined cycle power plant). This plant addition, along with NextEra Energy's acquisition of ownership share in natural gas power plants Oleander & Stanton, attributed to the increase in natural gas generation.
2) Some natural gas plants have the ability to use oil for additional fuel flexibility. In 2019, approximately 65% of NextEra Energy's natural gas capacity was dual-fuel capable. In 2020, approximately 68% of NextEra Energy's natural gas capacity was dual-fuel capable. In 2021, approximately 71% had dual fuel capability.
3) Per NextEra Energy 10K filings.
4) 2019 capital expenditures exclude capital expenditures related to the Gulf Power acquisition.

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EEI ESG/Sustainability Quantitative Metrics

Parent Company: NextEra Energy, Inc. (NextEra Energy)

Principal Operating Companies: Florida Power & Light Company (FPL), NextEra Energy Resources, LLC and Gulf Power Company (2019 - 2021 data only)

Emissions[5]	2005	2019	2020	2021
Carbon Dioxide (CO_2)[6]				
Owned Generation CO_2 Emissions (tons)	54,270,781	49,953,427	47,328,818	46,614,994
Owned Generation CO_2 Emissions Intensity (lbs/Net MWh)	843	482	438	422
Total Owned Generation CO_2 Emissions (MT)	49,233,638	45,317,000	42,935,994	42,288,462
Total Owned Generation CO_2 Emissions Intensity (MT/Net MWh)	0.260	0.219	0.199	0.191
Non-Generation CO_2e Emissions of Sulfur Hexafluoride (SF6)[7]				
Total CO_2e emissions of SF6 (MT)	--	--	43,731	19,579
Leak rate of CO_2e emissions of SF6 (MT/Net MWh)	--	--	0.000202	0.000088
Nitrogen Oxide (NOx)				
NOx Emissions (tons)	55,275	12,039	9,288	11,601
NOx Emissions Intensity (lbs/Net MWh)	0.86	0.12	0.09	0.11
Total NOx Emissions (MT)	50,145	10,922	8,426	10,525
Total NOx Emissions Intensity (MT/Net MWh)	0.0002651	0.0000527	0.0000390	0.0000476
Sulfur Dioxide (SO_2)				
SO_2 Emissions (tons)	121,480	2,482	1,142	926
SO_2 Emissions Intensity (lbs/Net MWh)	1.89	0.02	0.011	.008
Total SO_2 Emissions (MT)	110,205	2,252	1,036	840
Total SO_2 Emissions Intensity (MT/Net MWh)	0.000583	0.000011	0.000005	0.000004
Mercury (Hg)				
Hg Emissions (kg)	281	22	31	44
Hg Emissions Intensity (kg/Net MWh)	0.0000022	0.0000001	0.0000001	0.0000002

5) NextEra Energy conducts business under regulatory regimes that require CO_2 rather than CO_2e reporting. As a result, metrics may differ throughout the report in areas that report CO_2 from power generation only. This data includes emissions data for NextEra Energy-owned power plant sites, as well as joint ownership sites. Data for the joint ownership sites were adjusted to account for the company's ownership share only.
6) Purchased power is considered minimal, as this would make up less than 1% of emissions profile and is excluded from the EEI template.
7) As reported to the EPA in accordance with EPA's GHG Reporting Program (40 CFR Part 98, Subpart DD).

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EEI ESG/Sustainability Quantitative Metrics

Parent Company: NextEra Energy, Inc. (NextEra Energy)

Principal Operating Companies: Florida Power & Light Company (FPL), NextEra Energy Resources, LLC and Gulf Power Company (2019 - 2021 data only)

Resources	2005	2019	2020	2021
Human Resources				
Total Number of Employees	12,400	14,800	14,900	15,017
Percentage of Women in Total Workforce	Not reported	23%	24%	24%
Percentage of Minorities in Total Workforce	Not reported	36%	37%	39%
Total Number on Board of Directors	11	13	13	13[9]
Percentage of Women on Board of Directors	9%	23%	23%	15%
Percentage of Minorities on Board of Directors	18%	23%	15%	15%
Employee Safety - Recordable Incident Rate	2.40	0.62	0.39	0.33
Employee Safety - Work-related Fatalities	0	0	0	0
Fresh Water Resources used in Thermal Power Generation Activities[8]				
Water Withdrawals - Consumptive (Millions of Gallons)	21,061	26,960	22,178	21,112
Water Withdrawals - Non-Consumptive (Millions of Gallons)	341,107	476,694	475,507	481,040
Water Withdrawals - Consumptive Rate (Millions of Gallons/Net MWh)	0.0001385	0.0001298	0.0001024	0.0000942
Water Withdrawals - Non-Consumptive Rate (Millions of Gallons/Net MWh)	0.0022429	0.0022373	0.0021446	0.0021371
Waste Products				
Amount of Hazardous Waste Manifested for Disposal (tons)	Not tracked	1.1	0.8	1.3
Percent of Coal Combustion Products Beneficially Used	Not tracked	69%	93%	91%

8) Water metrics reported reflect use for plant operations and use associated with decommissioning or closure of generating facilities, except the rate metric. The rate metric only reflects water use for power generation per MWh. Water data may be periodically updated to incorporate improvements to our water data management system. With the development of our improved water data management system, the baseline for water data was adjusted to 2007.
9) Number of Board of Directors members reduced to 12, as of August 2022, following leadership transition.

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APPENDIX D

United Nations Sustainable Development Goals Metrics

Our business is aligned with global sustainability initiatives, particularly the United Nations Sustainable Development Goals (SDGs). The 17 goals and 169 targets provide a framework for governments, businesses and organizations to advance sustainable development. In 2021, we mapped our alignment with the SDGs to determine where our business most aligns with and contributes to supporting the goals. While nearly all of the SDGs are indirectly aligned with various aspects of our corporate strategies, we identified that our business strategy directly aligns with three priority SDGs (7, 9 and 13) and two additional SDGs (14 and 15) where our operations may make a significant contribution.

SDG	Our Approach	Section of Report
	Our investment in emissions-free and clean generation has reduced the impact on the air we breathe and demonstrates our commitment to environmental protection and stewardship. Our strategy is based on generating and delivering clean energy and building energy infrastructure that's reliable and affordable. We expect that our investments in emissions-free wind and solar generation, innovative battery storage technology, low-emissions natural gas generation, safe and emissions-free nuclear power, industry-leading energy efficiency programs and transmission lines designed to deliver energy where it's needed when it's needed will enable us to continue providing a wide range of benefits to our many valued stakeholders. » **FPL plans to install 12,626 MW of solar in Florida by 2031, expanding upon its earlier plan to install 30 million solar panels across the state of Florida. The company is on schedule to complete the installation of all 30 million by 2025 – five years ahead of schedule.** » **From 2022-2025, NextEra Energy Resources expects to bring online an additional 28-37 GW of clean, carbon-emissions-free renewable energy.** » **Our capital investments also will help us meet our near-term goal of reducing our CO_2 emissions rate 82% by 2030 from a 2005 baseline.** » **In 2022, NextEra Energy announced a commitment to achieve Real Zero carbon emissions by no later than 2045. This goal represents the most ambitious target set by any U.S. utility or power provider to-date.**	NextEra Energy's blueprint to reach Real Zero Florida Power & Light Company - Efficient generation and clean energy solutions NextEra Energy Resources - Positioned to decarbonize the U.S. economy Social - Affordable energy
	As one of the largest electric power and energy infrastructure companies in North America and a leader in the renewable energy industry, NextEra Energy is committed to building a sustainable energy future that is affordable, reliable and clean. NextEra Energy's Real Zero goal and ability to produce power with zero-carbon emissions will mean the customers we provide power to can meet their Net Zero goals faster, cheaper and easier. By investing in smart infrastructure and innovative clean energy solutions, we are helping to build a sustainable energy future that is affordable, reliable and clean. » **Over the past decade, we have invested ~$110 billion in infrastructure capital deployment, making us the largest U.S. infrastructure investor in the energy industry and one of the largest capital investors across any industry in the U.S. over this period.**	Florida Power & Light Company - Building America's smartest and strongest energy grid Florida Power & Light Company - Efficient generation and clean energy solutions NextEra Energy Resources - Positioned to decarbonize the U.S. economy Environment - Climate change, decarbonization and Real Zero carbon emissions reductions Social - Economic development

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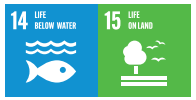
SDG	Our Approach	Section of Report
	We believe that no company in any industry has done more to reduce carbon emissions and to confront climate change than NextEra Energy. Climate-related risks and opportunities have influenced our financial plan for capital expenditures, acquisitions and revenues, to respond to our customers' demands for clean and renewable energy. This has influenced our capital plan in executing our significant renewable energy deployment and grid hardening initiatives. » **NextEra Energy's Real Zero goal calls for a significant investment that strives to eliminate all scope 1 and scope 2 carbon emissions across its operations by no later than 2045.** » **NextEra Energy's plan would generate only carbon emissions-free energy from a diverse mixture of wind, solar, battery storage, nuclear, green hydrogen and other renewable sources.**	NextEra Energy's blueprint to reach Real Zero Florida Power & Light Company - Building America's smartest and strongest energy grid Environment - Climate change, decarbonization and Real Zero carbon emissions reductions Risks and Opportunities - Emergency preparedness Risks and Opportunities - Our approach to risk management Risks and Opportunities - Preparing for storms, flooding and sea-level rise
	Before we build any operating facility, we study the local ecosystem so that we can better understand what it takes to be a partner in its preservation and to be a good neighbor to all the species that live there. We carefully consider the presence of any threatened or endangered species, as well as significant wildlife corridors, wetlands or other ecologically important areas. We seek to minimize and mitigate the impact of our development before we begin a project, and once a project is operating, we continue to monitor potential impacts to biodiversity. » **In the 1980s, FPL initiated a crocodile management program at the Turkey Point Clean Energy Center. Our crocodile management program includes protecting these nesting areas, completing population surveys, conducting capture and spatial distribution surveys and regulating plant activity at night and during nesting season. In 2021, FPL biologists captured, tagged and released a record setting 565 hatchlings.** » **In an effort to positively benefit the health of Florida manatees, the NextEra Energy Foundation provided grants to the Florida Atlantic University (FAU) Foundation for the FAU Harbor Branch Experimental Seagrass Nursery and to the Florida Oceanographic Society to support seagrass research and onsite seagrass nursery operations.** » **At our Florida solar energy centers, we work with Audubon Florida and other local organizations to craft site-specific enhancement and preservation plans focused on providing habitat opportunities for birds, pollinators and other wildlife.**	Environment - Wildlife

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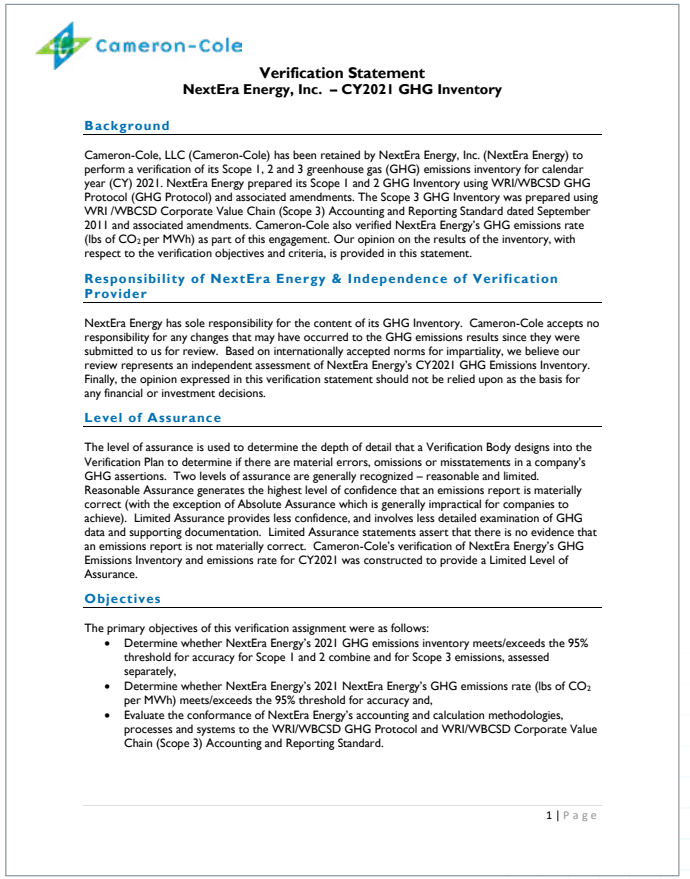
APPENDIX E

Emissions Data and Third-party Emissions Assurance Statements

2021 scope 1, scope 2 and scope 3 emissions inventory received independent third-party verification. The verification activities were conducted in alignment with the principles of ISO-14064-3:2006(E) specifications with Guidance for the Validation and Verification of Greenhouse Gas Assertions. Our GHG emissions rate (lbs of CO_2 per MWh) was also verified as part of this process.

Scope 1 emissions were reported for Stationary, Mobile, and Fugitive sources. Scope 2 (location-based) emissions were reported for office facilities (owned or leased), not served by FPL or Gulf Power. Emissions were estimated using actual kWh purchases (when available), sq. footage and a national average CO_2 emissions factor derived from electric sector emissions and generation data. Scope 2 (market-based) emissions were reported for office facilities (owned or leased) not served by FPL or Gulf Power. Emissions were estimated using actual kWh purchases (when available), sq. footage and Green-e Energy Residual Mix Emissions Rates (2018). Scope 3 emissions were reported as per GHG Protocol Scope 3 Standards for Category 3 (Fuel- and energy-related activities not included in scope 1 or scope 2), Category 6 (Business Travel) and Category 11 (Use of Sold Products).

	2021
Scope 1 emissions	43,027,155 metric tons CO_2e
Scope 2 emissions (location-based)	17,201 metric tons CO_2e
Scope 2 emissions (market-based)	17,872 metric tons CO_2e
Scope 3 emissions (fuel- and energy-related activities [not included in scope 1 or scope 2], business travel and use of sold products)	2,392,318 metric tons CO_2e
Emissions rate	422 lbs CO_2 per MWh



Cameron-Cole

Verification Statement
NextEra Energy, Inc. – CY2021 GHG Inventory

Background

Cameron-Cole, LLC (Cameron-Cole) has been retained by NextEra Energy, Inc. (NextEra Energy) to perform a verification of its Scope 1, 2 and 3 greenhouse gas (GHG) emissions inventory for calendar year (CY) 2021. NextEra Energy prepared its Scope 1 and 2 GHG Inventory using WRI/WBCSD GHG Protocol (GHG Protocol) and associated amendments. The Scope 3 GHG Inventory was prepared using WRI /WBCSD Corporate Value Chain (Scope 3) Accounting and Reporting Standard dated September 2011 and associated amendments. Cameron-Cole also verified NextEra Energy's GHG emissions rate (lbs of CO_2 per MWh) as part of this engagement. Our opinion on the results of the inventory, with respect to the verification objectives and criteria, is provided in this statement.

Responsibility of NextEra Energy & Independence of Verification Provider

NextEra Energy has sole responsibility for the content of its GHG Inventory. Cameron-Cole accepts no responsibility for any changes that may have occurred to the GHG emissions results since they were submitted to us for review. Based on internationally accepted norms for impartiality, we believe our review represents an independent assessment of NextEra Energy's CY2021 GHG Emissions Inventory. Finally, the opinion expressed in this verification statement should not be relied upon as the basis for any financial or investment decisions.

Level of Assurance

The level of assurance is used to determine the depth of detail that a Verification Body designs into the Verification Plan to determine if there are material errors, omissions or misstatements in a company's GHG assertions. Two levels of assurance are generally recognized – reasonable and limited. Reasonable Assurance generates the highest level of confidence that an emissions report is materially correct (with the exception of Absolute Assurance which is generally impractical for companies to achieve). Limited Assurance provides less confidence, and involves less detailed examination of GHG data and supporting documentation. Limited Assurance statements assert that there is no evidence that an emissions report is not materially correct. Cameron-Cole's verification of NextEra Energy's GHG Emissions Inventory and emissions rate for CY2021 was constructed to provide a Limited Level of Assurance.

Objectives

The primary objectives of this verification assignment were as follows:

- Determine whether NextEra Energy's 2021 GHG emissions inventory meets/exceeds the 95% threshold for accuracy for Scope 1 and 2 combine and for Scope 3 emissions, assessed separately,
- Determine whether NextEra Energy's 2021 NextEra Energy's GHG emissions rate (lbs of CO_2 per MWh) meets/exceeds the 95% threshold for accuracy and,
- Evaluate the conformance of NextEra Energy's accounting and calculation methodologies, processes and systems to the WRI/WBCSD GHG Protocol and WRI/WBCSD Corporate Value Chain (Scope 3) Accounting and Reporting Standard.

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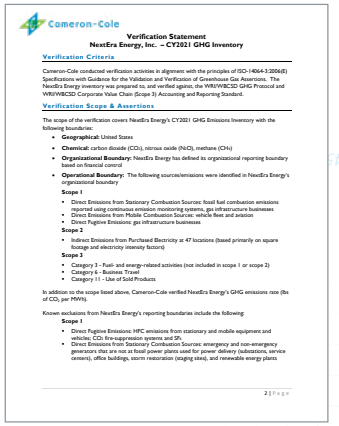

Cameron-Cole

Verification Statement
NextEra Energy, Inc. – CY2021 GHG Inventory

Verification Criteria

Cameron-Cole conducted verification activities in alignment with the principles of ISO-14064-3:2006(E) Specifications with Guidance for the Validation and Verification of Greenhouse Gas Assertions. The NextEra Energy inventory was prepared to, and verified against, the WRI/WBCSD GHG Protocol and WRI/WBCSD Corporate Value Chain (Scope 3) Accounting and Reporting Standard.

Verification Scope & Assertions

The scope of the verification covers NextEra Energy's CY2021 GHG Emissions Inventory with the following boundaries:

- **Geographical:** United States
- **Chemical:** carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4)
- **Organizational Boundary:** NextEra Energy has defined its organizational reporting boundary based on financial control
- **Operational Boundary:** The following sources/emissions were identified in NextEra Energy's organizational boundary

Scope 1

- Direct Emissions from Stationary Combustion Sources: fossil fuel combustion emissions reported using continuous emission monitoring systems, gas infrastructure businesses
- Direct Emissions from Mobile Combustion Sources: vehicle fleet and aviation
- Direct Fugitive Emissions: gas infrastructure businesses

Scope 2

- Indirect Emissions from Purchased Electricity at 47 locations (based primarily on square footage and electricity intensity factors)

Scope 3

- Category 3 - Fuel- and energy-related activities (not included in scope 1 or scope 2)
- Category 6 - Business Travel
- Category 11 – Use of Sold Products

In addition to the scope listed above, Cameron-Cole verified NextEra Energy's GHG emissions rate (lbs of CO_2 per MWh).

Known exclusions from NextEra Energy's reporting boundaries include the following:

Scope 1

- Direct Fugitive Emissions: HFC emissions from stationary and mobile equipment and vehicles; CO_2 fire-suppression systems and SF6
- Direct Emissions from Stationary Combustion Sources: emergency and non-emergency generators that are not at fossil power plants used for power delivery (substations, service centers), office buildings, storm restoration (staging sites), and renewable energy plants

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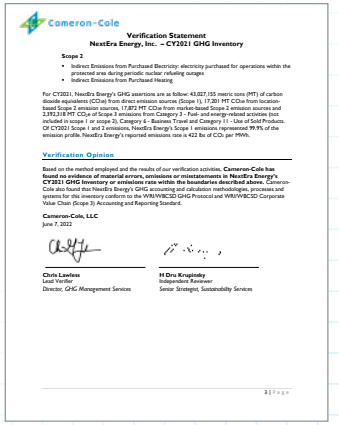

Cameron-Cole

Verification Statement
NextEra Energy, Inc. – CY2021 GHG Inventory

Scope 2

- Indirect Emissions from Purchased Electricity: electricity purchased for operations within the protected area during periodic nuclear refueling outages
- Indirect Emissions from Purchased Heating

For CY2021, NextEra Energy's GHG assertions are as follow: 43,027,155 metric tons (MT) of carbon dioxide equivalents (CO_2e) from direct emission sources (Scope 1), 17,201 MT CO_2e from location-based Scope 2 emission sources, 17,872 MT CO_2e from market-based Scope 2 emission sources and 2,392,318 MT CO_2e of Scope 3 emissions from Category 3 - Fuel- and energy-related activities (not included in scope 1 or scope 2), Category 6 – Business Travel and Category 11 – Use of Sold Products. Of CY2021 Scope 1 and 2 emissions, NextEra Energy's Scope 1 emissions represented 99.9% of the emission profile. NextEra Energy's reported emissions rate is 422 lbs of CO_2 per MWh.

Verification Opinion

Based on the method employed and the results of our verification activities, **Cameron-Cole has found no evidence of material errors, omissions or misstatements in NextEra Energy's CY2021 GHG inventory or emissions rate within the boundaries described above.** Cameron-Cole also found that NextEra Energy's GHG accounting and calculation methodologies, processes and systems for this inventory conform to the WRI/WBCSD GHG Protocol and WRI/WBCSD Corporate Value Chain (Scope 3) Accounting and Reporting Standard.

Cameron-Cole, LLC
June 7, 2022

Chris Lawless
Lead Verifier
Director, GHG Management Services

M Dru Krupinsky
Independent Reviewer
Senior Strategist, Sustainability Services

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FORWARD-LOOKING STATEMENTS

This report contains "forward-looking statements" within the meaning of the safe harbor provisions of the Private Securities Litigation Reform Act of 1995. Forward-looking statements are not statements of historical facts, but instead represent the current expectations of NextEra Energy, Inc. (together with its subsidiaries, NextEra Energy) regarding future operating results and other future events, many of which, by their nature, are inherently uncertain and outside of NextEra Energy's control. Forward-looking statements in this report include, among others, statements concerning adjusted earnings per share expectations and future operating performance, statements concerning future dividends, results of acquisitions, statements concerning the Real ZeroTM carbon emissions reduction goals and associated expectations, and statements regarding any impacts of, and the ability to arrive at acceptable mitigation measures in response to, trade-related laws and regulations including the U.S. Department of Commerce's decision to initiate an anti-circumvention investigation into the importation of solar panels from Malaysia, Vietnam, Thailand and Cambodia. In some cases, you can identify the forward-looking statements by words or phrases such as "will," "may result," "expect," "anticipate," "believe," "intend," "plan," "seek," "potential," "projection," "forecast," "predict," "goals," "target," "outlook," "should," "would" or similar words or expressions. You should not place undue reliance on these forward-looking statements, which are not a guarantee of future performance. The future results of NextEra Energy and its business and financial condition are subject to risks and uncertainties that could cause actual results to differ materially from those expressed or implied in the forward-looking statements, or may require it to limit or eliminate certain operations. These risks and uncertainties include, but are not limited to, those discussed in this report and the following: effects of extensive regulation of NextEra Energy's business operations; inability of NextEra Energy to recover in a timely manner any significant amount of costs, a return on certain assets or a reasonable return on invested capital through base rates, cost recovery clauses, other regulatory mechanisms or otherwise; impact of political, regulatory, operational and economic factors on regulatory decisions important to NextEra Energy; disallowance of cost recovery based on a finding of imprudent use of derivative instruments; effect of any reductions or modifications to, or elimination of, governmental incentives or policies that support utility scale renewable energy projects or the imposition of additional tax laws, tariffs, duties, policies or assessments on renewable energy or equipment necessary to generate it or deliver it; impact of new or revised laws, regulations, interpretations or constitutional ballot and regulatory initiatives on NextEra Energy; capital expenditures, increased operating costs and various liabilities attributable to environmental laws, regulations and other standards applicable to NextEra Energy; effects on NextEra Energy of federal or state laws or regulations mandating new or additional limits on the production of greenhouse gas emissions; exposure of NextEra Energy to significant and increasing compliance costs and substantial monetary penalties and other sanctions as a result of extensive federal regulation of its operations and businesses; effect on NextEra Energy of changes in tax laws, guidance or policies as well as in judgments and estimates used to determine tax-related asset and liability amounts; impact on NextEra Energy of adverse results of litigation; effect on NextEra Energy of failure to proceed with projects under development or inability to complete the construction of (or capital improvements to) electric generation, transmission and distribution facilities, gas infrastructure facilities or other facilities on schedule or within budget; impact on development and operating activities of NextEra Energy resulting from risks related to project siting, planning, financing, construction, permitting, governmental approvals and the negotiation of project development agreements, as well as supply chain disruptions; risks involved in the operation and maintenance of electric generation, transmission and distribution facilities, gas infrastructure facilities, retail gas distribution system in Florida and other facilities; effect on NextEra Energy of a lack of growth or slower growth in the number of customers or in customer usage; impact on NextEra Energy of severe weather and other weather conditions; threats of terrorism and catastrophic events that could result from terrorism, cyberattacks or other attempts to disrupt NextEra Energy's business or the businesses of third parties; inability to obtain adequate insurance coverage for protection of NextEra Energy against significant losses and risk that insurance coverage does not provide protection against all significant losses; a prolonged period of low gas and oil prices could impact NextEra Energy's gas infrastructure business and cause NextEra Energy to delay or cancel certain gas infrastructure projects and could result in certain projects becoming impaired; risk of increased operating costs resulting from unfavorable supply costs necessary to provide full energy and capacity requirement services; inability or failure to manage properly or hedge effectively the commodity risk within its portfolio; effect of reductions in the liquidity of energy markets on NextEra Energy's ability to manage operational risks; effectiveness of NextEra Energy's risk management tools associated with its hedging and trading procedures to protect against significant losses, including the effect of unforeseen price variances from historical behavior; impact of unavailability or disruption of power transmission or commodity transportation facilities on sale and delivery of power or natural gas; exposure of NextEra Energy to credit and performance risk from customers, hedging counterparties and vendors; failure of counterparties to perform under derivative contracts or of requirement for NextEra Energy to post margin cash collateral under derivative contracts; failure or breach of NextEra Energy's information technology systems; risks to NextEra Energy's retail businesses from compromise of sensitive customer data; losses from volatility in the market values of derivative instruments and limited liquidity in over-the-counter markets; impact of negative publicity; inability to maintain, negotiate or renegotiate acceptable franchise agreements; occurrence of work strikes or stoppages and increasing personnel costs; NextEra Energy's ability to successfully identify, complete and integrate acquisitions, including the effect of increased competition for acquisitions; environmental, health and financial risks associated with ownership and operation of nuclear generation facilities; liability of NextEra Energy for significant retrospective assessments and/or retrospective insurance premiums in the event of an incident at certain nuclear generation facilities; increased operating and capital expenditures and/or reduced revenues at nuclear generation facilities resulting from orders or new regulations of the Nuclear Regulatory Commission; inability to operate any of NextEra Energy's owned nuclear generation units through the end of their respective operating licenses; effect of disruptions, uncertainty or volatility in the credit and capital markets or actions by third parties in connection with project-specific or other financing arrangements on NextEra Energy's ability to fund its liquidity and capital needs and meet its growth objectives; inability to maintain current credit ratings; impairment of liquidity from inability of credit providers to fund their credit commitments or to maintain their current credit ratings; poor market performance and other economic factors that could affect NextEra Energy's defined benefit pension plan's funded status; poor market performance and other risks to the asset values of nuclear decommissioning funds; changes in market value and other risks to certain of NextEra Energy's investments; effect of inability of NextEra Energy subsidiaries to pay upstream dividends or repay funds to NextEra Energy or of NextEra Energy's performance under guarantees of subsidiary obligations on NextEra Energy's ability to meet its financial obligations and to pay dividends on its common stock; the fact that the amount and timing of dividends payable on NextEra Energy's common stock, as well as the dividend policy approved by NextEra Energy's board of directors from time to time, and changes to that policy, are within the sole discretion of NextEra Energy's board of directors and, if declared and paid, dividends may be in amounts that are less than might be expected by shareholders; NextEra Energy Partners, LP's inability to access sources of capital on commercially reasonable terms could have an effect on its ability to consummate future acquisitions and on the value of NextEra Energy's limited partner interest in NextEra Energy Operating Partners, LP; effects of disruptions, uncertainty or volatility in the credit and capital markets on the market price of NextEra Energy's common stock; and the ultimate severity and duration of public health crises, epidemics and pandemics, and its effects on NextEra Energy's business. NextEra Energy discusses these and other risks and uncertainties in its annual report on Form 10-K for the year ended December 31, 2021 and other Securities and Exchange Commission (SEC) filings, and this report should be read in conjunction with such SEC filings. The forward-looking statements made in this report are made only as of the date of this report and NextEra Energy undertakes no obligation to update any forward-looking statements.

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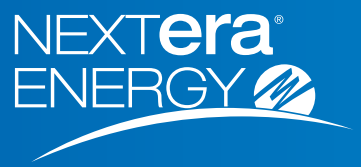

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For more information:
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NextEraEnergyResources.com

AUGUST 2022

Appendix B

Studies and Assessments

Appendix B1. Electromagnetic Interference Analysis

Oliver Wind IV, ND Electromagnetic Interference Analysis

Oliver Wind IV LLC

The following document was prepared by NextEra Analytics, an indirect wholly- owned subsidiary of NextEra Energy Resources, LLC (NEER) for the use of Oliver Wind IV, LLC, as an indirect wholly owned subsidiary of NEER. NextEra Analytics has prepared this report based on available government information by the Federal Communications Commission (FCC) and internal analysis methods. We cannot guarantee the accuracy of the data collected by the FCC. Microwave tower and link information may be inaccurate or incomplete due to FCC applicant error.

Executive Summary

NextEra Analytics, an affiliate of Oliver Wind IV LLC (Oliver IV) assessed the potential for interference of licensed communication links in close proximity to the proposed Oliver Wind IV Project area for the purposes of determining exclusion zones to aid the design of a proposed wind energy generation project. This report summarizes the microwave links and towers along with local cellular towers, media towers (AM and FM), television, and aviation towers, identified within and near the assessment area.

A review of the Federal Communications Commission (FCC) national database and the Universal Licensing System was conducted to identify these possible constraints. Wind turbine offset distances were taken in consideration for the design of the wind turbine array.

Electromagnetic analysis results show that interference is not expected to impact nearby microwave, AM, FM, cellular, TV, and aviation towers based on the array design.

The analysis is current as of July 19, 2023. NextEra Analytics recommends a refresh of this analysis if the proposed wind energy generation project has not been constructed after two years.

This report only provides analysis for licensed radio towers and links found within the FCC database. Many local municipalities (police, fire, etc.) do not license microwave links, NextEra Analytics recommends that Oliver Wind IV LLC coordinate with the appropriate local municipality officials. Also not included within the database are microwave towers and links utilized by the Federal government (Dept. of Defense, Dept. of Commerce, etc.), again for public safety concerns. A letter stating “minor issues” has been received from the National Telecommunications and Information Agency (NTIA) in coordination with Department of Commerce on May 19, 2022.

Oliver Wind IV, ND – Electromagnetic Interference

NextEra Analytics, an affiliate of Oliver Wind IV LLC (Oliver IV) assessed the potential for interference of licensed communication links in close proximity to the proposed Oliver Wind IV Project area for the purposes of determining exclusion zones to aid the design of a proposed wind energy generation project. This report summarizes the microwave links and towers along with local cellular towers, media towers (AM and FM), television, and aviation towers, identified within and near the assessment area.

A review of the FCC national database and the Universal Licensing System was conducted to identify these possible constraints. Wind turbine offset distances were taken into consideration for the design of the wind turbine array.

The site is located in Oliver and Mercer Counties in North Dakota. Figure 1 below, depicts the project location of Oliver Wind IV.

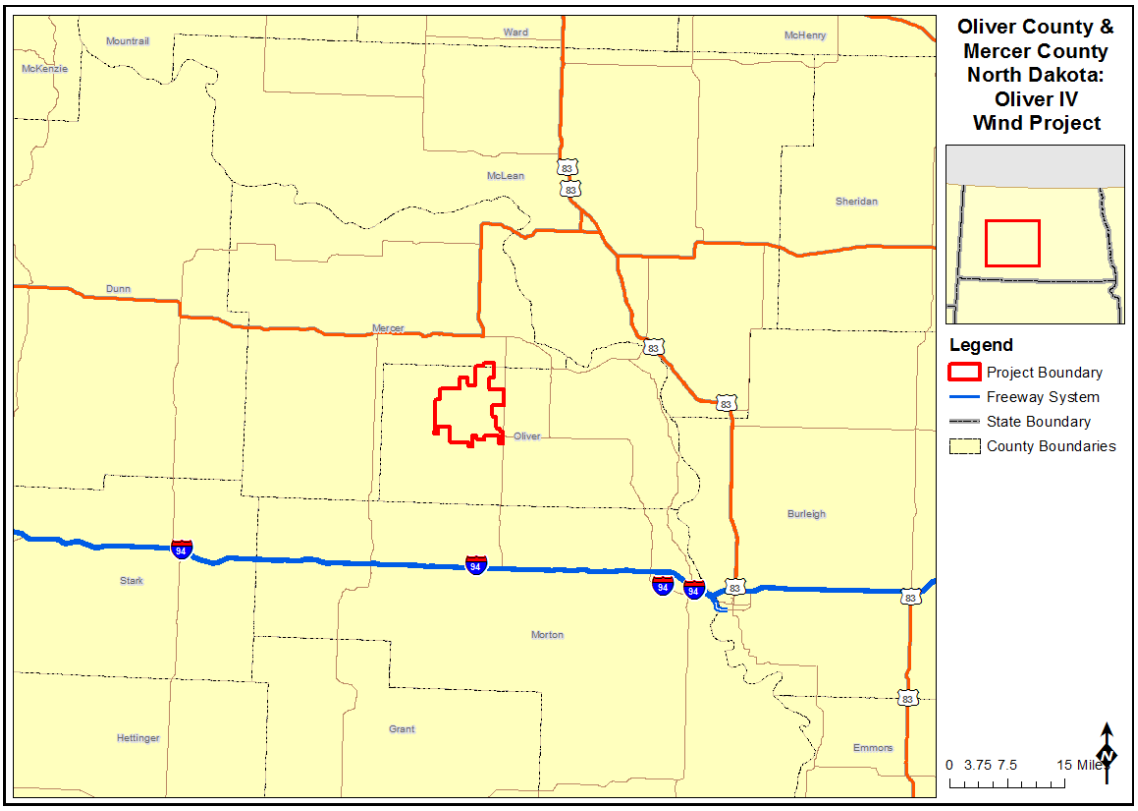

Figure 1: Oliver Wind IV Project Location

Turbine Technology

Oliver Wind IV is a proposed wind energy generation site that consists of 71 turbine locations. The layout is composed of 55 GE2.82-127-89 turbines (2.82MW rated capacity; 127m rotor diameter, or RD; 89m hub height, or HH), 9 GE2.82-127-89 turbines NRO 108 (2.73MW rated capacity; 127m RD; 89m HH), 9 GE2.82-127-89 turbines NRO 106 (2.21MW rated capacity; 127m RD; 89m HH) for a total capacity of 199.5MW. Turbine layout details are included in Table 1 and Figure 2.

Turbine Technology	GE2.82-127-89/ GE2.82-127-89 NRO 106/ GE2.82-127-89 NRO 108
Turbine Count	55/9/9
Hub Height (m)	89
Rotor Diameter (m)	127
Turbine Rated Power (MW)	2.82/2.21/2.73
Total Capacity (MW)	199.5

Table 1: Oliver IV Layout Summary

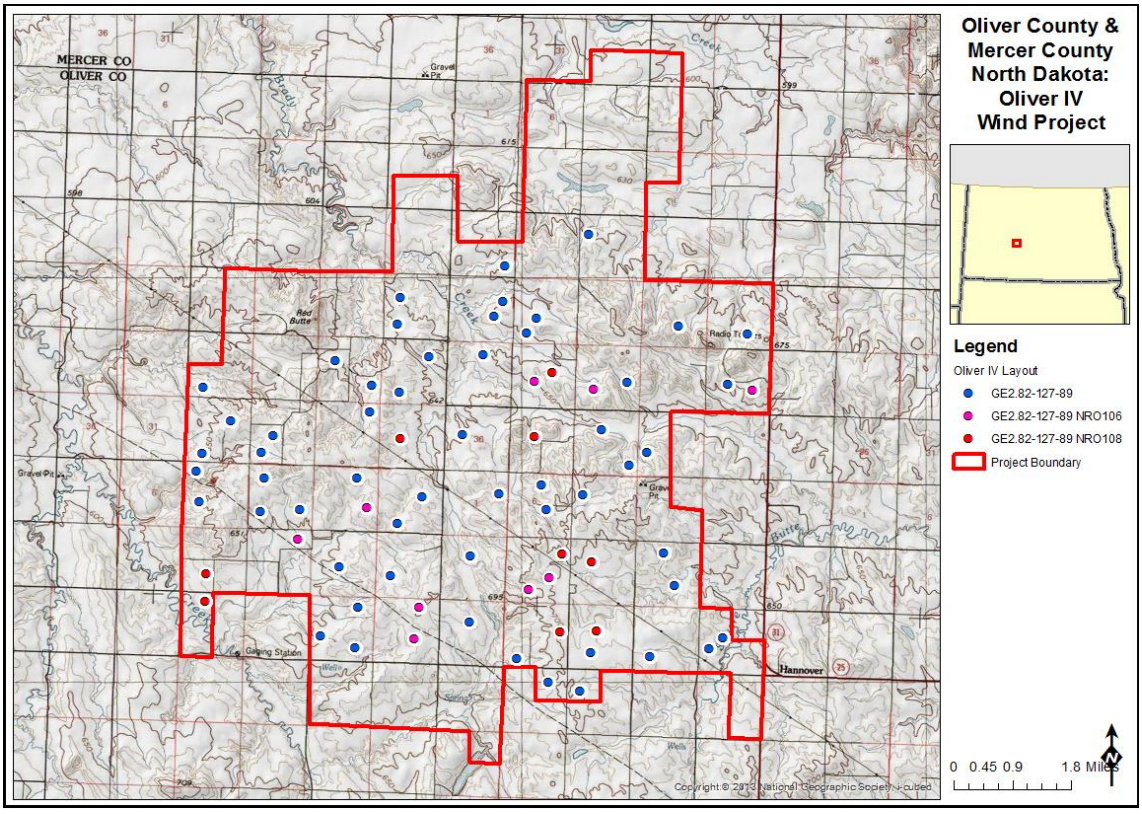

Figure 2: Oliver Wind IV Turbine Technology Allocation

It should be noted that the technology of some of the turbines in this layout may be changed prior to construction. In that event, provided that the rotor diameter of the turbine in question does not increase and the location of the turbine is not shifted, the conclusions outlined in this report regarding the telecommunications impact from Oliver IV will not materially change. Any modifications to turbine capacity and hub height will also not change the telecommunications impact of the wind farm.

Data Sources

Within the United States, the location of industrial and commercial telecommunication systems, including microwave links, are collected and maintained by the Wireless Telecommunications Bureau (WTB), a division of the FCC. This data is made publicly available through the ULS database, which contains licensing information on both current and permit pending facilities for microwave, cellular, media, and several radio services utilized by private industry (non-Federal telecommunication systems). License information supplied within the ULS database is updated daily, and is dependent upon information provided by each individual applicant.

NextEra Analytics used several data sources (ESRI satellite imagery, Google Earth, etc.) of high-resolution imagery to aid in assessing the accuracy of the geographic locations of each microwave tower with links intersecting the project boundary or area of interest (AOI).

Methodology

The ULS database, described earlier, was used to identify the microwave towers, microwave links, cellular, AM, FM, and aviation towers within a 25-kilometer radius that may impact the Oliver Wind IV Farm. Television towers were identified within a 100-kilometer radius. The database provides detailed information for each radio tower and link, which was used to calculate turbine exclusion zones to ensure interference compliance.

Exclusion zones for wind turbines near microwave links are calculated using a theory proposed by Bacon (2002), which identifies the radius of the 2nd Fresnel zone, a theoretical sphere representative of a propagating radio wave, as an appropriate offset distance. Calculations of the 2nd Fresnel zone can be determined by:

$$2nd\ Fresnel\ zone\ Radius = \sqrt{\frac{2\lambda d_1 d_2}{d_1 + d_2}} \qquad (1)$$

Where:
d_1, d_2 = distances from each end of the radio path.
λ= wavelength of the corresponding radio frequency.

To account for precision errors within the ULS database, and to further reduce the potential for interference from a wind turbine, a Worst Case Fresnel Zone (WCFZ) was calculated for each microwave link. The WCFZ provides the maximum offset distance required, and is determined by the 2nd Fresnel zone radius obtained at the midpoint of the link, where $d_1 = d_2$. Adjusting Eq. 1 to calculate the WCFZ in meters yields the following:

$$WCFZ = 17.32\sqrt{\frac{nD}{4(F)}} \quad (2)$$

Where:
D = distance between the transmitter and receiver towers.
F = frequency in GHz.
n = Fresnel zone, which for the 2nd Fresnel Zone n = 2.

The calculated radius distance from Eq. 2 provides a three-dimensional turbine exclusion zone around each microwave link that can be used to guide wind turbine array design.

In addition to the WCFZ calculated for each microwave link, NextEra Analytics applies an offset of one-half RD plus 10 meter to account for turbine blade overhang. A turbine overhang offset using a 127 m turbine technology is included within this analysis to represent the GE2.82-127 wind turbine generator, which is the generator with the largest rotor diameter at the site, and is thus the turbine technology that would potentially cause the greatest interference.

The WTB cannot provide quality assurance for every license within the ULS database, so accuracy of the data relies on applicant certifications, and, in extreme cases, license audits. It has been NextEra Analytics' experience that most inaccuracies occur with regard to the location of the radio towers, where approximation or lack of precision of the geographic coordinates can result in a difference in the position of the tower by as much as 500 meters.

To fully account for these location errors, NextEra Analytics recommends on-site verification to identify the exact location of the transmitter and receiver towers. However, for this analysis, NextEra Analytics used high-resolution satellite imagery to identify possible tower location errors. Most microwave, media, and cellular towers extend well over 80m above ground level, and can be clearly viewed within high resolution satellite imagery. Each tower that may impact the project boundary was investigated for potential location error. Adjustments to the location of the microwave, media, and cellular towers are only made if clear evidence from the satellite imagery shows an inaccuracy.

Microwave Links and Microwave Towers

No microwave towers were identified within the Project area. No microwave links have been identified near the project area and none have been found to intersect the AOI.

Cellular Towers

No cellular towers were identified within the project boundary. Seven cellular towers were discovered within 25 km of the project boundary and are identified in Table 3 and Figure 3.

Harmful interference associated with cellular towers is not likely as cellular transitions or packet switching occurs when a cellular link becomes unavailable.

ID	CALLSIGN	LICENSEE	STATUS	LATITUDE	LONGITUDE	DISTANCE TO AOI (KM)
1	KNKN285	AT&T Mobility Spectrum LLC	Pending	47.31	-101.73	27.00
2	KNKN285	AT&T Mobility Spectrum LLC	Pending	47.30	-101.80	30.00
3	KNKN343	AT&T Mobility Spectrum, LLC	Active	47.11	-101.24	8.27
4	KNKN481	BADLANDS CELLULAR OF NORTH DAKOTA LIMITED PARTNERSHIP	Active	47.36	-101.63	19.24
5	KNKN481	BADLANDS CELLULAR OF NORTH DAKOTA LIMITED PARTNERSHIP	Pending	47.11	-101.30	2.96
6	WQJQ691	Cellco Partnership	Active	47.31	-101.40	10.10
7	WQJC846	Mercer County Regional Airport Authority	Active	47.29	-101.58	11.40

Table 3: Cellular Towers within 25 km of the Project Boundary

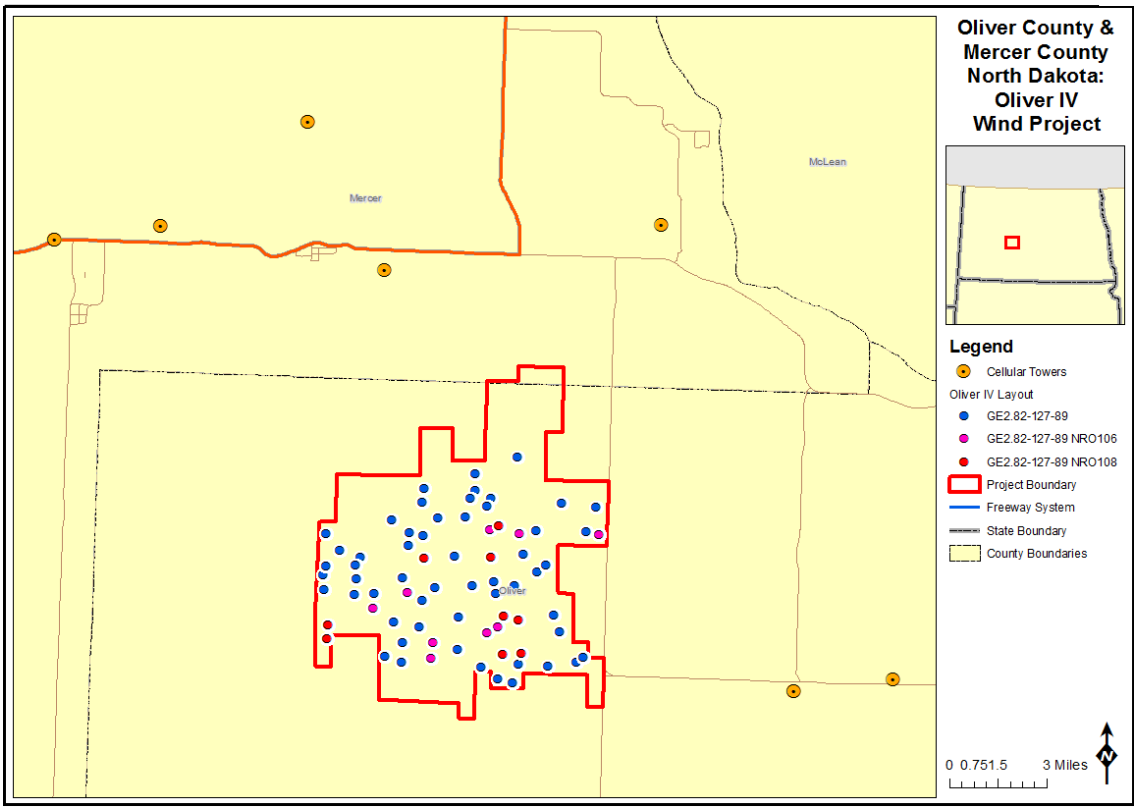

Figure 3: Cellular Towers within 25 km of the Project Boundary

Media Towers

No active AM radio towers were identified within the project boundary. Only one AM tower was identified within 25 km of the project boundary. Four AM towers were discovered within 100 km of the project boundary and are included in Table 4.

While no harmful interference to the AM towers is expected, reception of AM radio stations near each individual turbine may be impacted, especially for areas on the edge of AM radio coverage. The exclusion distance from AM towers is 1 wavelength from non-directional antennas and 10 wavelengths or 3 kilometers from directional antennas (Marlowe, 2015). Given most AM radio receptors will be nearby dwellings, which should have a sufficient offset from each turbine, any interruption to reception from the installation of wind turbines is expected to be minimal. The closest AM tower, KDKT, is located 26.2 km from the project boundary, and has a broadcasting frequency of 1410 kHz, which corresponds to a wavelength of 213 m. Thus, the proposed layout is greater than 10 wavelengths away from the closest station.

ID	CALLSIGN	LICENSEE	FREQUENCY (kHz)	Distance to AOI (km)	LATITUDE	LONGITUDE
1	KDKT	DIGITAL SYNDICATE NETWORK, LLC	1410	26.2	47.29	101.76
2	KLXX	TOWNSQUARE MEDIA BISMARCK LICENSE, LLC	1270	62.2	46.81	100.84
3	KBMR	IHM LICENSES, LLC	1130	68.6	46.81	100.74
4	KXMR	IHM LICENSES, LLC	710	75.6	46.67	100.78
5	KFYR-TV	GRAY TELEVISION LICENSEE, LLC	572	78.9	46.61	100.81
6	KFYR	IHM LICENSES, LLC	550	79.6	46.85	100.54
7	KNDB	BEK SPORTS NETWORK, INC.	542	80.8	46.59	100.79
8	KDIX	STARRDAK, INC.	1230	97.8	46.87	102.74

Table 4: AM Transmitter Towers within 100 km of the Project Boundary

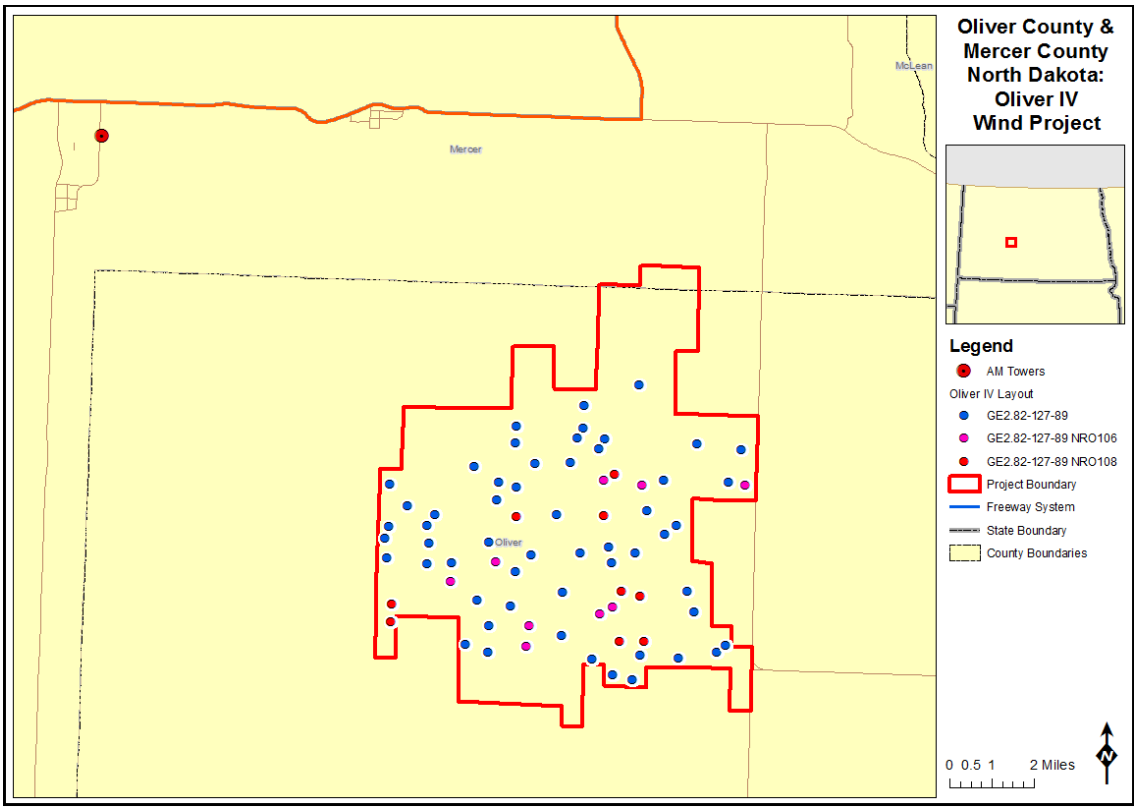

Figure 4: AM Transmitter Towers within 25 km of the Project Boundary

No active FM radio towers were identified within the project boundary. Only one FM tower was identified within 25 km of the project boundary and is shown in Figure 5. Eight FM towers were discovered within 100 km of the project boundary and are included in Table 5.

While no harmful interference to the FM towers is expected, reception of FM radio stations near each individual turbine may be impacted, especially for areas on the edge of FM radio coverage. The recommended exclusion distance for FM towers is approximately 4 kilometers. FM stations that are closer than 4 kilometers to wind turbines have the potential to experience interference (Marlowe, 2015). Given most FM radio receptors will be nearby dwellings, which should have a sufficient offset from each turbine, any interruption to reception from the installation of wind turbines is expected to be minimal. One FM towers is located less than 26 km from the AOI, K300BP, which is the most vulnerable towers to experience interference. The nearest wind turbine is located 25.9 km away from this tower.

ID	CALLSIGN	LICENSEE	FREQUENCY (MHz)	LATITUDE	LONGITUDE	DISTANCE TO AOI (km)
1	K300BP	DAVID L. JUST	107.9	47.31	101.73	25.9
2	K293CS	DIGITAL SYNDICATE NETWORK, LLC D/B/A DSN RADIO, LLC	106.5	47.29	101.76	26.2
3	KXRF-LP	THE PRAIRIE CENTER BROADCASTING	100.3	47.30	102.20	55.9
4	K204FG	BIBLE BROADCASTING NETWORK, INC.	88.7	46.85	100.77	64.2
5	KLBE-LP	NEW SONG COMMUNITY CHURCH	100.7	46.84	100.78	64.4
6	KBEP-LP	BISMARCK EDUCATIONAL PRAYER ASSOCIATION	93.7	46.83	100.77	65.2
7	K237FQ	RADIO 74 INTERNATIONALE	95.3	46.83	100.77	65.2
8	KUAK-LP	DAKOTA MEDIA ACCESS	102.5	46.83	100.77	65.2
9	KJIT-LP	HE WILL PROVIDE RADIO	106.7	46.83	100.77	65.2
10	KQDY	IHM LICENSES, LLC	94.5	46.94	100.69	65.4
11	KYYY	IHM LICENSES, LLC	92.9	46.94	100.69	65.5
12	KSSS	IHM LICENSES, LLC	101.5	46.94	100.69	65.5
13	K259AF	IHM LICENSES, LLC	99.7	46.81	100.78	65.8
14	KLBF	UNIVERSITY OF NORTHWESTERN - ST. PAUL	89.1	46.61	100.81	78.9
15	KCND	PRAIRIE PUBLIC BROADCASTING, INC.	90.5	46.59	100.80	80.5
16	KNDR	CENTRAL DAKOTA ENTERPRISES, INC.	104.7	46.59	100.81	80.5
17	KBYZ	Townsquare License, LLC	96.5	46.59	100.80	80.7
18	KKCT	Townsquare License, LLC	97.5	46.59	100.80	80.7
19	KACL	Townsquare License, LLC	98.7	46.59	100.80	80.7
20	KUSB	Townsquare License, LLC	103.3	46.59	100.80	80.7
21	KXRP	Real Presence Radio	91.3	46.59	100.79	80.8
22	KPHA	REAL PRESENCE RADIO	91.7	46.57	100.80	82.3
23	KKBO	RADIO BISMARCK MANDAN, LLC	105.9	46.57	100.80	82.3
24	KXRV	RADIO BISMARCK MANDAN, LLC	107.5	46.57	100.80	82.3
25	KZRX	IHM LICENSES, LLC	92.1	46.94	102.73	95.1
26	KCAD	IHM LICENSES, LLC	99.1	46.94	102.73	95.1
27	K201FN	CSN INTERNATIONAL	88.1	46.92	102.73	95.3
28	KSLS	University of Northwestern - St. Paul	90.7	46.92	102.73	95.3
29	K295BR	International Church of the Foursquare Gospel	106.9	46.92	102.73	95.3
30	KTWJ	BISMARCK ADVENTIST EDUCATION STATION	90.9	47.21	100.26	95.4
31	KZZQ	Real Presence Radio	101.9	46.69	102.62	97.0
32	KPAR-LP	HIGHER PLAIN MEDIA	103.7	46.91	102.78	99.4

Table 5: FM Transmitter Towers within 100 km of the Project Boundary

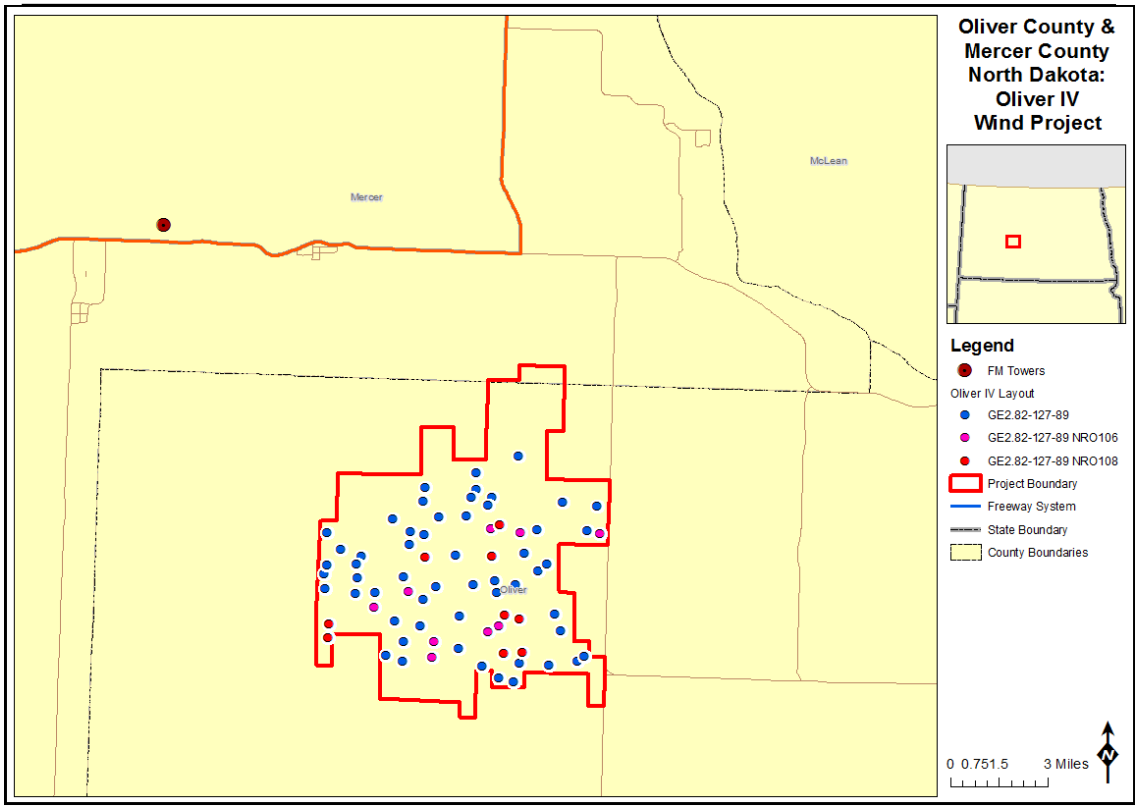

Figure 5: FM Transmitter Tower within 25 km of the Project Boundary

Television Stations

No digital or analog television stations were identified within the project boundary. Table 6 and Figure 6 identifies television stations with approved or pending licenses within 100 km of the project boundary as determined by the FCC. There are no stations less than 50 km from the project boundary which are likely to be broadcasting to the region.

ID	CALLSIGN	LICENSE	SERVICE	CHANNEL	ERP (kW)	LATITUDE	LONGITUDE	DISTANCE TO AOI (km)
1	K43JQ-D	-	LPD	43	1.6	46.84	-100.78	64.37
2	KXBK-LD	-	LPD	15	3.0	46.81	-100.79	65.76
3	K23OL-D	-	LPD	23	2.0	46.83	-100.77	65.77
4	K28MS-D	-	LPD	28	2.0	46.83	-100.77	65.77
5	K34LO-D	-	LPD	34	0.1	46.83	-100.77	65.77
6	K34LO-D	-	LPD	34	0.1	46.83	-100.77	65.77
7	KFYR-TV	-	DTV	31	500.0	46.61	-100.81	78.89
8	K35PO-D	-	LPD	35	15.0	46.61	-100.81	78.89
9	KXMB-TV	-	DTV	12	10.6	46.59	-100.81	80.26
10	KXMB-TV	-	DTV	12	19.1	46.59	-100.81	80.26
11	KBMY	-	DTV	17	75.0	46.59	-100.81	80.46
12	KBME-TV	-	DTV	22	97.3	46.59	-100.80	80.53
13	KNDB	-	DTV	26	50.0	46.59	-100.79	80.86
14	KSRE	-	DTV	15	84.0	48.05	-101.39	103.32
15	KNDM	-	DTV	24	50.0	48.05	-101.43	103.45
16	KMCY	-	DTV	14	40.0	48.05	-101.39	103.63
17	KXMC-TV	-	DTV	13	16.1	48.05	-101.34	103.64

Table 6: Television Stations within 100 km of the Project Boundary

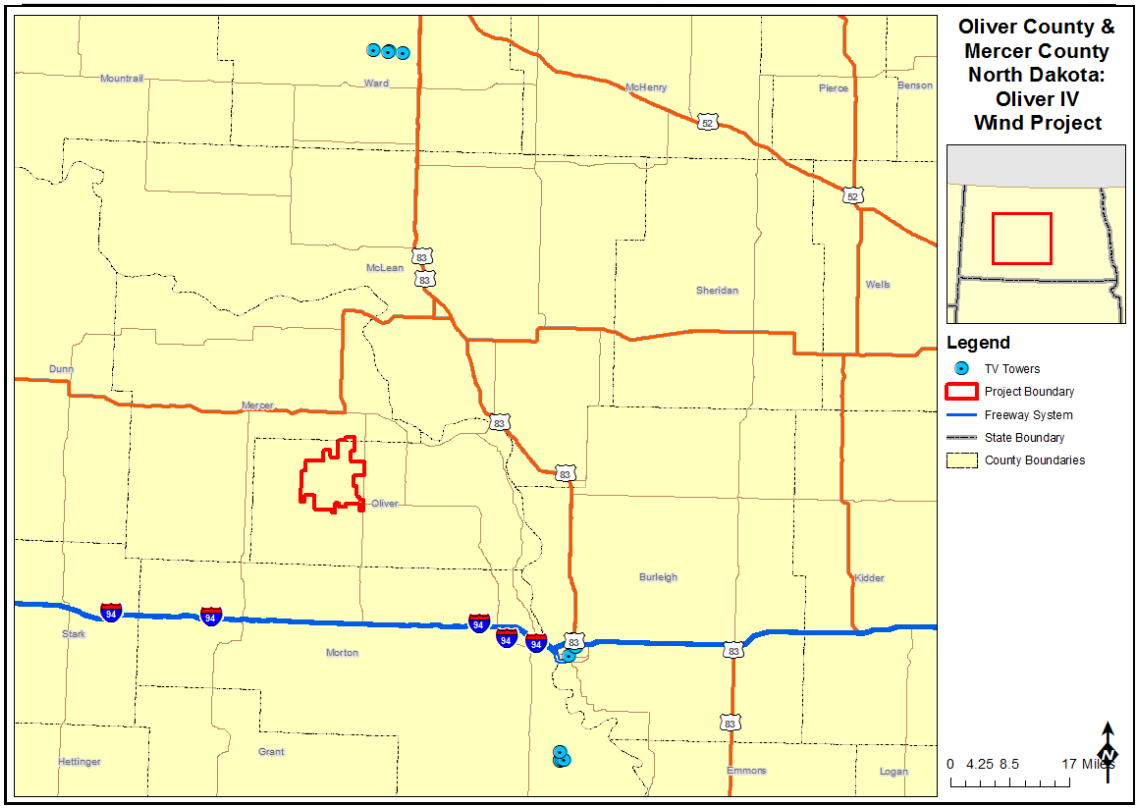

Figure 6: Television Stations within 100 km of the Project Boundary

While the impact of wind turbines on digital television reception is not well known due to limited cases and testing, any interference is expected to be limited to areas near the edge of station reception, areas near a turbine that is within the line-of-sight between the transmit tower and receptor, and areas of complex topography (OfCom, 2009). Most of the stations within 100km are low power stations or translator stations and have limited range and are not anticipated to experience reception degradation. There are four full power stations, KFYR-TV, KBME-TV, KSRE, and KBMY which have a possibility of experiencing reception degradation if the proposed wind farm is in the line-of-sight.

It is important to note that this assessment is based on broad assumptions, as it is difficult to accurately pinpoint the impact a large wind farm may have on each individual household due to a large number of external variables (topography, weather, antennae, etc.) which affect the propagation of the television radio signal.

Aviation Towers

No active Aviation towers were identified within the project boundary. One aviation towers was discovered within 25 km of the project boundary and shown in Figure 7. The closest aviation tower, WQJC846, is located 11.9 km from the project boundary. 14 Aviation towers were discovered within 100 km of the project boundary and are included in Table 7.

While no harmful interference is expected for the aviation towers; Oliver Wind IV is subject to a Federal Aviation Agency (FAA) to determine any exclusion zones. Proposed turbine locations will maintain the standard appropriate offset distances in addition to any setbacks set by the agency to minimize harmful impact.

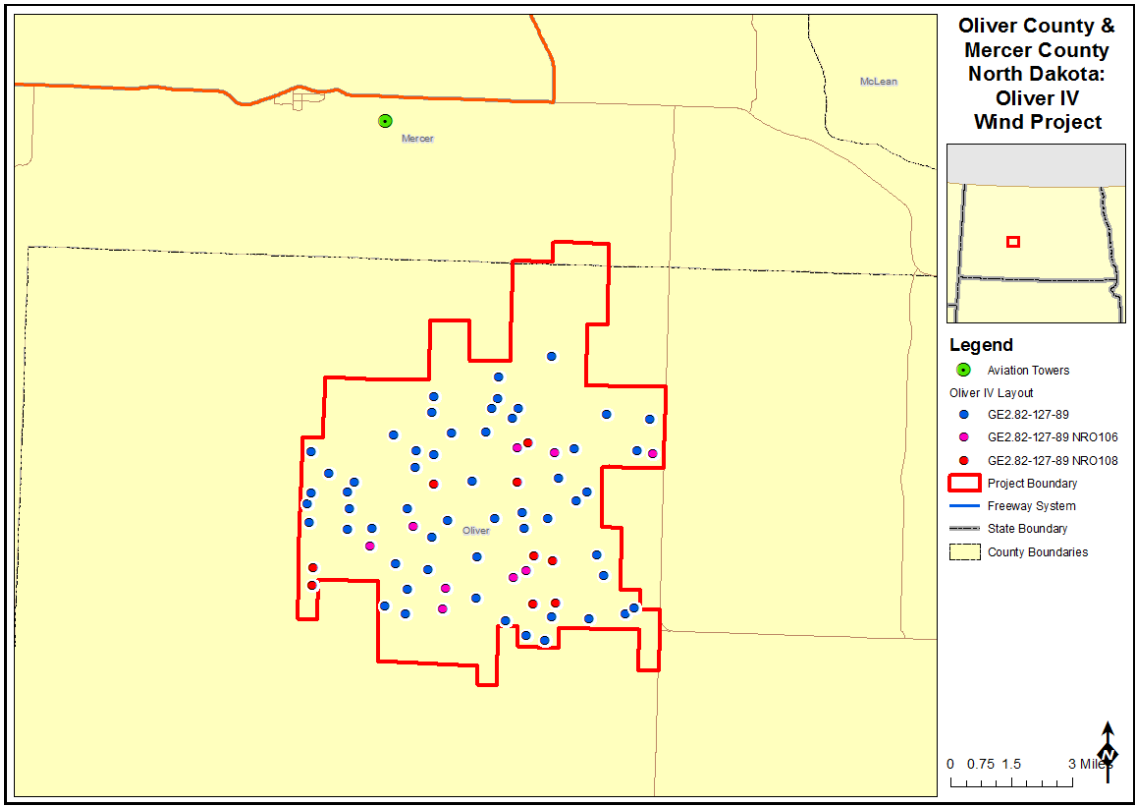

Figure 7: Aviation Tower within 25 km of the Project Boundary

ID	CALLSIGN	LICENSEE	STATUS	LATITUDE	LONGITUDE	DISTANCE TO AOI (KM)
1	WQJC846	Mercer County Regional Airport Authority	Active	47.29	-101.58	11.99
2	WRBX621	Aviation Spectrum Resources Inc	Active	46.80	-102.79	34.82
3	WQJE398	Mandan Municipal Airport Authority	Active	46.77	-100.90	47.66
4	KIL4	Aviation Spectrum Resources Inc	Active	46.78	-100.76	57.6
5	KKH6	Aviation Spectrum Resources Inc	Active	46.77	-100.76	57.6
6	KLA2	EXECUTIVE AIR TAXI CORPORATION	Active	46.78	-100.76	57.6
7	KVF5	Aviation Spectrum Resources Inc	Active	46.77	-100.76	57.6
8	WHW5	BISMARCK, CITY OF	Active	46.78	-100.76	57.6
9	WPYU967	Aviation Spectrum Resources Inc	Active	46.77	-100.75	57.6
10	WQOE476	Trego Dugan Aviation of Grand Island	Active	46.77	-100.76	57.6
11	WQUS421	Aviation Spectrum Resources Inc	Active	46.78	-100.76	57.6
12	WRWC358	Glen Ullin Regional Airport Authority	Active	46.82	-101.87	96.2
13	KGP7	DICKINSON MUNICIPAL AIRPORT AUTHORITY	Active	46.80	-102.80	97.01
14	WQRQ690	Aviation Spectrum Resources Inc	Active	46.80	-102.80	97.01

Table 7: Aviation Towers within 100 km of the Project Boundary

Conclusion and Recommendations

NextEra Analytics analyzed the potential for wind turbine interference on licensed microwave links located within the proposed Oliver Wind IV Project energy generation site. This report summarizes the microwave towers, microwave links, cellular towers, media towers, television towers, and aviation towers within and near the project boundary.

No microwave links were found to intersect the project boundary. Some interference from the proposed turbine layout is possible near microwave, AM, FM, cellular, aviation, and TV towers. This analysis is current as of July 11, 2023. NextEra Analytics recommends a refresh of this analysis if the proposed wind energy generation project has not been constructed after two years.

It is important to note that this report only provides analysis for licensed radio towers and links found within the FCC-ULS database. Many local municipalities (police, fire, etc.) do not license microwave links, NextEra Analytics recommends Oliver Wind IV LLC coordinate with the appropriate local municipality officials. Also not included within the database are microwave towers and links utilized by the Federal government (Dept. of Defense, Dept. of Commerce, etc.), again for public safety concerns. A Federal communications study by the National Telecommunications and Information Agency (NTIA) was completed on May 19, 2022 and specific concerns from Commerce were mentioned in the response letter.

References

Bacon, David F.,"A proposed method for establishing an exclusion zone around a terrestrial fixed radio link outside of which a wind turbine will cause negligible degradation of the radio link performance." http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/fixed/Windfarms/windfarmdavidbacon.pdf,Version 1.1,Oct 2002.

Ofcom, "Tall structures and their impact on broadcast and other wireless services." http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/fixed/Windfarms/tallstructures/tall_structures.pdf, August 2009.

Marlowe, Frank. "The Importance of Electromagnetic-impact Analyses for Wind Permitting." *Windpower Engineering & Development*. Broadcast Wind, 2015. Web. 19 July 2017.

Appendix B2. Acoustic Assessment

AECOM

Acoustic Assessment

Oliver Wind IV Energy Center

Oliver County, North Dakota

Oliver Wind IV, LLC

September 14, 2023

Delivering a better world

Prepared for:

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Acronyms and Abbreviations

Oliver Wind IV	Oliver Wind IV, LLC
dB	decibel(s)
dBA	A-weighted decibel(s)
GE	General Electric
Hz	hertz
ISO	International Organization for Standardization
kV	kilovolt(s)
L_{eq}	equivalent sound level
LNTE	low-noise trailing edge
LORS	Laws, Ordinances, Regulations, and Standards
L_w	sound power
MW	megawatt(s)
NRO	Noise-Reduced Operation
OBCF	octave band center frequency
Project	Oliver Wind IV Energy Project
SPL	sound pressure level
WTG	wind turbine generator

1. Introduction

Oliver Wind IV, LLC (Oliver IV Wind), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC, is submitting an application for a Certificate of Site Compatibility (Certificate) to construct and operate the Oliver Wind IV Energy Center (Project) in Oliver County, in west-central North Dakota. AECOM has conducted the following acoustic analysis for the Project to support Oliver Wind IV's application for a Certificate under the North Dakota Public Service Commission.

In 2019 NextEra, through its associated subsidiary, began development of the Red Butte Wind Energy Center, a 400 MW wind project which overlapped with the current Oliver Wind IV Project Area. In 2023, the Red Butte Wind project was reduced to a 200 MW project and the Oliver Wind IV and Red Butte Wind projects began development separately. This Assessment addresses just the Project.

1.1 Study Area and Existing Environment

The Oliver IV Wind Project Area encompasses approximately 22,291 acres in Oliver County. The acoustic assessment study area encompasses approximately 54,275 acres, approximately bounded on the north by 12th Street SW, on the east by State Highway 31, on the south by 22nd Street SW, and on the west by 53rd Avenue SW. The major roadways within the Project vicinity are County Road 17, County Road 24, County Road 20, and State Highway 31, which generally parallel the eastern, and northern boundaries of the study area.

The land uses within the study area are primarily agricultural, with rural farmstead residences and ancillary structures dispersed throughout the study area. The topography in this region is characterized by rolling grassy terrain, interspersed with many natural lakes and ponds.

A total of 76 receptors were identified within and near the Project that are considered either inhabited or capable of habitation or a community building. Determination of habitation for existing structures was limited to public knowledge and roadside surveys in order to reduce disturbances to landowners. For purposes of conservatism in this analysis, all structures that were identified as capable of habitation were considered active residential structures and considered potential sound sensitive receptors for the purpose of this analysis. Oliver County would generally be considered comprised of rural agricultural areas and thus would be expected to have reasonably low ambient sound levels. Existing sound sources in the area are likely dominated by distant traffic on arterial roadways, intermittent aircraft overflights, agricultural operations, and wind-generated sounds.

1.2 Project Components

The Project will have a nameplate capacity of approximately 200 megawatts (MW), consisting of up to 73 wind turbines using General Electric (GE) 2.82 MW utility-grade wind turbines. In addition to the 73 primary turbines, up to three alternative turbine locations have also been considered. The alternate turbine locations are proposed to provide siting flexibility based on ongoing studies, landowner preferences, and issues identified during construction. Only 73 turbines will be constructed. The turbine technology is three-bladed, upwind, and horizontal-axis. Each GE 2.82 MW model will have an 89-meter (292 feet) hub height and a 127-meter (417 feet) rotor diameter with a rotor swept area of 12,668 m^2 (3.13 ac). The turbines begin operation in wind speeds of 3.0 meters per second (m/s), or 6.7 miles per hour (mph), and are designed to operate in wind speeds of up to 30 m/s (67 mph).

1.3 Acoustical Terminology

Sound Propagation

Atmospheric conditions (*e.g.*, wind, temperature gradients, humidity) can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound traveling over an acoustically absorptive surface (*e.g.*, grass) attenuates at a greater rate than sound traveling over a hard surface (*e.g.*, pavement, expanses of open water). When located near either the sound source or the listener position, physical barriers (*e.g.*, naturally occurring ridgelines or buildings, and other topography that block the line-of-sight between a source and receiver) also increase the attenuation of sound over distance.

Multiple Sound Sources

Because sound pressure levels (SPLs) in decibels are based on a logarithmic scale, they cannot be added or subtracted in an arithmetic fashion. Therefore, SPLs in decibels (dB) are added logarithmically on an energy summation basis. In other words, adding a new noise source to an existing noise source, both producing noise at the same level, does not double the noise level. Instead, if the difference between two noise sources is 10 A-weighted decibels (dBA) or more, the louder noise source dominates, and the resultant noise level is equal to the noise level of the louder source. In general, if the difference between two noise sources is 0 to 1 dBA, the resultant noise level is 3 dBA higher than the louder noise source, or both sources if they are equal. If the difference between two noise sources is 2 to 3 dBA, the resultant noise level is 2 dBA above the louder noise source. If the difference between two noise sources is 4 to 10 dBA, the resultant noise level is 1 dBA higher than the louder noise source.

1.4 Review of Sound Generated by Wind Turbine Generator Facilities

Sound generated by the operation of a modern downwind-mast (*i.e.*, a supporting tower downstream from the spinning bladed rotor) wind turbine generator (WTG) is a combination of the following sound sources:

- blade sounds created by trailing edge pressure fluctuations and turbulence, leading edge inflow turbulence, tip vortex structures; and
- the mechanical equipment housed within the nacelle just behind the WTG-bladed rotor hub, which includes a gearbox, generator, and cooling fan(s).

For large, utility-scale WTGs currently engineered and offered by leading manufacturers, such as the models considered for this Project, mechanical sounds from the nacelle tend to be much less than the sound produced from aerodynamic effects caused by rotor interaction with the incoming wind.

At rest, when little or no wind energy exists to convert, a WTG produces negligible sound. As wind speeds rise to a “cut-in” magnitude, the WTG-bladed rotor begins rotation and power generation. WTG energy conversion and corresponding aerodynamic sound then increase with increasingly greater received wind speed, up to a maximum rotational speed when the WTG maximum power capacity is attained. Although the WTG may experience elevated wind speeds that exceed what is necessary for maximum power capacity, the rotor rotational speed will not increase further and will produce an essentially constant SPL.

Oliver IV Wind 000229

2. Regulatory Setting & Acoustic Impact Criteria

A review was conducted of Federal, State, and Local laws, ordinances, regulations, and standards (LORS), applicable to sound levels generated by Project construction and operation. This review did not identify any applicable LORS at the federal level. At the state level, North Dakota Administrative Code (N.D.A.C.) Section 69-06-08-01(4) establishes sound limits that apply to wind energy conversion facilities.

2.1 State of North Dakota

The N.D.A.C. Section 69-06-08-01(4) reads as follows:

> *A wind energy conversion facility site must not include a geographic area where, due to operation of the facility, the sound within one hundred feet of an inhabited residence or a community building will exceed forty-five dBA. The sound level avoidance area criteria may be waived in writing by the owner of the occupied residence or the community building.*

Sound levels produced by the Project were predicted at a minimum distance of 100 feet from all receptors and assessed for compliance against the exclusion area's sound level exceedance of 45 dBA. All receptors in the study area, regardless of county jurisdiction, are held to this maximum sound level limit.

2.2 County Legislation

All 76 studied receptors are located within Oliver County, which has not established any restrictions on noise from the operation of wind energy facilities. In the absence of a local standard, impact assessment will rely wholly on the State requirements.

Oliver IV Wind 000230

3. Sound Prediction Methodology & Results

3.1 Modeling Software and Calculation Methods

The DataKustik CadnaA® Noise Prediction Model (Version 2023) was used to estimate the aggregate SPL from Project operations at the identified receptor locations. CadnaA is a Microsoft Windows-based software program that predicts sound levels near sound sources based on the International Organization for Standardization (ISO) 9613-2 standard for outdoor sound propagation calculation. The model uses these industry-accepted propagation algorithms and accepts full-octave band (1/1) and one-third octave band (1/3) Lw (in dB re: one picowatt), provided by the equipment manufacturer and other sources.

The software's calculations account for classical sound wave geometric divergence, reflection off surfaces, source directivity, meteorological effects, and attenuation factors resulting from air absorption, basic ground effects, and barrier/shielding from structures and/or topography. Topographical information was imported into the model using the official U.S. Geological Survey's National Elevation Dataset to accurately represent existing topography in the Project area.

3.2 Modeling Input Parameters

Predictive noise models were designed to conform with the ANSI/ACP 111-1 (2022) Wind Turbine Sound Modeling standard (ACP 2022) and follow recommendations from the Institute of Acoustics (IOA 2013).

3.2.1 Meteorological Input and Model Configuration

The sound propagation prediction model developed for this analysis assumed an outdoor air temperature of 50 degrees Fahrenheit (ºF) and a relative humidity of 70%.

The average ground absorption coefficient, which can range from zero (0, for acoustically reflective surfaces, such as water or pavement) to unity (1, for acoustically absorptive ground coverings, such as loose, porous soils or snow), was set to an average of 0.5. This input parameter is notably conservative in comparison to actual site conditions which are expected to exhibit higher ground absorption coefficients of 0.7 to 0.9 due to the prevalence of natural grasslands, agricultural soils, and seasonal snow cover.

As sound waves propagate from the source, their energy is continuously degraded by atmospheric absorption. Atmospheric absorption rates improve as acoustical frequency increases and vary with temperature and moisture content. While acoustical energy loss due to this environmental factor is generally modest at distances less than 1,000 feet, over greater distances the result will be a substantial reduction of high-frequency sound and the apparent preservation of low-frequency sound that attenuates (due to ground and atmospheric absorption) at much lower rates.

With respect to wind speed and direction, the ISO 9613-2 standard conservatively assumes that all receptors are located downwind from the sound-producing source. Acknowledged as a physical impossibility (*i.e.*, because wind is experienced as having direction), this downwind assumption is intended to represent worst-case meteorological conditions, such as moderate temperature inversions. Such conditions are assumed to be valid for the study of WTG operation sound, which assumes operation under wind conditions at which the "maximum [rotor] rotational speed" is expected, coinciding with maximum power production per tower.

3.2.2 Receiver Input

Representative receiver points were modeled at each identified residential structure in the study area. To consider sound from multiple WTG locations arriving from different angles and paths, each receptor

was assigned a circular array of twelve equally spaced receivers at 30-degree steps. Receivers were modeled at a height of 4 meters (13 feet) relative to the ground.

Per the Commission sound limit regulation, sound levels from Project operations are to be assessed "within 100 feet of an inhabited residence or the community building," thus, the modeled receiver arrays were plotted in a manner to ensure a minimum 100-foot distance from each receptor façade.

A total of 76 receptors were identified within the study area, resulting in a total of 912 modeled receiver points.

3.2.3 Source Input

The Project plans to install GE 2.82 MW WTG units throughout the Project vicinity. Sources in the model were located at each discrete proposed WTG pole location as a single, omnidirectional point source, with a relative hub height of 292 feet (hub height variant of the GE 2.82 MW WTG).

The Project will incorporate low-noise trailing edge, or "LNTE" blade technology at 85% of the WTG units, effectively reducing each WTG unit sound emission by up to 1.5 dBA. Select turbines were identified to permanently operate in a curtailed condition called "Noise-Reduced Operation" or "NRO", which would further reduce their sound emission by up to 4 dBA.

Performance specifications and proprietary sound data for the selected WTG units and LNTE/NRO variants were provided by the manufacturer for the purpose of this study. **Table 1** displays the various A-weighted sound power level ratings for the GE 2.82 MW in its standard, with-LNTE, and NRO variants at maximum rotational wind speed.

In addition to anticipated sound levels at various wind speeds and blade types, these specifications also reported the spectral content of the WTGs in one-third octave band center frequency (OBCF) resolution. These documents report that source measurements were conducted in accordance with the International Electrotechnical Commission standard 61400-11 for acoustic measurement techniques. Specified one-third OBCF sound power levels provided by the manufacturer for both WTG models are presented in **Table 2**. All WTGs were assigned an uncertainty adjustment of +2 dB across all frequency bands.

3.2.4 Modeled Scenarios

The predictive acoustic assessment reviewed two Project WTG layouts: one with additional WTG locations ("With Alternates"), and one without the additional WTGs ("No Alternates").

3.3 Modeling Results

Each predictive operations model assumed that all WTGs would be operating concurrently in a maximum rotational wind speed scenario. Predicted levels in this section are presented in both tabulated form and as sound level contour plots, which depict the operational sound in the Project area as color-coded isopleths (Project-attributed sound level "contours" that depict equivalent predicted sound levels). While aggregate WTG operation sound levels may be compliant with the Commission and County requirements, under the right meteorological conditions, it may be possible for WTG sound to be audible at a sound-sensitive receptor.

Predicted operational sound levels associated with the "No Alternates" and "With Alternates" layouts are provided in **Tables 3 and 4,** respectively.

Figures 1 and 2 display predicted sound level contours associated with each layout scenario.

As shown in **Tables 3 and 4**, Project-generated sound levels will range from 34 to 45 dBA, L_{eq}. Operation of Project WTG units will not exceed the Commission 45 dBA limit at any receptors.

4. Additional Acoustic Assessment Considerations

4.1 Collection Substation Sound

There will be one 345 kilovolt (kV) collection substation constructed within the Project Area featuring one 225 megavolt-amperes (MVA) transformer. Sound generated by the substation would be dominated by a “humming” sound from the main transformer. The transformer overall sound power level was provided by the manufacturer, who tested the unit according to the Institute of Electrical and Electronics Engineers Standards Association (IEEE) standards C57.12.00-2015 and C57.12.90-2015. The maximum OBCF sound power levels for the transformer are provided in **Table 5**. The 345 kV collection substation is located along 47th Avenue SW, south of 17th Street SW and north of Hannover Road. The substation center is approximately 1.15 miles from the closest receptor: R103 to the southeast. At this distance, sound levels from the operating transformer would be lower than 20 dBA and thus compliant with Commission limit of 45 dBA.

5. Conclusions

Project operational sound has been predicted and assessed against the 45 dBA Commission sound limit. The predictive operational acoustical modeling, performed with CadnaA software (and its algorithm basis per ISO 9613-2) and inclusive of conservative parameter assumptions and uncertainty corrections, demonstrates that the Project will not generate exceedances of the Commission threshold within 100 feet of any receptor locations.

Oliver IV Wind 000234

6. Literature Cited

American Clean Power (ACP). 2022. Wind Turbine Sound Modeling ANSI/ACP 111-1 (2022).

Institute of Acoustics (IOA), 2013, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise.

International Organization for Standardization (ISO), 1996, “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.” ISO 9613-2:1996(E).

Oliver County Planning and Zoning Commission. 2016. Revised Zoning Ordinances. Accessed August 28. 2023. Available online at: https://olivercountynd.org/vertical/sites/%7B6E6CB90D-6F4C-4198-8B57-AAF2D42615E1%7D/uploads/2_Oliver_County_PZ_Ordinance.pdf

State of North Dakota, Energy conversion facility siting criteria, 69-06-08, North Dakota Administrative Code. Last accessed on August 28, 2022: https://www.ndlegis.gov/information/acdata/pdf/69-06-08.pdf

TABLES

Table 1. Modeled WTGs and Reference Sound Level Emission

WTG Model	Sound Level (PWL, dBA) During Maximum Rotation Wind Speed	Quantity Modeled (Includes Alternates)
GE 2.82 MW Standard	110	11
GE 2.82 MW with LNTE	109	44
GE 2.82 MW under NRO 108	108	11
GE 2.82 MW under NRO 106	106	10

Table 2. WTG Sound Power Level by One-Third Octave Band Center Frequency (1/3 OBCF) at Maximum Rotational Wind Speed

WTG Model	1/3 OBCF, Hz (bold) and Respective A-Weighted Sound Power Level, dBA								
GE 2.82 MW Standard	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
	72	77	81	84	87	90	92	93	94
	200	**250**	**315**	**400**	**500**	**630**	**800**	**1k**	**1.25k**
	95	96	97	98	99	101	101	101	101
	1.6k	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
	99	97	95	92	88	83	76	65	52
GE 2.82 MW with LNTE	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
	72	77	81	84	87	90	92	93	93
	200	**250**	**315**	**400**	**500**	**630**	**800**	**1k**	**1.25k**
	93	93	94	94	96	97	98	99	100
	1.6k	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
	99	98	96	93	89	84	77	66	53
GE 2.82 MW under NRO 108	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
	72	76	80	84	87	89	91	92	91
	200	**250**	**315**	**400**	**500**	**630**	**800**	**1k**	**1.25k**
	91	91	92	91	93	94	96	98	100
	1.6k	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
	100	99	97	94	90	86	80	70	58
GE 2.82 MW under NRO 106	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
	71	75	79	82	85	88	90	90	90
	200	**250**	**315**	**400**	**500**	**630**	**800**	**1k**	**1.25k**
	90	90	91	91	92	93	94	96	98
	1.6k	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
	97	96	95	93	89	85	79	70	58

Table 3. Predicted Aggregate WTG Operation Sound Levels, "No Alternates" Layout, Sorted by Predicted Sound Level

Receptor ID	Participating Landowner?	Nearest WTG ID	Distance to Nearest WTG (ft)	UTM-18 Easting (m)	UTM-18 Northing (m)	Predicted Sound Level at 100' from Receptor (dBA, SPL)
R015	Yes	71	1,711	315920	5227908	45
R096	Yes	30	2,069	307877	5221622	45
R098	Yes	52	2,350	310199	5221481	45
R100	No	43	2,290	311092	5222262	45
R101	Yes	43	2,337	311284	5222481	45
R106	Yes	24	2,432	307400	5223585	45
R108	Yes	1	1,943	301611	5222494	45
R112	Yes	11	2,153	304276	5223122	45
R113	Yes	19	2,644	305460	5224116	45
R114	Yes	47	1,940	309691	5227720	45
R115	Yes	47	2,019	310255	5227042	45
R116	Yes	48	2,756	310992	5227085	45
R117	Yes	60	2,787	311023	5227045	45
R118	Yes	60	2,801	311035	5227017	45
R119	Yes	60	2,113	311256	5227067	45
R142	Yes	25	2,259	307027	5225551	45
R147	Yes	16	1,973	304837	5228484	45
R157	Yes	34	2,183	308095	5223608	45
R158	Yes	47	1,969	309679	5227680	45
R012	Yes	73	2,163	315036	5228420	44
R013	Yes	73	2,045	315988	5228358	44
R086	Yes	54	2,944	312282	5220190	44
R093	No	13	2,592	305201	5220603	44
R097	No	30	2,389	308051	5222429	44
R103	Yes	57	2,556	312455	5223012	44
R104	Yes	57	2,728	312498	5222967	44
R105	Yes	34	2,363	308246	5223894	44
R107	Yes	24	2,601	307349	5223478	44
R120	Yes	65	2,679	312816	5226852	44
R143	Yes	26	3,117	307869	5227137	44
R159	No	38	3,443	308243	5229345	44
U145	No	38	3,511	308234	5229438	44
U156	No	13	2,273	304851	5220692	44
R035	Yes	70	2,639	315575	5221819	43
R092	No	13	2,389	304845	5220657	43
R102	Yes	66	3,579	312668	5222427	43
R111	No	5	3,357	301533	5226643	43
R144	Yes	16	3,018	305918	5228886	43
R176	No	5	3,282	301596	5226631	43
R034	Yes	70	2,942	315602	5221928	42
R094	No	29	2,213	307877	5220908	42
R095	No	41	2,885	309014	5220505	42
R123	Yes	72	2,600	314595	5226931	42
R138	No	61	2,345	311194	5231852	42
U124	Yes	68	3,043	314037	5228104	42
R025	No	67	3,437	314338	5224000	41
R121	Yes	65	3,950	313591	5226991	41
R122	Yes	64	3,899	313602	5226942	41
R180	No	2	3,139	301296	5223312	41
R024	No	67	3,468	314300	5224067	40

Table 3. Predicted Aggregate WTG Operation Sound Levels, "No Alternates" Layout, Sorted by Predicted Sound Level

Receptor ID	Participating Landowner?	Nearest WTG ID	Distance to Nearest WTG (ft)	UTM-18 Easting (m)	UTM-18 Northing (m)	Predicted Sound Level at 100' from Receptor (dBA, SPL)
R038	No	70	3,897	315795	5220475	40
R039	No	70	3,997	315803	5220440	40
R040	No	70	4,113	315895	5220486	39
R041	No	70	4,235	315900	5220436	39
R085	Yes	69	4,604	314542	5219648	39
R019	No	71	3,758	316000	5226334	38
R020	No	71	3,643	316129	5226416	38
R043	No	70	4,768	316025	5220332	38
R045	No	70	4,682	316056	5220408	38
R046	No	70	4,765	316090	5220410	38
R047	No	70	4,975	316114	5220338	38
R182	No	1	3,475	301352	5221495	38
R011	Yes	73	3,571	316259	5229653	37
R016	Yes	71	3,966	316879	5227197	37
R048	Yes	70	5,156	315974	5220118	37
R109	No	13	5,196	303471	5220965	37
R125	Yes	68	5,158	312595	5229948	37
R126	Yes	68	5,027	312645	5229948	37
R181	No	1	4,929	300674	5222576	37
R010	Yes	73	3,902	315795	5229982	36
R049	Yes	70	5,783	316126	5219997	36
R110	Yes	13	5,783	304459	5219691	36
R148	No	5	6,071	303084	5229063	35
R129	Yes	61	5,213	313186	5231667	34
R130	Yes	61	4,965	312933	5232083	34
R131	Yes	61	5,092	312972	5232093	34

Table 4. Predicted Aggregate WTG Operation Sound Levels, "With Alternates" Layout, Sorted by Predicted Sound Level

Receptor ID	Participating Landowner?	Nearest WTG ID	Distance to Nearest WTG (ft)	UTM-18 Easting (m)	UTM-18 Northing (m)	Predicted Sound Level at 100' from Receptor (dBA, SPL)
R015	Yes	71	1,711	315920	5227908	45
R096	Yes	30	2,069	307877	5221622	45
R098	Yes	52	2,350	310199	5221481	45
R100	No	43	2,290	311092	5222262	45
R101	Yes	43	2,337	311284	5222481	45
R106	Yes	24	2,432	307400	5223585	45
R108	Yes	1	1,943	301611	5222494	45
R112	Yes	11	2,153	304276	5223122	45
R113	Yes	19	2,644	305460	5224116	45
R114	Yes	47	1,940	309691	5227720	45
R115	Yes	47	2,019	310255	5227042	45
R116	Yes	48	2,756	310992	5227085	45
R117	Yes	60	2,787	311023	5227045	45
R118	Yes	60	2,801	311035	5227017	45
R119	Yes	60	2,113	311256	5227067	45
R142	Yes	25	2,259	307027	5225551	45
R144	Yes	Alt2	2,177	305918	5228886	45
R147	Yes	16	1,973	304837	5228484	45
R157	Yes	34	2,183	308095	5223608	45
R158	Yes	47	1,969	309679	5227680	45
R012	Yes	73	2,163	315036	5228420	44
R013	Yes	73	2,045	315988	5228358	44
R086	Yes	54	2,944	312282	5220190	44
R093	No	13	2,592	305201	5220603	44
R097	No	30	2,389	308051	5222429	44
R103	Yes	57	2,556	312455	5223012	44
R104	Yes	57	2,728	312498	5222967	44
R105	Yes	34	2,363	308246	5223894	44
R107	Yes	24	2,601	307349	5223478	44
R120	Yes	65	2,679	312816	5226852	44
R143	Yes	26	3,117	307869	5227137	44
R159	No	38	3,443	308243	5229345	44
U145	No	38	3,511	308234	5229438	44
U156	No	13	2,273	304851	5220692	44
R035	Yes	70	2,639	315575	5221819	43
R092	No	13	2,389	304845	5220657	43
R102	Yes	66	3,579	312668	5222427	43
R111	No	5	3,357	301533	5226643	43
R176	No	5	3,282	301596	5226631	43
R034	Yes	70	2,942	315602	5221928	42
R085	Yes	Alt1	2,707	314542	5219648	42
R094	No	29	2,213	307877	5220908	42
R095	No	41	2,885	309014	5220505	42
R123	Yes	72	2,600	314595	5226931	42
R138	No	61	2,345	311194	5231852	42
U124	Yes	68	3,043	314037	5228104	42
R025	No	67	3,437	314338	5224000	41
R038	No	Alt1	3,575	315795	5220475	41
R039	No	Alt1	3,482	315803	5220440	41
R040	No	Alt1	3,753	315895	5220486	41

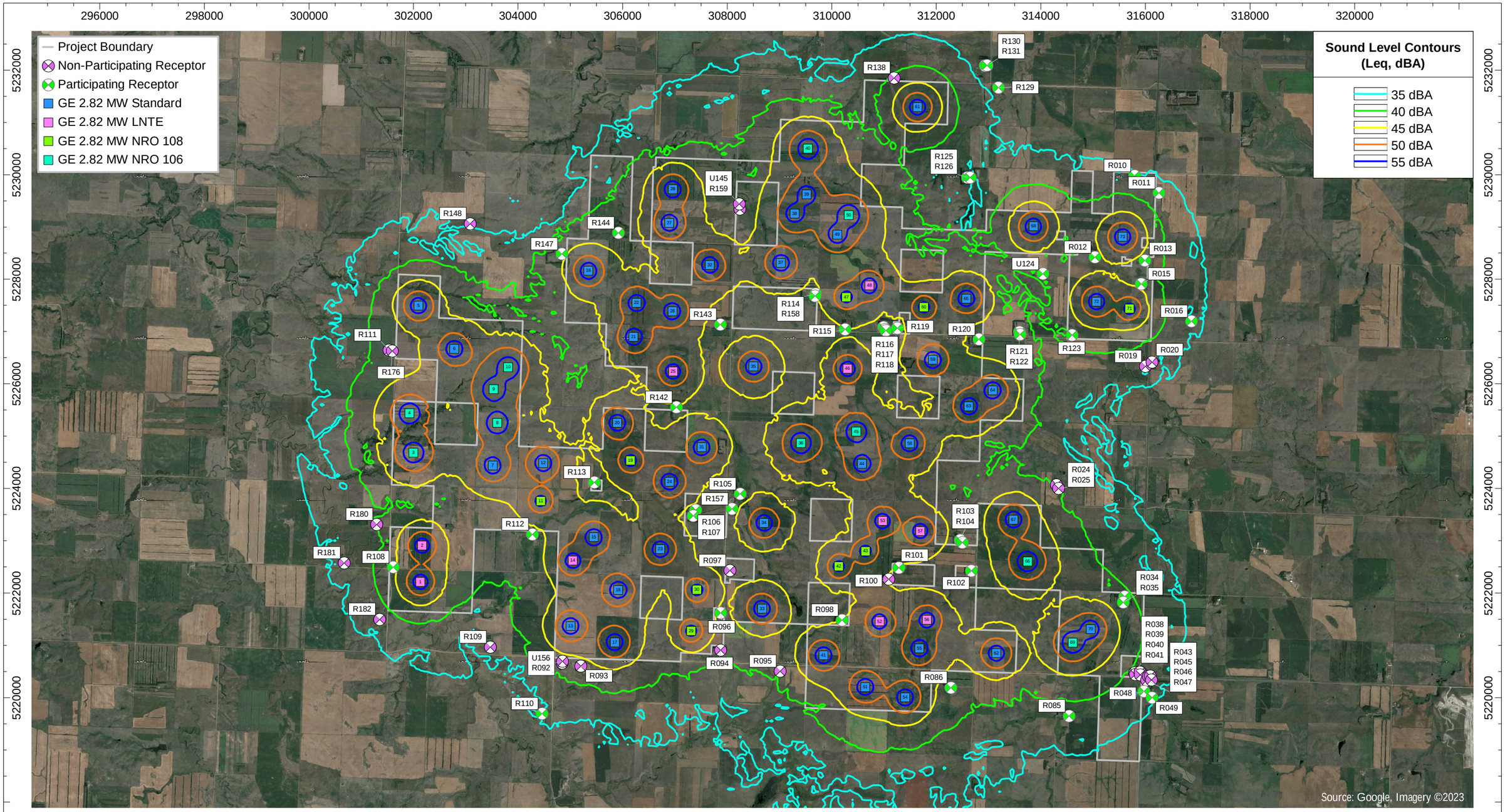
Table 4. Predicted Aggregate WTG Operation Sound Levels, "With Alternates" Layout, Sorted by Predicted Sound Level

Receptor ID	Participating Landowner?	Nearest WTG ID	Distance to Nearest WTG (ft)	UTM-18 Easting (m)	UTM-18 Northing (m)	Predicted Sound Level at 100' from Receptor (dBA, SPL)
R041	No	Alt1	3,618	315900	5220436	41
R048	Yes	Alt1	2,927	315974	5220118	41
R121	Yes	65	3,950	313591	5226991	41
R122	Yes	64	3,899	313602	5226942	41
R180	No	2	3,139	301296	5223312	41
R024	No	67	3,468	314300	5224067	40
R043	No	Alt1	3,565	316025	5220332	40
R045	No	Alt1	3,825	316056	5220408	40
R046	No	Alt1	3,898	316090	5220410	40
R047	No	Alt1	3,768	316114	5220338	40
R049	Yes	Alt1	3,058	316126	5219997	40
R182	No	1	3,475	301352	5221495	39
R019	No	71	3,758	316000	5226334	38
R020	No	71	3,643	316129	5226416	38
R011	Yes	73	3,571	316259	5229653	37
R016	Yes	71	3,966	316879	5227197	37
R109	No	13	5,196	303471	5220965	37
R125	Yes	68	5,158	312595	5229948	37
R126	Yes	68	5,027	312645	5229948	37
R181	No	1	4,929	300674	5222576	37
R010	Yes	73	3,902	315795	5229982	36
R110	Yes	13	5,783	304459	5219691	36
R148	No	5	6,071	303084	5229063	35
R129	Yes	61	5,213	313186	5231667	34
R130	Yes	61	4,965	312933	5232083	34
R131	Yes	61	5,092	312972	5232093	34

Table 3. Substation Transformer – Sound Power Level by Octave Band Center Frequency (OBCF)

Transformer Rating	OBCF A-Weighted Sound Power Level, dB								
225 MVA	31.5	63	125	250	500	1k	2k	4k	**8k**
	37	51	88	85	89	78	68	56	46

FIGURES



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Date Created:
9/3/2023

Created by:
CK

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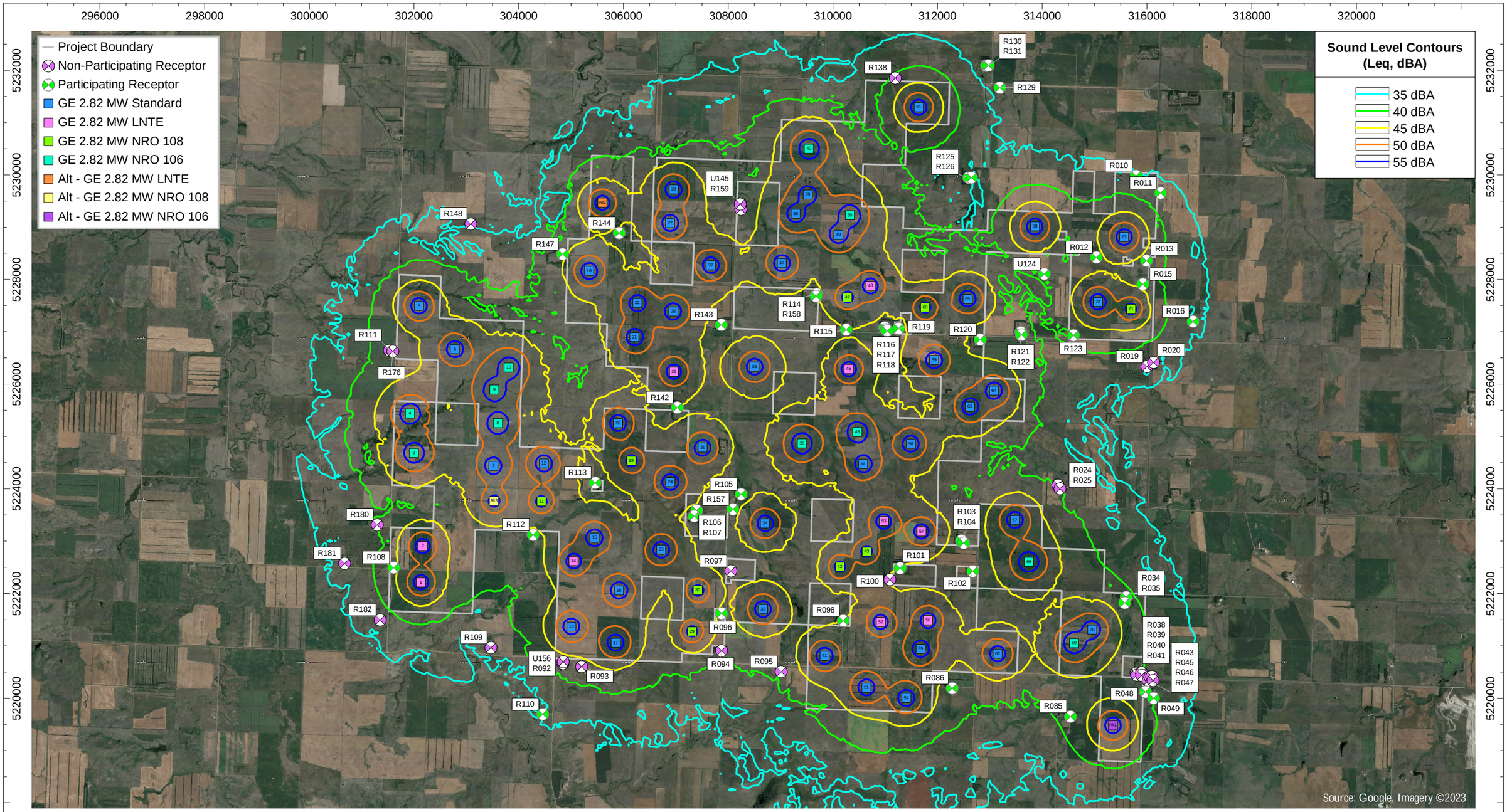
Acoustics & Noise Control Practice

Operational Sound Levels | No Alternates
Wind Turbines at Maximum Rotational Wind Speed

Predicted Project Operation Noise Contours
Oliver Wind IV Energy Center
Oliver County, ND

Figure 1



N	Date Created: 9/3/2023	**Operational Sound Levels | With Alternates** **Wind Turbines at Maximum Rotational Wind Speed**
	Created by: CK	**Predicted Project Operation Noise Contours** **Oliver Wind IV Energy Center** **Oliver County, ND**
AECOM Delivering a better world Acoustics & Noise Control Practice		**Figure 2**

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Appendix B3. Shadow Flicker Assessment

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Shadow Flicker Assessment

Oliver Wind IV Energy Center

Oliver County, North Dakota

Oliver Wind IV, LLC

September 14, 2023

Delivering a better world

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1. Introduction

Oliver Wind IV, LLC (OliverWind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC, is submitting an application for a Certificate of Site Compatibility (Certificate) to construct and operate the Oliver Wind IV Energy Center (Project) in Oliver County, in west-central North Dakota. AECOM has conducted the following shadow flicker analysis for the Project to support Oliver Wind IV's application for a Certificate under the North Dakota Public Service Commission (Commission).

In 2019 NextEra, through its associated subsidiary, began development of the Red Butte Wind Energy Center, a 400 MW wind project which overlapped with the current Oliver Wind IV Project Area. In 2023, the Red Butte Wind project was reduced to a 200 MW project and the Oliver Wind IV and Red Butte Wind projects began development separately. This Assessment addresses just the Project.

1.1 Study Area and Existing Environment

The Oliver Wind IV Project Area encompasses approximately 22,291 acres in Oliver County. The shadow flicker assessment study area encompasses approximately 54,275 acres, approximately bounded on the north by 12th Street SW, on the east by State Highway 31, on the south by 22nd Street SW, and on the west by 53rd Avenue SW. The major roadways within the Project vicinity are County Road 17, County Road 24, County Road 20, and State Highway 31, which generally parallel the eastern, and northern boundaries of the study area. The land uses within the study area are primarily agricultural, with rural farmstead residences and ancillary structures dispersed throughout the study area. The topography in this region is characterized by rolling grassy terrain, interspersed with many natural lakes and ponds.

A total of 76 receptors were identified within and near the Project that are considered either inhabited or capable of habitation. Determination of habitation for existing structures was limited to public knowledge and roadside surveys in order to reduce disturbances to landowners. For purposes of conservatism in this analysis, all structures that were identified as capable of habitation were considered active residential structures and considered potential shadow-flicker receptors and are shown in **Figure 1**. All turbines were setback from receptors the required Oliver County distance of 1,320 feet or more (Oliver County, 2016). Several receptors included in the analysis are under agreement with the Red Butte wind project. Those agreements are in the process of being amended to include Oliver Wind IV and are labeled as participating receptors in the results tables and figures.

1.2 Project Components

The Project will have a nameplate capacity of approximately 200 megawatts (MW), consisting of up to 73 wind turbines using General Electric (GE) 2.82 MW utility-grade wind turbines. In addition to the 73 primary turbines, three alternative turbine locations have also been considered. The alternate turbine locations are proposed to provide siting flexibility based on ongoing studies, landowner preferences, and issues identified during construction. Only 73 turbines will be constructed. The turbine technology is 3-bladed, upwind, and horizontal-axis. Each GE 2.82 MW model will have an 89-meter (292 feet) hub height and a 127-meter (417 feet) rotor diameter with a rotor swept area of 12,668 m^2 (3.13 ac). The turbines begin operation in wind speeds of 3.0 meters per second (m/s), or 6.7 miles per hour (mph), and are designed to operate in wind speeds of up to 30 m/s (67 mph). The coordinates for the 76 (73 proposed and three alternate locations) turbines are listed in **Table 1** and shown in **Figure 1**.

Table 1 Turbine Locations

Turbine ID	UTM Coordinates		Turbine ID	UTM Coordinates		Turbine ID	UTM Coordinates	
	Easting	Northing		Easting	Northing		Easting	Northing
1	302132	5222212	27	306893	5229077	53	310974	5223378
2	302163	5222907	28	306962	5229724	54	311404	5220004
3	301999	5224683	29	307311	5221275	55	311678	5220940
4	301924	5225436	30	307423	5222060	56	311822	5221489
5	302094	5227499	31	307513	5224789	57	311695	5223184
6	302779	5226669	32	307669	5228272	58	311490	5224860
7	303514	5224437	33	308666	5221700	59	311936	5226461
8	303602	5225251	34	308703	5223337	60	311760	5227468
9	303536	5225896	35	308504	5226335	61	311641	5231294
10	303812	5226316	36	309410	5224870	62	313149	5220851
11	304434	5223759	37	309026	5228313	63	312620	5225572
12	304484	5224484	38	309289	5229257	64	313076	5225876
13	305003	5221368	39	309519	5229623	65	312571	5227631
14	305048	5222619	40	309545	5230500	66	313745	5222603
15	305447	5223068	41	309840	5220807	67	313477	5223403
16	305347	5228165	42	310134	5222509	68	313861	5229015
17	305848	5221057	43	310647	5222800	69	314607	5221050
18	305914	5222059	44	310580	5224472	70	314951	5221311
19	306150	5224533	45	310470	5225088	71	315694	5227438
20	305898	5225255	46	310300	5226287	72	315064	5227570
21	306210	5226897	47	310279	5227657	73	315564	5228815
22	306265	5227550	48	310720	5227880	Alt1	315350	5219480
23	306721	5222837	49	310104	5228856	Alt2	305599	5229468
24	306895	5224128	50	310326	5229227	Alt3	303528	5223763
25	306966	5226237	51	310638	5220200	-		
26	306953	5227390	52	310915	5221456	-		

Source: Oliver Wind IV, August 2023

2. Shadow Flicker Background

Shadow flicker is a temporary condition resulting from the sun casting intermittent shadows from the rotating blades of a wind turbine onto a sensitive receptor such as a building window. The flicker is due to alternating light intensity between the direct beam of sunlight and the shadow from the turbine blades. For shadow flicker to occur, the following criteria must be met:

1. The sun must be shining and unobscured.
2. The wind turbine blades must be between the sun and the shadow receptor. The wind turbine must be facing directly towards (or away from) the sun such that the rotational plane of the blades is perpendicular to the azimuth of incident sun rays (*i.e.*, the sun, turbine, and receptor are aligned, and the turbine blades are perpendicular to the receptor). For this to occur, the wind direction would have to perpetually be parallel to the azimuth of the incident sun rays throughout the day.
3. The line of sight between the turbine and the shadow receptor must be clear. Light-impermeable obstacles, such as trees, buildings, or other structures, will prevent or reduce shadow flicker from occurring at the receptor. Terrain can also affect the exposure at a receptor.
4. The receptor has to be close enough to the turbine to be in the shadow. The shadow from a turbine extends furthest when the sun is low in the sky (sunrise and sunset) such that receptors to the east or west of a turbine will be exposed more than receptors to the north and south.
5. The turbine is operational and not stationary due to a lack of wind or maintenance activities.

The frequency of shadow flicker is dependent on the wind turbine's rotor blade speed and the number of blades on the rotor. Shadow flicker intensity diminishes with greater receptor-to-turbine separation distance. Shadow flicker intensity for receptor-to-turbine distances beyond 2,500 meters (8,202 feet) is very low and generally considered imperceptible. In general, increasing proximity to turbines may make shadow flicker more noticeable, with the largest number of shadow flicker hours, along with the greatest shadow flicker intensity, occurring nearest the wind turbines.

Although shadow flicker does not impact health it can be a nuisance to neighboring properties if not kept to a reasonable number of hours a year (Knopper et al., 2014). There have been public concerns that flickering light from wind turbines could trigger seizures in people with epilepsy, but these concerns are unfounded. The UK Epilepsy Society states that turbine blades would need to rotate at speeds greater than 3 Hertz (flashes per second) to potentially cause seizures in persons with photosensitive epilepsy (Epilepsy Society 2016); however, turbines on commercial wind farms rotate at speeds of 2 Hertz or less. The Project turbine models have a maximum rotational speed of 15.7 revolutions per minute (rpm), which corresponds to a shadow flicker frequency of 0.26 Hertz. Therefore, the Project turbines will result in a flash frequency well below that which could cause photosensitive epileptic seizures.

Shadow flicker impacts are not regulated in applicable state or federal law, and there is no permitting threshold with regard to hours per year of anticipated impacts to a receptor from a wind energy project. However, a widely used industry standard of 30 hours per year has been used for this shadow flicker impact analysis. The Commission requires effects from the impact upon light-sensitive land uses to be managed and maintained at an acceptable minimum.[1] The Commission has recognized the 30-hour-per-year standard and historically evaluates shadow flicker impacts to receptors pursuant to this standard.

[1] N.D. Admin. Code § 69-06-08-01(5)(c)(3).

3. Shadow Flicker Analysis

The shadow flicker analysis for the Project was completed using the WindPRO Version 3.4 Service Pack 3 modeling software. As discussed above, the Project will include up to 73 wind turbines. The 73 primary locations as well as three alternate locations have been assessed in two scenarios:

- Scenario A: 73 wind turbines (proposed locations only)
- Scenario B: 76 wind turbines (proposed and alternate locations)

WindPRO considers the terrain features determined by U.S. Geological Survey (USGS) Digital Elevation Model (DEM) data, receptor, and turbine locations in the modeling analysis. It is generally accepted that shadow flicker from wind turbines does not occur beyond a certain distance from a wind turbine (Department of Energy and Climate Change 2011). The *Update of UK Shadow Flicker Evidence Base* by Parsons Brinckerhoff, on behalf of the Department of Energy and Climate Change, states this distance is equivalent to 10 rotor diameters. AECOM calculated a maximum distance of 4,167 feet (*i.e.*, the 416.7-foot rotor diameter times 10) for all turbines. WindPRO also assumes the sun is shining during all daytime hours and that the turbines are always operating. This method produces a theoretical worst-case astronomical prediction at each receptor. Five years (2015 – 2019) of hourly meteorological data (USEPA 2020) from the Beulah, North Dakota meteorological tower (operated by the North Dakota Department of Environmental Quality), approximately 14 miles northwest of the Project area, shows that the wind blows predominantly from the southwest or northwest and thus, receptors directly to the east or west of a turbine are less likely to experience shadow flicker as the longer shadows extend in the southwest, southeast, northwest or northeast directions. **Table 2** summarizes the hours per year by wind direction.

WindPRO was run in “greenhouse mode” such that the wind turbine blades are always perpendicular to the receptor with a direct line of sight where the window is one meter by one meter and the height above ground to the middle of the window is 1.5 meters to determine the maximum exposure. The amount of bright sunshine can also affect the frequency and duration of exposure to shadow flicker. **Table 3** summarizes the percentage of possible sunshine (classified as zero or few clouds) by month at Bismarck Municipal Airport, Bismarck, North Dakota based on 19-year climatological data (1965 – 1983) from the National Climatic Data Center (NCDC 2018). Bismarck is the closest station in the database to the Project. These monthly values were input to WindPRO to adjust the number of hours when shadow flicker occurs on a monthly basis.

The analysis is inherently conservative by assuming that the receptors all have windows with a direct in-line view of the incoming sunlight affected by shadow flicker and does not account for trees or other obstructions that may block sunlight. In reality, the windows of many houses will not face the sun directly. Adding to the conservatism, both the primary and alternate turbines (for a total of 76 turbines) are modeled cumulatively for Scenario B, even though Oliver Wind IV will only construct no more than 73 turbines.

Table 2 Wind Direction (Hours/Year)

Wind Direction	Hours/Year
	Beulah Meteorological Tower (2015 – 2019)
N	376
NNE	314
NE	339
ENE	425
E	445
ESE	474
SE	693
SSE	570
S	488
SSW	386
SW	872
WSW	609
W	772
WNW	651
NW	677
NNW	667

Source: USEPA Air Quality System (AQS), 2020

Table 3 Percent of Possible Sunshine By Month

Month	% Possible Sunshine
	Bismarck Municipal Airport
January	54
February	52
March	61
April	58
May	64
June	67
July	75
August	72
September	67
October	53
November	42
December	45

Source: NCDC, 2018

4. Shadow Flicker Analysis Results

The shadow flicker analysis accounts for the placement of turbines, receptors, and sun angle such that the time when the turbine is in between the sun and the receptor is included in the total hours per year that shadow flicker could occur. However, this is a conservative analysis that does not account for maintenance time, wind speeds less than three meters per second (m/s) when the turbines will not operate, light-permeable obstacles such as trees and other structures, or that the turbine will rarely be directly facing the sun, which will narrow the shadow from the turbine blades. It was assumed that the receptor is always perpendicular (facing) to the turbine and a window measuring one meter by one meter at each receptor is located 1.5 meters high off the ground.

4.1 Scenario A Results

The results of the Scenario A analysis are summarized in **Table 4** and **Table 5** and shown on **Figure 2**. The majority of the receptors (68 out of 76) are expected to experience less than 20 hours of shadow flicker per year. The maximum shadow flicker per year is 29.6 hours per year (rounded to 30 hours/year) at a participating receptor. This value is based on the monthly wind direction in **Table 2** and percent possible of sunshine in **Table 3**. This analysis is conservative as it assumes that there is a window facing the turbine at all times (“greenhouse mode”) and includes all hours during which the wind speed would be less than the cut-in speed of 3 m/s or the turbine is down for maintenance. Even using this conservative analysis, no receptors were predicted to have shadow flicker values of 30 hours or greater each year.

Table 4 Scenario A Statistical Summary of Predicted Shadow Flicker at Receptors

Total Shadow Flicker Time (predicted hours/year)	Number of Receptors
= 0 Hours	28
> 0 Hours < 10 Hours	21
> 10 Hours < 20 Hours	19
> 20 Hours < 30 Hours	8
> 30 Hours	0
Total	76

Table 5 Scenario A Results by Modeled Receptor (Sorted by Hours/Year)

Receptor ID	Landowner Participation Status	Nearest Turbine ID	Distance to Nearest Turbine (ft)	Receptor Coordinates (UTM Zone 14, NAD 83)		Expected Shadow Flicker Hours/Year
				Easting (m)	Northing (m)	
R101	Yes	43	2,337	311284	5222481	29.6
R119	Yes	60	2,113	311256	5227067	25.8
R104	Yes	57	2,728	312498	5222967	24.8
R158	Yes	47	1,969	309679	5227680	24.1
R114	Yes	47	1,940	309691	5227720	23.8
R096	Yes	30	2,069	307877	5221622	22.3
R103	Yes	57	2,556	312455	5223012	20.4
R095	No	41	2,885	309014	5220505	20.2
R116	Yes	48	2,756	310992	5227085	18.3
R108	Yes	1	1,943	301611	5222494	15.6
R120	Yes	65	2,679	312816	5226852	15.1
R035	Yes	70	2,639	315575	5221819	14.8
R147	Yes	16	1,973	304837	5228484	14.5
R105	Yes	34	2,363	308246	5223894	13.6
R113	Yes	19	2,644	305460	5224116	13.4
R097	No	30	2,389	308051	5222429	12.7
R098	Yes	52	2,350	310199	5221481	12.2
R157	Yes	34	2,183	308095	5223608	11.9
R138	No	61	2,345	311194	5231852	11.9
R117	Yes	60	2,787	311023	5227045	11.6
R100	No	43	2,290	311092	5222262	11.4
R112	Yes	11	2,153	304276	5223122	11.0
R094	No	29	2,213	307877	5220908	10.7
R092	No	13	2,389	304845	5220657	10.7
R123	Yes	72	2,600	314595	5226931	10.7
R034	Yes	70	2,942	315602	5221928	9.8
R143	Yes	26	3,117	307869	5227137	9.8
U156	No	13	2,273	304851	5220692	9.3
R024	No	67	3,468	314300	5224067	8.7
R118	Yes	60	2,801	311035	5227017	8.4
R144	Yes	16	3,018	305918	5228886	7.6
R121	Yes	65	3,950	313591	5226991	7.1
R107	Yes	24	2,601	307349	5223478	6.9
R086[1]	Yes	54	2,944	312282	5220190	6.5

Receptor ID	Landowner Participation Status	Nearest Turbine ID	Distance to Nearest Turbine (ft)	Receptor Coordinates (UTM Zone 14, NAD 83)		Expected Shadow Flicker Hours/Year
				Easting (m)	Northing (m)	
R025	No	67	3,437	314338	5224000	6.4
R180	No	2	3,139	301296	5223312	5.9
R159	No	38	3,443	308243	5229345	5.3
U145	No	38	3,511	308234	5229438	5.0
R015	Yes	71	1,711	315920	5227908	4.5
R013	Yes	73	2,045	315988	5228358	4.4
R176	No	5	3,282	301596	5226631	4.2
R102	Yes	66	3,579	312668	5222427	4.0
R111	No	5	3,357	301533	5226643	3.7
R142	Yes	25	2,259	307027	5225551	3.6
R122	Yes	64	3,899	313602	5226942	3.5
U124	Yes	68	3,043	314037	5228104	3.3
R016	Yes	71	3,966	316879	5227197	3.3
R106	Yes	24	2,432	307400	5223585	0.7
R010	Yes	73	3,902	315795	5229982	0.0
R011[1]	Yes	73	3,571	316259	5229653	0.0
R012	Yes	73	2,163	315036	5228420	0.0
R019	No	71	3,758	316000	5226334	0.0
R020	No	71	3,643	316129	5226416	0.0
R038	No	70	3,897	315795	5220475	0.0
R039	No	70	3,997	315803	5220440	0.0
R040	No	70	4,113	315895	5220486	0.0
R041	No	70	4,235	315900	5220436	0.0
R043	No	70	4,768	316025	5220332	0.0
R045	No	70	4,682	316056	5220408	0.0
R046	No	70	4,765	316090	5220410	0.0
R047	No	70	4,975	316114	5220338	0.0
R048[1]	Yes	70	5,156	315974	5220118	0.0
R049[1]	Yes	70	5,783	316126	5219997	0.0
R085[1]	Yes	69	4,604	314542	5219648	0.0
R093	No	13	2,592	305201	5220603	0.0
R109	No	13	5,196	303471	5220965	0.0
R110	Yes	13	5,783	304459	5219691	0.0
R115	Yes	47	2,019	310255	5227042	0.0
R125	Yes	68	5,158	312595	5229948	0.0
R126	Yes	68	5,027	312645	5229948	0.0

Receptor ID	Landowner Participation Status	Nearest Turbine ID	Distance to Nearest Turbine (ft)	Receptor Coordinates (UTM Zone 14, NAD 83)		Expected Shadow Flicker Hours/Year
				Easting (m)	Northing (m)	
R129	Yes	61	5,213	313186	5231667	0.0
R130	Yes	61	4,965	312933	5232083	0.0
R131	Yes	61	5,092	312972	5232093	0.0
R148	No	5	6,071	303084	5229063	0.0
R181	No	1	4,929	300674	5222576	0.0
R182	No	1	3,475	301352	5221495	0.0

[1] Participant in Red Butte Wind Project.

4.2 Scenario B Results

The results of the Scenario B analysis are summarized in **Table 6** and **Table 7** and shown on **Figure 3**. Similar to Scenario A, the maximum shadow flicker per year at a receptor is 29.6 hours per year (rounded to 30 hours/year) It is based on monthly wind direction in **Table 2** and percent possible of sunshine in **Table 3**. This analysis is conservative as it assumes that there is a window facing the turbine at all times ("greenhouse mode") and includes all hours during which the wind speed would be less than the cut-in speed of 3 m/s or the turbine is down for maintenance. Even using this conservative analysis, no receptors were predicted to have shadow flicker values of 30 hours or greater each year.

Table 6 Scenario B Statistical Summary of Predicted Shadow Flicker at Receptors

Total Shadow Flicker Time (predicted hours/year)	Number of Receptors
= 0 Hours	25
> 0 Hours < 10 Hours	24
> 10 Hours < 20 Hours	19
> 20 Hours < 30 Hours	8
> 30 Hours	0
Total	76

Table 7 Scenario B Results by Modeled Receptor (Sorted by Hours/Year)

Receptor ID	Landowner Participation Status	Nearest Turbine ID	Distance to Nearest Turbine (ft)	Receptor Coordinates (UTM Zone 14, NAD 83)		Expected Shadow Flicker (Hours/Year)
				Easting (m)	Northing (m)	
R101	Yes	43	2,337	311284	5222481	29.6
R119	Yes	60	2,113	311256	5227067	25.8
R104	Yes	57	2,728	312498	5222967	24.8
R158	Yes	47	1,969	309679	5227680	24.1
R114	Yes	47	1,940	309691	5227720	23.8
R096	Yes	30	2,069	307877	5221622	22.3
R103	Yes	57	2,556	312455	5223012	20.4
R095	No	41	2,885	309014	5220505	20.2
R116	Yes	48	2,756	310992	5227085	18.3
R108	Yes	1	1,943	301611	5222494	15.6
R120	Yes	65	2,679	312816	5226852	15.1
R035	Yes	70	2,639	315575	5221819	14.8
R147	Yes	16	1,973	304837	5228484	14.5
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R097	No	30	2,389	308051	5222429	12.7
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R100	No	43	2,290	311092	5222262	11.4
R112	Yes	11	2,153	304276	5223122	11.0
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R092	No	13	2,389	304845	5220657	10.7
R123	Yes	72	2,600	314595	5226931	10.7
R034	Yes	70	2,942	315602	5221928	9.8
R143	Yes	26	3,117	307869	5227137	9.8
U156	No	13	2,273	304851	5220692	9.3
R024	No	67	3,468	314300	5224067	8.7
R118	Yes	60	2,801	311035	5227017	8.4
R085[1]	Yes	Alt1	2,707	314542	5219648	8.2
R144	Yes	Alt2	2,177	305918	5228886	7.6
R048[1]	Yes	Alt1	2,927	315974	5220118	7.5

Receptor ID	Landowner Participation Status	Nearest Turbine ID	Distance to Nearest Turbine (ft)	Receptor Coordinates (UTM Zone 14, NAD 83)		Expected Shadow Flicker (Hours/Year)
				Easting (m)	Northing (m)	
R049[1]	Yes	Alt1	3,058	316126	5219997	7.4
R121	Yes	65	3,950	313591	5226991	7.1
R107	Yes	24	2,601	307349	5223478	6.9
R086[1]	Yes	54	2,944	312282	5220190	6.5
R025	No	67	3,437	314338	5224000	6.4
R180	No	2	3,139	301296	5223312	5.9
R159	No	38	3,443	308243	5229345	5.3
U145	No	38	3,511	308234	5229438	5.0
R015	Yes	71	1,711	315920	5227908	4.5
R013	Yes	73	2,045	315988	5228358	4.4
R176	No	5	3,282	301596	5226631	4.2
R102	Yes	66	3,579	312668	5222427	4.0
R111	No	5	3,357	301533	5226643	3.7
R142	Yes	25	2,259	307027	5225551	3.6
R122	Yes	64	3,899	313602	5226942	3.5
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R106	Yes	24	2,432	307400	5223585	0.7
R010	Yes	73	3,902	315795	5229982	0.0
R011[1]	Yes	73	3,571	316259	5229653	0.0
R012	Yes	73	2,163	315036	5228420	0.0
R019	No	71	3,758	316000	5226334	0.0
R020	No	71	3,643	316129	5226416	0.0
R038	No	Alt1	3,575	315795	5220475	0.0
R039	No	Alt1	3,482	315803	5220440	0.0
R040	No	Alt1	3,753	315895	5220486	0.0
R041	No	Alt1	3,618	315900	5220436	0.0
R043	No	Alt1	3,565	316025	5220332	0.0
R045	No	Alt1	3,825	316056	5220408	0.0
R046	No	Alt1	3,898	316090	5220410	0.0
R047	No	Alt1	3,768	316114	5220338	0.0
R093	No	13	2,592	305201	5220603	0.0
R109	No	13	5,196	303471	5220965	0.0
R110	Yes	13	5,783	304459	5219691	0.0
R115	Yes	47	2,019	310255	5227042	0.0

Receptor ID	Landowner Participation Status	Nearest Turbine ID	Distance to Nearest Turbine (ft)	Receptor Coordinates (UTM Zone 14, NAD 83)		Expected Shadow Flicker (Hours/Year)
				Easting (m)	Northing (m)	
R125	Yes	68	5,158	312595	5229948	0.0
R126	Yes	68	5,027	312645	5229948	0.0
R129	Yes	61	5,213	313186	5231667	0.0
R130	Yes	61	4,965	312933	5232083	0.0
R131	Yes	61	5,092	312972	5232093	0.0
R148	No	5	6,071	303084	5229063	0.0
R181	No	1	4,929	300674	5222576	0.0
R182	No	1	3,475	301352	5221495	0.0

[1] Participant in Red Butte Wind Project

5. Conclusions

As expected, the analysis predicts that shadow flicker impacts will be greatest at receptors nearer to the wind turbines. Oliver Wind IV applied the Oliver County Zoning Regulations wind turbine setback distance of one-quarter mile (1,320 feet) from any occupied structure, assuming all identified receptors are occupied, which results in less shadow flicker at receptors. The analysis of predicted shadow flicker impacts from the Project on nearby receptors are expected to be less than the Commission-recognized 30 hours per year industry standard at all receptors.

The analysis was deliberately conservative and actual shadow flicker is expected to occur for less than the modeled durations. The analysis assumes that the receptors all have a direct in-line view of the incoming shadow flicker sunlight and does not account for trees or other obstructions that may block sunlight. In reality, the windows of some houses will not face the sun directly for the key shadow flicker impact times. Adding to the conservatism, both the primary and alternate turbines were modeled cumulatively in Scenario B. Oliver Wind IV will only construct up to 73 turbines, which is fewer wind turbines than were included in the Scenario B modeled results.

6. Literature Cited

Department of Energy and Climate Change. 2011. Update of UK Shadow Flicker Evidence Base. Accessed June 20, 2018. Available online at: https://www.gov.uk/government/publications/update-of-uk-shadow-flicker-evidence-base

Epilepsy Society. 2016. Wind Turbines and Photosensitive Epilepsy. Accessed June 20, 2018. Available online at: https://www.epilepsysociety.org.uk/wind-turbines-and-photosensitive-epilepsy#.WU1pn1UrLcs

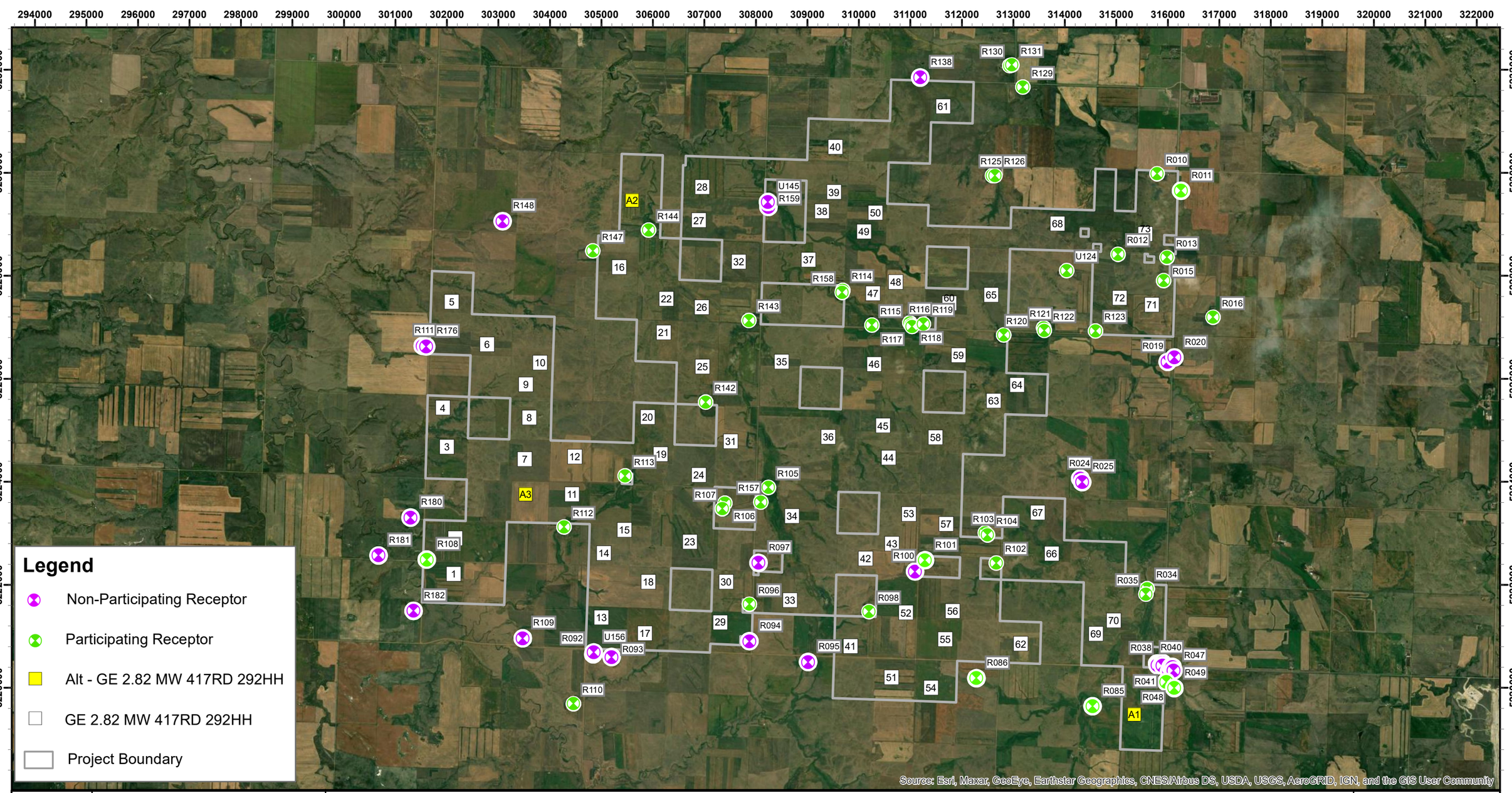
Knopper, L.D., Ollson, C.A., McCallum, L.C., Aslund, M.L., Berger, R.G, Souweine, K., and McDaniel, M. 2014. Wind Turbines and Human Health. Frontiers in Public Health. Vol. 2, Art. 63. Accessed June 20, 2018. Available online at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4063257/

NCDC (National Climatic Data Center). 2018. Sunshine – Average Percent of Possible. Accessed August 22, 2023. Available online at: http://www1.ncdc.noaa.gov/pub/data/ccd-data/pctpos18.dat

Oliver County Planning and Zoning Commission. 2016. Revised Zoning Ordinances. Accessed August 28. 2023. Available online at: https://olivercountynd.org/vertical/sites/%7B6E6CB90D-6F4C-4198-8B57-AAF2D42615E1%7D/uploads/2_Oliver_County_PZ_Ordinance.pdf

United States Environmental Protection Agency (USEPA). 2020. AQS Meteorological Data, Beulah, North Dakota (Site ID: 35-057-0004). Accessed September 29, 2020. Available online at: https://aqs.epa.gov/aqsweb/documents/data_api.html

FIGURES



N

Date Created:
9/2/23

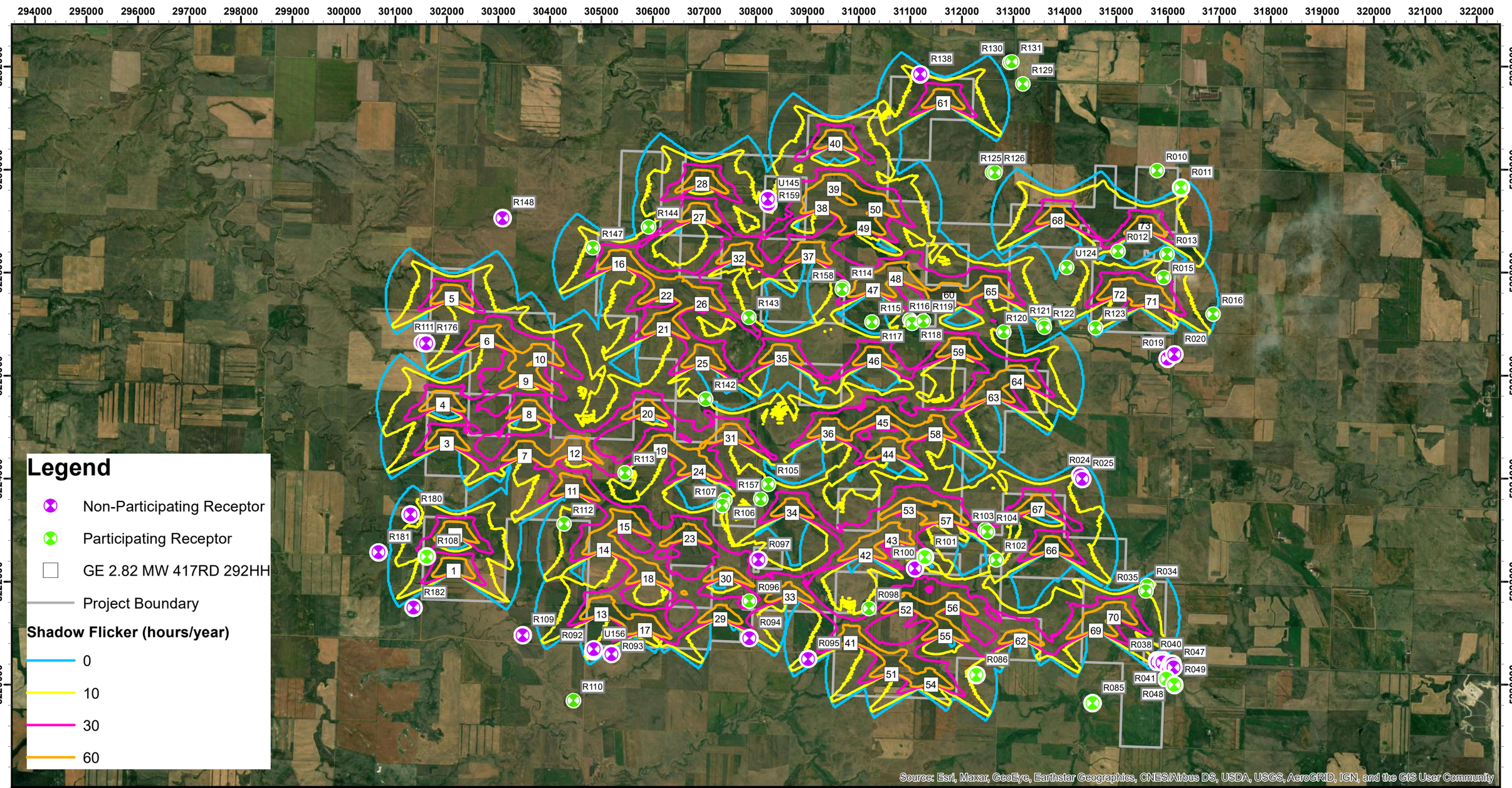
Created by:
MK

AECOM

Turbine and Receptor Locations

Oliver Wind IV Energy Project
Oliver County, ND

Figure 1



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Date Created:
9/2/23

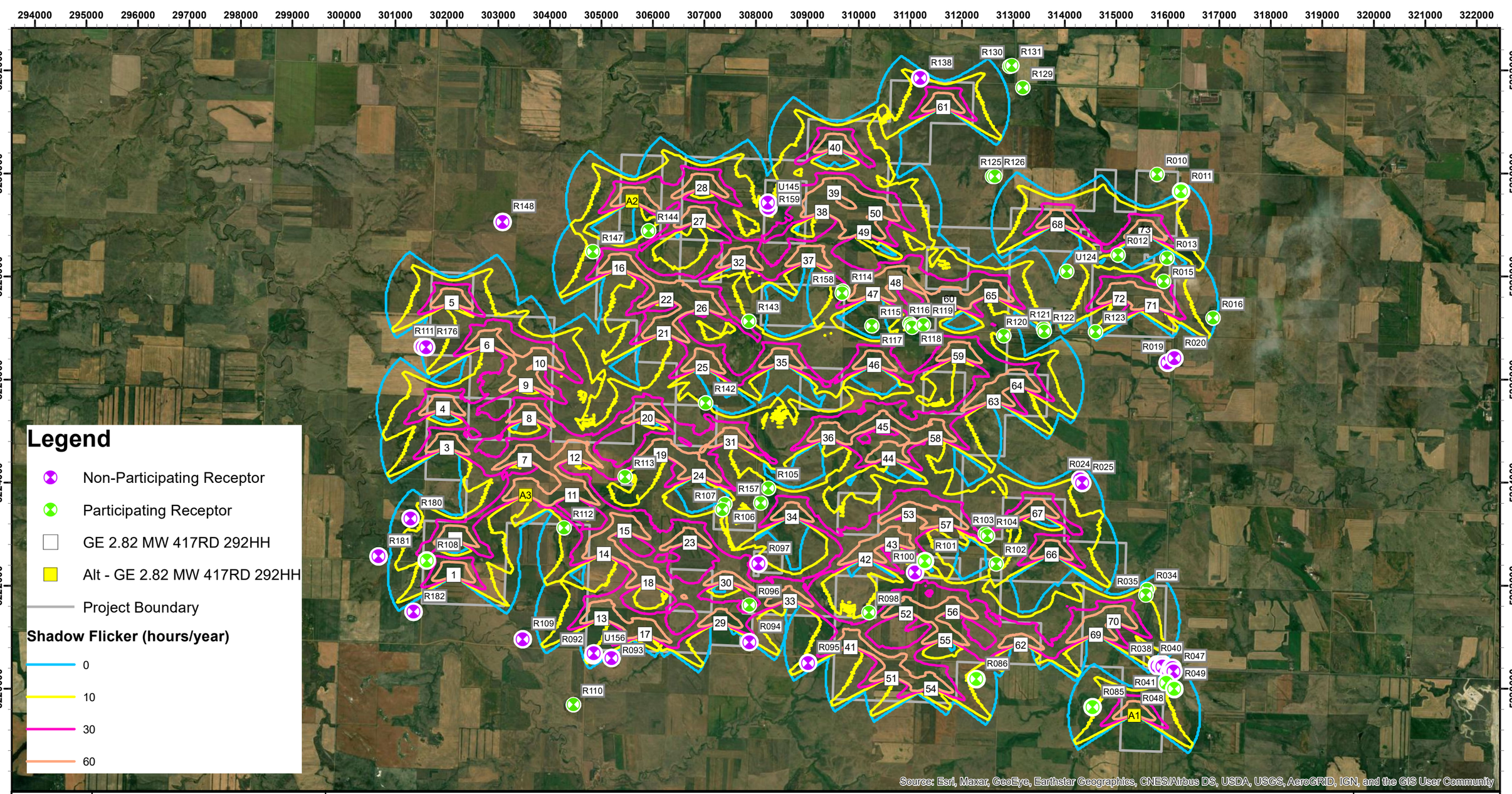
Created by:
MK

AECOM

Expected Shadow Flicker (Hours/Year) - No Alternates

Oliver Wind IV Energy Project
Oliver County, ND

Figure 2



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Date Created:
9/2/23

Created by:
MK

AECOM

Expected Shadow Flicker (Hours/Year) - With Alternates

Oliver Wind IV Energy Project
Oliver County, ND

Figure 3

Appendix A Detailed Shadow Flicker Results

Licensed user:
AECOM
250 APOLLO DR, AECOM
US-01824-3627 Chelmsford
+1 9789 052 260
Mary Kaplan / mary.kaplan@aecom.com
Calculated:
8/26/2023 3:11 PM/3.4.424

SHADOW - Main Result

Calculation: Oliver IV Array 012 without Alts 8/26/2023

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

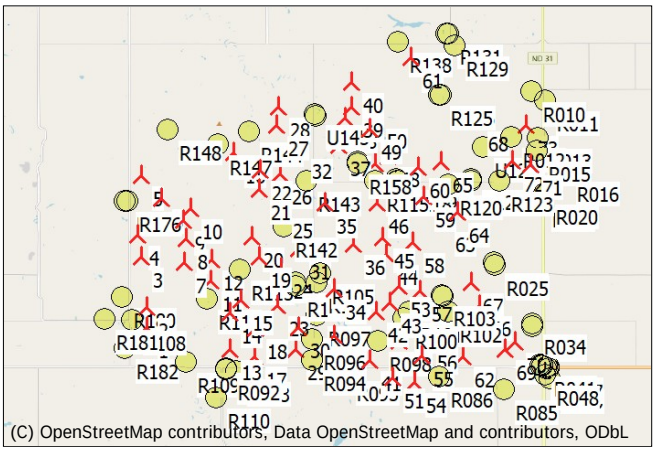
Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.54	0.52	0.61	0.58	0.64	0.67	0.75	0.72	0.67	0.53	0.42	0.45

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
376	314	339	425	445	474	693	570	488	386	872	609

W	WNW	NW	NNW	Sum
772	651	677	667	8,758



Scale 1:250,000
New WTG Shadow receptor

All coordinates are in
UTM (north)-WGS84 Zone: 14

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	302,132	5,222,212	622.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
2	302,163	5,222,907	634.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
3	301,999	5,224,683	648.6	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
4	301,924	5,225,436	643.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
5	302,094	5,227,499	644.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
6	302,779	5,226,669	660.5	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
7	303,514	5,224,437	666.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
8	303,602	5,225,251	668.1	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
9	303,536	5,225,896	662.6	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
10	303,812	5,226,316	671.8	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
11	304,434	5,223,759	647.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
12	304,484	5,224,484	659.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
13	305,003	5,221,368	652.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
14	305,048	5,222,619	651.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
15	305,447	5,223,068	656.5	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
16	305,347	5,228,165	646.8	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
17	305,848	5,221,057	658.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
18	305,914	5,222,059	664.2	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
19	306,150	5,224,533	670.9	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
20	305,898	5,225,255	681.8	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
21	306,210	5,226,897	664.2	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
22	306,265	5,227,550	669.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
23	306,721	5,222,837	679.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
24	306,895	5,224,128	677.6	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
25	306,966	5,226,237	664.8	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
26	306,953	5,227,390	669.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
27	306,893	5,229,077	653.2	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
28	306,962	5,229,724	645.6	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
29	307,311	5,221,275	681.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
30	307,423	5,222,060	694.6	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
31	307,513	5,224,789	667.5	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
32	307,669	5,228,272	653.5	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
33	308,666	5,221,700	688.5	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
34	308,703	5,223,337	672.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
35	308,504	5,226,335	650.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
36	309,410	5,224,870	666.3	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
37	309,026	5,228,313	647.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
38	309,289	5,229,257	647.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
39	309,519	5,229,623	645.6	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
40	309,545	5,230,500	650.1	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
41	309,840	5,220,807	685.2	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
42	310,134	5,222,509	697.1	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8

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SHADOW - Main Result

Calculation: Oliver IV Array 012 without Alts 8/26/2023

...continued from previous page

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
43	310,647	5,222,800	702.9	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
44	310,580	5,224,472	684.9	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
45	310,470	5,225,088	693.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
46	310,300	5,226,287	658.1	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
47	310,279	5,227,657	652.9	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
48	310,720	5,227,880	657.8	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
49	310,104	5,228,856	651.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
50	310,326	5,229,227	659.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
51	310,638	5,220,200	694.9	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
52	310,915	5,221,456	704.1	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
53	310,974	5,223,378	700.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
54	311,404	5,220,004	694.9	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
55	311,678	5,220,940	696.2	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
56	311,822	5,221,489	688.2	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
57	311,695	5,223,184	694.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
58	311,490	5,224,860	698.9	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
59	311,936	5,226,461	651.7	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
60	311,760	5,227,468	674.2	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
61	311,641	5,231,294	651.1	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
62	313,149	5,220,851	696.5	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
63	312,620	5,225,572	675.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
64	313,076	5,225,876	674.6	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
65	312,571	5,227,631	661.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
66	313,745	5,222,603	664.8	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
67	313,477	5,223,403	674.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
68	313,861	5,229,015	670.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
69	314,607	5,221,050	658.4	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
70	314,951	5,221,311	655.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
71	315,694	5,227,438	659.0	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
72	315,064	5,227,570	659.6	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
73	315,564	5,228,815	663.9	GE WIND ENERGY GE 2.82-127 2820 127...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
R010	315,795	5,229,982	640.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R011	316,259	5,229,653	640.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R012	315,036	5,228,420	663.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R013	315,988	5,228,358	676.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R015	315,920	5,227,908	678.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R016	316,879	5,227,197	663.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R019	316,000	5,226,334	647.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R020	316,129	5,226,416	646.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R024	314,300	5,224,067	665.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R025	314,338	5,224,000	663.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R034	315,602	5,221,928	641.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R035	315,575	5,221,819	641.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R038	315,795	5,220,475	652.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R039	315,803	5,220,440	653.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R040	315,895	5,220,486	652.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R041	315,900	5,220,436	652.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R043	316,025	5,220,332	653.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R045	316,056	5,220,408	654.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R046	316,090	5,220,410	656.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R047	316,114	5,220,338	656.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R048	315,974	5,220,118	659.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R049	316,126	5,219,997	659.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R085	314,542	5,219,648	662.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R086	312,282	5,220,190	683.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R092	304,845	5,220,657	650.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R093	305,201	5,220,603	654.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R094	307,877	5,220,908	677.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R095	309,014	5,220,505	665.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0

To be continued on next page...

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SHADOW - Main Result

Calculation: Oliver IV Array 012 without Alts 8/26/2023

...continued from previous page

No.	Easting	Northing	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
R096	307,877	5,221,622	690.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R097	308,051	5,222,429	699.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R098	310,199	5,221,481	694.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R100	311,092	5,222,262	695.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R101	311,284	5,222,481	695.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R102	312,668	5,222,427	678.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R103	312,455	5,223,012	679.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R104	312,498	5,222,967	677.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R105	308,246	5,223,894	656.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R106	307,400	5,223,585	676.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R107	307,349	5,223,478	671.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R108	301,611	5,222,494	613.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R109	303,471	5,220,965	631.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R110	304,459	5,219,691	630.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R111	301,533	5,226,643	639.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R112	304,276	5,223,122	635.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R113	305,460	5,224,116	656.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R114	309,691	5,227,720	643.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R115	310,255	5,227,042	645.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R116	310,992	5,227,085	655.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R117	311,023	5,227,045	657.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R118	311,035	5,227,017	654.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R119	311,256	5,227,067	657.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R120	312,816	5,226,852	658.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R121	313,591	5,226,991	648.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R122	313,602	5,226,942	646.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R123	314,595	5,226,931	656.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R125	312,595	5,229,948	665.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R126	312,645	5,229,948	663.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R129	313,186	5,231,667	632.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R130	312,933	5,232,083	628.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R131	312,972	5,232,093	628.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R138	311,194	5,231,852	644.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R142	307,027	5,225,551	664.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R143	307,869	5,227,137	644.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R144	305,918	5,228,886	634.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R147	304,837	5,228,484	658.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R148	303,084	5,229,063	650.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R157	308,095	5,223,608	673.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R158	309,679	5,227,680	642.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R159	308,243	5,229,345	631.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R176	301,596	5,226,631	640.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R180	301,296	5,223,312	619.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R181	300,674	5,222,576	608.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R182	301,352	5,221,495	619.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
U124	314,037	5,228,104	659.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
U145	308,234	5,229,438	628.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
U156	304,851	5,220,692	650.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0

Calculation Results

Shadow receptor

No.	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Shadow, worst case: Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
R010	0:00	0	0:00	0:00
R011	0:00	0	0:00	0:00
R012	0:00	0	0:00	0:00
R013	14:50	46	0:23	4:22
R015	13:18	42	0:30	4:30
R016	7:29	31	0:22	3:16
R019	0:00	0	0:00	0:00
R020	0:00	0	0:00	0:00
R024	29:16	72	0:30	8:42

To be continued on next page...

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8/26/2023 3:11 PM/3.4.424

SHADOW - Main Result

Calculation: Oliver IV Array 012 without Alts 8/26/2023

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
R025	21:31	67	0:30	6:24
R034	33:13	65	0:36	9:48
R035	49:51	90	0:40	14:49
R038	0:00	0	0:00	0:00
R039	0:00	0	0:00	0:00
R040	0:00	0	0:00	0:00
R041	0:00	0	0:00	0:00
R043	0:00	0	0:00	0:00
R045	0:00	0	0:00	0:00
R046	0:00	0	0:00	0:00
R047	0:00	0	0:00	0:00
R048	0:00	0	0:00	0:00
R049	0:00	0	0:00	0:00
R085	0:00	0	0:00	0:00
R086	16:52	42	0:33	6:29
R092	23:30	73	0:29	10:41
R093	0:00	0	0:00	0:00
R094	23:48	53	0:36	10:44
R095	44:29	98	0:35	20:13
R096	64:08	133	0:46	22:20
R097	41:39	100	0:42	12:41
R098	28:20	54	0:41	12:13
R100	30:41	88	0:30	11:26
R101	64:26	119	0:44	29:38
R102	9:12	36	0:24	3:58
R103	45:27	100	0:39	20:22
R104	55:02	134	0:36	24:50
R105	44:15	71	0:44	13:35
R106	2:33	16	0:12	0:42
R107	23:43	52	0:34	6:56
R108	44:38	68	0:50	15:35
R109	0:00	0	0:00	0:00
R110	0:00	0	0:00	0:00
R111	8:35	31	0:23	3:39
R112	31:28	86	0:33	11:02
R113	31:59	110	0:29	13:25
R114	55:04	93	0:49	23:47
R115	0:00	0	0:00	0:00
R116	44:49	109	0:37	18:20
R117	32:15	110	0:27	11:35
R118	27:44	86	0:29	8:22
R119	74:20	144	0:56	25:45
R120	36:59	111	0:30	15:05
R121	15:34	55	0:23	7:03
R122	7:55	41	0:16	3:32
R123	23:39	79	0:25	10:39
R125	0:00	0	0:00	0:00
R126	0:00	0	0:00	0:00
R129	0:00	0	0:00	0:00
R130	0:00	0	0:00	0:00
R131	0:00	0	0:00	0:00
R138	38:46	64	0:44	11:52
R142	9:41	32	0:26	3:33
R143	22:41	66	0:32	9:48
R144	17:27	46	0:30	7:35
R147	44:35	78	0:50	14:31
R148	0:00	0	0:00	0:00
R157	32:50	60	0:45	11:56
R158	55:30	89	0:53	24:03
R159	12:08	37	0:28	5:16
R176	9:48	33	0:25	4:10
R180	16:33	44	0:31	5:51
R181	0:00	0	0:00	0:00
R182	0:00	0	0:00	0:00
U124	9:48	36	0:25	3:18

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SHADOW - Main Result

Calculation: Oliver IV Array 012 without Alts 8/26/2023

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
U145	11:43	35	0:28	4:58
U156	20:29	60	0:29	9:16

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (619)	44:38	15:35
2	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (621)	16:33	5:51
3	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (625)	0:00	0:00
4	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (609)	0:00	0:00
5	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (624)	0:00	0:00
6	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (622)	10:28	4:27
7	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (606)	0:00	0:00
8	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (607)	0:00	0:00
9	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (626)	0:00	0:00
10	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (608)	0:00	0:00
11	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (604)	9:25	3:15
12	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (603)	16:19	7:30
13	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (628)	0:00	0:00
14	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (612)	21:46	6:52
15	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (613)	9:42	4:11
16	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (620)	44:35	14:31
17	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (611)	28:56	13:09
18	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (610)	0:00	0:00
19	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (571)	6:15	2:40
20	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (563)	9:41	3:33
21	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (573)	0:00	0:00
22	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (595)	0:00	0:00
23	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (569)	23:43	6:56
24	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (576)	0:00	0:00
25	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (575)	0:00	0:00
26	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (574)	20:17	9:07
27	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (578)	17:27	7:35
28	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (579)	0:00	0:00
29	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (570)	65:04	23:16
30	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (568)	33:24	10:13
31	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (572)	0:00	0:00
32	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (577)	0:00	0:00
33	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (567)	31:07	12:21
34	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (601)	77:05	25:32
35	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (615)	2:24	0:41
36	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (600)	0:00	0:00
37	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (594)	0:00	0:00
38	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (581)	21:36	9:15
39	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (580)	0:00	0:00
40	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (593)	0:00	0:00
41	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (630)	44:29	20:13
42	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (565)	23:24	10:17
43	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (564)	56:00	25:59
44	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (588)	0:00	0:00
45	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (599)	0:00	0:00
46	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (591)	33:03	9:43
47	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (584)	77:17	33:56
48	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (587)	19:34	8:28
49	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (583)	0:00	0:00
50	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (582)	0:00	0:00
51	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (629)	0:00	0:00
52	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (638)	28:20	12:13
53	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (627)	0:00	0:00
54	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (633)	16:52	6:29
55	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (631)	0:00	0:00
56	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (632)	15:43	4:49
57	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (566)	36:45	16:28
58	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (616)	0:00	0:00

To be continued on next page...

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SHADOW - Main Result

Calculation: Oliver IV Array 012 without Alts 8/26/2023

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
59	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (614)	65:59	20:54
60	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (586)	57:46	25:56
61	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (592)	38:46	11:52
62	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (634)	0:00	0:00
63	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (617)	0:00	0:00
64	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (618)	0:00	0:00
65	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (585)	15:34	7:01
66	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (635)	9:12	3:58
67	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (639)	78:43	28:56
68	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (590)	0:00	0:00
69	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (636)	22:54	6:49
70	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (637)	61:52	18:20
71	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (596)	31:08	13:55
72	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (597)	37:56	12:12
73	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (589)	0:00	0:00

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

Project:
Oliver IV Array 012 8/26/2023

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8/26/2023 2:11 PM/3.4.424

SHADOW - Main Result

Calculation: Oliver IV Array 012 with 3 Alts 8/26/2023

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

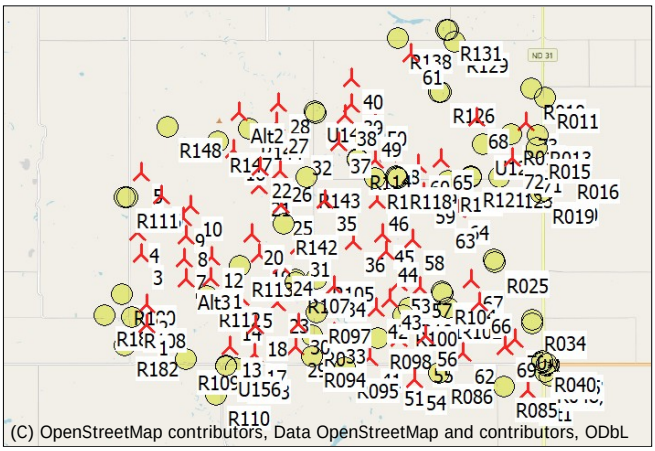
Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.54	0.52	0.61	0.58	0.64	0.67	0.75	0.72	0.67	0.53	0.42	0.45

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
376	314	339	425	445	474	693	570	488	386	872	609

W	WNW	NW	NNW	Sum
772	651	677	667	8,758



All coordinates are in
UTM (north)-WGS84 Zone: 14

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	302,132	5,222,212	622.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
10	303,812	5,226,316	671.8	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
11	304,434	5,223,759	647.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
12	304,484	5,224,484	659.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
13	305,003	5,221,368	652.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
14	305,048	5,222,619	651.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
15	305,447	5,223,068	656.5	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
16	305,347	5,228,165	646.8	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
17	305,848	5,221,057	658.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
18	305,914	5,222,059	664.2	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
19	306,150	5,224,533	670.9	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
2	302,163	5,222,907	634.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
20	305,898	5,225,255	681.8	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
21	306,210	5,226,897	664.2	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
22	306,265	5,227,550	669.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
23	306,721	5,222,837	679.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
24	306,895	5,224,128	677.6	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
25	306,966	5,226,237	664.8	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
26	306,953	5,227,390	669.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
27	306,893	5,229,077	653.2	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
28	306,962	5,229,724	645.6	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
29	307,311	5,221,275	681.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
3	301,999	5,224,683	648.6	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
30	307,423	5,222,060	694.6	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
31	307,513	5,224,789	667.5	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
32	307,669	5,228,272	653.5	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
33	308,666	5,221,700	688.5	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
34	308,703	5,223,337	672.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
35	308,504	5,226,335	650.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
36	309,410	5,224,870	666.3	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
37	309,026	5,228,313	647.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
38	309,289	5,229,257	647.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
39	309,519	5,229,623	645.6	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
4	301,924	5,225,436	643.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
40	309,545	5,230,500	650.1	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
41	309,840	5,220,807	685.2	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
42	310,134	5,222,509	697.1	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
43	310,647	5,222,800	702.9	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
44	310,580	5,224,472	684.9	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
45	310,470	5,225,088	693.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
46	310,300	5,226,287	658.1	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8

To be continued on next page...

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SHADOW - Main Result

Calculation: Oliver IV Array 012 with 3 Alts 8/26/2023

...continued from previous page

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
47	310,279	5,227,657	652.9	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
48	310,720	5,227,880	657.8	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
49	310,104	5,228,856	651.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
5	302,094	5,227,499	644.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
50	310,326	5,229,227	659.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
51	310,638	5,220,200	694.9	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
52	310,915	5,221,456	704.1	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
53	310,974	5,223,378	700.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
54	311,404	5,220,004	694.9	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
55	311,678	5,220,940	696.2	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
56	311,822	5,221,489	688.2	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
57	311,695	5,223,184	694.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
58	311,490	5,224,860	698.9	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
59	311,936	5,226,461	651.7	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
6	302,779	5,226,669	660.5	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
60	311,760	5,227,468	674.2	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
61	311,641	5,231,294	651.1	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
62	313,149	5,220,851	696.5	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
63	312,620	5,225,572	675.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
64	313,076	5,225,876	674.6	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
65	312,571	5,227,631	661.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
66	313,745	5,222,603	664.8	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
67	313,477	5,223,403	674.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
68	313,861	5,229,015	670.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
69	314,607	5,221,050	658.4	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
7	303,514	5,224,437	666.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
70	314,951	5,221,311	655.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
71	315,694	5,227,438	659.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
72	315,064	5,227,570	659.6	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
73	315,564	5,228,815	663.9	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
8	303,602	5,225,251	668.1	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
9	303,536	5,225,896	662.6	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
Alt1	315,350	5,219,480	670.3	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
Alt2	305,599	5,229,468	639.5	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8
Alt3	303,528	5,223,763	645.0	GE WIND ENERGY GE 2.82-127 2820 1...	Yes	GE WIND ENERGY	GE 2.82-127-2,820	2,820	127.0	89.0	1,270	14.8

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
R010	315,795	5,229,982	640.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R011	316,259	5,229,653	640.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R012	315,036	5,228,420	663.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R013	315,988	5,228,358	676.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R015	315,920	5,227,908	678.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R016	316,879	5,227,197	663.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R019	316,000	5,226,334	647.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R020	316,129	5,226,416	646.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R024	314,300	5,224,067	665.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R025	314,338	5,224,000	663.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R034	315,602	5,221,928	641.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R035	315,575	5,221,819	641.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R038	315,795	5,220,475	652.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R039	315,803	5,220,440	653.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R040	315,895	5,220,486	652.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R041	315,900	5,220,436	652.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R043	316,025	5,220,332	653.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R045	316,056	5,220,408	654.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R046	316,090	5,220,410	656.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R047	316,114	5,220,338	656.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R048	315,974	5,220,118	659.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R049	316,126	5,219,997	659.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R085	314,542	5,219,648	662.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0

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SHADOW - Main Result

Calculation: Oliver IV Array 012 with 3 Alts 8/26/2023

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
R086	312,282	5,220,190	683.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R092	304,845	5,220,657	650.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R093	305,201	5,220,603	654.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R094	307,877	5,220,908	677.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R095	309,014	5,220,505	665.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R096	307,877	5,221,622	690.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R097	308,051	5,222,429	699.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R098	310,199	5,221,481	694.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R100	311,092	5,222,262	695.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R101	311,284	5,222,481	695.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R102	312,668	5,222,427	678.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R103	312,455	5,223,012	679.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R104	312,498	5,222,967	677.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R105	308,246	5,223,894	656.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R106	307,400	5,223,585	676.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R107	307,349	5,223,478	671.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R108	301,611	5,222,494	613.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R109	303,471	5,220,965	631.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R110	304,459	5,219,691	630.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R111	301,533	5,226,643	639.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R112	304,276	5,223,122	635.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R113	305,460	5,224,116	656.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R114	309,691	5,227,720	643.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R115	310,255	5,227,042	645.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R116	310,992	5,227,085	655.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R117	311,023	5,227,045	657.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R118	311,035	5,227,017	654.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R119	311,256	5,227,067	657.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R120	312,816	5,226,852	658.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R121	313,591	5,226,991	648.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R122	313,602	5,226,942	646.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R123	314,595	5,226,931	656.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R125	312,595	5,229,948	665.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R126	312,645	5,229,948	663.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R129	313,186	5,231,667	632.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R130	312,933	5,232,083	628.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R131	312,972	5,232,093	628.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R138	311,194	5,231,852	644.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R142	307,027	5,225,551	664.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R143	307,869	5,227,137	644.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R144	305,918	5,228,886	634.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R147	304,837	5,228,484	658.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R148	303,084	5,229,063	650.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R157	308,095	5,223,608	673.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R158	309,679	5,227,680	642.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R159	308,243	5,229,345	631.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R176	301,596	5,226,631	640.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R180	301,296	5,223,312	619.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R181	300,674	5,222,576	608.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R182	301,352	5,221,495	619.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
U124	314,037	5,228,104	659.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
U145	308,234	5,229,438	628.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
U156	304,851	5,220,692	650.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0

Calculation Results

Shadow receptor

No.	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
R010	0:00	0	0:00	0:00
R011	0:00	0	0:00	0:00
R012	0:00	0	0:00	0:00
R013	14:50	46	0:23	4:22

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SHADOW - Main Result

Calculation: Oliver IV Array 012 with 3 Alts 8/26/2023

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
R015	13:18	42	0:30	4:30
R016	7:29	31	0:22	3:16
R019	0:00	0	0:00	0:00
R020	0:00	0	0:00	0:00
R024	29:16	72	0:30	8:42
R025	21:31	67	0:30	6:24
R034	33:13	65	0:36	9:48
R035	49:51	90	0:40	14:49
R038	0:00	0	0:00	0:00
R039	0:00	0	0:00	0:00
R040	0:00	0	0:00	0:00
R041	0:00	0	0:00	0:00
R043	0:00	0	0:00	0:00
R045	0:00	0	0:00	0:00
R046	0:00	0	0:00	0:00
R047	0:00	0	0:00	0:00
R048	25:26	54	0:34	7:27
R049	25:07	66	0:33	7:25
R085	19:49	44	0:36	8:14
R086	16:52	42	0:33	6:29
R092	23:30	73	0:29	10:41
R093	0:00	0	0:00	0:00
R094	23:48	53	0:36	10:44
R095	44:29	98	0:35	20:13
R096	64:08	133	0:46	22:20
R097	41:39	100	0:42	12:41
R098	28:20	54	0:41	12:13
R100	30:41	88	0:30	11:26
R101	64:26	119	0:44	29:38
R102	9:12	36	0:24	3:58
R103	45:27	100	0:39	20:22
R104	55:02	134	0:36	24:50
R105	44:15	71	0:44	13:35
R106	2:33	16	0:12	0:42
R107	23:43	52	0:34	6:56
R108	44:38	68	0:50	15:35
R109	0:00	0	0:00	0:00
R110	0:00	0	0:00	0:00
R111	8:35	31	0:23	3:39
R112	31:28	86	0:33	11:02
R113	31:59	110	0:29	13:25
R114	55:04	93	0:49	23:47
R115	0:00	0	0:00	0:00
R116	44:49	109	0:37	18:20
R117	32:15	110	0:27	11:35
R118	27:44	86	0:29	8:22
R119	74:20	144	0:56	25:45
R120	36:59	111	0:30	15:05
R121	15:34	55	0:23	7:03
R122	7:55	41	0:16	3:32
R123	23:39	79	0:25	10:39
R125	0:00	0	0:00	0:00
R126	0:00	0	0:00	0:00
R129	0:00	0	0:00	0:00
R130	0:00	0	0:00	0:00
R131	0:00	0	0:00	0:00
R138	38:46	64	0:44	11:52
R142	9:41	32	0:26	3:33
R143	22:41	66	0:32	9:48
R144	17:27	46	0:30	7:35
R147	44:35	78	0:50	14:31
R148	0:00	0	0:00	0:00
R157	32:50	60	0:45	11:56
R158	55:30	89	0:53	24:03
R159	12:08	37	0:28	5:16

To be continued on next page...

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SHADOW - Main Result

Calculation: Oliver IV Array 012 with 3 Alts 8/26/2023

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
R176	9:48	33	0:25	4:10
R180	16:33	44	0:31	5:51
R181	0:00	0	0:00	0:00
R182	0:00	0	0:00	0:00
U124	9:48	36	0:25	3:18
U145	11:43	35	0:28	4:58
U156	20:29	60	0:29	9:16

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (619)	44:38	15:35
10	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (608)	0:00	0:00
11	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (604)	9:25	3:15
12	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (603)	16:19	7:30
13	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (628)	0:00	0:00
14	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (612)	21:46	6:52
15	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (613)	9:42	4:11
16	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (620)	44:35	14:31
17	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (611)	28:56	13:09
18	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (610)	0:00	0:00
19	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (571)	6:15	2:40
2	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (621)	16:33	5:51
20	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (563)	9:41	3:33
21	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (573)	0:00	0:00
22	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (595)	0:00	0:00
23	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (569)	23:43	6:56
24	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (576)	0:00	0:00
25	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (575)	0:00	0:00
26	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (574)	20:17	9:07
27	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (578)	17:27	7:35
28	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (579)	0:00	0:00
29	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (570)	65:04	23:16
3	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (625)	0:00	0:00
30	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (568)	33:24	10:13
31	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (572)	0:00	0:00
32	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (577)	0:00	0:00
33	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (567)	31:07	12:21
34	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (601)	77:05	25:32
35	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (615)	2:24	0:41
36	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (600)	0:00	0:00
37	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (594)	0:00	0:00
38	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (581)	21:36	9:15
39	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (580)	0:00	0:00
4	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (609)	0:00	0:00
40	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (593)	0:00	0:00
41	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (630)	44:29	20:13
42	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (565)	23:24	10:17
43	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (564)	56:00	25:59
44	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (588)	0:00	0:00
45	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (599)	0:00	0:00
46	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (591)	33:03	9:43
47	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (584)	77:17	33:56
48	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (587)	19:34	8:28
49	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (583)	0:00	0:00
5	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (624)	0:00	0:00
50	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (582)	0:00	0:00
51	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (629)	0:00	0:00
52	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (638)	28:20	12:13
53	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (627)	0:00	0:00
54	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (633)	16:52	6:29
55	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (631)	0:00	0:00
56	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (632)	15:43	4:49
57	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (566)	36:45	16:28

To be continued on next page...

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SHADOW - Main Result

Calculation: Oliver IV Array 012 with 3 Alts 8/26/2023

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No.	Name	Worst case [h/year]	Expected [h/year]
58	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (616)	0:00	0:00
59	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (614)	65:59	20:54
6	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (622)	10:28	4:27
60	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (586)	57:46	25:56
61	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (592)	38:46	11:52
62	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (634)	0:00	0:00
63	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (617)	0:00	0:00
64	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (618)	0:00	0:00
65	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (585)	15:34	7:01
66	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (635)	9:12	3:58
67	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (639)	78:43	28:56
68	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (590)	0:00	0:00
69	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (636)	22:54	6:49
7	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (606)	0:00	0:00
70	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (637)	61:52	18:20
71	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (596)	31:08	13:55
72	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (597)	37:56	12:12
73	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (589)	0:00	0:00
8	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (607)	0:00	0:00
9	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (626)	0:00	0:00
Alt1	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (640)	70:22	23:06
Alt2	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (598)	0:00	0:00
Alt3	GE WIND ENERGY GE 2.82-127 2820 127.0 !O! hub: 89.0 m (TOT: 152.5 m) (605)	0:00	0:00

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

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Appendix B4. Cultural Resources and Architectural History Summaries

Burns & McDonnell
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Architectural History Survey Report Summary

To	Oliver Wind IV, LLC
Subject	Oliver Wind IV Wind Energy Center Class II/III Architectural Resource Inventory Summary Oliver County, North Dakota
From	Burns & McDonnell Engineering Company, Inc.
Date	September 11, 2023

Introduction and Purpose

Oliver Wind IV, LLC (Oliver Wind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC, proposes to develop the Oliver Wind IV Energy Center (Project) in Oliver County, North Dakota. The Project consists of up to 73 wind turbines, access roads, underground electrical collection and communication systems, two aircraft detection lighting systems, a collection substation, an operations and maintenance facility, and a permanent meteorological evaluation tower.

The Project will require a Certificate of Site Compatibility from the North Dakota Public Service Commission; therefore, the Project is subject to the review of the State Historical Society of North Dakota (SHSND) under North Dakota Century Code Section 49-22-09. Based on Consultation with the SHSND, the Architectural Survey Corridor (Survey Corridor) was defined as all areas within two miles (mi) of turbines and is based on the location of the turbines within the proposed turbine layout dated August 24, 2023. The purpose of this investigation is to facilitate the SHSND review by documenting the aboveground historic buildings and structures within the Survey Corridor defined for this Project. No architectural survey was required by SHSND for the Project transmission line.

Methods

As the Project is designed to avoid all direct effects to architectural sites, only indirect visual effects were considered. Based on guidelines from the SHSND, the relationship between the Project and the view towards a property from the main access point to said property was considered. All accessible public rights-of-way within this area were traveled during the survey. Where permission was received, private property was entered so that buildings could be more closely examined and documented.

Results

A previous Class II/III inventory was completed by AECOM in 2019 and 2020. During this survey, a total of 215 architectural sites were documented including 83 new architectural resources and 32 previously documented sites. Based on updated Survey Corridors from 2022 and 2023 Oliver Wind IV turbine arrays, Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) completed two further rounds of Class II/III Inventory in November 2022 and May 2023. During the surveys, a Burns & McDonnell architectural historian identified five new architectural resources. The newly documented resources contain features including homes, barns, silos, garages, sheds, livestock shelters, and grain bins.

A total of 186 of the AECOM 2019 and 2020 Class II/III resources remained within the updated Survey Corridor. Due to their recent recordation, these sites were not updated during the Burns & McDonnell survey unless changes were noted in the field that would alter the previous condition assessment or integrity evaluation. One previously recorded site was reevaluated by Burns & McDonnell during the survey due to storm damage observed since its original documentation, and an updated NDCRS form was submitted.

During the combined inventories, an architectural historian surveyed and evaluated 191 resources within the final Oliver Wind IV Survey Corridor. It is Burns & McDonnell's recommendation that two of the documented sites, 32OL888 and 32OL916, are eligible for the National Register of Historic Places (NRHP).

32OL888 is an abandoned Ethnic/Vernacular style farmhouse built of stacked stone walls with mud brick interior walls and a woven wood and clay floor loft, while 32OL916 is an abandoned farmstead containing two Ethnic/Vernacular stone buildings. Both 32OL888 and 32OL916 are recommended eligible for the NRHP under criteria A and C for their connection to early settlement traditions and their distinctive ethnic construction styles. 32OL888 is located 0.64 mi from the closest turbine, and 32OL916 is located 1.5 mi from the closest turbine.

As the Project has been designed to avoid all direct effects to historical resources, only indirect visual effects to these two properties were considered. Based on methods and guidance from SHSND, Burns & McDonnell assessed the views from the property to the Project from each site's main access point. Both sites are situated relative to the Project in such a way that a view of the Project will likely be possible from the main access point to the property. Oliver Wind IV is in consultation with the North Dakota State Historic Preservation Office (NDSHPO) to determine if the Project would have indirect effects to the sites that would diminish their eligibility for listing on the NRHP.

The Class II/III report from 2022/2023 will be submitted to the NDSHPO once complete, and concurrence will be obtained prior to construction of the Project. Once the NDSHPO concurrence letter is received, it will be submitted to the Commission. NDSHPO concurrence for the 2019/2020 report is attached (Attachment A).

Archaeology Survey Report Summary

To	Oliver Wind IV, LLC
Subject	Oliver Wind IV Wind Energy Center Class III: Intensive Archaeological Resource Inventory Summary Oliver County, North Dakota
From	Burns & McDonnell Engineering Company, Inc.
Date	September 12, 2023

Introduction and Purpose

Oliver Wind IV, LLC (Oliver Wind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC, proposes to construct the Oliver Wind IV Energy Center (Project) located approximately 6.4 miles (mi) (10.3 kilometers [km]) west of the city of Center in Oliver County, North Dakota. The Project consists of up to 73 wind turbines, three alternative turbine locations, service roads, underground electrical collection and communication systems, two aircraft detection lighting systems (ADLS), a collection substation, an operations and maintenance (O&M) facility, a permanent and a temporary meteorological evaluation tower (MET tower), and temporary workspaces for a construction laydown area, crane paths, and a batch plant.

The Project will require a Certificate of Site Compatibility from the North Dakota Public Service Commission (Commission); therefore, the Project is subject to the review of the State Historical Society of North Dakota (SHSND) under North Dakota Century Code Section 49-22-09. The purpose of this investigation is to provide the necessary information for the SHSND review by confirming the presence or absence of archaeological sites within the Survey Corridor, as more particularly described below.

In 2019 and 2020, AECOM completed a Class III: Intensive Cultural Resource Inventory for approximately 3,714.49 acres (ac) (1,503.2 hectares [ha]) (see North Dakota State Historic Preservation Office [NDSHPO] manuscript number 019304 for details). The report for these inventories received SHSND concurrence on July 14, 2021 (Attachment A). As shifts to the site plan were implemented additional surveys occurred between April 2022 and August 2023 and covered approximately 963.2 ac (389.79 ha). The combined Class III: Intensive Cultural Resource Inventory Survey Corridor is shown in Figure 1.

The Survey Corridor includes all areas that may be permanently or temporarily affected during construction of the Project and is based on the current site plan which includes:

- The turbine layout dated August 24, 2023;
- The service road layout dated August 24, 2023;
- The electrical collection line layout dated August 25, 2023;
- The MET tower layout dated May 05, 2023; and,
- The crane path layout dated June 6, 2023.

For these Project facilities, Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) surveyed:

- A 600-foot- (ft) (182.88 meter [m]) diameter circular area centered on the proposed turbine locations;
- A 232-ft- (70.7 m) wide corridor for the service roads;
- A 50- to 200-ft- (15.24 to 60.69 m) wide corridor for the collection lines;
- A 600-ft- (182.88 m) diameter circular area centered on the proposed MET towers; and
- A 600-ft- (182.88 m) diameter circular area centered on the proposed ADLS locations.

Results

The results presented in this memorandum are based on the current site plan. The literature review identified five previously recorded archaeological sites or site leads. Three of these resources are Native American or Euro-American site leads, one is a Euro-American site, and one is a Native American site; none of these resources have been evaluated for the National Register of Historic Places (NRHP).

During the updated Class III: Intensive Cultural Resource Inventory, Burns & McDonnell documented seven Native American site leads, 27 Native American isolated finds, 14 Native American sites, one Euro-American site, and one multicomponent site that contains both a Native American and a Euro-American component. A total of 483 shovel test probes were completed in medium to high probability areas of the Survey Corridor with low ground visibility or at the location of surface finds to determine the presence or absence of subsurface artifacts.

A survey for Sites of Religious and Cultural Significance to Tribes (SRCSTT) was also undertaken for the updated Project by Traditional Cultural Surveyors (TCS) from Rosebud Sioux Tribe, Turtle Mountain Band of Chippewa Indians, Northern Cheyenne Tribe, Northern Arapaho, Standing Rock Sioux Tribe, and the Spirit Lake Sioux Tribe. Twelve SRCSTT were documented and recorded on NDSHPO Cultural Heritage Forms by Burns & McDonnell on behalf of the participating tribes.

Recommendations

A total of 46 Native American isolated finds, one Native American site, and one Euro-American site documented by AECOM in 2019 and 2020 are within the current site plan, and 13 Native American isolated finds and one Euro-American site documented by Burns & McDonnell are within the current site plan.

Burns & McDonnell recommends avoidance of all cultural resources that are potentially eligible for listing on the NRHP, sites deemed culturally sensitive, or sites that have not been evaluated for eligibility following the guidelines outlined by the NDSHPO. For this investigation, Oliver Wind IV has committed to avoiding effects to archaeological resources that could be considered archaeologically or culturally significant. In the absence of a formal evaluation of the significance of an identified archaeological resource, Burns & McDonnell recommends that the resource, with the exception of isolated finds, be avoided. It is Burns & McDonnell's understanding that the current proposed infrastructure incorporates all recommended avoidance buffers. If the Project is redesigned in such a way that a resource cannot be avoided, Burns & McDonnell recommends additional investigation that would constitute formal evaluation of site significance.

Burns & McDonnell is not recommending avoidance for all 59 isolated finds and for the two Euro-American sites as it was determined through pedestrian survey and shovel test probes that the areas contained low artifact density with little to no potential to produce intact subsurface deposits or important information.

Burns & McDonnell is recommending a 100 ft avoidance buffer for one Native American site, 32OL879.

If this site and its associated avoidance buffer can be avoided during construction, then Burns & McDonnell recommends a determination of *No Significant Sites Affected* as documented and mapped in the current Class III: Intensive Cultural Resource Inventory report. If areas beyond the combined Survey Corridor are to be used during construction, Burns & McDonnell recommends completion of an addendum Class III: Intensive Cultural Resource Inventory to determine the presence or absence of cultural resources within these areas.

The Class III report will be submitted to NDSHPO once complete, and concurrence will be obtained prior to construction of the Project. Once the NDSHPO concurrence letter is received, it will be submitted to the Commission.

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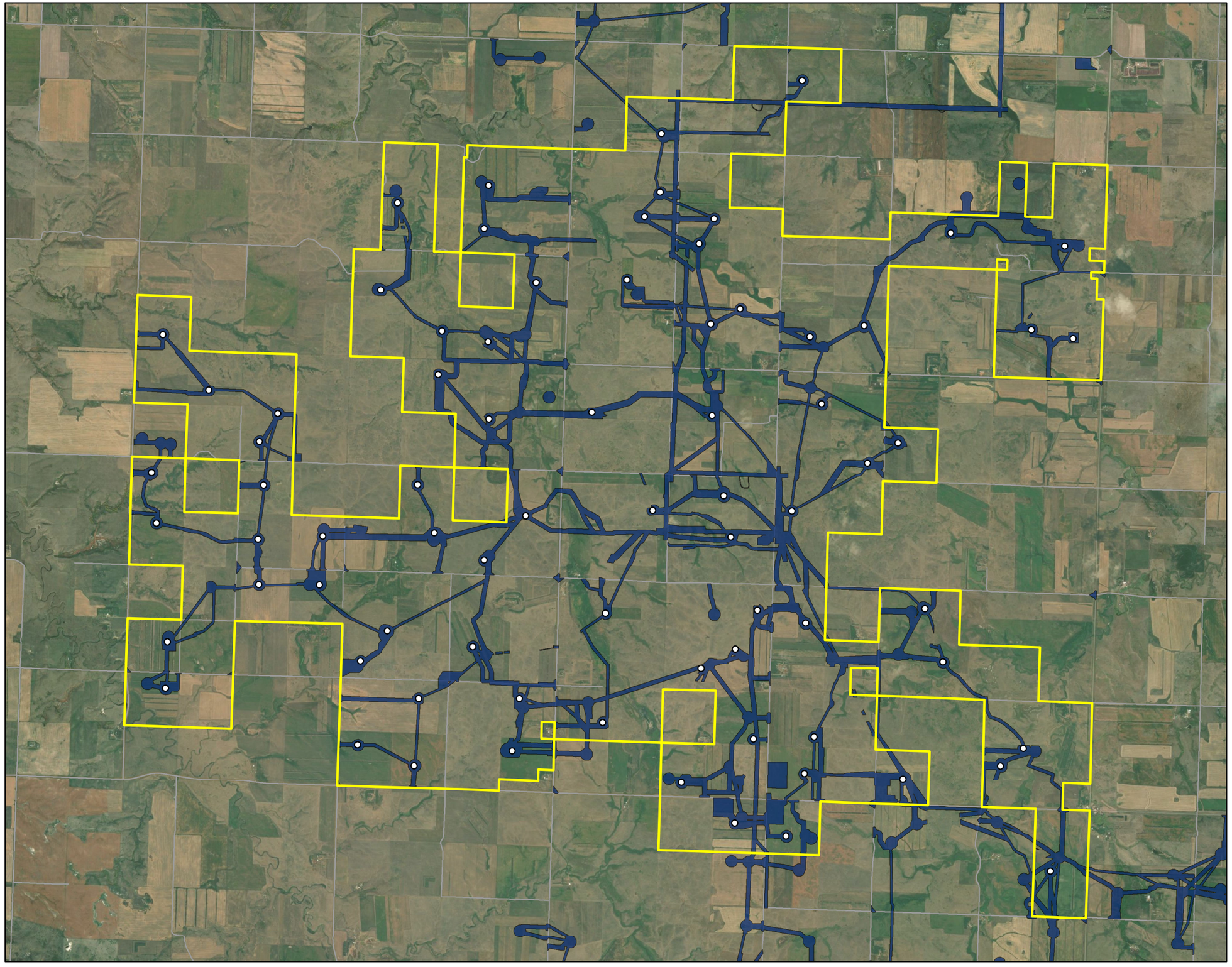

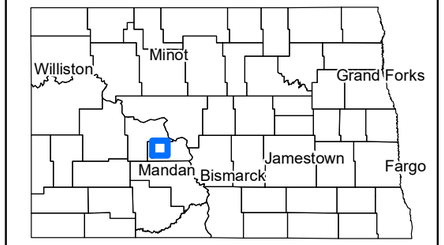

Legend

- Turbine
- County Road
- Project Boundary
- Survey Corridor

N
W E
S

0 0.5 1 2 Miles

Figure 1
Cultural Survey Corridor
Oliver Wind IV
Cultural Resource Inventory
Oliver County, ND

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Attachment A:
Concurrence Letter

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June 23, 2021

Melinda McCarthy
AECOM
1000 East Calgary Ave, Ste 1
Bismarck, ND 58503

ND SHPO Ref.: 19-0332 Red Butte Wind Energy Center transmission line NextEra in portions of 33 Sections in Mercer and Oliver Counties, North Dakota

Dear Melinda McCarthy,

We reviewed the report for ND SHPO Ref: 19-0332 Red Butte Wind Energy Center transmission line NextEra in portions of 33 Sections in Mercer and Oliver Counties, titled "A Class II/III Architectural Survey – Red Butte Wind Energy Center in Oliver County, North Dakota" and find this AECOM report by Melinda M. McCarthy acceptable. We will add it to our Manuscript Collection. We also concur with the eligibility recommendations within the report.

If you have any questions, please contact Lorna Meidinger, Historic Preservation Specialist at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson PhD
State Historic Preservation Officer
(North Dakota)

19-0332

July 14, 2021

Christina Huling
AECOM
1000 E Calgary Ave, Ste 1
Bismarck, ND 58503

ND SHPO Ref: 19-0332 Red Butte Wind Energy Center transmission line NextEra in portions of 33 Sections in Mercer and Oliver Counties, North Dakota

Dear Ms. Huling,

We received ND SHPO Ref: 19-0332 "Red Butte Wind Energy Center: Class III Cultural Resource Inventory Results for the 2019 and 2020 Field Seasons in Oliver County, North Dakota" in portions of [T141N R85W Sections 2, 11, & 14, T142N R85W Sections 5-9, 15-30, & 33-36, T142N R86W Sections 1-5, 8-15, 17, 25, 26, 35, & 36, T143N R85W Sections 7, 17, 19-22, 27, & 29-33 and T143N R86W Section 1, 12-14, 22-27, & 32-36] and find this AECOM report by Christina Huling, Melinda McCarthy, Kaleigh Perry, Rebecca Pace, Lucy Harrington, Robin Roberts, Max Bieber, Marcia Bender, and Alexander Cassidy-Neumiller acceptable. We will add it to our Manuscript Collection. We also concur with no significant sites affected.

If you have any questions, please contact either Andrew Clark, Chief Archeologist at (701) 328-3574 or andrewclark@nd.gov or Lorna Meidinger, Historic Preservation Specialist at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson PhD
State Historic Preservation Officer
(North Dakota)

19-0332

Appendix B5. Unbroken Grassland Assessment

UNBOKEN GRASSLAND ASSESSMENT

OLIVER WIND IV ENERGY CENTER

OLIVER COUNTY, NORTH DAKOTA

SUBMITTED TO:

North Dakota Public Service Commission

SUBMITTED BY:

Oliver Wind IV, LLC
700 Universe Boulevard
Juno Beach, FL 33408

PREPARED BY:

MERJENT, INC.
1 Main Street SE, Suite 300
Minneapolis, Minnesota 55414

SEPTEMBER 2023

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1.0 INTRODUCTION

Oliver Wind IV, LLC, a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC, is proposing to construct the Oliver Wind IV Energy Center (Project) in Oliver County, North Dakota. This Unbroken Grassland Assessment supports the application to the North Dakota Public Service Commission for a Certificate of Site Compatibility. This report describes the results of the desktop assessment and field surveys conducted for the Project. The locations of the proposed 73 turbines and three alternative turbine sites, along with their associated construction easements, are shown in Figure 1.

2.0 PROJECT AREA

Oliver Wind IV proposes to obtain a Certificate of Site Compatibility for the designated Project Area as depicted in Figure 1. The Project Area facilitates siting flexibility and allows Oliver Wind IV to modify the Project site plan to avoid potential constraints if they are identified. The Project Area encompasses 22,291 acres in Oliver County, North Dakota and comprises cultivated land, hayfields, pasturelands, and grasslands. Much of the area serves agricultural purposes, supporting both livestock grazing and crops.

3.0 METHODOLOGY

Unbroken grassland was identified as grassland that has not been actively or historically disturbed by tilling, construction, or other mechanical methods. Other disturbance methods such as grazing, haying, fire, or other types of management actions, as well as undesirable species, did not qualify a grassland as broken. The North Dakota Game and Fish Department (NDGFD) defines unbroken grasslands as “grasslands that have not been tilled or otherwise broken” (NDGFD 2021).

Broken grassland was identified as grassland that has been actively or historically broken by tilling, construction, or other mechanical methods. Features that indicated the grassland had been broken included straight line features indicating plowing, disking, harvesting, or planting; rock piles or absence of scattered rocks indicating extensive mechanized rock clearing; planted windbreak indicating protection to buildings or crops; landowner input; or any other features indicating human disturbance.

Cropland (non-grassland) was identified as areas currently under crop cultivation.

Desktop Assessment

Prior to field surveys, a desktop assessment was conducted to determine areas of unbroken grassland within the Project Area. The desktop assessment was conducted using a variety of publicly available online mapping tools and resources, including:

- Esri World Imagery aerial imagery (Esri 2023);
- Google Earth aerial imagery from the following collection dates: December 30, 1985; June 18, 1995; July 6, 1995; August 31, 1995; September 1, 1995; September 26, 1995; August 23, 2003; July 29, 2005; June 5, 2006; August 20, 2006; June 13, 2007; June 21, 2007; August 1, 2007; August 31, 2009; December 30, 2010; August 15, 2013; May 2, 2016; June 11, 2020; June 19, 2020; July 8, 2020; July 14, 2020; August 22, 2021; October 11, 2021, August 20, 2022; May 19, 2023, and June 16, 2023 (Google Earth 2023);
- LiDAR-Derived Elevation Data (NDDWR 2023a);

- NDGFD Unbroken Grassland 2008 (NDGFD 2022a) and 2014 (NDGFD 2022b) landcover analysis;
- North Dakota Department of Water Resources (NDDWR) historical imagery including historical imagery from the following collection dates and years: 1957, 1971, 1995; 2013, July 15, 2018 - October 23, 2018; June 23, 2019 - September 19, 2019 (NDDWR 2023b);
- US Department of Agriculture (USDA) Farm Service Agency (FSA) Color Infrared imagery layer (USDA FSA 2023);
- USDA FSA National Agriculture Imagery Program (NAIP) historical aerial imagery from the following years: 2003, 2004, 2005, 2006, 2009, 2010, 2012, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, and 2022 (USDA, FSA, NAIP 2022);
- USDA National Agriculture Statistics Service (NASS) CroplandCROS data layer (USDA, NASS 2022);
- US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) data (USFWS 2023);
- US Geological Survey National (USGS) Gap Analysis Program (GAP) Land Cover Data dataset (USGS 2019); and
- USGS National Land Cover Database (NLCD) landcover (Dewitz, USGS NLCD 2021).

Areas evaluated to be unbroken grassland were mapped using Google Earth and Geographic Information Systems (GIS) mapping service to produce a digital data layer of polygons. The unbroken grassland layer was then used to facilitate the siting of proposed turbine locations during development of the Project. As proposed turbine locations were adjusted, the turbine location and their associated construction easement was reviewed for placement on unbroken grassland and recommendations for shifts or adjustments were communicated. Based on the recommendations, turbines and their associated construction easement were then shifted or adjusted to avoid direct impacts to unbroken grassland. The desktop assessment resulted in GIS layers that identified areas of unbroken grassland that were then carried forward to the field surveys.

Field Survey

After the completion of the desktop assessment, field surveys were conducted from 2020 through 2023 to validate the desktop assessment. Field surveys were conducted at the proposed location of each turbine. During the field surveys the unbroken grassland layer was either validated or updated based on characteristics identified in the field. Updates to the unbroken grassland layer were made using a Global Positioning System or documented on field maps. The field-collected data were plotted as a map layer using GIS software.

4.0 RESULTS

Through a combination of the desktop assessment and field surveys, the assessment determined that 10,442 acres, or 46.8 percent of the Project Area, qualify as unbroken grassland. All of the 73 planned and three alternative turbine locations are located in cropland or broken grassland. Table 4.0-1 summarizes the sod type per turbine location.

TABLE 4.0-1
Number of Turbines by Sod Type

Turbine Type	Grassland Sod Type		
	Non-Grassland (Cropland)	**Broken Grassland**	**Unbroken Grassland**
Planned Turbine	45	28	0
Alternative Turbine	3	0	0

The unbroken grassland layer and turbine locations are presented in Figure 2. Photographs of representative landscapes of the different sod types present within the Project Area including non-grassland (cropland), broken grassland, and unbroken grassland within the Project Area are provided in Appendix A.

5.0 LITERATURE CITED

Dewitz, J., and U.S. Geological Survey. 2021. National Land Cover Database (NLCD) 2019 Products (ver. 2.0, June 2021): U.S. Geological Survey data release. Available online at: https://doi.org/10.5066/P9KZCM54

Esri. 2023. World Imagery. ArcGIS Resource Center. Esri, producers of ArcGIS software, Redlands, California. Available online: https://www.arcgis.com/home/webmap/viewer.html?use%20Existing=1&layers=10df2279f9684e4a9f6a7f08febac2a9

Google Earth. 2023. Map showing the location of the Oliver Wind IV Energy Center Project Area in Oliver County, North Dakota. Aerial imagery from 1985 to 2023. Available online at: https://earth.google.com/web

North Dakota Department of Water Resources (NDDWR). 2023a. ND Department of Water Resources MapService. Shaded relief LiDAR. Available online at: https://mapservice.dwr.nd.gov/

NDDWR. 2023b. ND Historical Map and Aerial Photography Dissemination Service. Available online at: https://aerial.dwr.nd.gov/

NDGFD. 2022a. Unbroken Grassland 2008. Published by NDGISHDP-GNF on September 20, 2021 and updated on December 2, 2022. Available online at: https://gishubdata-ndgov.hub.arcgis.com/maps/ce799e8e966b40a9bacf0be3c65750d2/explore

NDGFD. 2022b. Unbroken Grassland 2014. Published by NDGISHDP-GNF on September 20, 2021 and updated on December 2, 2022. Available online at: https://gishubdata-ndgov.hub.arcgis.com/maps/0107971cdc464f009be31cba01e6b97e/explore

US Department of Agriculture (USDA) Farm Service Agency (FSA) National Agriculture Imagery Program (NAIP). 2023. Imagery Programs - National Agriculture Imagery Program (NAIP). Aerial imagery from 2010 to 2021. Created June 25, 2014 and updated March 16, 2023. Available online: https://www.arcgis.com/home/item.html?id=e4da3b6720f545aeaaf3fe8141da1e21

USDA National Agriculture Statistics Service (NASS). 2022. Cropland Collaborative Research Outcomes System (CROS) data layer. Available online at: https://croplandcros.scinet.usda.gov/

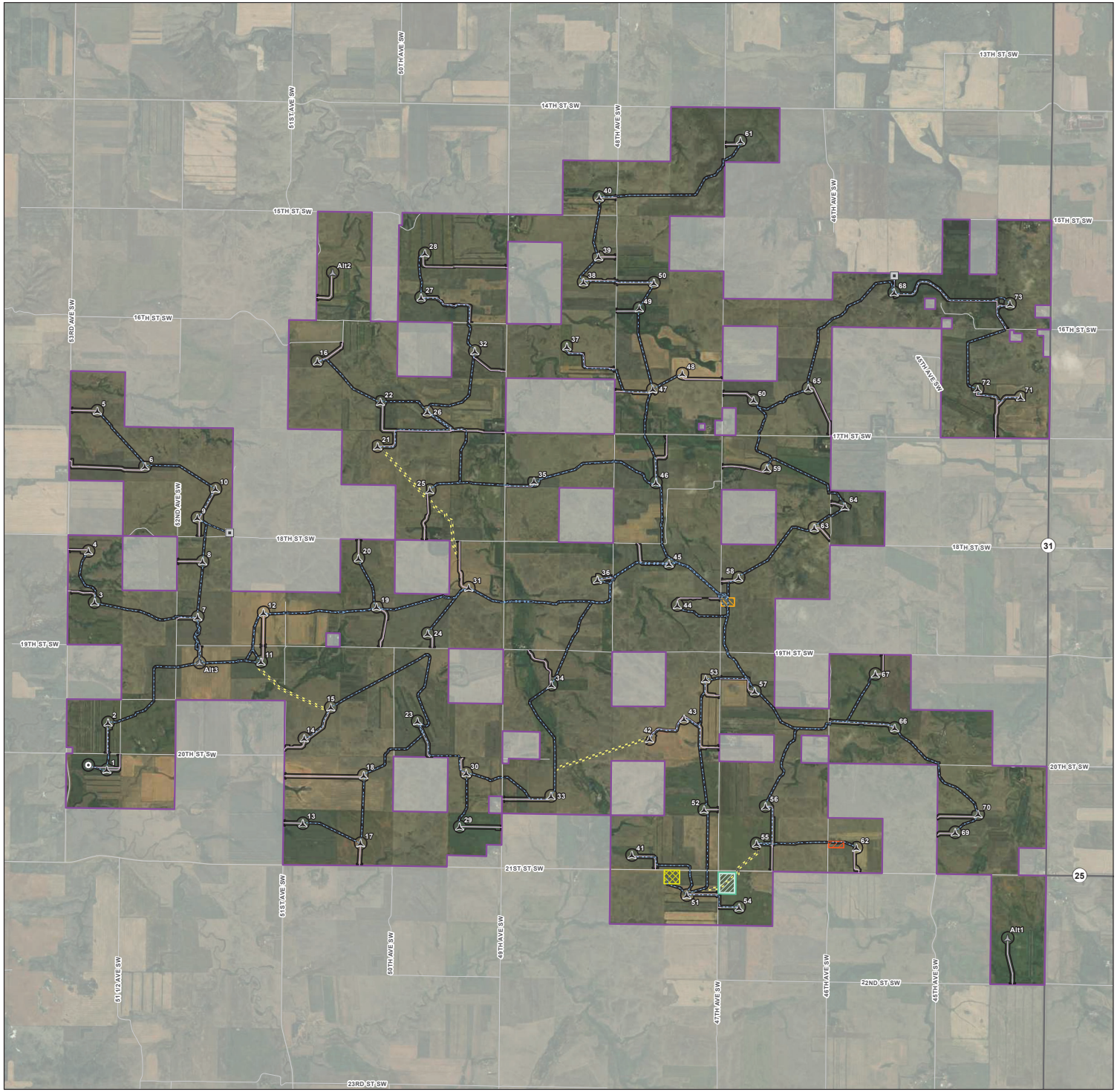
US Fish and Wildlife Service (USFWS). 2023. National Wetlands Inventory (NWI). Available online at: https://www.fws.gov/wetlands/data/mapper.html

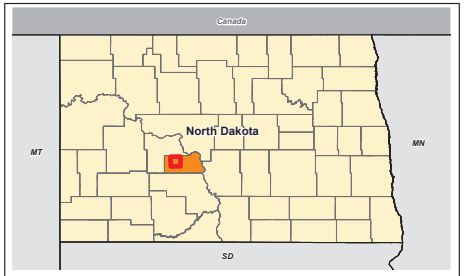
US Geological Survey National (USGS). 2019. USA Land Cover Gap Analysis Program (GAP). Available online at: https://www.arcgis.com/home/item.html?id=3a2065904112474eb1ec49bd7f61db0b#:~:text=%22National%20GAP%20Land%20Cover%20Data,areas%20of%20the%20United%20States

6.0 ACRONYMS AND ABBREVIATIONS

CROS	Cropland Collaborative Research Outcomes System
FSA	Farm Service Agency
GAP	Gap Analysis Program
GIS	Geographic Information Systems
NAIP	National Agriculture Imagery Program
NASS	National Agriculture Statistics Service
NDDWR	North Dakota Department of Water Resources
NDGFD	North Dakota Game and Fish Department
NWI	National Wetlands Inventory
Project	Oliver Wind IV Energy Center
USDA	US Department of Agriculture
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey

Figures





0 0.5 1 Miles

N

1:36,000

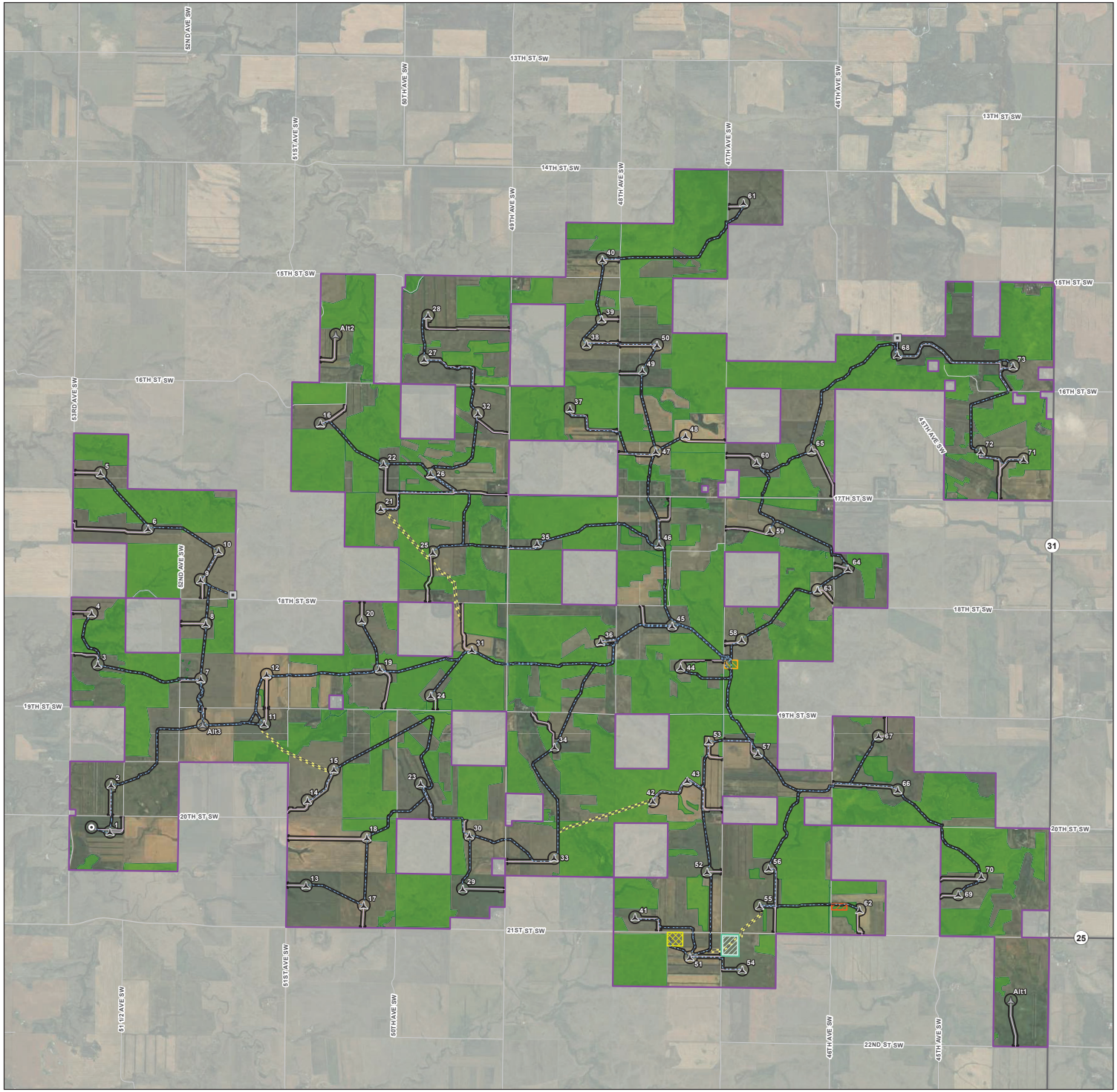
- Project Area
- Construction Easement
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Crane Path
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

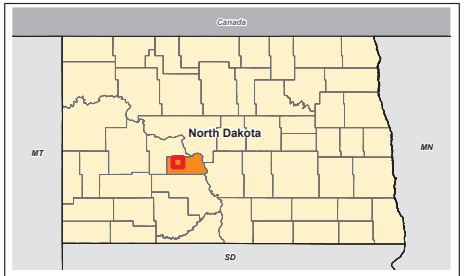
Figure 1:
Project Location

Oliver Wind IV Energy Center
Oliver County, North Dakota

Merjent

For Environmental Review Purposes Only





0 0.5 1 Miles

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1:36,000

- Project Area
- Construction Easement
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Crane Path
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road
- Unbroken Grassland

Figure 2:
Unbroken Grasslands

Oliver Wind IV Energy Center
Oliver County, North Dakota

Merjent

For Environmental Review Purposes Only

Appendix A
Representative Landscape Photographs

Photograph 1: Representative photograph of non-grassland (cropland) within the Project Area.

Photograph 2: Representative photograph of broken grassland within the Project Area.

Photograph 3: Representative photograph of unbroken grassland within the Project Area.

Appendix B6. Wetlands and Other Waters Delineation Report

WETLANDS AND OTHER WATERS DELINEATION REPORT

OLIVER WIND IV ENERGY CENTER

OLIVER COUNTY, NORTH DAKOTA

PREPARED FOR:

Oliver Wind IV, LLC
700 Universe Boulevard
Juno Beach, Florida 33408

PREPARED BY:

Merjent, Inc.
1 Main Street SE, Suite 300
Minneapolis, Minnesota 55414

SEPTEMBER 2023

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Appendix A Photographic Log

1.0 INTRODUCTION

Oliver Wind IV, LLC (Oliver Wind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC (NextEra), is proposing to construct the Oliver Wind IV Energy Center (Project) in Oliver County, North Dakota. The Project consists of up to 73 wind turbines, three alternative turbine locations, access roads, underground electrical collection and communication systems, two aircraft detection lighting systems (ADLS), a collection substation, an operations and maintenance (O&M) facility, a permanent and a temporary meteorological evaluation tower (MET tower), and temporary workspaces for a construction laydown area and a concrete batch plant.

This Wetland and Other Waters Delineation Report is in support of the Project's application to the North Dakota Public Service Commission for a Certificate of Site Compatibility.

Merjent Inc. (Merjent) delineated wetlands and other waters in support of the Project. Other waters can include, but are not limited to streams, ponds, and impoundments. The field surveys occurred from 2020 through 2023 within the survey area. The survey area is defined as the location where Project infrastructure has the potential to be sited within the Project Area. The Project Area encompasses approximately 22,291 acres in Oliver County, North Dakota. The Project infrastructure and the Project Area are shown on Figure 1. Presented in this report are the methods, results, and a summary of the wetland and other waters delineations.

2.0 METHODS

2.1 DESKTOP REVIEW

Prior to the field surveys, Merjent conducted a review of desktop resources to establish the potential location of wetlands and other waters within the Project Area. The desktop review was conducted using a variety of publicly available online mapping tools and resources, including:

- Environmental Systems Research Institute (ESRI) World Imagery aerial imagery (Esri 2023)
- Google Earth aerial imagery (Google Earth 2023)
- United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey Database (Soil Survey Staff, NRCS, USDA 2023; Figure 2)
- United States Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2023; Figure 3)
- United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) (USFWS 2023a 2023; Figure 3)

A desktop review was also conducted for lands and waters administered by the USFWS, including wetland easements within the Project Area.

2.2 FIELD SURVEY

2.2.1 Wetlands

Merjent conducted wetland field surveys within the survey area from 2020 through 2023. Wetland field survey delineations followed methodology from the United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Great Plains Region (Version 2.0) (USACE 2010). The wetland delineation process was used to document dominant vegetation, soils, and hydrology in the survey area. For a site to be considered a wetland, there must be dominance by hydrophytic vegetation, presence of hydric soils, and characteristic wetland hydrology. Under normal conditions, if a sample plot lacks any of these three criteria, it is considered upland. To determine these three variables, the field team designated paired sample plots, placed at discrete (typically less than 20 feet) distances from one another, for each wetland. One sample plot represented wetland conditions; the other sample plot represented upland conditions. Each sample plot featured a hand-dug soil pit averaging 16 inches in depth. The sample plot also included nested concentric sampling rings for vegetation cover and species identification, as follows:

- Herbaceous vegetation was identified within a 5-foot radius of the sample plot center;
- Sapling/shrub vegetation was identified within a 15-foot radius of the sample plot center; and,
- Trees and woody vines were documented within a 30-foot radius of the sample plot center.

A Wetland Determination Data Form, specific to the Great Plains Region, was completed for each paired wetland and upland sample plot. In cases where wetlands were assessed outside of the growing season, assessed during drought conditions, or when a wetland boundary was difficult to assess, Merjent conservatively mapped the wetland boundaries.

2.2.1.1 Hydrophytic Vegetation Indicators

The dominant vegetation at each sample plot was identified to species level, and each species was assigned a wetland indicator status according to the Cowardin classification system, using the Great Plains National Wetland Plant List (USACE 2020). The wetland scientist used Wetland and Aquatic Plants of the Northern Great Plains (Chadde 2019) and Weeds of the West (Whitson et al. 2009) as field references for identifying unknown plant species.

Hydrophytic vegetation, or plants likely to occur in wetlands, include those species indicated as obligate, facultative wetland, or facultative. Upland plants include all other indicators, including unlisted plants. As a general rule, for a sample plot to meet the wetland vegetation criteria, greater than 50 percent of the plants must be hydrophytes.

2.2.1.2 Hydric Soils Indicators

Soil from each soil pit was evaluated for hue, value, and chroma in each observable horizon, using Munsell Soil Color Charts (Gretag/Macbeth 2009). Each soil horizon was also checked for texture and for the presence of redoximorphic features, depleted matrix, saturation, and other specific criteria used to document hydric conditions.

2.2.1.3 Hydrology Indicators

Each sample plot was evaluated for the presence of hydrology indicators. One primary indicator is sufficient to conclude that wetland hydrology is present. In the absence of a primary indicator, two or more secondary indicators are required to conclude that wetland hydrology is present. For each wetland, hydrology was analyzed for all primary and secondary wetland indicators. Once established, the soil pits were left open a sufficient amount of time to allow the apparent high-water table, if present, to stabilize. Depth to surface water, water table, and saturation were recorded when present.

2.2.1.4 Mapping

The wetland scientist mapped wetland boundaries with a Global Positioning System (GPS) by walking the outer limit of visibly identifiable wetland vegetation between the paired wetland and upland sample plots. The field-collected data were plotted as a map layer using geographic information system (GIS) software. Additionally, the GPS was used to record the locations of the wetland and upland soil pits.

2.2.1.5 Photographs

Photographs were taken by the wetland scientist throughout the survey area during the field survey. Photographs of select wetlands that represent the wetlands throughout the survey area are provided in the photographic log in Appendix A.

2.2.2 Other Waters

Since the USACE does not have a data form for other waters for the Great Plains Region, data were collected using GPS technology and included data point locations and boundary delineations, including the ordinary high-water mark (OHWM), flow characteristics, substrate, and vegetation features.

2.2.2.1 Mapping

The wetland scientist mapped other waters with a GPS. The field-collected data were plotted as a map layer using GIS software.

2.2.2.2 Photographs

Photographs were taken by the wetland scientist throughout the survey area during the field survey. Photographs of select other waters that represent the other waters throughout the survey area are provided in the photographic log in Appendix A.

3.0 RESULTS

3.1 DESKTOP REVIEW

3.1.1 Geography and Topography

The Project Area is located in the Missouri Plateau Class IV ecoregion, which is a more detailed ecoregion for state-level applications (Bryce et al. 1996). The Missouri Plateau was largely

unaffected by glaciation and retains its original soils and complex stream drainage pattern. The landscape within the Project Area is gently rolling to flat, with elevations ranging from approximately 1,980 to 2,350 feet above sea level (Google Earth 2023).

3.1.2 Hydric Soils

Merjent acquired soils data from a USDA NRCS Web Soil Survey site-specific soil report (Soil Survey Staff, NRCS, USDA 2023; Figure 2). There are six different soil map units classified as hydric soils within the Project Area, consisting primarily of loams and silt loams. Table 3.1-1 below describes the mapped hydric soil map units within the Project Area.

TABLE 3.1-1
Hydric Soil Map Units within the Project Area

Soil Map Unit Name	Area (acres)	Percent of Project Area	Drainage Class
Harriet loam, 0 to 2 percent slopes, occasionally flooded	128.44	0.58%	Poorly drained
Parnell silt loam, 0 to 1 percent slopes	13.32	0.06%	Very poorly drained
Regan silt loam, 0 to 2 percent slopes, occasionally flooded	131.73	0.59%	Poorly drained
Regan silt loam, strongly saline, 0 to 1 percent slopes, occasionally flooded	64.53	0.29%	Poorly drained
Regan silt loam, very poorly drained, 0 to 1 percent slopes	55.74	0.25%	Very poorly drained
Tonka silt loam, 0 to 1 percent slopes	6.76	0.03%	Poorly drained
Source Soil Survey Staff, NRCS, USDA 2023			

3.1.3 Hydrology and Surface Waters

The USFWS NWI and USGS NHD were used to identify potential hydrology and surface waters within the Project Area (USFWS 2023a; USGS 2023; Figure 2). The Project Area is located within the sub-watersheds of Brady Creek, Upper Otter Creek, Middle Otter Creek, Lower Otter Creek, Kinneman Creek, and Headwaters Square Butte Creek (USGS 2023; Figure 2).

The USFWS online Wetlands Mapper tool depicts wetlands mapped as part of the NWI Program. Within the Project Area, the NWI dataset identified approximately 206.94 acres, as depicted in Figure 3 and in Table 3.1-2 below (USFWS 2023a).

The desktop review resulted in no USFWS administered lands or waters, including wetland easements, within the Project Area (USFWS 2023b).

TABLE 3.1-2
NWI Wetlands within the Project Area

NWI Type	Total Area (acres)	Percentage of Project Area
Freshwater Emergent Wetland	185.47	0.83%
Freshwater Pond	21.09	0.09%
Freshwater Forested/Shrub Wetland	0.38	>0.01%
Source USFWS 2023a		

The NHD was used to identify perennial and intermittent streams, ponds, and lakes. The online database NHD Viewer tool was queried and found intermittent and perennial streams and

lakes/ponds that crossed the Project Area, as depicted in Figure 3 (USGS 2023). Three of the features are named creeks: Brady Creek, Otter Creek, and Square Butte Creek.

3.2 FIELD SURVEY

3.2.1 Wetlands

Merjent delineated 86 wetlands, totaling approximately 223.10 acres within the survey area. Summaries of the wetlands are provided below in Table 3.2-1. Maps depicting the delineated wetlands are included on Figure 4.

TABLE 3.2-1
Summary of Delineated Wetlands within Project Area

Wetland ID	Latitude	Longitude	Figure 4, Map Page	Size (acres)
RB-08-WETLAND	-101.523882	47.142034	8	0.43
RB-A01-WETLAND	-101.484749	47.207402	13	0.17
RB-A40-WETLAND	-101.426937	47.104832	21	3.21
RB-A41-WETLAND	-101.436688	47.104776	21	0.22
RB-A46-WETLAND	-101.533583	47.194191	12	10.55
RB-A47-WETLAND	-101.544044	47.18574	12	0.02
RB-A48-WETLAND	-101.542661	47.185951	12	0.06
RB-A49-WETLAND	-101.536503	47.162483	9, 10	37.57
RB-A50-WETLAND	-101.54241	47.148414	8, 9	1.33
RB-A51-WETLAND	-101.460487	47.136925	24, 25	2.00
RB-B03-WETLAND	-101.462459	47.130802	24	0.57
RB-C01-WETLAND	-101.512005	47.194876	14	0.08
RB-C02-WETLAND	-101.515272	47.184005	14, 15	13.42
RB-C03-WETLAND	-101.531371	47.16619	9, 10	10.21
RB-C04-WETLAND	-101.530868	47.162344	9	0.42
RB-C05-WETLAND	-101.530819	47.160142	9	0.08
RB-C06-WETLAND	-101.531261	47.159361	9	0.19
RB-C07-WETLAND	-101.530522	47.159517	9	0.13
RB-C12-WETLAND	-101.508647	47.18353	14, 15	5.49
RB-C13-WETLAND	-101.539184	47.125857	7	0.02
RB-C14-WETLAND	-101.50664	47.172667	15	14.96
RB-D02-WETLAND	-101.504744	47.147648	17	12.12
RB-D03-WETLAND	-101.499856	47.14518	17	0.72
RB-D04-WETLAND	-101.490316	47.146663	17, 25	0.53
RB-D05-WETLAND	-101.522615	47.177863	15	4.45
RB-D07-WETLAND	-101.521327	47.165341	9, 16	0.81
RB-D08-WETLAND	-101.510203	47.174195	15	0.07
RB-D09-WETLAND	-101.447659	47.197757	28	0.31
RB-E04-WETLAND	-101.534453	47.152416	9	7.45
RB-E04-WETLAND	-101.529208	47.147845	8, 9	31.81
RB-E05-WETLAND	-101.506262	47.170211	15, 16	2.13
RB-E06-WETLAND	-101.503905	47.171891	15	0.00

TABLE 3.2-1
Summary of Delineated Wetlands within Project Area

Wetland ID	Latitude	Longitude	Figure 4, Map Page	Size (acres)
RB-E07-WETLAND	-101.474919	47.124668	24	8.04
RB-E08-WETLAND	-101.446431	47.112285	22	3.57
RB-F03-WETLAND	-101.517766	47.125422	18	2.59
RB-F04-WETLAND	-101.487927	47.141121	17, 25	0.03
RB-F05-WETLAND	-101.488329	47.140499	17, 25	0.04
RB-F06-WETLAND	-101.49173	47.142889	17	0.21
RB-F09-WETLAND	-101.462648	47.134689	24	0.45
RB-F10-WETLAND	-101.542144	47.157467	9	0.13
RB-G02-WETLAND	-101.515274	47.14665	17	0.01
RB-G02-WETLAND	-101.515083	47.146422	17	0.01
RB-G02-WETLAND	-101.515013	47.146602	17	0.01
RB-J01-WETLAND	-101.509312	47.166977	16	0.68
RB-K15-WETLAND	-101.527927	47.139518	8	4.11
RB-K16-WETLAND	-101.575448	47.139891	5	0.69
RB-K16-WETLAND	-101.575507	47.140566	5	0.10
RB-K17-WETLAND	-101.571976	47.124236	6	2.87
RB-K19-WETLAND	-101.52879	47.162942	9	0.37
RB-K25-WETLAND	-101.49273	47.154332	16	0.37
RB-K26-WETLAND	-101.496907	47.155101	16	2.30
RB-K28-WETLAND	-101.563482	47.177814	10, 11	0.79
RB-K28-WETLAND	-101.564356	47.177354	10, 11	0.18
RB-K28-WETLAND	-101.564232	47.178022	10, 11	0.04
RB-L06-WETLAND	-101.433163	47.105548	21	0.18
RB-L14-WETLAND	-101.464105	47.139654	25	0.14
RB-L15-WETLAND	-101.456932	47.132931	23, 24	0.23
RB-M05-WETLAND	-101.504697	47.126485	18	0.10
RB-M06-WETLAND	-101.495751	47.133484	18	0.03
RB-M07-WETLAND	-101.5263	47.133811	8	0.26
RB-M09-WETLAND	-101.475494	47.155533	26	2.61
RB-Q01-WETLAND	-101.520232	47.176791	15	0.23
RB-Q02-WETLAND	-101.501635	47.16892	16	0.02
RB-Q03-WETLAND	-101.501452	47.168131	16	1.10
RB-Q04-WETLAND	-101.502474	47.168673	16	0.02
RB-Q06-WETLAND	-101.614069	47.148764	2	1.00
RB-Q07-WETLAND	-101.563387	47.145217	4	1.47
RB-Q09-WETLAND	-101.53079	47.16209	9	0.03
RB-Q10-WETLAND	-101.528715	47.162846	9	0.33
RB-Q11-WETLAND	-101.538949	47.1622	9	0.92
RB-Q12-WETLAND	-101.475749	47.157072	26	0.67
RB-Q13-WETLAND	-101.473854	47.157226	26	0.50
RB-Q14-WETLAND	-101.440586	47.111478	22	0.56
RB-Q26-WETLAND	-101.532427	47.192251	12	0.16

TABLE 3.2-1
Summary of Delineated Wetlands within Project Area

Wetland ID	Latitude	Longitude	Figure 4, Map Page	Size (acres)
RB-Q35-WETLAND	-101.555344	47.136078	5	0.86
RB-Q36-WETLAND	-101.517794	47.165158	16	0.26
RB-Q37-WETLAND	-101.51868	47.164487	16	0.04
RB-Q38-WETLAND	-101.520191	47.164588	16	0.28
RB-Q39-WETLAND	-101.519407	47.164498	16	0.06
RB-Q52-WETLAND	-101.438315	47.122217	22	1.66
RB-Q53-WETLAND	-101.438894	47.124667	22, 23	12.06
RB-Q54-WETLAND	-101.447315	47.127705	23	6.15
RB-Q55-WETLAND	-101.454637	47.129013	23	0.64
RB-Q55-WETLAND	-101.457521	47.132426	23, 24	0.73
RB-Q56-WETLAND	-101.563616	47.18511	11	0.14
RB-Q57-WETLAND	-101.468337	47.126062	24	0.53
			Total:	**223.10**

3.2.2 Other Waters

Merjent delineated five other waters, totaling approximately 6.13 acres within the survey area. Summaries of the other waters are provided below in Table 3.2-2. Maps depicting the delineated other waters are included on Figure 4.

TABLE 3.2-2
Summary of Delineated Other Waters within Project Area

Other Water ID	Feature Name	Figure 4, Map Page	Size (acres)
RB-A04-POND	NA	9	1.67
RB-C01-STREAM	Brady Creek	12	1.41
RB-F01-POND	NA	12	0.22
RB-L01_STREAM	Unnamed tributary to Otter Creek	5	2.62
RB-L01-POND	NA	6	0.21
		Total:	**6.13**

4.0 SUMMARY

Merjent delineated wetlands and other waters in support of the Project in 2020 through 2023 within the survey area, which is defined as the location where Project infrastructure has the potential to be sited. Based on the field survey and desktop review, it is our professional opinion that 86 wetlands, totaling approximately 223.10 acres, and five other waters, totaling approximately 6.13 acres, exist within the survey area.

5.0 LITERATURE CITED

Bryce, S.A., Omernik, J.M., Pater, D.A., Ulmer, M., Schaar, J., Freeouf, J., Johnson, R., Kuck, P., and Azevedo, S.H. 1998. Ecoregions of North Dakota and South Dakota, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

Chadde, S.W. 2019. Wetland and Aquatic Plants of the Northern Great Plains: A field guide for North and South Dakota, Nebraska, eastern Montana and eastern Wyoming. San Bernardino, CA: Steve W. Chadde.

Cowardin, L.M., V. Carter V., F.C. Golet, E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service Report No. FWS/OBS/-79/31.Washington, D.C.

Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Environmental Systems Research Institute (ESRI). 2023. World Imagery. ArcGIS Resource Center. Esri, producers of ArcGIS software, Redlands, California. Available online: https://www.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=10df2279f9684e4a9f6a7f08febac2a9

Google Earth. 2023. Oliver County, North Dakota. Map showing location of Survey Area. Accessed August 2023. Available online at: https://www.google.com/earth/index.html

Gretag/Macbeth. 2009. Munsell® Soil Color Charts 2009 Revision. New Windsor, NY.

Soil Survey Staff, Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA). 2023. Web Soil Survey. Accessed August 2023. Available online at: http://websoilsurvey.sc.egov.usda.gov/.

United States Army Corps of Engineers (USACE). 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

USACE. 2020. National Wetland Plant List, version 3.5. Accessed August 2023. Available online at: https://wetland-plants.sec.usace.army.mil/nwpl_static/v34/home/home.html

United States Fish and Wildlife Service (USFWS). 2023a. National Wetlands Inventory (NWI). Accessed August 2023. Available online at: https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper

USFWS. 2023b. Fish & Wildlife Service Catalog. Geospatial Dataset. Accessed August 2023. Available online at: https://ecos.fws.gov/ServCat/

United States Geological Survey (USGS). 2023. National Hydrography Dataset. Accessed August 2023. Available online at: http://nhd.usgs.gov/data.html

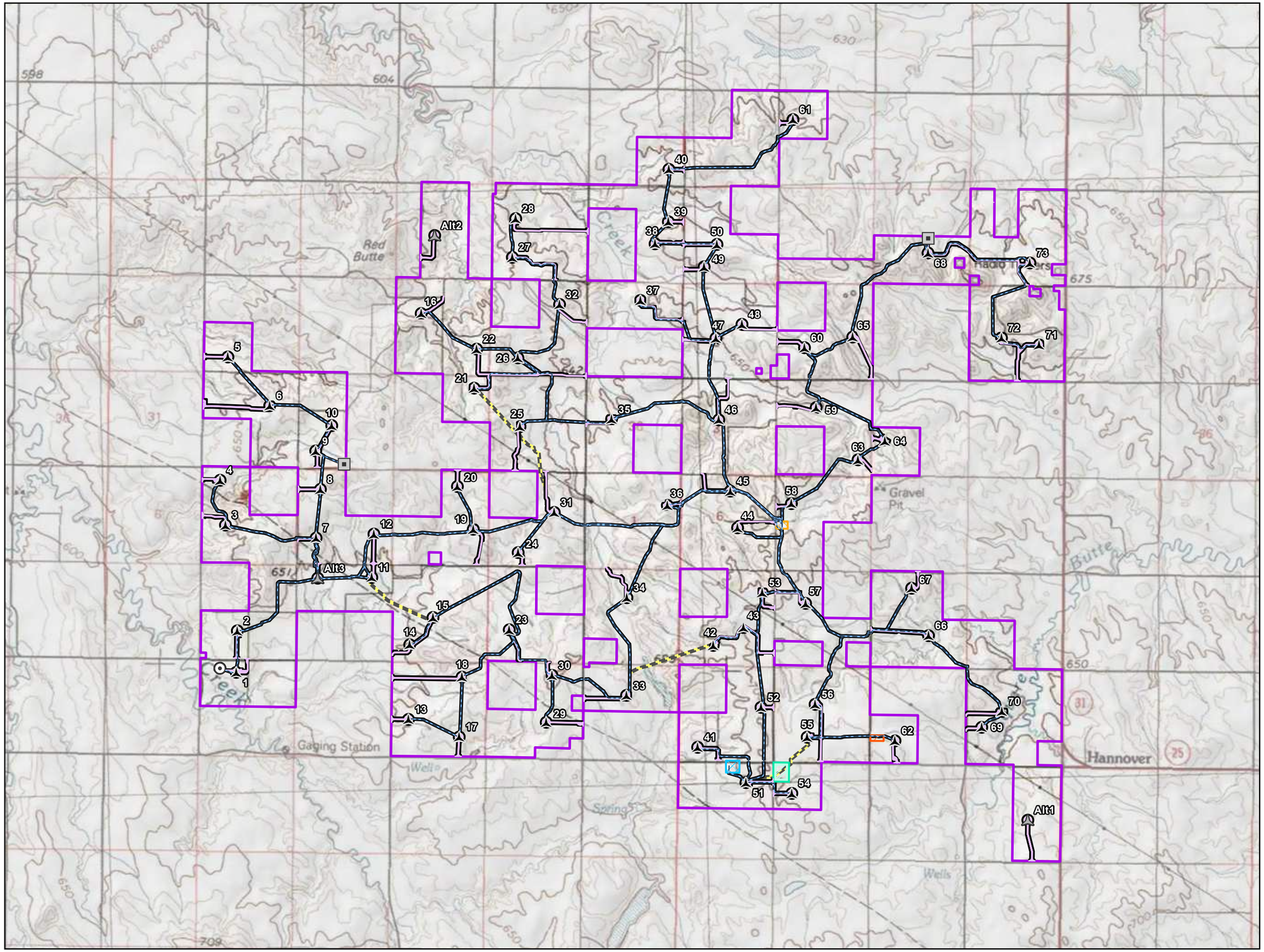
Whitson, T.D. (ed.), L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2009. Weeds of the West. Las Cruces, NM: Western Society of Weed Science in

cooperation with the Western United States Land Grant Universities Cooperative Extension Services.

6.0 ACRONYMS AND ABBREVIATIONS

ESRI	Environmental Systems Research Institute
GIS	Geographic Information System
GPS	Global Positioning System
Merjent	Merjent, Inc.
NHD	National Hydrography Dataset
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
OHWM	ordinary high-water mark
Project	Oliver Wind IV Energy Center
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Figures



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N W E S

- Project Area
- Construction Easement
- Crane Path
- O&M Building
- Substation
- Batch Plant
- Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road

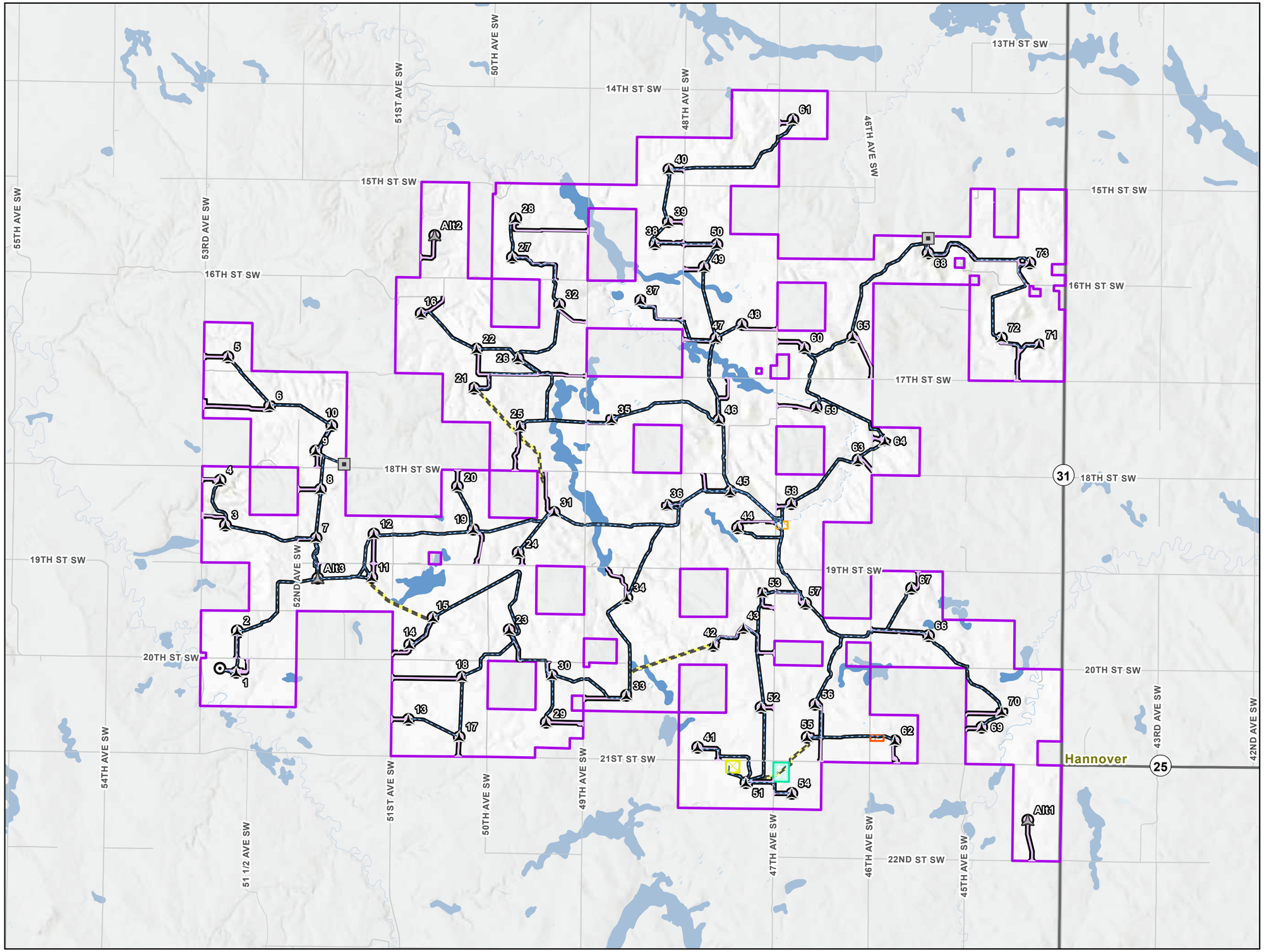
Figure 1:
Project Location
Oliver Wind IV Energy Center
Oliver County, North Dakota

Source: ZoomEarth_PNWorkforce_BuildAndDemolition_Data\DIVERsignalKit_Acc\KMZs_OW_Wind_MET_Site.kml

Date: (9/2023)

Merjent

For Environmental Review Purposes Only
Contractor Will Bore All Wetlands And Roads



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- Crane Path
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- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road
- Hydric Soil

Figure 2:
SSURGO Soils
Oliver Wind IV Energy Center
Oliver County, North Dakota

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Contractor Will Bore All Wetlands And Roads

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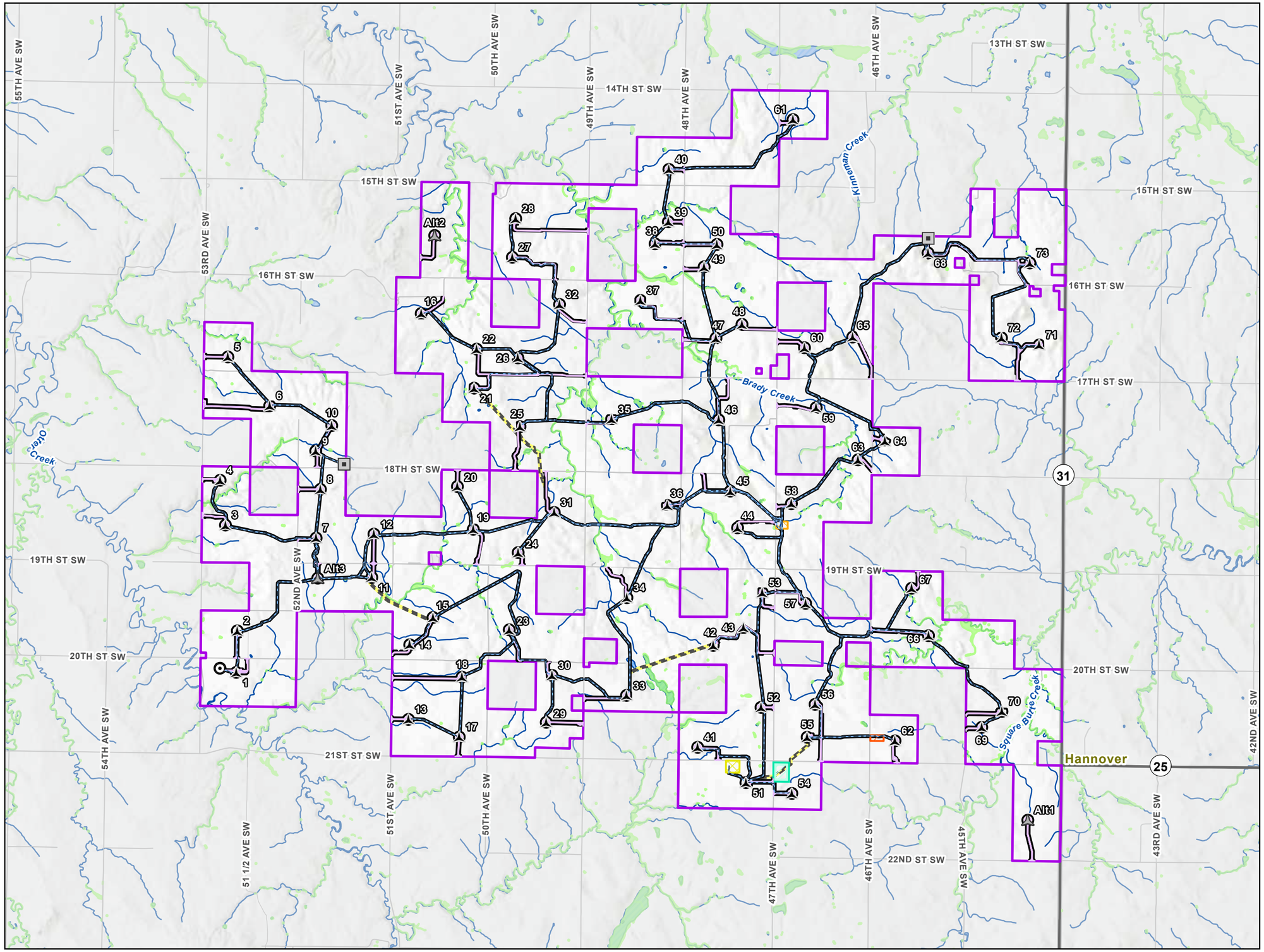

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- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- MET Tower
- ADLS Radar Tower
- Collection Line
- Access Road
- NHD Waterway
- NHD Waterbody
- NWI Wetland

Figure 3: Hydrology

Oliver Wind IV Energy Center

Oliver County, North Dakota

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Contractor Will Bore All Wetlands And Roads

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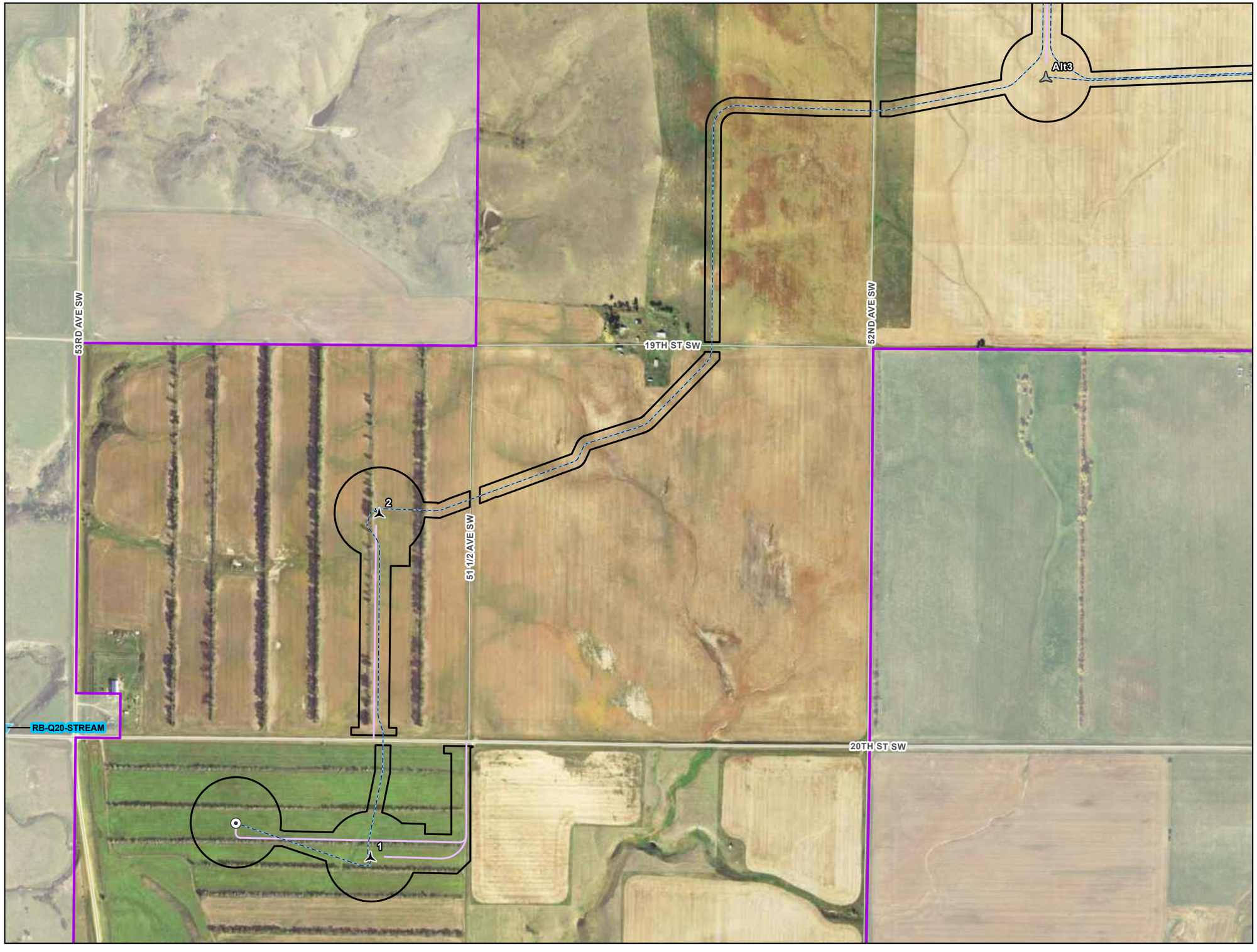

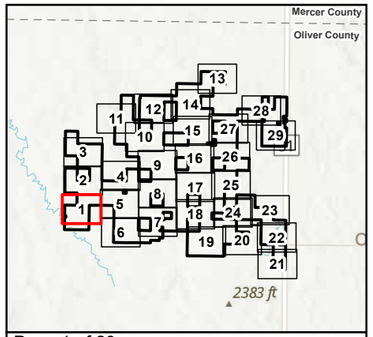

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- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
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- Alternative Turbine
- ADLS Radar Tower
- MET Tower
- Collection Line
- Access Road
- Delineated Wetland and Other Water

Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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Source: ArcGIS/M_Riveira/Red_Butte/ACCESS/Field_Data/GIS/Biological/01_MXD/Oliver_GIS_Wind_WEC_Bio.aprx
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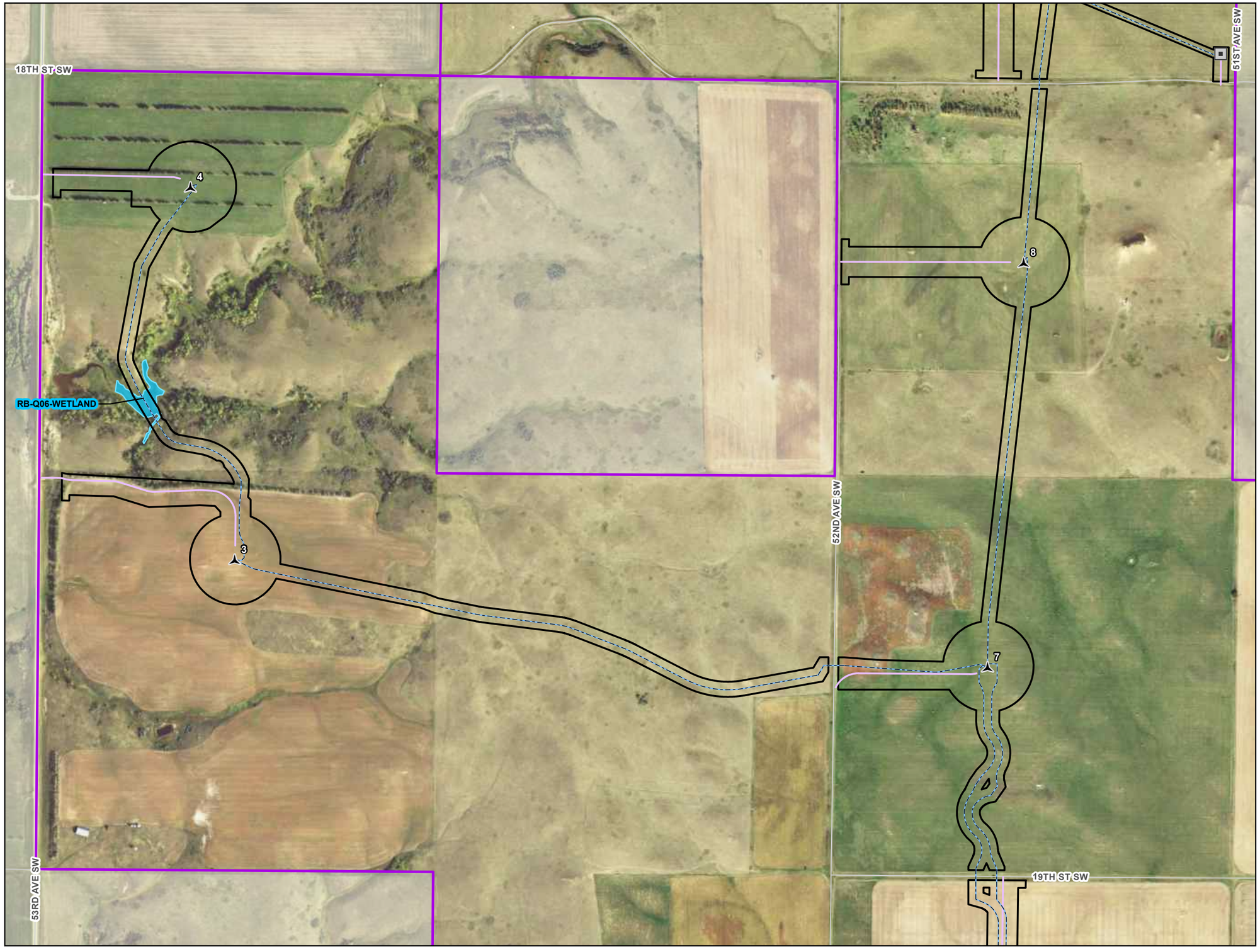

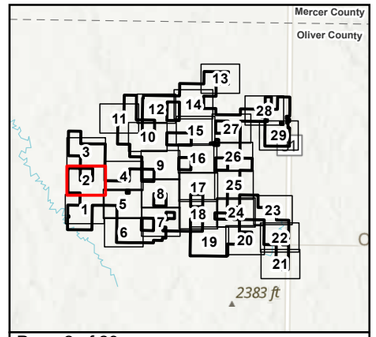

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- Delineated Wetland and Other Water

Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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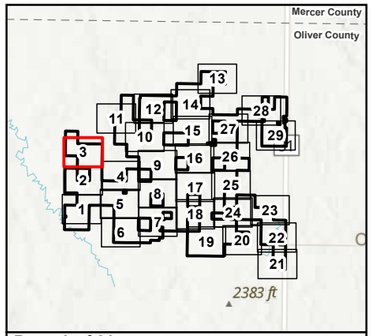

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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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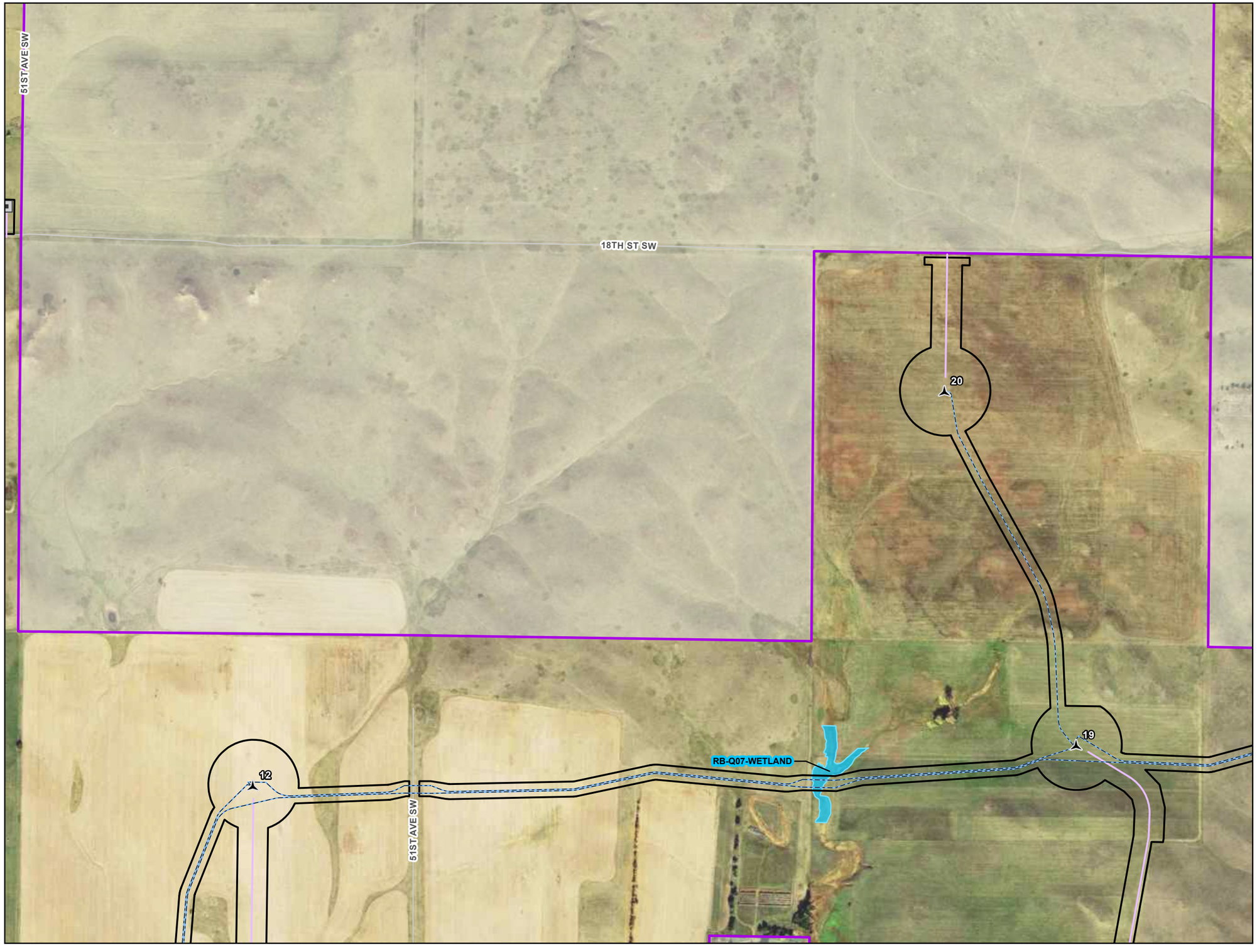

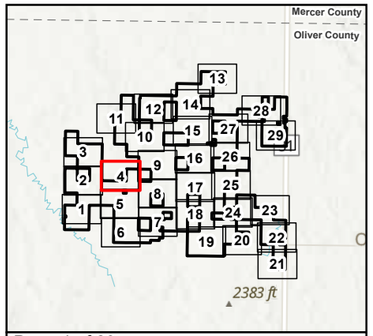

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- Delineated Wetland and Other Water

Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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For Environmental Review Purposes Only

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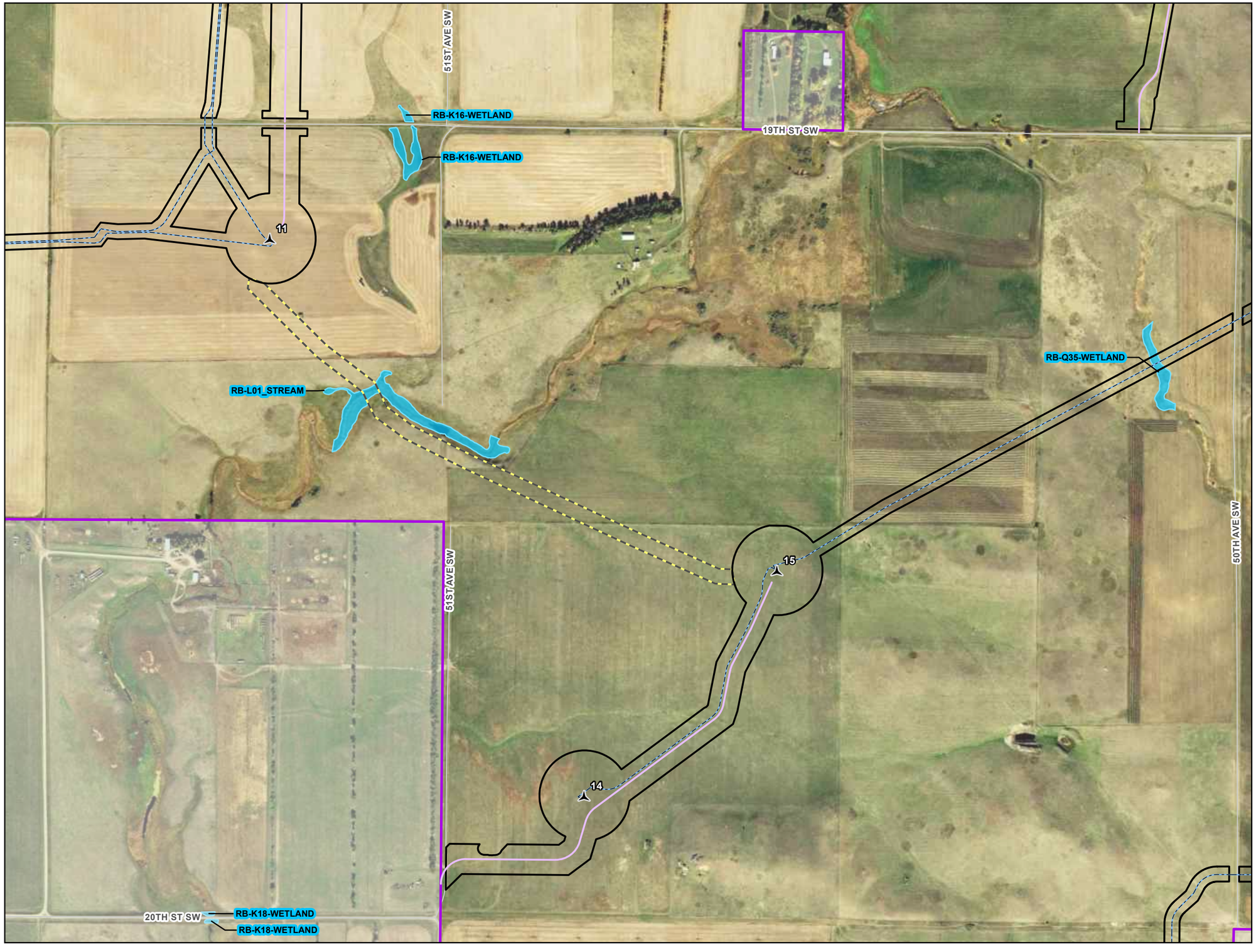

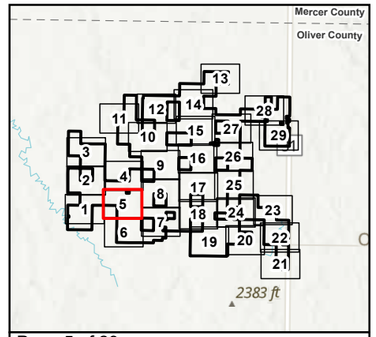

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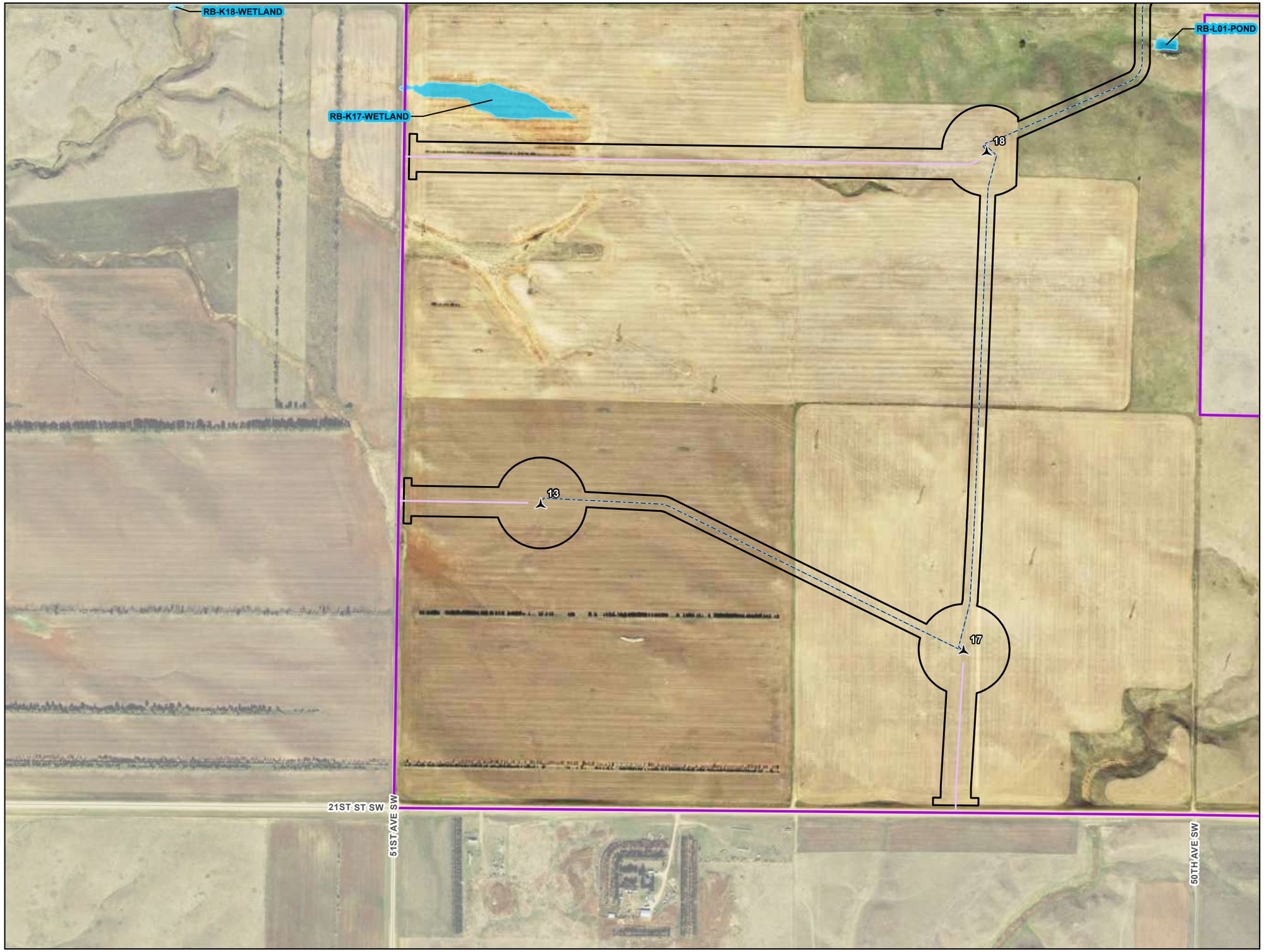
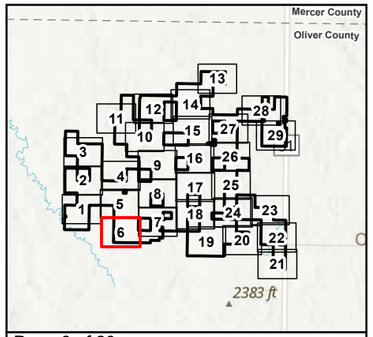
- ADLS Radar Tower
- MET Tower
- Collection Line
- Access Road
- Delineated Wetland and Other Water

Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

Source: Z:\Clients\M_P\Nextera_Butler\Maps\Oliver_Wind_IV\Data\Delineation_Area\NextEra_OW_Wind_IV_EEC_Bio.aprx
Date: (4/22/2025)

For Environmental Review Purposes Only





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- Project Area
- Construction Easement
- Crane Path
- O&M Facility
- Collection Substation
- Concrete Batch Plant
- Construction Laydown Yard
- Primary Turbine
- Alternative Turbine
- ADLS Radar Tower
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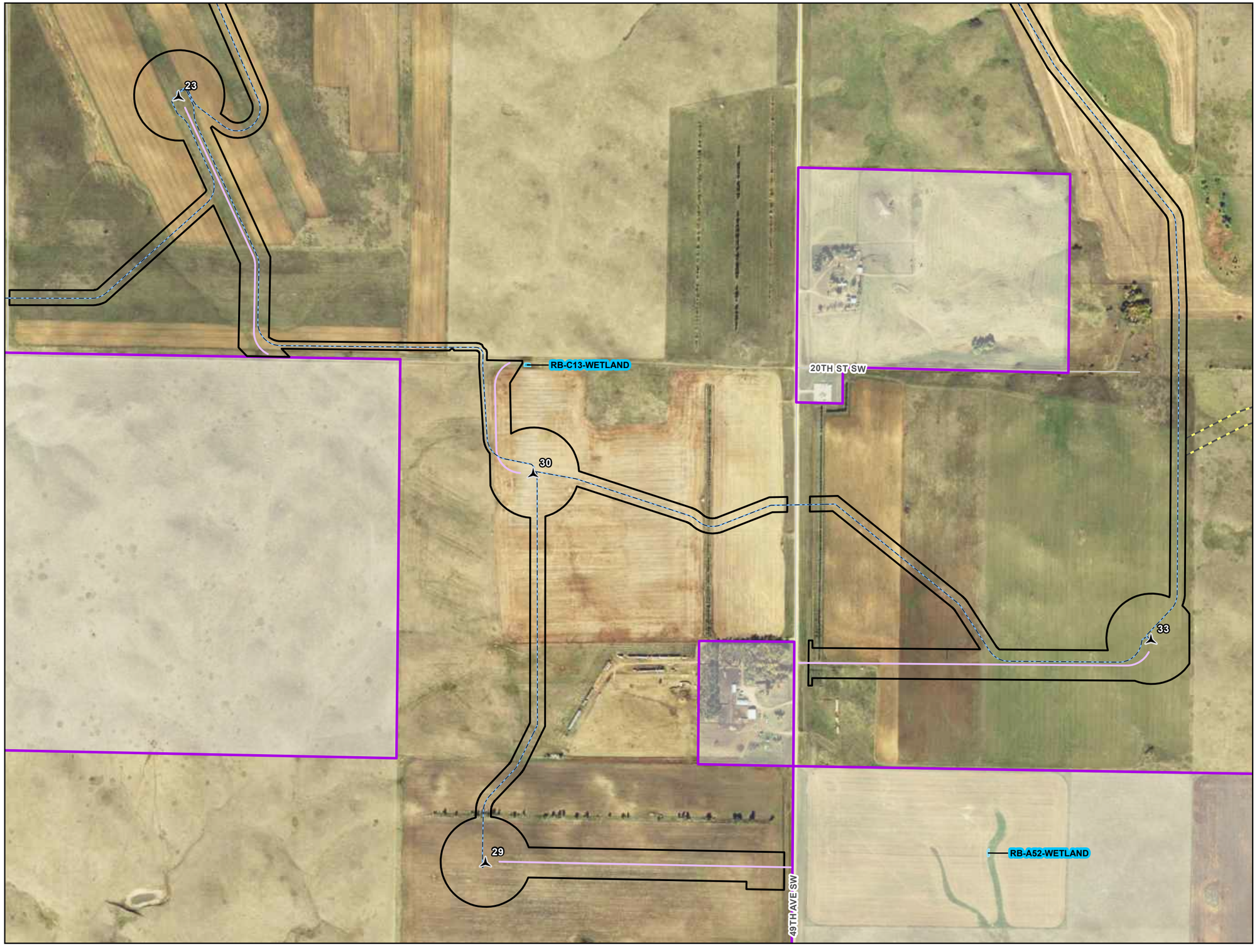
- Collection Line
- Access Road
- Delineated Wetland and Other Water

Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

Source: ArcGIS/NAIP_PhotoExtract_Buffer/ArcGIS/Hosted_Data/OIV/Background/01_ArcPro/NewEra_OIV_Wind_MEC_Pro.aprx

Date: (9/2/2022)

For Environmental Review Purposes Only



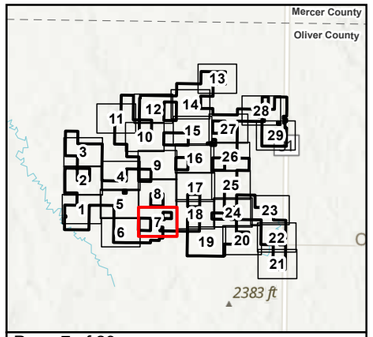


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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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For Environmental Review Purposes Only

Source: Z:\Clients\...\Revised_Route\ArcGIS\Field_Data\ON\Biological\01_Archive\Notice_ON_Wind_WEC_Bio.aprx
Date: (6/2/2023)

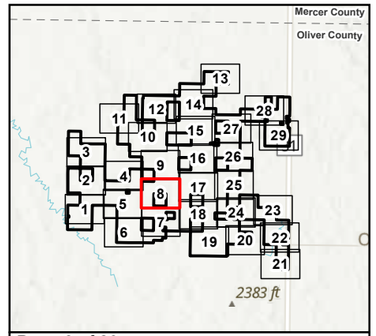

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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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For Environmental Review Purposes Only

Date: (5/6/2025) Source: Z:\Clients\M_P\NextEra\GIS_Data\ArcGIS\Wind_Data\OliverWind\Projects\001_AVEPO\MXDs\Fig_OW_Wind_WEC_Bio.aprx

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RB-A49-WETLAND
RB-A49-WETLAND
RB-C03-WETLAND
RB-D07-WETLAND
RB-Q10-WETLAND
RB-K19-WETLAND
35
RB-C04-WETLAND
RB-Q11-WETLAND
RB-Q09-WETLAND
25
RB-C05-WETLAND
RB-C06-WETLAND
RB-C07-WETLAND
RB-A49-WETLAND
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49TH AVE SW
18TH ST SW
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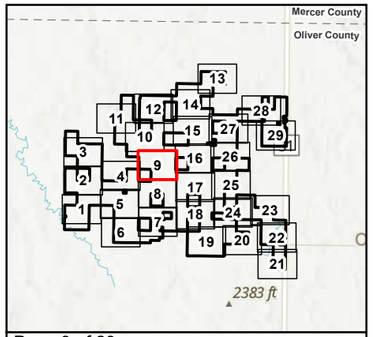

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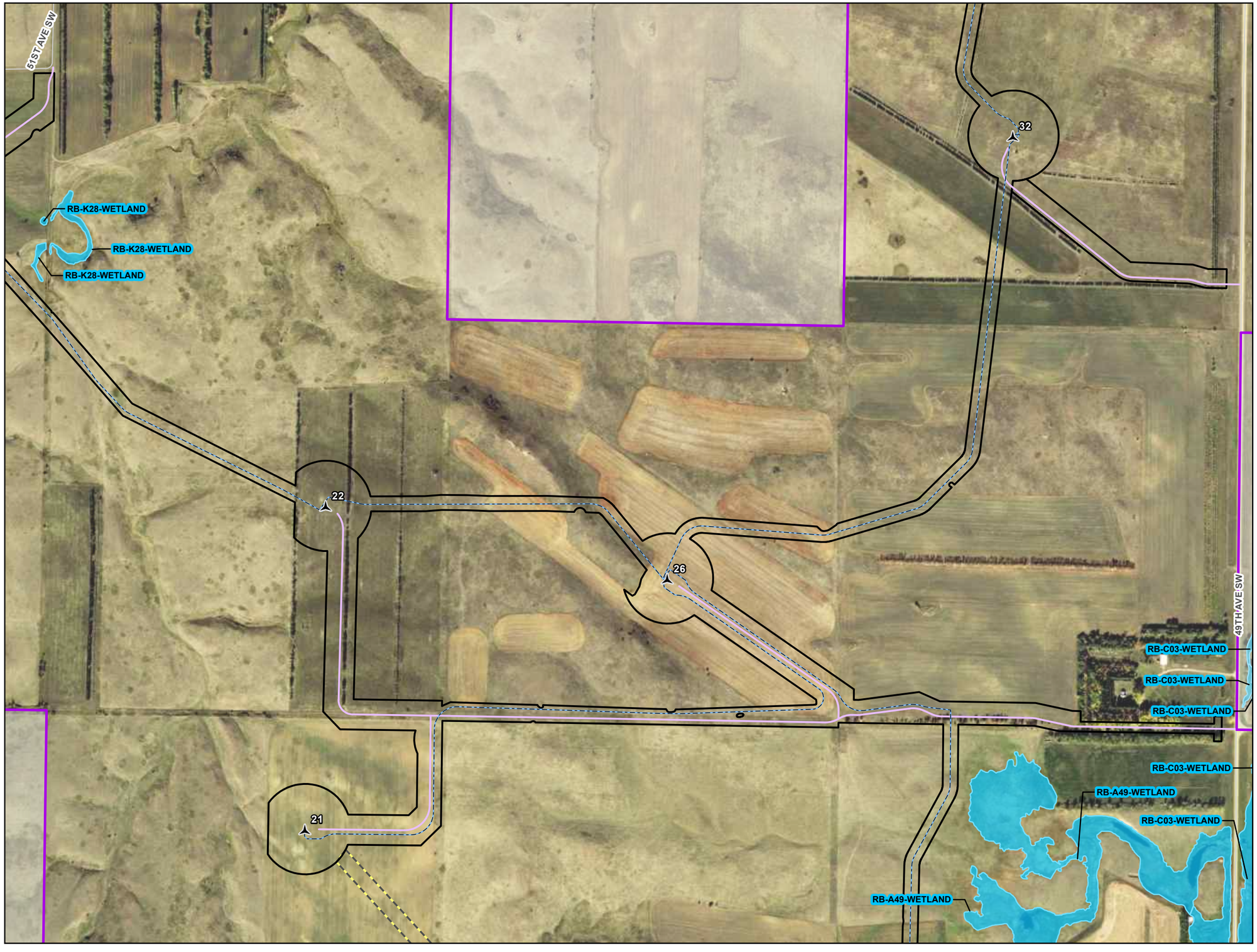
Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

For Environmental Review Purposes Only

Source: ArcGIS/M_PW/Projects/Post_Build/Oliver/Wind_Data/OliWind/gis/mxd_ArcPro/MxdEra_OliV_Wind_WEC_Bio.aprx
Date: (9/6/2022)



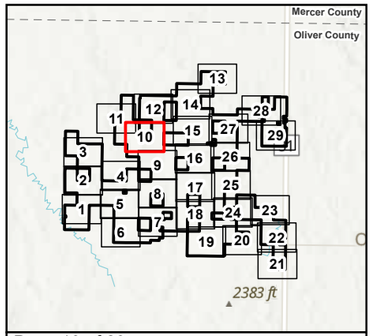


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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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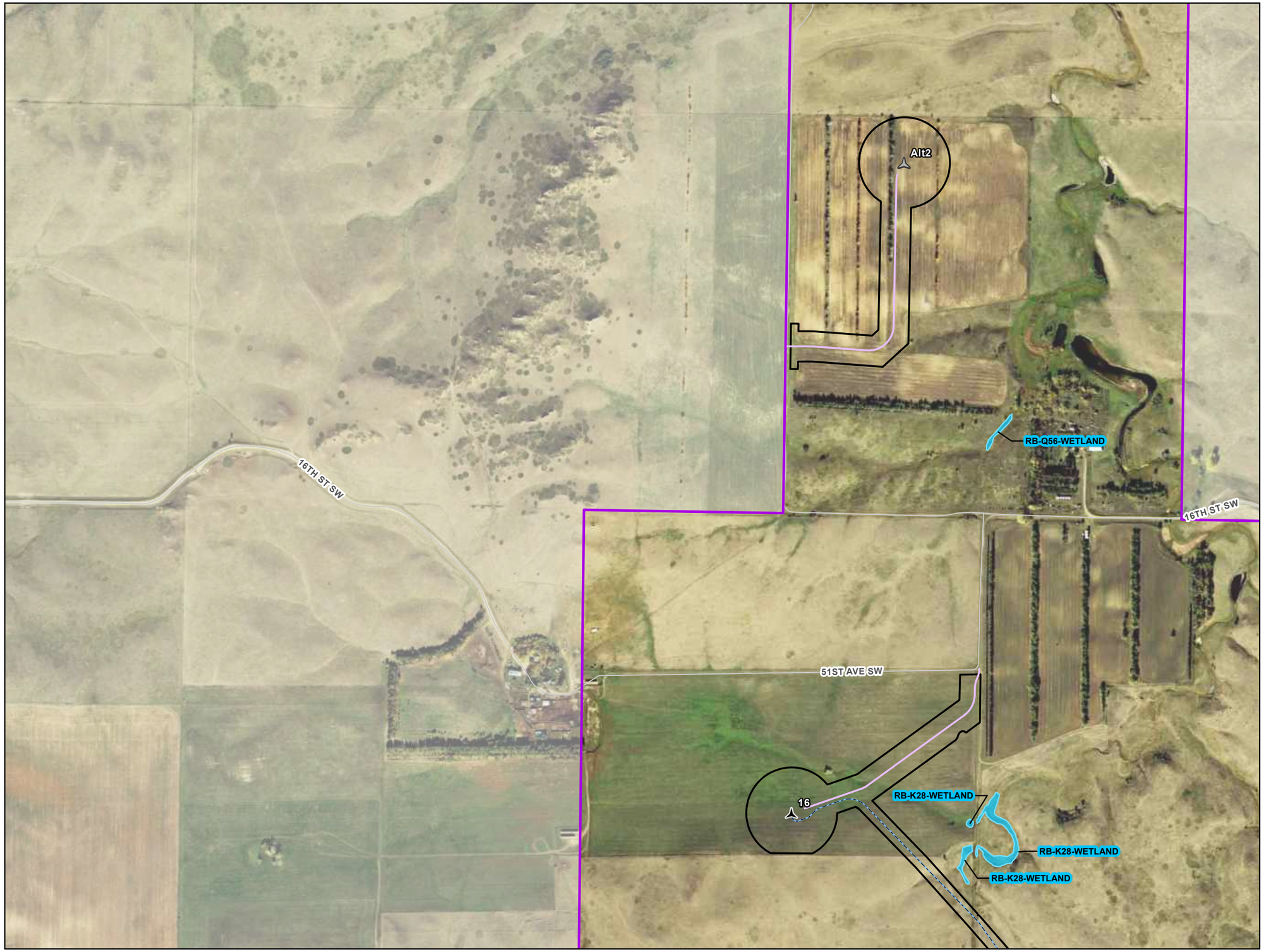
For Environmental Review Purposes Only

Date (6/5/2025) Source: Z:\Clients\...\Project\Oliver_Wind_IV\Maps\Oliver_Wind_IV_Delineated_Wetlands_Figure_4.mxd



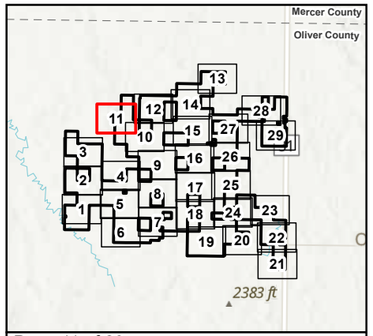


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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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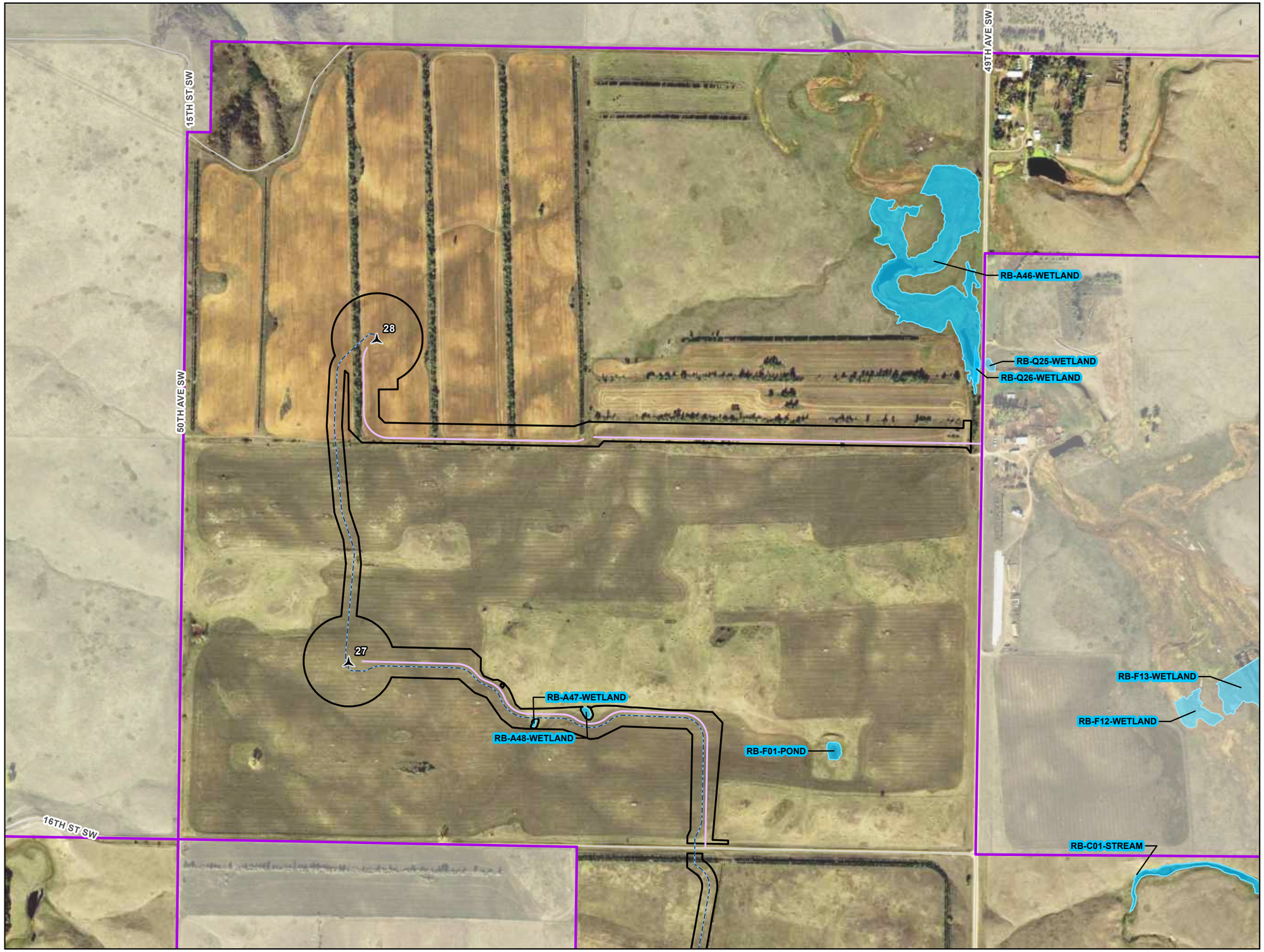
Sources: Z:\Clients\M_P\WatfordCity_SolarArcGISProject_Data\OliverWind\Biological\01_Maps\Project\Figure_OW_Wind_WEC_Bio.aprx
Date: (8/6/2025)



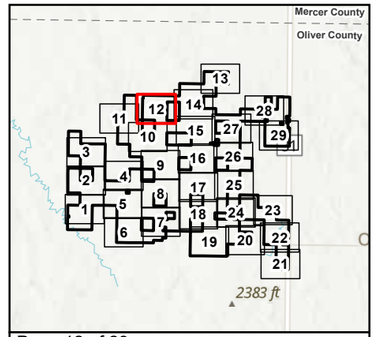


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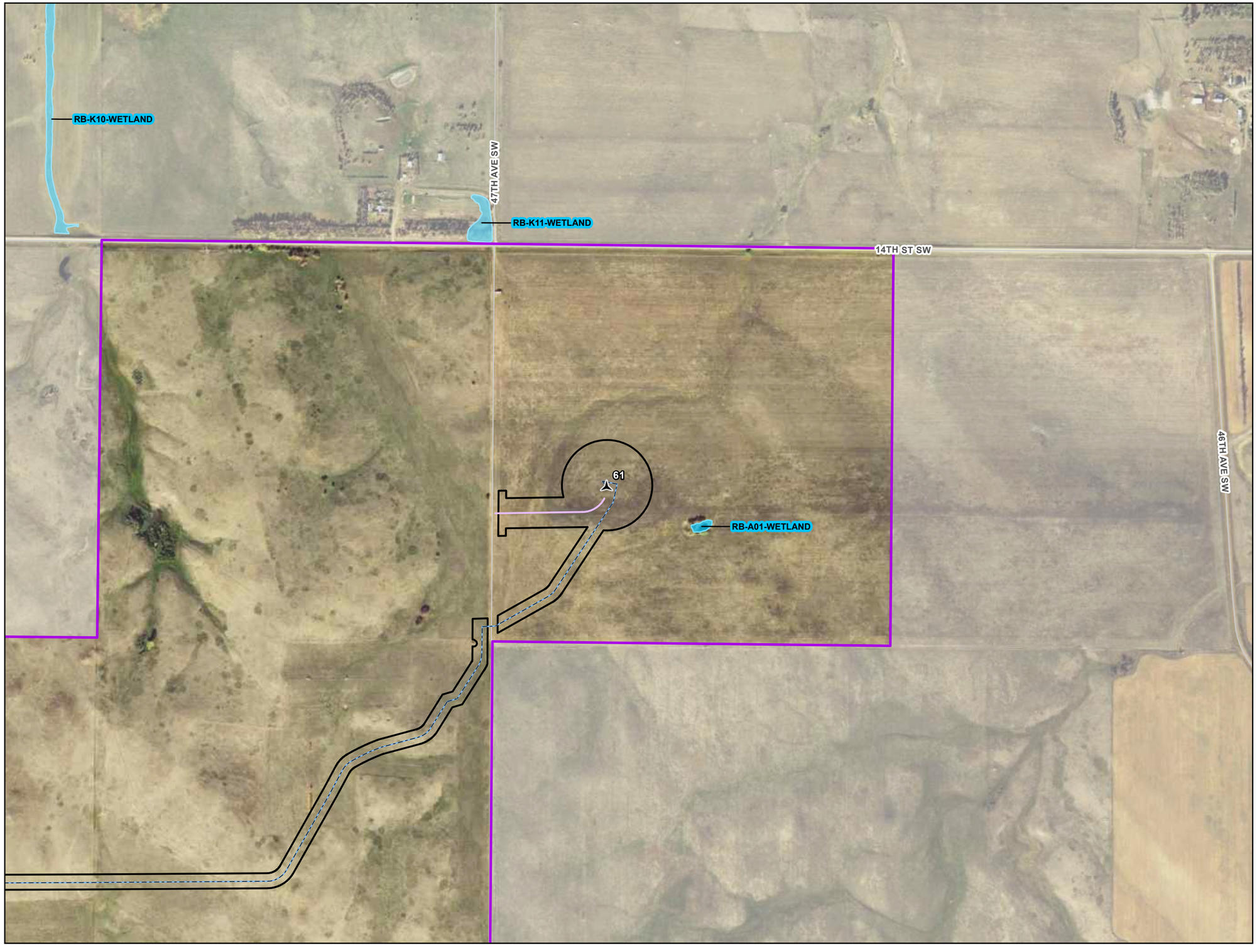
Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

Source: ArcGIS/NAIP, PWA/Esri/Esri_Burbio/ArcGIS/Field_Data/OV/Biological/01_ArcPro/MxDs_OV_Wind_WEC_Bio.aprx

Date: (9/9/2022)

For Environmental Review Purposes Only



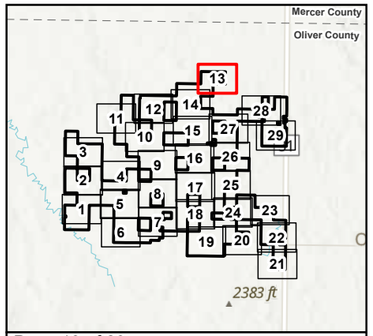


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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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Source: ArcGIS/NAIP; Project Area/Access Road_Data/GIS/Shapefiles/01_Active/Oliver_OIV_Wind_WEC_Bio.aprx
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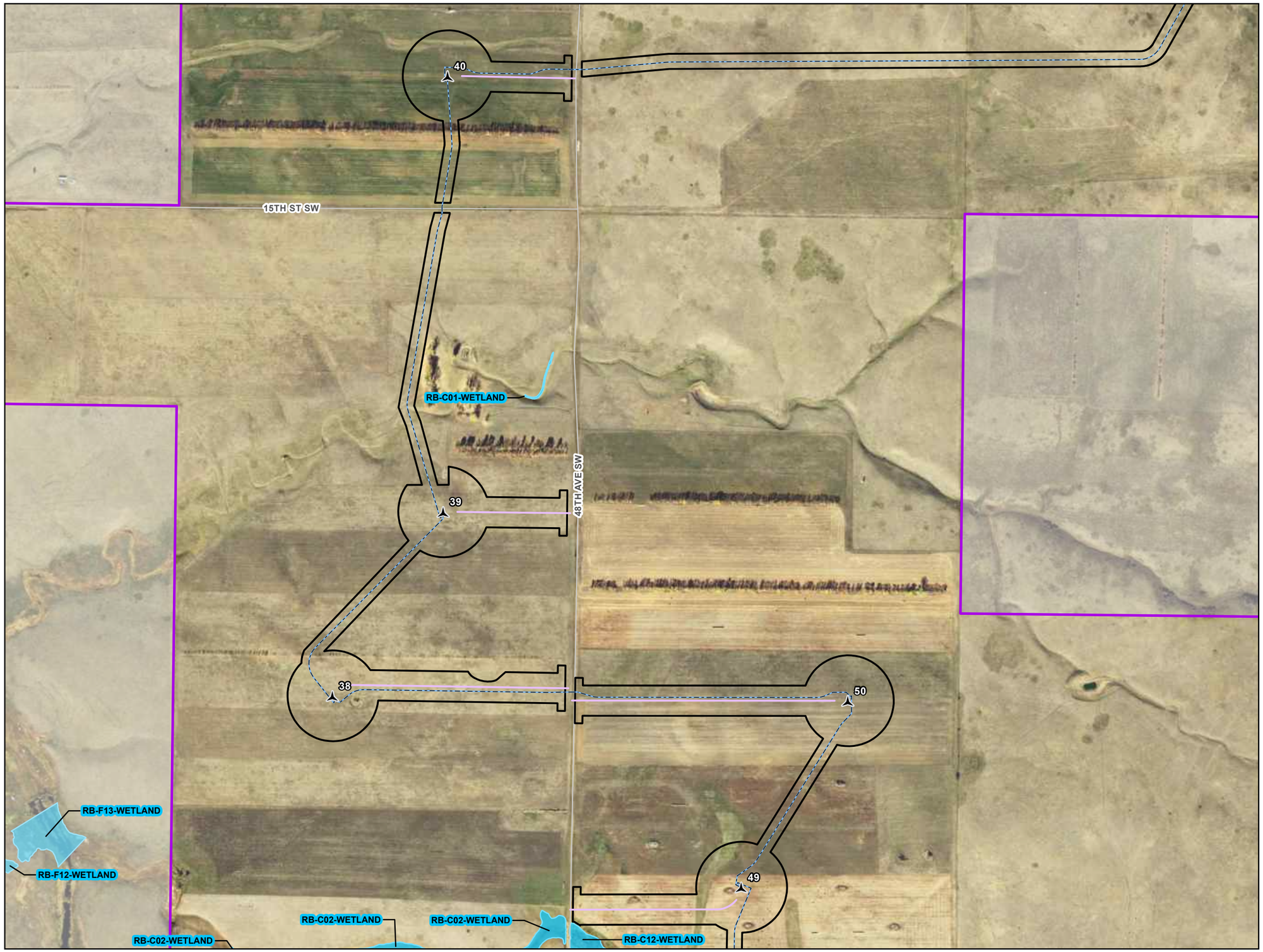

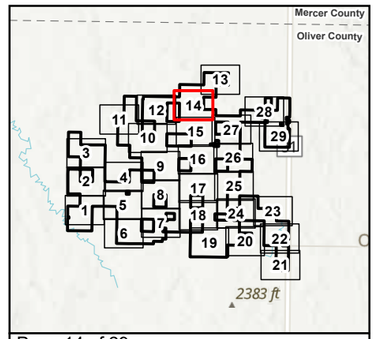

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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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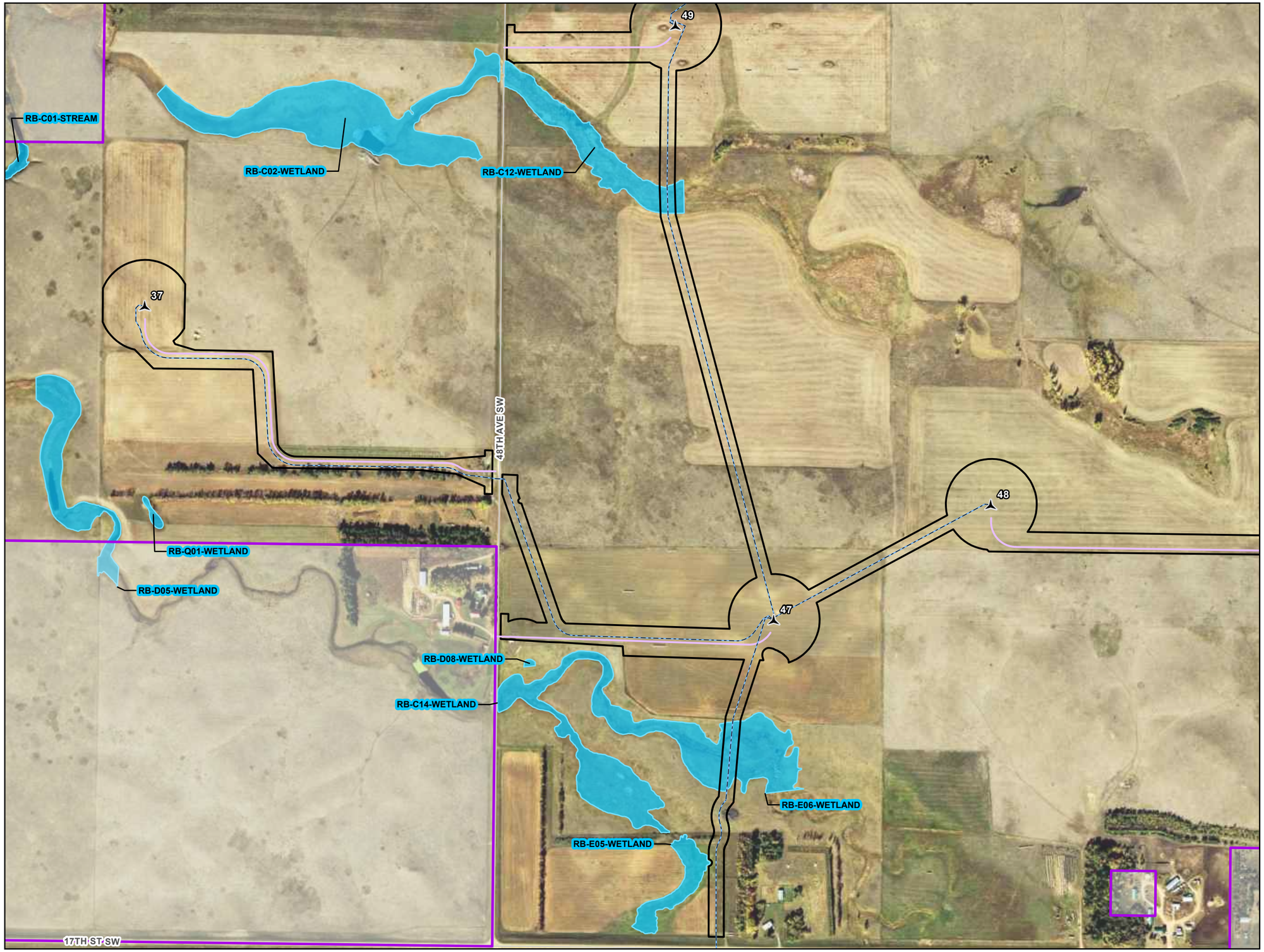
Source: Z:\Clients\MI_PN\Maps\Post_Build\MXD\Post_Build_OliverWind_Biological01_ArcPro\NextEra_OW_Wind_WEC_Bio.aprx
Date: (8/6/2020)



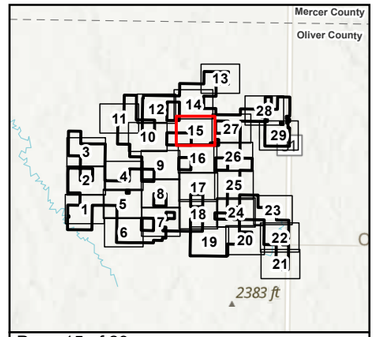


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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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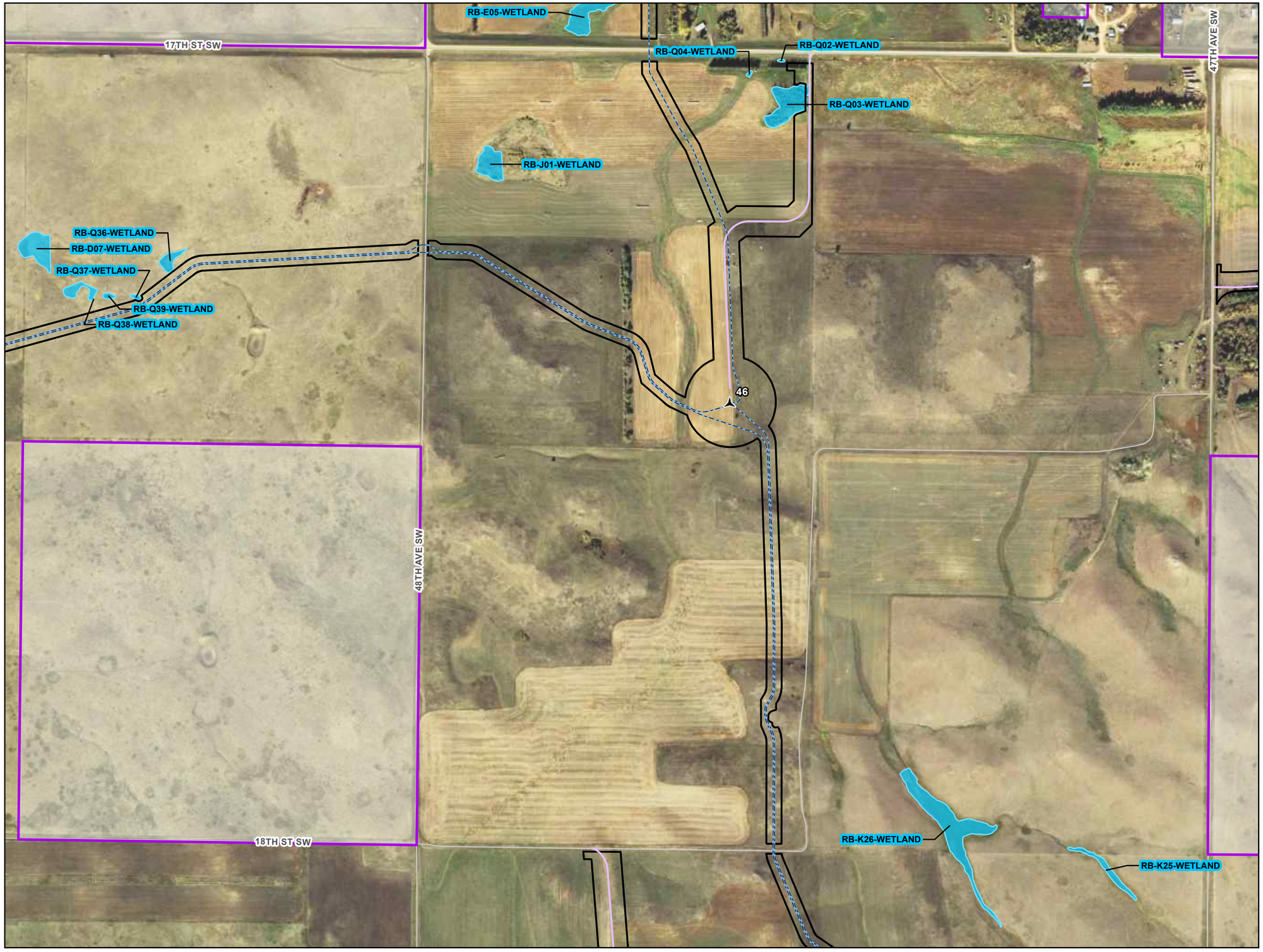
For Environmental Review Purposes Only

Source: Z:\Clients\NJ_PW\Maps\Post_Build\MXD\Post_Build_OIV\Biological\001_ArcPro\Fig4_OIV_Wind_WEC_Bio.aprx
Date: (8/6/2025)



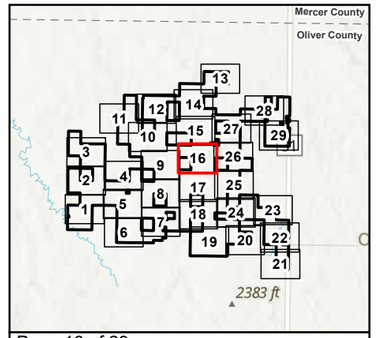


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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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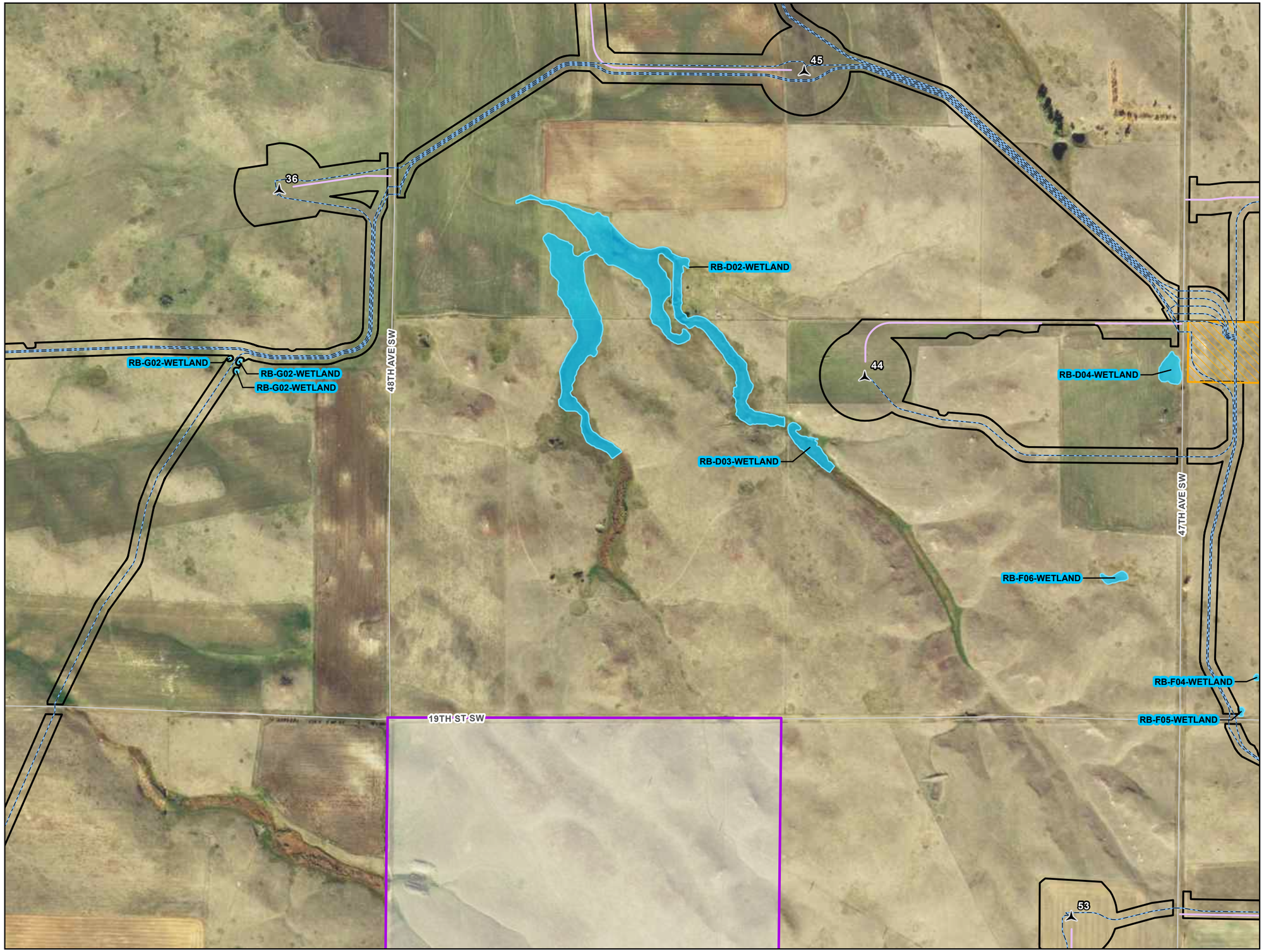
For Environmental Review Purposes Only

Source: ArcGIS/M_Wetlands/Red_Basin/ArcGIS/Red_Basin/GIS/Biological/MXD_Archive/Figure_OW_Wind_WEC_Bio.aprx
Date: (8/2/2023)



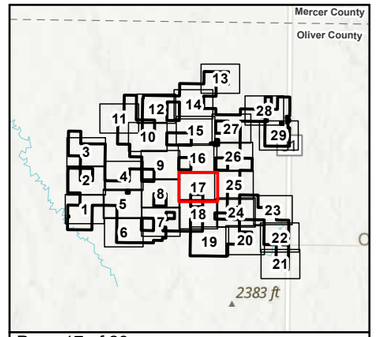


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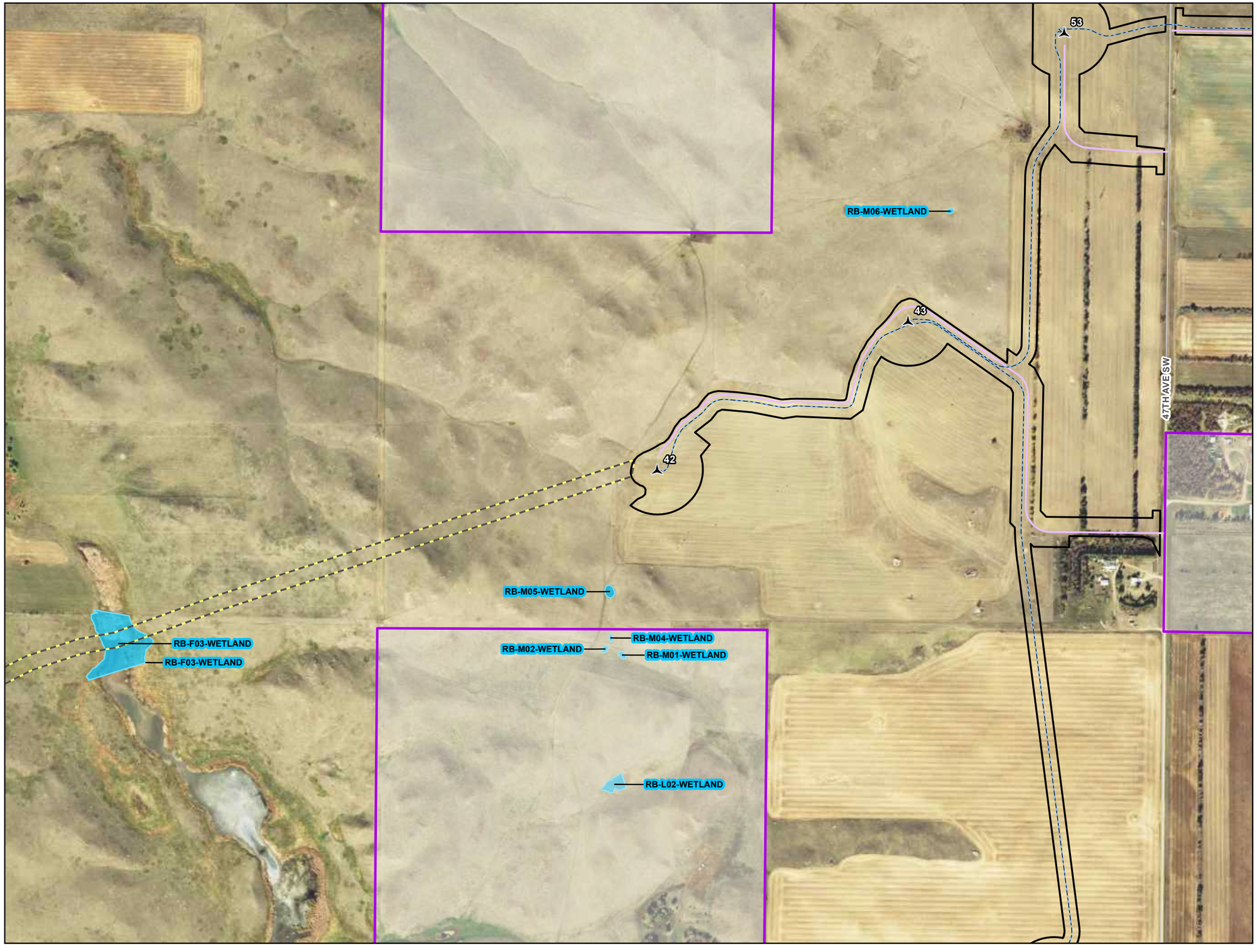
Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

For Environmental Review Purposes Only

Source: ArcGIS/USA_Topo_Maps; Date: (8/8/2022); Path: Z:\Clients\M_P\Oliver Wind_Burns\ArcGIS\Mxd_Data\OliverWind_ArcProMxds\Fig4_OW_Wind_WEC_Bio.aprx



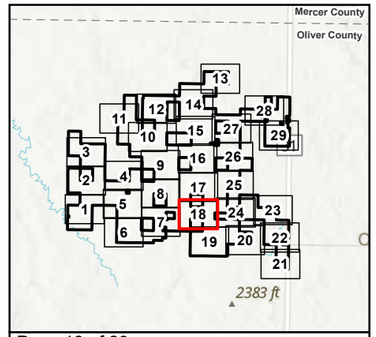


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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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For Environmental Review Purposes Only

Source: ArcGIS/M_Pineda/Red_Butte/ACCESS/Field_Data/ON/Biological/01_Archive/Maps_ON_Wind_WEC_Bio.aprx
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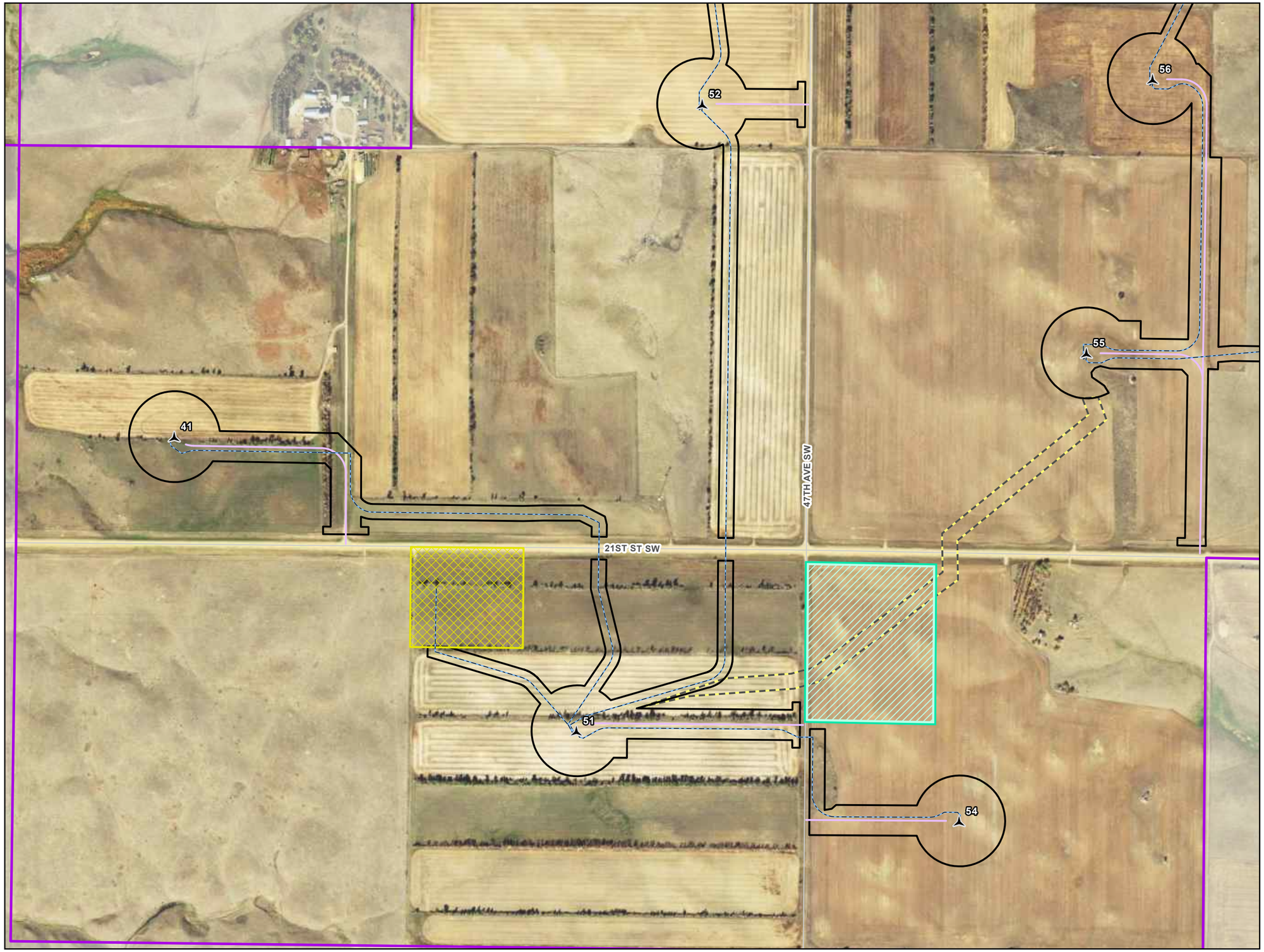

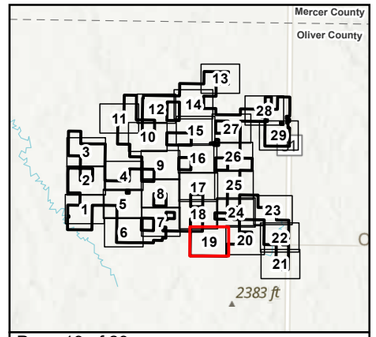

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Figure 4:
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Oliver Wind IV Energy Center
Oliver County, North Dakota

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For Environmental Review Purposes Only

Date: (9/2/2025) Source: Z:\Clients\M_P\NextEra\Post_Build\Oliver\Shared_Data\OIV\Figures\mxd_Arc\PrjNextEra_OIV_Wind_PEC_fig4.aprx

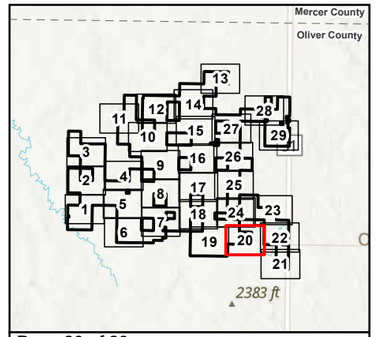

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Figure 4:
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Oliver Wind IV Energy Center
Oliver County, North Dakota

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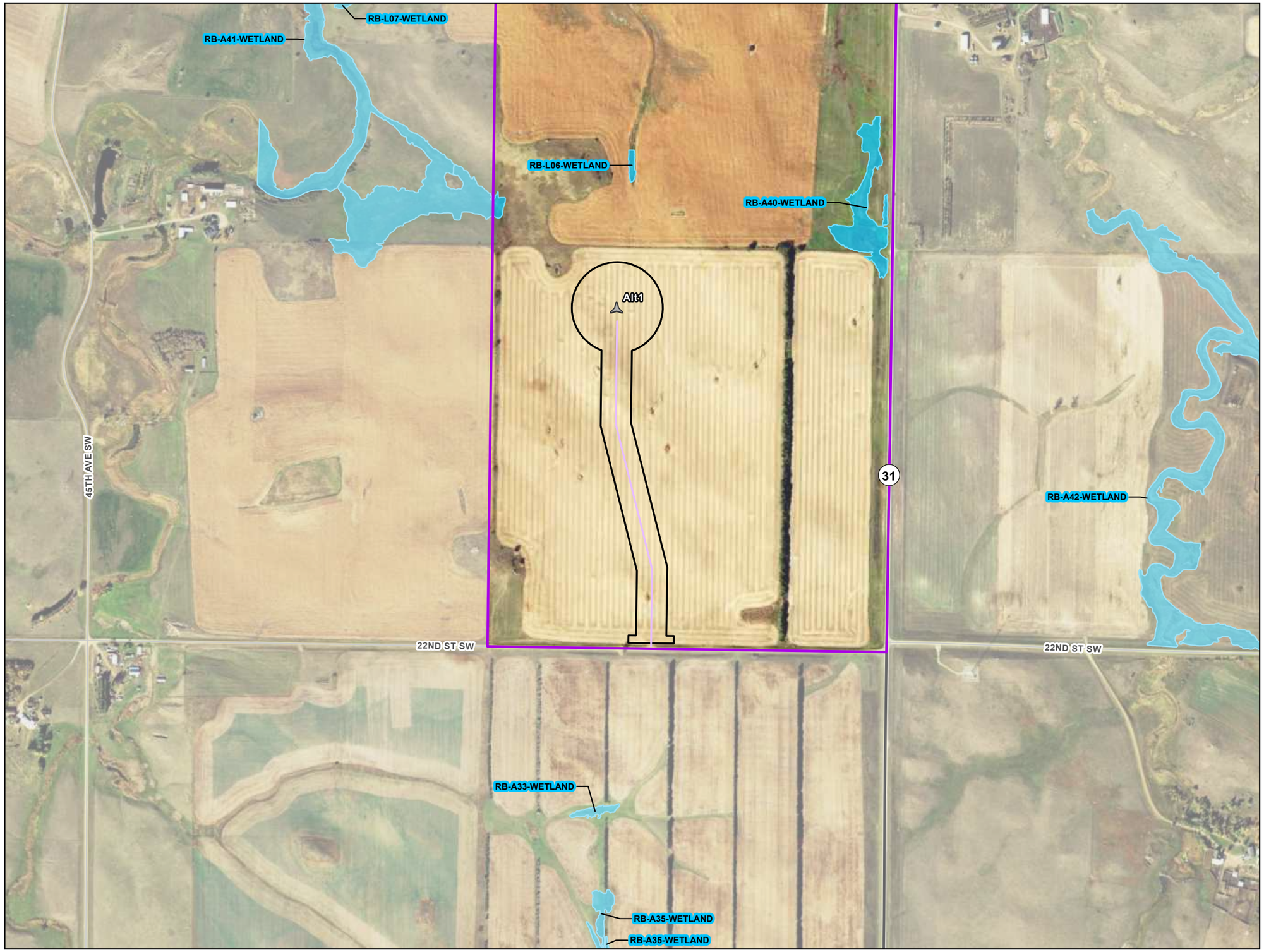
For Environmental Review Purposes Only

Date: (9/2/2025) Source: Z:\Clients\M_P\Western Area Power Admin\Oliver Wind IV\GIS\Project\Biological\MXD\Wetlands\Fig4_OWIV_Wetlands_Waters_WEC_Bio.aprx



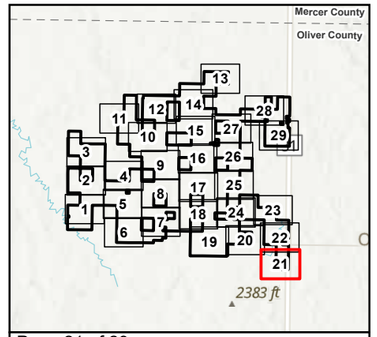


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Figure 4:
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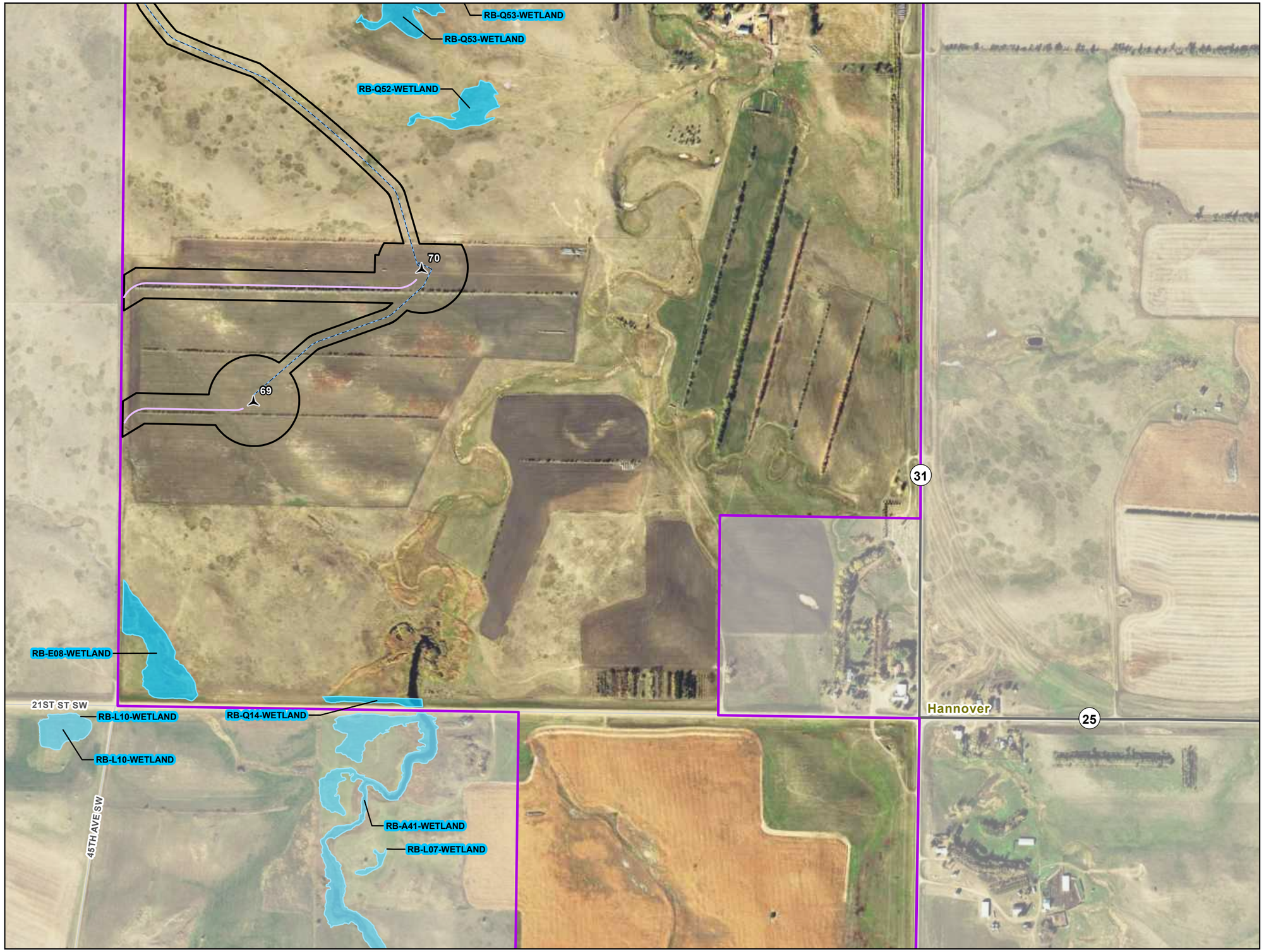
Oliver County, North Dakota

For Environmental Review Purposes Only

Source: ArcGIS/NAIP_PY\Wetlands\Buffer\Added\Final_Data\OVBiological\01_ArcPro\MapFig_OW_Wind_IV_EC_Bio.aprx
Date: (8/20/2025)



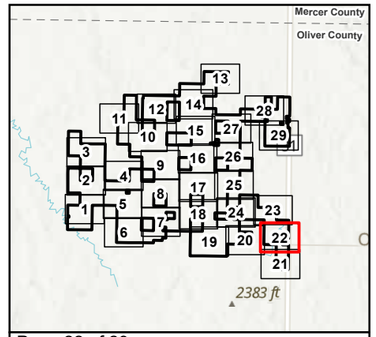


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Figure 4:
Delineated Wetlands and Other Waters
Oliver Wind IV Energy Center
Oliver County, North Dakota

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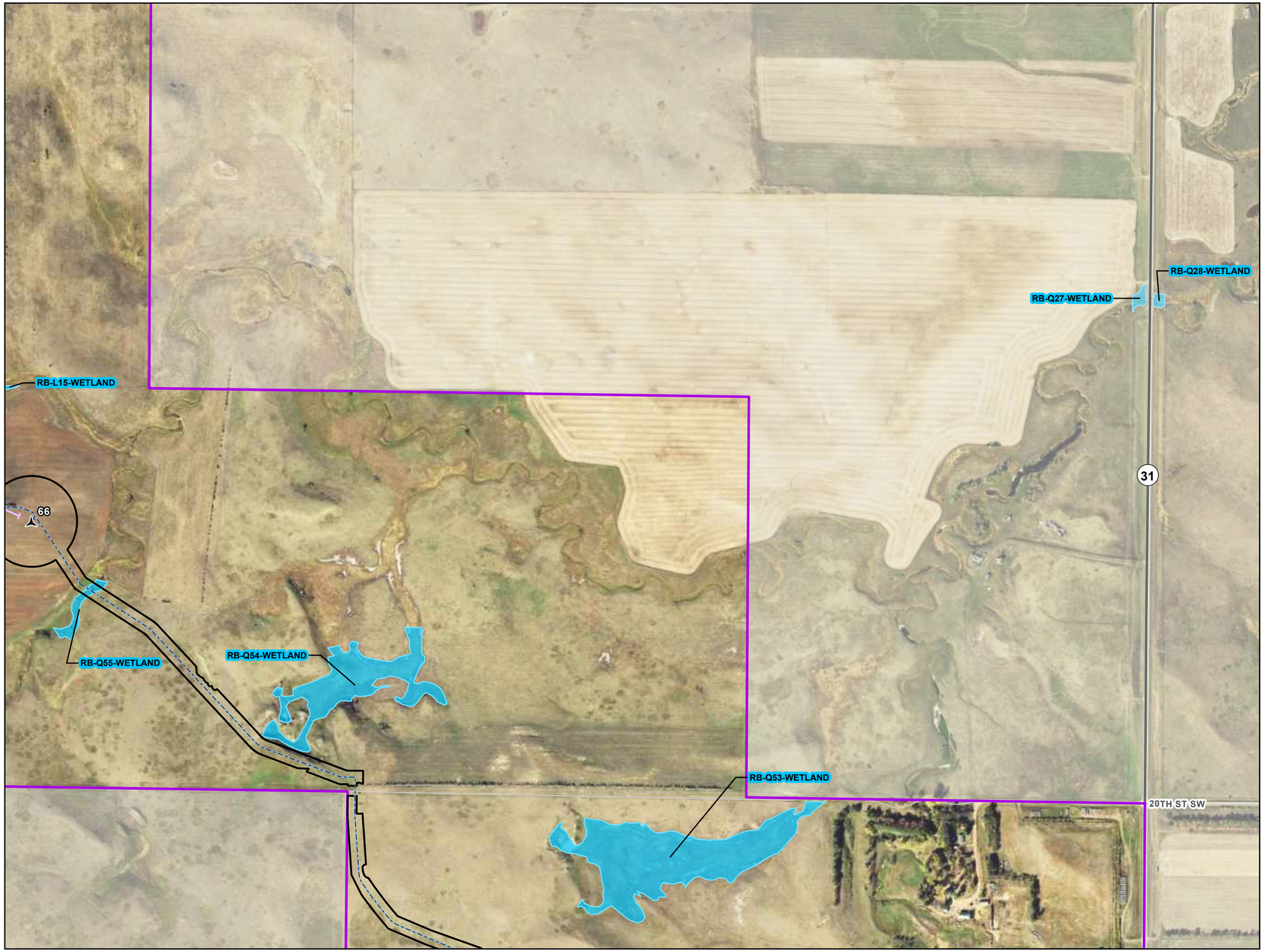

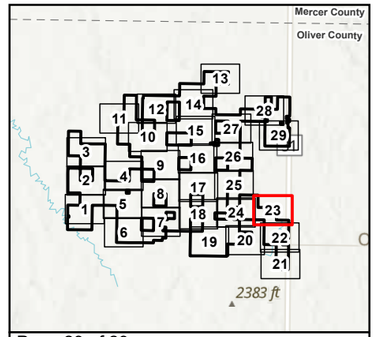

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Figure 4:
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Oliver Wind IV Energy Center
Oliver County, North Dakota

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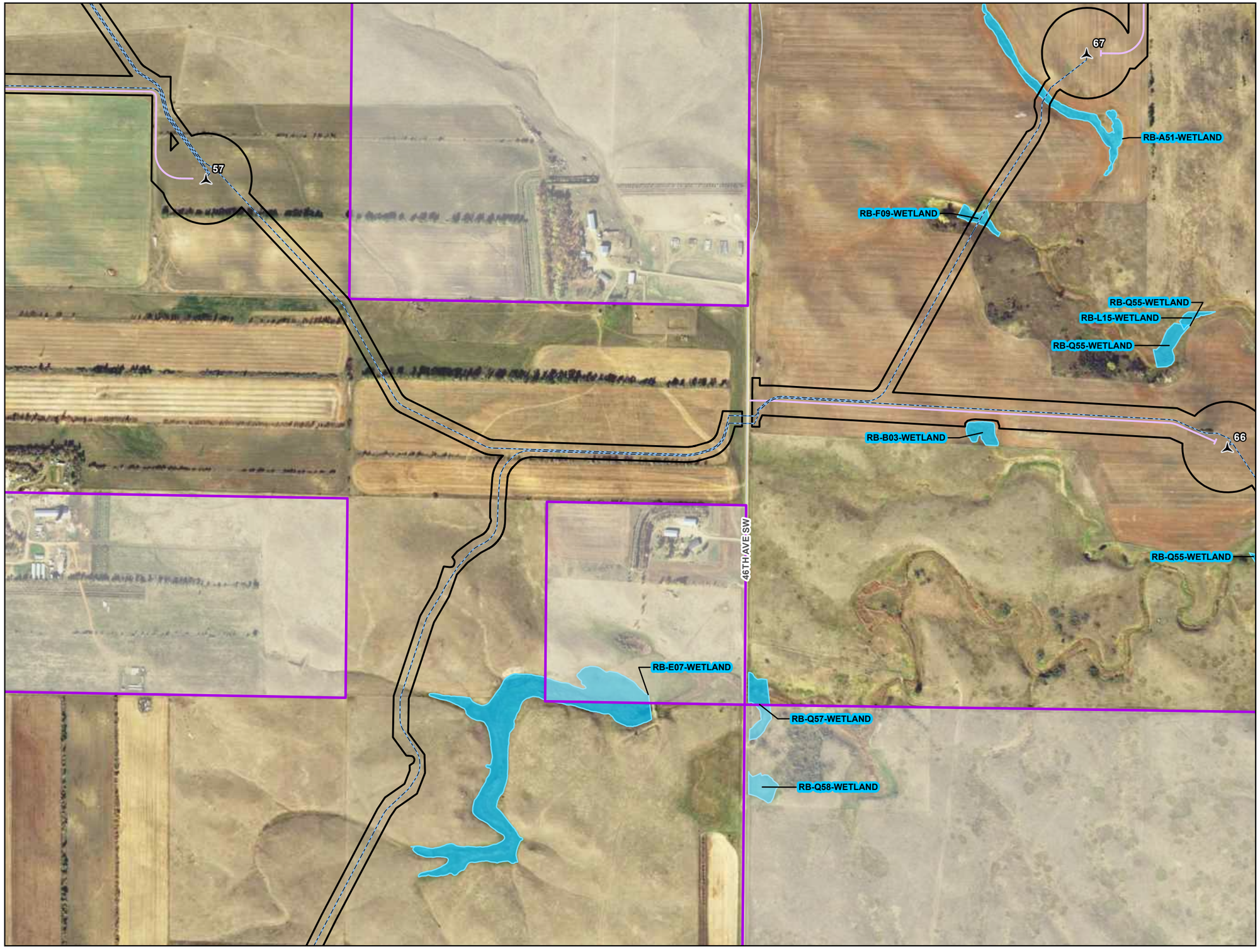

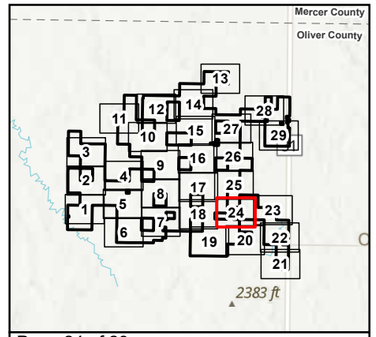

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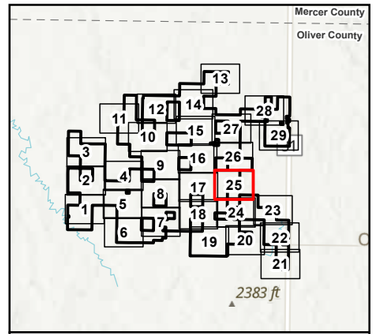

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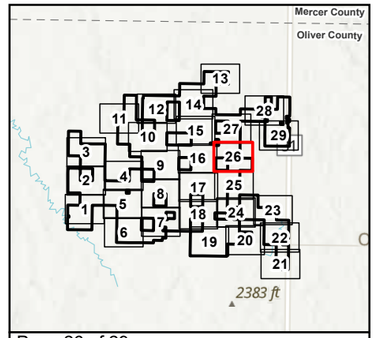

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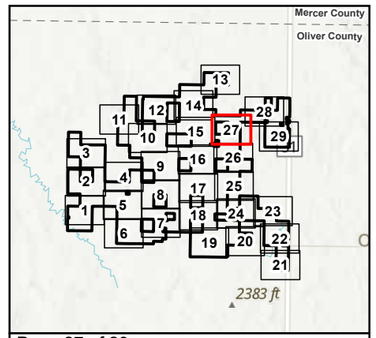

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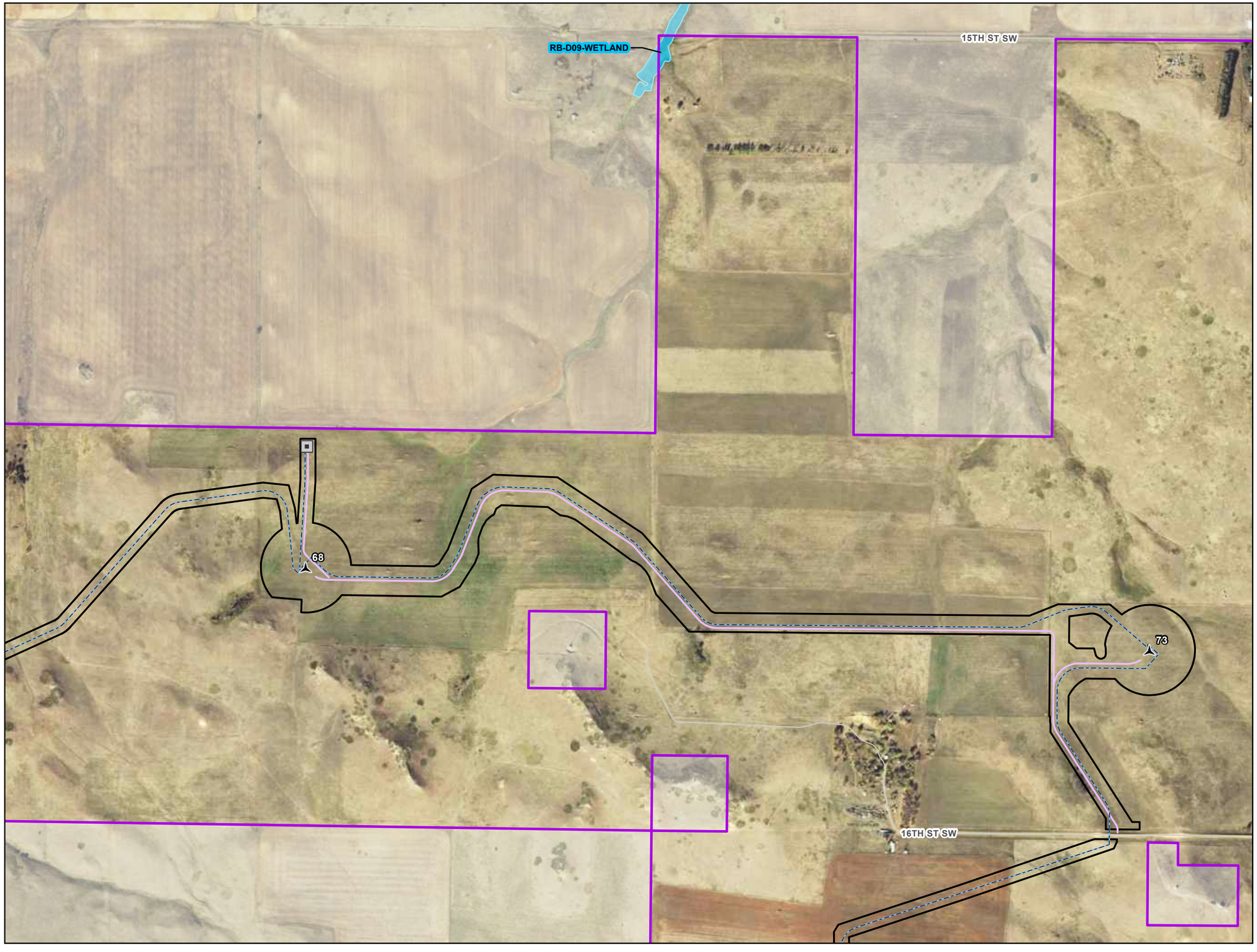

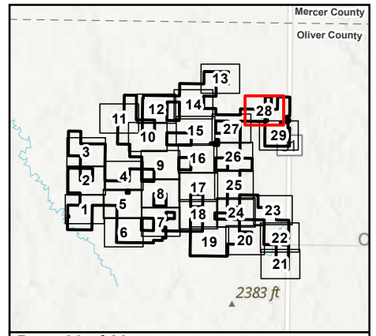

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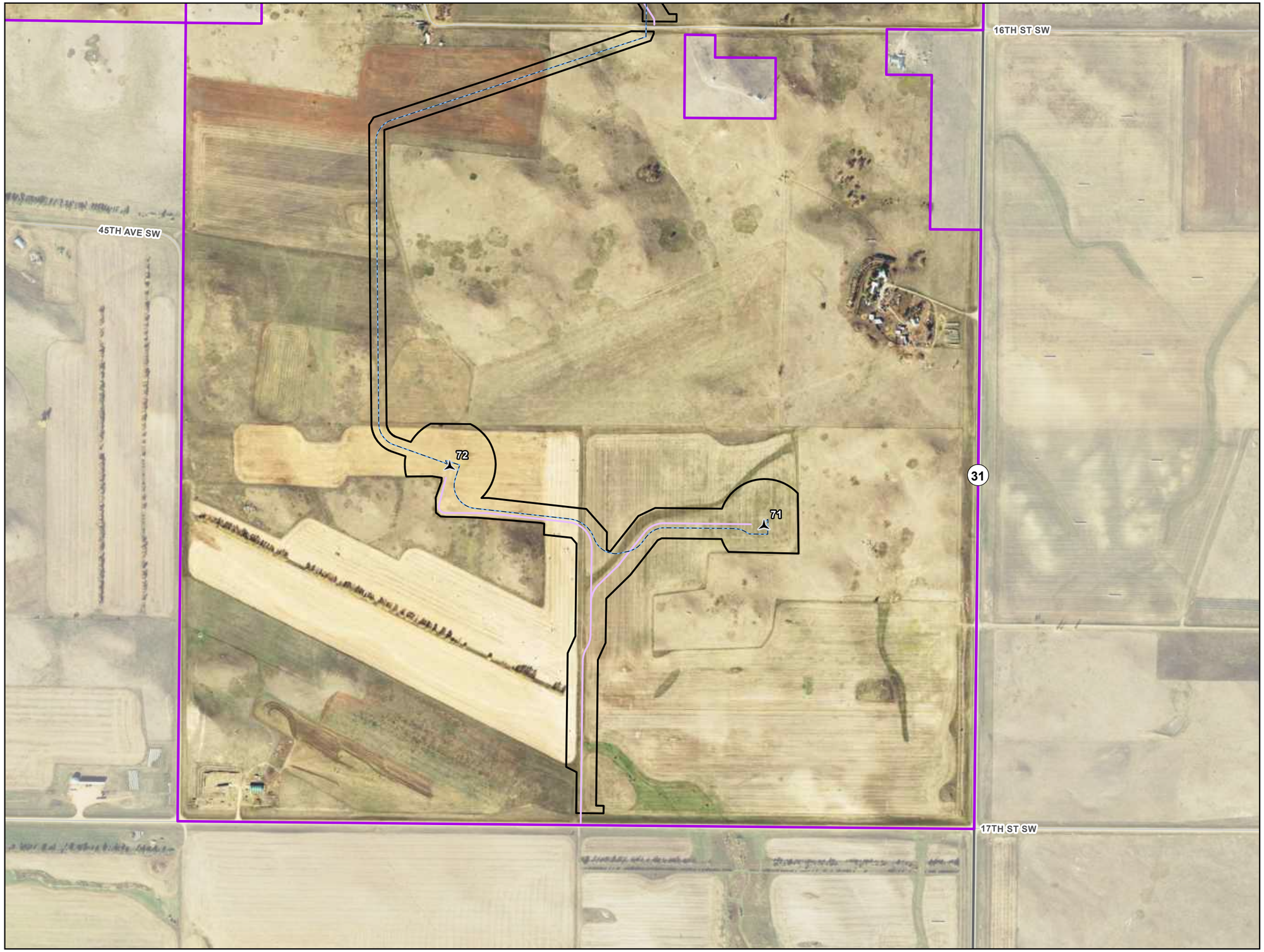

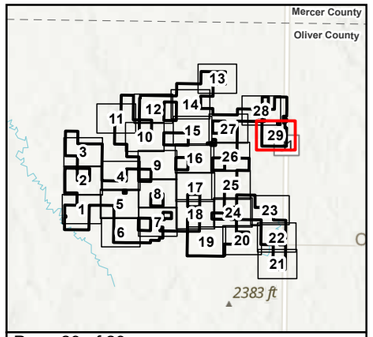

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Appendix A

Photographic Log

Date Taken: July 28, 2022 **Description:** Photo of RB-Q06-WETLAND facing north. Photo shows the wetland vegetation marking the edge of the wetland.	
Date Taken: August 22, 2022 **Description:** Photo of RB-Q35-WETLAND facing south. Photo shows standing water wetland vegetation in a small pothole depression.	

Date Taken: May 16, 2023 **Description:** Overview photo of RB-Q57-WETLAND facing east. Photo shows a depressional wetland.	
Date Taken: September 2, 2022 **Description:** Overview photo of RB-C12-WETLAND facing south. Photo shows a section line road bisecting a wetland.	

Date Taken: May 8, 2023 **Description:** Overview photo of RB-Q54-WETLAND facing north. Photo shows a large wetland with vegetation and topography marking the edge.	
Date Taken: May 8, 2023 **Description:** Photo of RB-Q55-WETLAND facing west. Photo shows a wetland dominated with cattails.	

Date Taken: August 1, 2022 **Description:** Photo of RB-Q07-WETLAND facing north. Photo shows the wetland vegetation marking the edge of the wetland.	
Date Taken: August 22, 2022 **Description:** Photo of RB-Q11-WETLAND facing south. Photo shows wetland consisting of prairie cordgrass.	

Date Taken: June 23, 2022 **Description:** Overview photo of RB-A50-WETLAND facing east. Photo shows a depressional wetland surrounded by agriculture.	
Date Taken: August 3, 2022 **Description:** Overview photo of wetland RB-Q10-WETLAND facing north. Photo shows a wetland surrounded by agriculture. Wetland vegetation marks the edges.	

Appendix B7. Avian Use Study (2019-2020)

Avian Use Study

June 2019 – May 2020

Oliver Wind IV Project

Oliver and Mercer Counties, North Dakota

Final Report

Prepared for:

Oliver Wind IV, LLC

Prepared by:

Sofía Agudelo and Clayton Derby

Western EcoSystems Technology, Inc.
4007 State Street, Suite 109
Bismarck, North Dakota 58503

Report Revised: June 26, 2023

Privileged and Confidential – Not For Distribution

EXECUTIVE SUMMARY

Oliver Wind IV, LLC (Company) is evaluating the potential for wind energy development at the Oliver Wind IV Project and Transmission Line (collectively, the Project) in Oliver and Mercer Counties, North Dakota. Western EcoSystems Technology, Inc. (WEST) conducted baseline avian use studies for the Project pursuant to Tier 3 of the US Fish and Wildlife Service (USFWS) 2012 Land-Based Wind Energy Guidelines (WEG), Stage 2 of the USFWS Eagle Conservation Plan Guidance (ECPG), and the revised USFWS eagle permit rules of 2016 (2016 Final Eagle Rule). The principal objectives of the study were to gather information on spatial and temporal use in the Study Area by large birds and document incidental wildlife observations.

WEST established a 106,260-acre (43,001 hectare) Avian Use Study Area (Study Area) that largely encompassed the Project Boundary. From June 6, 2019 – May 31, 2020, WEST conducted avian and eagle use surveys at 64 survey locations (survey points) centered on a circular survey plot with an 800-meter (2,625-foot) radius. Surveys were conducted during daylight hours as specified in the ECPG and 2016 Final Eagle Rule. Surveys at each of the 64 survey points were completed by qualified WEST staff approximately once per month, for a total of 12 visits and 745 surveys in the study year. The surveys resulted in 6,723 large bird observations in 1,422 separate groups.

A total of 28 bald (*Halieeatus luecocephalus*) and golden eagle (*Aquila chrysaetos*) observations were recorded during standardized surveys, resulting in 153 eagle minutes and 49 exposure minutes from 22 eagle observations within the risk cylinder. Eagle use ranged from 0.08–0.25 eagles/60-min survey across survey points where eagle use was observed. No discernible flight patterns or areas of concentrated eagle use were observed. Two additional bald eagles were recorded incidentally within the Project Boundary during the year 2019 – 2020 survey year.

Large bird mean use varied among seasons, but was highest in the spring, due mostly to waterfowl. Waterfowl use was consistently observed in all seasons. Diurnal raptors were observed in all seasons, with buteos (mainly red-tailed hawk) and northern harrier making up the majority of use across seasons. Large bird mean use was highest at Survey Point 9 with waterfowl species the most frequently observed. Survey Point 9 is located in the northern portion of the Study Area, in an area with croplands interspersed by grasslands and adjacent wetlands. The combination of habitats at Survey Point 9 provided suitable roosting and foraging areas for a broad suite of birds.

No federally listed avian species were observed during the 2019 – 2020 survey year within the Study Area. Nine avian species of concern including bald and golden eagles, and other avian species categorized as Species of Conservation Priority or Species of Habitat Fragmentation Concern in North Dakota, or USFWS' Birds of Conservation Concern, were observed during the 2019 – 2020 study year. The results of this study may be used to inform avoidance and minimization measures.

STUDY PARTICIPANTS

Clayton Derby	Senior Manager, Reviewer
Sofía Agudelo	Report Writer, Technical Editor
Guy DiDonato	Statistician
Catherine Read	Data Analyst
Terri Thorn	GIS Specialist
Alex Brazeal	Field Supervisor, Field Biologist
Jeanette Hall, Shawn Opitz, Sarah Rosche, Rachel Rusten, Karen Seginak	Field Staff

REPORT REFERENCE

Agudelo, S. and C. Derby. Avian Use Study, June 2019 – May 2020, Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota. Final Report. Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Report Revised: August 22, 2023.

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INTRODUCTION

Oliver Wind IV, LLC (Company) is evaluating the potential for wind energy development at the Oliver Wind IV Project and Transmission Line (collectively, the Project) in Oliver and Mercer Counties, North Dakota (Figure 1). To support the development of the Project, the Company contracted Western EcoSystems Technology, Inc. (WEST) to conduct a pre-construction avian use study for the Project. Study methodology was based upon the recommendations in the US Fish and Wildlife Service's (USFWS) 2012 *Final Land-Based Wind Energy Guidelines* (WEG; USFWS 2012), Appendix C(1)(a) of the 2013 USFWS *Eagle Conservation Plan Guidelines* (ECPG; USFWS 2013), and the USFWS *Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests* (2016 Final Eagle Rule; 81 Federal Regulation 91494 [December 16, 2016]). This report summarizes results from the 2019 – 2020 avian use surveys conducted for the Project.

The objectives of the study were to provide site-specific large bird resource and temporal and spatial use data following the WEG, to collect data on eagle use following the ECPG and the 2016 Final Eagle Rule, and to provide information useful for planning and design of the Project. This report summarizes results from the 2019 – 2020 avian use surveys conducted for the Project.

STUDY AREA

The Project Boundary largely overlaps the Avian Use Study Area (Study Area) where avian surveys were conducted in the 2019 – 2020 study year. The Study Area was defined in early 2019, prior to the beginning of avian use surveys, based on the Project Boundary available at that time (Figure 1). Land ownership within the Study Area is primarily private, with some scattered State Land Board parcels (US Geological Survey [USGS] Protected Areas Database of the United States 2019). The landscape within the Study Area is gently rolling to flat, with elevations ranging from 604–738 meters (m; 1,982–2,421 feet [ft]) above sea level (USGS 2019).

The Study Area encompasses approximately 106,260 acres (43,001 hectares) in Oliver and Mercer Counties in central North Dakota; the town of Center is located on the southeastern edge of the Study Area (Figure 1). The Study Area falls within the Level III Northwestern Glaciated Plains Ecoregion, a transitional region characterized by significant surface irregularity and high concentrations of seasonal and semi-permanent wetlands (US Environmental Protection Agency [USEPA 2017]). Historically dominated by grasslands, this area has been partially converted to agricultural use with crop production the primary practice (Griffith 2010, Sayler 2016). Trees and shrubs can be found around farmsteads, within planted shelterbelts, and along/within drainages. Few natural wetlands are present and scattered throughout the Project and Study Area.

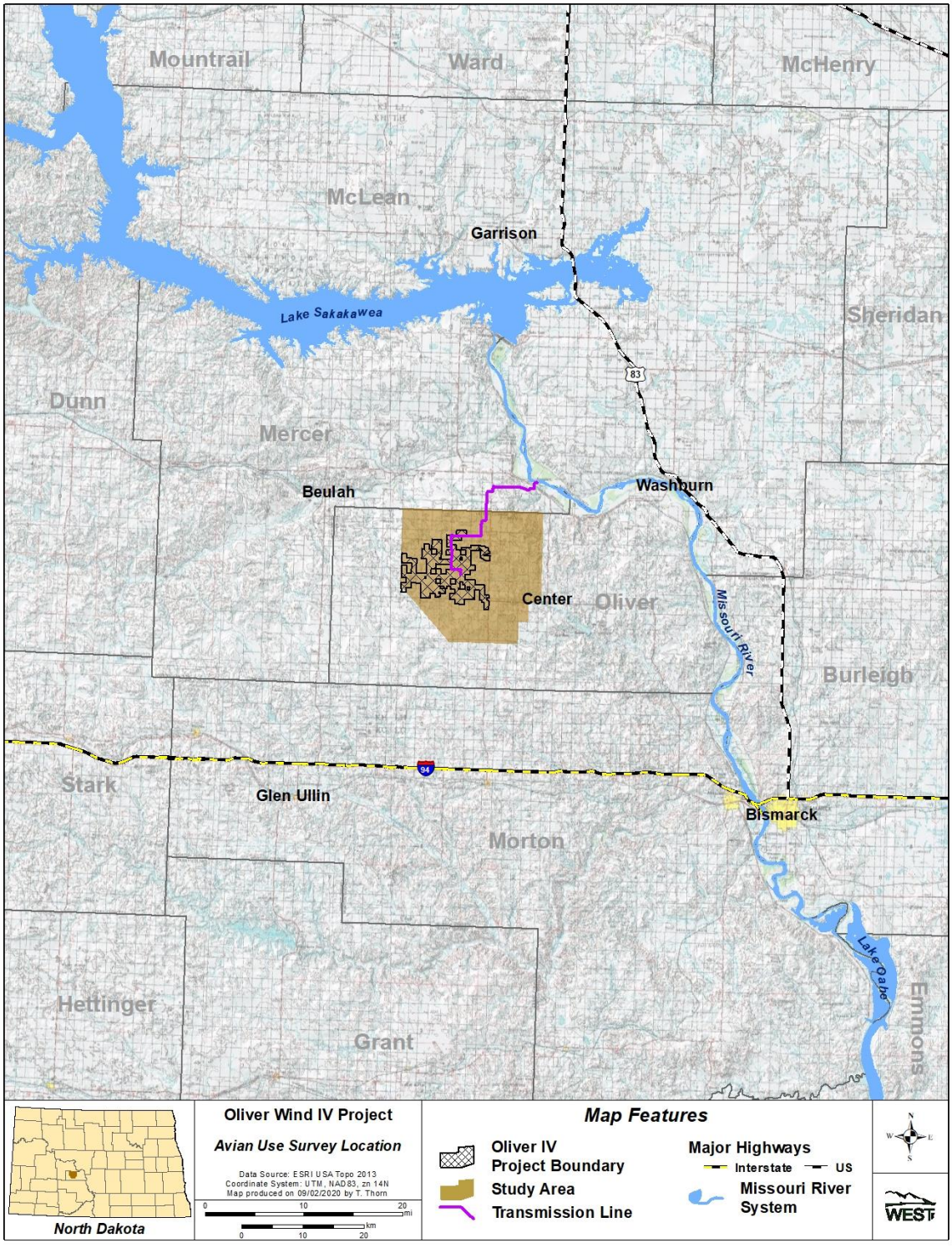

Figure 1. Location of the Oliver Wind IV Project and Avian Use Study Area, Oliver and Mercer Counties, North Dakota.

Based on data contained in the National Land Cover Database (Yang et al. 2018, Multi-Resolution Land Characteristics 2019), the majority (48.8%) of the Study Area is herbaceous, followed by cultivated crops (36.2%; Table 1, Figure 2). Hay/Pasture and developed represent 9.9% and 2.7% of the Study Area, respectively; all other land covers represent 1.0% or less of the Study Area each (Table 1, Figure 2).

Table 1. Land cover, coverage, and percent (%) composition within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota.

Land Cover	Coverage (Acres)	% Composition
Herbaceous	51,858.4	48.8
Cultivated crops	38,510.7	36.2
Hay/Pasture	10,552.7	9.9
Developed	2,820.6	2.7
Wetlands	1,078.3	1.0
Woodland/Forest	1,045.6	1.0
Shrub/Scrub	199.3	0.2
Open water	118.8	0.1
Barren land	75.2	0.1
Total	106,259.6	100

Source: National Land Cover Database (Yang et al. 2018, Multi-Resolution Land Characteristics 2019)

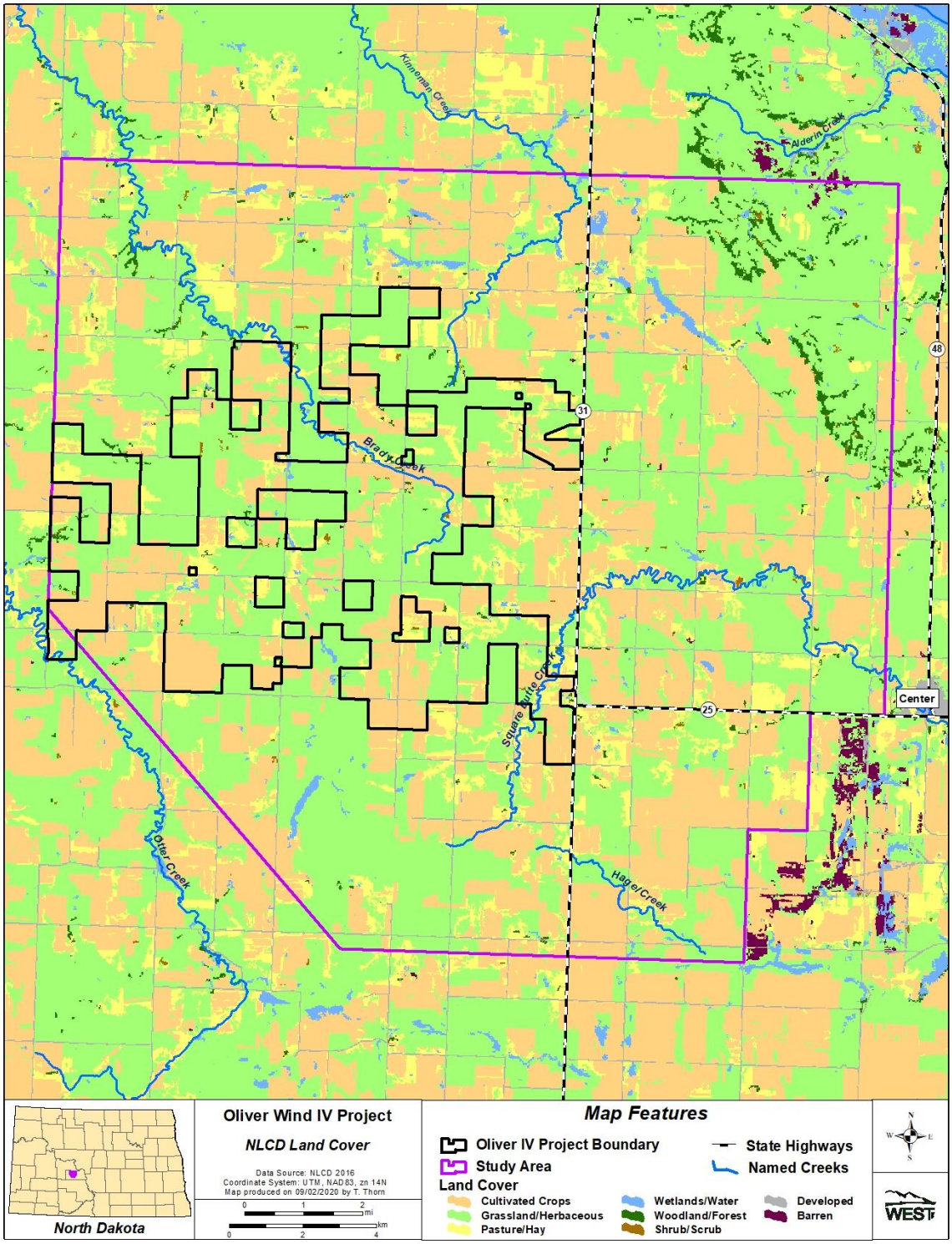

Figure 2. Land cover within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota.

METHODS

The study design and survey methods primarily follow guidance in the ECPG and the 2016 Final Eagle Rule because of the need to collect information on eagles, while also following guidance from the WEG to collect information on other large birds, including species of concern. *Large birds* are defined as waterbirds, waterfowl, shorebirds, gulls/terns, diurnal raptors (i.e., kites, accipiters, buteos, eagles, falcons, northern harrier, and osprey), owls, vultures, upland game birds, doves/pigeons, goatsuckers, and large corvids. For the purpose of this study, *Species of Concern* (SOC) are defined as: 1) any species listed as an endangered, threatened or candidate species under the Endangered Species Act (ESA; 1973) or subject to the Bald and Golden Eagle Protection Act (BGEPA; 1940); 2) listed as a Species of Conservation Priority (SCP; Dyke et al. 2015) or Species of Habitat Fragmentation Concern (SHFC; USFWS North Dakota Field Office 2013) in North Dakota; and 3) listed as a Bird of Conservation Concern (BCC) within the Badlands and Prairies Bird Conservation Region (USFWS 2008).

Study Design

Sixty-four survey locations were selected within the Study Area using a spatially balanced sampling procedure to cover a minimum of 30.0% of the Study Area while achieving relatively even coverage of representative habitats, vegetation types, and topography, with some survey points located near water sources (Figure 3). Each survey location was defined as *survey point* centered on a circular *survey plot* with an 800-m (2,625-ft) radius (Reynolds et al. 1980, ECPG, 2016 Final Eagle Rule). Survey points were selected to: 1) maximize the spatial coverage of the Study Area, 2) ensure good visibility for conducting the surveys, and 3) provide ready access from roads.

Surveys were conducted by a qualified WEST field staff member once per month from June 6, 2019 – May 31, 2020, as specified in the ECPG and 2016 Final Eagle Rule, during all seasons. Seasons were defined as spring (March 1 – May 31), summer (June 1 – August 31), fall (September 1 – November 30), and winter (December 1 – February 29). Surveys were conducted during daylight hours as specified in the ECPG and 2016 Final Eagle Rule, and survey times at survey points were randomized to cover all daylight hours during a season. Surveys were conducted under all weather conditions except when visibility was less than 800 m horizontally and 200 m (656 ft) vertically (2016 Final Eagle Rule) or when access to survey points was limited.

Survey Methods

All Large Birds

Surveys at each survey point were conducted for a period of 60 minutes (min) with all large birds observed or heard out to an 800-m radius. Small birds were not recorded during this survey effort, as earlier surveys of all birds (large and small) were previously conducted. Field staff recorded the following information for each survey: date, start and end time, and weather (i.e., temperature, wind speed, wind direction, precipitation, and percent cloud cover). Additionally, the following data were recorded for each group of birds observed:

- Observation number
- Species (or best possible identification)
- Number of individuals
- Sex and age class (if possible)
- Distance (first and closest) from survey plot center to the nearest 5-m (16-ft) interval
- Flight height (first, lowest, and highest) above ground level (AGL)
- Flight direction when first observed
- Dominant habitat
- Activity (e.g., flying, perched)
- Observation type (i.e., visual or aural)
- Flight paths and perch locations of eagles and other SOC

Eagles

Data were collected based on the recommendations in the ECPG and the 2016 Final Eagle Rule if a golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), or unidentified eagle was observed during the survey period. Field staff recorded eagle behavior (i.e., flight height, distance from observer, and activity) each minute (eagle minute), at the top of the minute, to provide an instantaneous count for every eagle observed, whether an eagle was flying below 200 m AGL and within 800 m of the survey point at any time during the minute.

Incidental Observations

For the purpose of this study, incidental observations are wildlife observed in the Study Area when not conducting avian use surveys, and are focused on federal-listed species, eagles, and SOC. Data recorded for incidentally observed species were similar to that recorded during scheduled surveys.

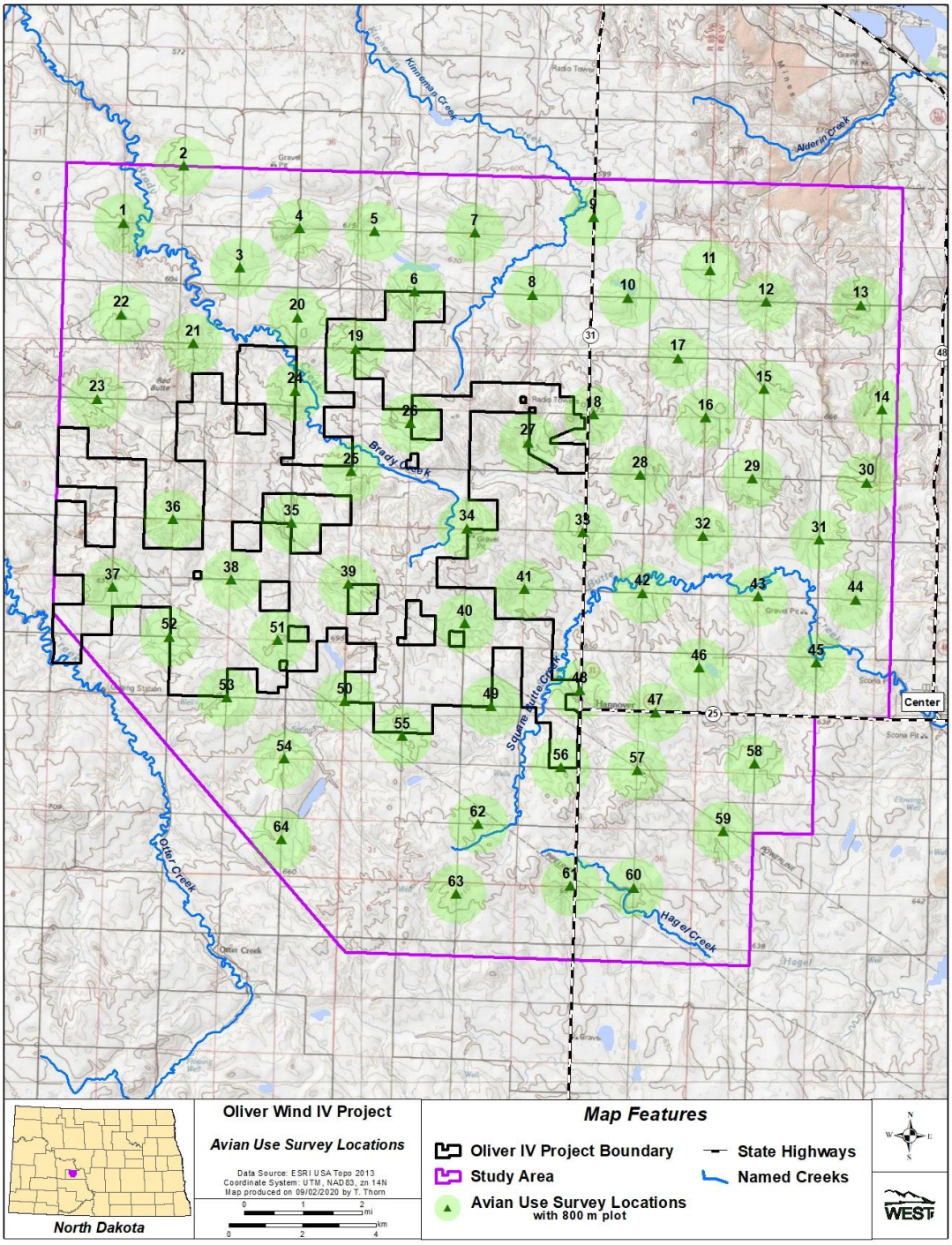

Figure 3. Avian use survey locations (survey points centered on circular survey plots) within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Data Management

Quality Assurance and Quality Control

WEST implemented quality assurance and quality control (QA/QC) measures at all stages of the study, including in the field, during data entry and analysis, and report writing. Following surveys, field staff were responsible for inspecting data forms for completeness, accuracy, and legibility. If errors or anomalies were found within the data, follow-up measures were implemented including discussions and review of field data with field staff and/or Project Managers. If any errors, omissions, or problems were identified in later stages of analysis, they were traced back to the raw data forms where appropriate changes and measures were implemented, no matter what stage of analysis. Multiple reviews were conducted as QA/QC measures.

Data Compilation and Storage

A Microsoft® SQL database was specifically developed to store, organize, and retrieve survey data. Project data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. WEST retained all data forms and electronic data files for reference.

Statistical Analysis

A *visit* was defined as surveying all of the survey plots once and could occur across multiple dates but had to be completed in a single season (e.g., spring). If extreme weather conditions prevented all plots from being surveyed during a visit, then a visit might not have constituted a complete survey of all plots. A *survey* was defined as a single 60 min count of birds. Although attempts were made not to recount the same individuals more than once, in some cases, a count of bird observations may represent repeated observations of the same individual. Only observations within the survey plot were included for data analysis.

Mean Use, Percent of Use, and Frequency of Occurrence

Mean use is the average number of birds observed per plot per survey for large birds. Large bird use (per 800-m plot per 60-min survey) is calculated by: 1) summing birds per plot per visit, 2) averaging number of birds over plots within a visit, and 3) averaging number of birds across visits within a season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season. *Percent of use* was calculated as the percentage of large bird use that was attributable to a particular bird type or species. *Frequency of occurrence* was calculated as the percent of surveys in which a particular bird type or species was observed.

Mean use and frequency of occurrence describe different aspects of relative abundance, in that mean use is based on the number of birds (i.e., large groups can produce high estimates), whereas frequency of occurrence is based on the number of groups (i.e., it is not influenced by group size). Qualitative comparisons were made with these metrics among bird types, seasons, and survey points to help illustrate temporal and spatial avian use of the Project.

Flight Height

Flight heights are important metrics to assess relative potential exposure to turbine blades and were used to calculate the percentage of birds observed flying within the rotor-swept height (RSH) of proposed turbines. A RSH of 25–150 m (82–492 ft) AGL was assumed for the purpose of the analysis. Flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH and mean flight height.

Spatial Use

Mean use was calculated by survey point for eagles and large birds to make spatial comparisons among the survey points. Additionally, flight paths and perched locations of eagles were mapped during large bird use surveys to qualitatively show potential areas of concentration of flight paths and consistent flight patterns within the Study Area compared to Project's characteristics (e.g., topographic features).

Eagles

Eagle observations during surveys were summarized to provide flight heights (see *Flight Height*) and flight path maps (see *Spatial Use*). Data collected during each minute eagles were observed were examined to count eagle exposure minutes. *Eagle exposure minutes* is defined as the number of minutes an eagle was observed in flight within the *risk cylinder* (defined as the area within 800 m of the survey point and below 200 m AGL during the 60-min survey periods); *total minutes* is defined as the amount of time eagles were observed inside and outside the risk cylinder. Data collected on perched eagles and those outside of the risk cylinder were not considered eagle exposure minutes; however, they were considered in the total eagle minutes. The perch locations and flight paths of all eagles were mapped to qualitatively assess areas of eagle use within the Study Area.

RESULTS

Thirty-eight identified species of large birds were observed or heard during surveys conducted over the 2019 – 2020 study (Appendix A). Overall, 745 avian use surveys were conducted for large birds within the Study Area (Table 2) resulting in 6,723 observations in 1,422 separate groups (Appendix A). Study results are summarized below and supplemented by the appendices, which present species-level details on the following: scientific names and number of groups and observations seen during surveys but not limited to viewshed (Appendix A); mean bird use, percent of use, and frequency of occurrence within the survey plot by season (Appendix B); and mean use by survey point (Appendix C).

Table 2. Summary of survey effort within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Season[1]	Number of Visits[2]	Number of Surveys[3]
Spring	3	192
Summer	3	192
Fall	3	169
Winter	3	192
Overall	**12**	**745**

[1] Season dates: Spring (March 1 – May 31), Summer (June 1 – August 31), Fall (September 1 – November 30), Winter (December 1 – February 29).

[2] A visit was defined as surveying all of the survey plots once and could occur across multiple dates but had to be completed in a single season.

[3] A survey was defined as a single 60-minute count of large birds.

Species of Concern

Eagles

Mean Use

Both bald and golden eagles were recorded during standardized surveys, with golden eagles recorded in fall and spring and bald eagles in all seasons (Appendix A). Golden eagle mean use in the fall and spring was 0.01 observations/800-m plot/60-min survey while bald eagle use ranged from 0.01 in summer to 0.07 in spring (Appendix B). Overall eagle mean use was 0.03 observations/800-m plot/60-min survey.

Activity Minutes

During 745 total survey hours, a total of 28 eagle observations (two golden eagle and 26 bald eagle) were recorded, corresponding to 153 eagle minutes (three golden eagle minutes and 150 bald eagle minutes) and 49 exposure minutes (two golden eagle minutes and 47 bald eagle minutes) from 22 eagle observations (two golden eagle and 20 bald eagle) within the risk cylinder (Table 3). Across months, exposure minutes per survey hour ranged from 0–0.0156 for golden eagles and 0–0.1875 for bald eagles, resulting in 0.0027 golden eagle and 0.0631 bald eagle exposure minutes per survey hour for the entire year of surveys (Table 3).

Golden eagle exposure minutes per survey hour were highest at Survey Point 36 (0.11 risk minutes/survey hour) followed by Survey Point 15 (0.08); all other survey points had zero golden eagle exposure minutes. Bald eagle exposure minutes were highest at Survey Point 47 (1.00 eagle risk minute/survey hour) and ranged from 0.08–0.42 at all other survey points where exposure minutes were recorded.

Table 3. The bald eagle minutes (mins) and observations (obs) recorded during large bird avian use surveys within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

		Golden Eagle					Bald Eagle				
Year-Month	Survey Hours	Mins Within Cylinder[1]	Total Mins[2]	Obs Within Cylinder[1]	Total Obs[2]	Exposure Mins/ Survey Hour	Mins Within Cylinder[1]	Total Mins[2]	Obs Within Cylinder[1]	Total Obs[2]	Exposure Mins/ Survey Hour
19-Jun	72	0	0	0	0	0	1	6	1	3	0.0139
19-Jul	56	0	0	0	0	0	0	0	0	0	0
19-Aug	64	0	0	0	0	0	0	0	0	0	0
19-Sep	64	1	2	1	1	0.0156	0	0	0	0	0
19-Oct	64	0	0	0	0	0	1	3	1	1	0.0156
19-Nov	64	0	0	0	0	0	9	35	4	4	0.1406
19-Dec	57	0	0	0	0	0	7	19	3	3	0.1228
20-Jan	53	0	0	0	0	0	4	5	1	1	0.0755
20-Feb	59	0	0	0	0	0	0	0	0	0	0
20-Mar	64	0	0	0	0	0	2	43	2	3	0.0312
20-Apr	64	1	1	1	1	0.0156	11	27	5	8	0.1719
20-May	64	0	0	0	0	0	12	12	3	3	0.1875
Total	**745**	**2**	**3**	**2**	**2**	**0.0027**	**47**	**150**	**20**	**26**	**0.0631**

[1.] Within cylinder = mins or obs inside the risk cylinder; minutes inside risk cylinder = eagle exposure minutes.
[2.] Total = mins or obs inside and outside the risk cylinder.

Eagle Flight Height

Eagles were recorded flying mostly (63.6%) within RSH (25–150 m) with fewer flights below RSH range (Table 4).

Table 4. Group and individual observation flight height characteristics by large bird[a] type and raptor subtype during 60-minute large bird use surveys within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Bird Type	Number (#) Groups Flying	# Observations Flying	Percent (%) Observations Flying	Mean Flight Height (meters [m])	% within Flight Height Categories		
					<25 m	25-150 m[b]	>150 m
Waterbirds	**24**	**871**	**93.9**	**246.7**	**1.1**	**10.2**	**88.6**
Waterfowl	**187**	**3,937**	**99.5**	**75.1**	**12.7**	**59.0**	**28.3**
Shorebirds	**56**	**74**	**61.7**	**10.6**	**86.5**	**13.5**	**0**
Gulls/Terns	**22**	**157**	**98.7**	**97.9**	**5.7**	**89.8**	**4.5**
Diurnal Raptors	**482**	**558**	**92.7**	**75.5**	**31.4**	**56.1**	**12.5**
Accipiters	*16*	*16*	*94.1*	*72.0*	*31.3*	*50.0*	*18.8*
Buteos	*332*	*392*	*93.1*	*78.5*	*23.2*	*64.0*	*12.8*
Northern harrier	*77*	*86*	*95.6*	*32.6*	*74.4*	*24.4*	*1.2*
Eagles	*22*	*22*	*88.0*	*153.4*	*9.1*	*63.6*	*27.3*
Falcons	*13*	*15*	*68.2*	*49.9*	*66.7*	*26.7*	*6.7*
Other Raptors	*22*	*27*	*100*	*119.9*	*11.1*	*55.6*	*33.3*
Owls	**1**	**1**	**100**	**21.0**	**100**	**0**	**0**
Vultures	**86**	**131**	**100**	**80.6**	**20.6**	**67.9**	**11.5**
Upland Game Birds	**56**	**158**	**45.4**	**4.0**	**95.6**	**4.4**	**0**
Doves/Pigeons	**172**	**299**	**83.3**	**10.2**	**91.3**	**8.7**	**0**
Large Corvids	**36**	**110**	**95.7**	**22.4**	**62.7**	**37.3**	**0**
Large Birds Overall	**1,122**	**6,296**	**93.7**	**61.3**	**20.3**	**48.3**	**31.4**

[a.] 800-meter (2,625-foot) radius plot for large birds.

[b.] The likely "rotor-swept height" for potential collision with a turbine blade, or 25–150 meter (82–492 feet) AGL.

All metrics developed based on First Activity and First Flight Height.

Spatial Use

Mean Use by Survey Point and Flight Paths

Eagle use was observed at 15 of the 64 survey points. Mean eagle use at survey points 47 and 48 was 0.25 eagles/60-min survey (Appendix C); mean eagle use at all other survey points where eagle use was recorded during standardized surveys ranged from 0.08–0.17. Bald and golden eagle flight paths are shown in Figure 4. No discernible flight patterns or areas of concentrated eagle use were observed.

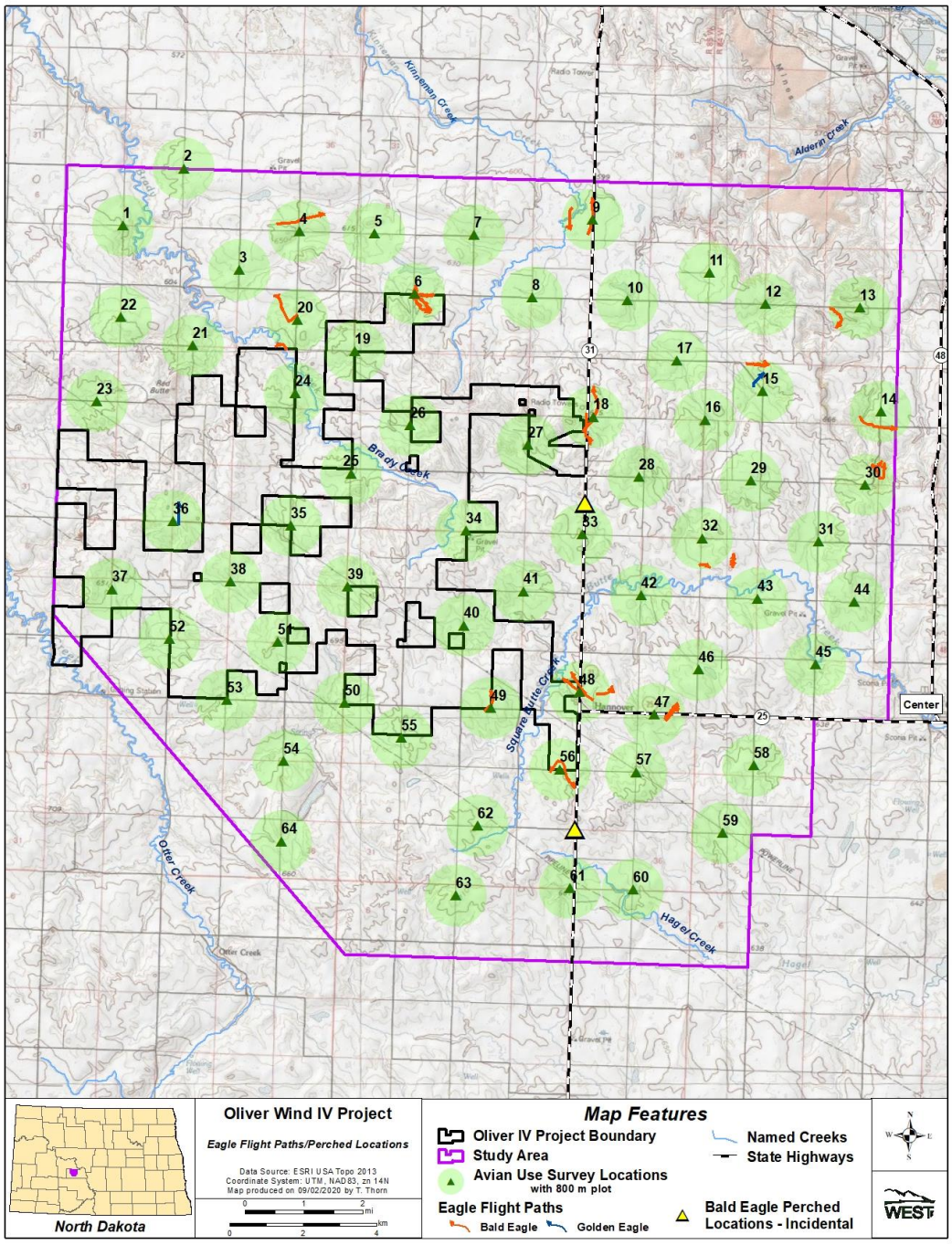

Figure 4. Eagle flight paths recorded[1] at avian use survey locations (survey points centered on a circular survey plot) within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

[1.] Survey points where eagle flight paths were recorded: 4, 6, 9, 13, 14, 15,18, 20, 30, 32, 36, 47, 48, 49, and 56.

Other Species of Concern

No federal-listed species were observed during the 2019 – 2020 survey year. A total of nine SOC in 282 groups totaling 391 observations were observed during surveys and incidentally within the Study Area (Table 5). A total of 30 eagles (federally protected under the BGEPA, SCP in North Dakota, and BCC in the Badlands and Prairies Bird Conservation Region) were observed during the 2019 – 2020 year survey: two golden eagle observations (during surveys) and 28 bald eagle observations (26 during surveys and two incidentally). There were seven additional SCP, SHFC, and/or BCC, with northern harrier making up the bulk of observations (95 observations in 84 groups; Table 5). Unless further protected by federal regulations, SCP and BCC are not afforded additional protections under existing state or federal law.

Table 5. Number (#) of groups (grps) and observations (obs) of Species of Concern observed during the large bird use surveys and as incidental wildlife observations within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Species	Scientific Name	Status	Surveys		Incidental		Total	
			# of grps	# of obs	# of grps	# of obs	# of grps	# of obs
American kestrel	*Falco sparverius*	SCP LII	16	19	0	0	16	19
American white pelican	*Pelecanus erythrorhynchos*	SCP LII	8	21	0	0	8	21
bald eagle	*Haliaeetus leucocephalus*	SCP LII; BGEPA; BCC	26	26	2	2	28	28
ferruginous hawk	*Buteo regalis*	SCP LI; BCC	4	4	0	0	4	4
golden eagle	*Aquila chrysaetos*	SCP LII; BGEPA; BCC	2	2	0	0	2	2
northern harrier	*Circus hudsonius*	SCP LII; SHFC	81	90	3	5	84	95
sharp-tailed grouse	*Tympanuchus phasianellus*	SCP LII; SHFC	15	71	0	0	15	71
Swainson's hawk	*Buteo swainsoni*	SCP LI	63	80	2	3	65	83
upland sandpiper	*Bartramia longicauda*	SCP LII; BCC; SHFC	60	68	0	0	60	68
Total	**9 species**		**275**	**381**	**7**	**10**	**282**	**391**

SCP = Species of Conservation Priority Levels I, II, and III (LI, LII, LIII; Dyke et al. 2015)

SHFC = Species of Habitat Fragmentation Concern in North Dakota (USFWS North Dakota Field Office 2013)

BGEPA = Bald and Golden Eagle Protection Act (1940).

BCC = Birds of Conservation Concern (USFWS 2008)

Large Birds

Mean Use, Percent of Use, and Frequency of Occurrence

Mean use, percent of use, and frequency of occurrence were calculated by season for large bird types (Figure 5a, b, c) and species (Appendix B). Large bird mean use was highest in the spring (17.80 observations/800-m plot/60-min survey) compared to any other season, and summer (4.44 observations/800-m plot/60-min survey) was lowest (Figure 5a, Appendix B). Overall large bird mean use was 8.91 observations/800-m plot/60-min survey. Waterbirds, waterfowl, diurnal raptors, upland game birds, and doves/pigeons were consistently observed and comprised the

majority of large bird use across seasons (Appendix B). Waterbird use was recorded in all seasons but winter, with sandhill crane (*Antigone canadensis*) use being recorded in fall (0.94) and spring (3.67) and comprising the majority (or all) of waterbird use during these seasons (Appendix B). Waterfowl comprised the majority of use during fall (5.30), winter (3.96), and spring (11.28) compared to any other bird type, with Canada goose (*Branta canadensis*) making up the majority of this use; green-winged teal (*Anas crecca*) and gadwall (*Mareca strepera*) were only recorded in the summer, snow goose (*Anser caerulescens*) only in the fall, and cackling goose (*Branta hutchinsii*) and northern shoveler (*Spatula clypeata*) only in spring. Doves/pigeons comprised the majority of use during summer (1.38) followed by diurnal raptors (0.84) with red-tailed hawk (*Buteo jamaicensis*) and northern harrier (*Circus hudsonius*) making up the majority of raptor observations across all seasons, with some seasonal turnover in species (Figure 5a, Appendix B). Overall, waterfowl and waterbirds comprised the majority of use during the 2019 – 2020 year survey (5.27 and 1.22, respectively; Figure 5a, Appendix B).

Doves/pigeons comprised the majority of observations during summer (30.9%), while waterfowl did so during fall (60.8%), winter (86.5%), and spring (63.4%; Figure 5b, Appendix B). Large bird frequency of occurrence varied among seasons, with doves/pigeons the most frequently observed during summer (45.3%), diurnal raptors during fall (37.5%) and spring (54.2%), and upland game birds during winter (13.8%; Figure 5c, Appendix B).

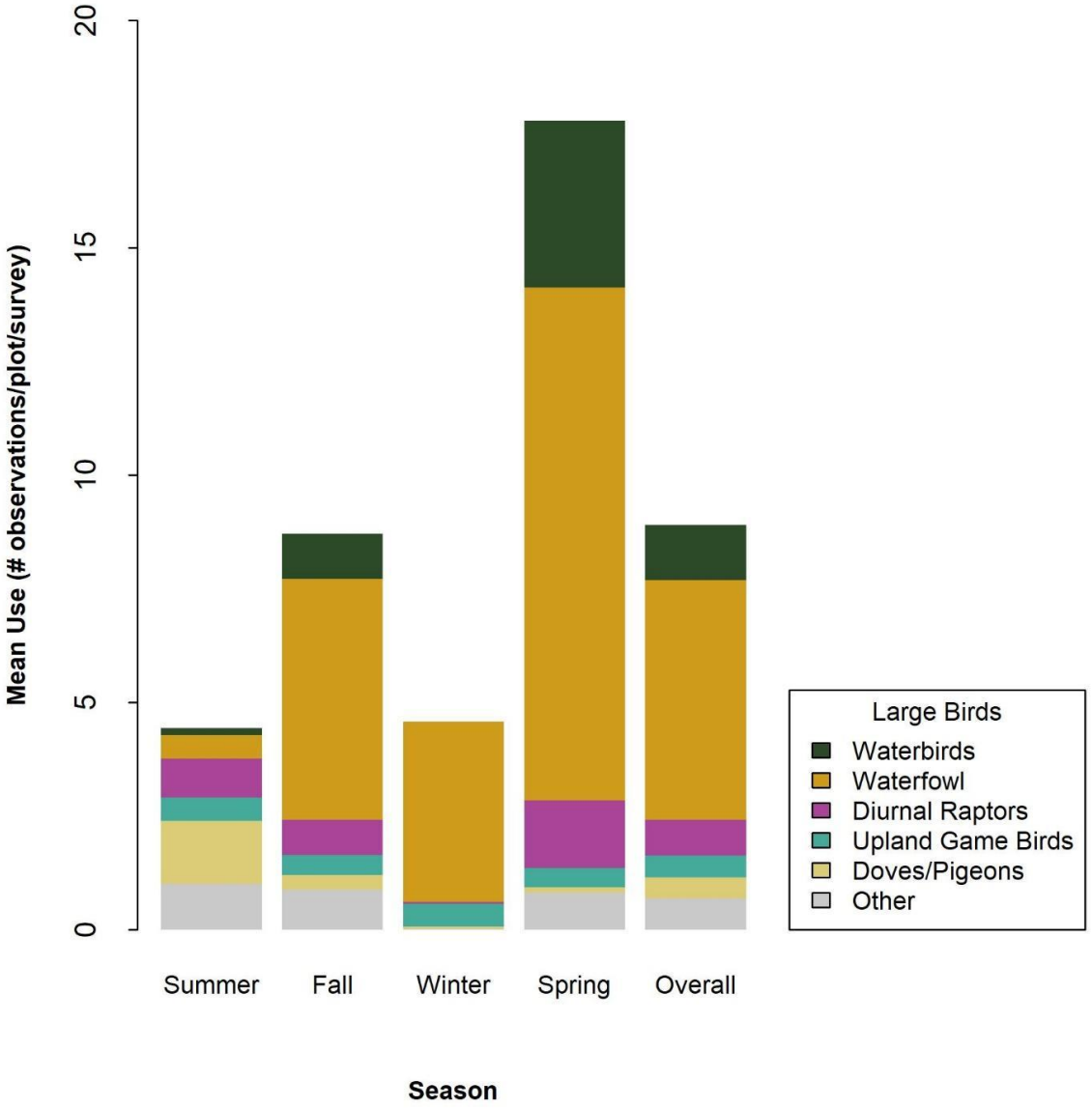

Figure 5a. Large bird[1] mean use by season and bird type within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

[1.] 800-meter (2,625-foot) radius plot and 60-minute survey for large birds. Only select bird types included in figure. See Appendix B for complete list and details.

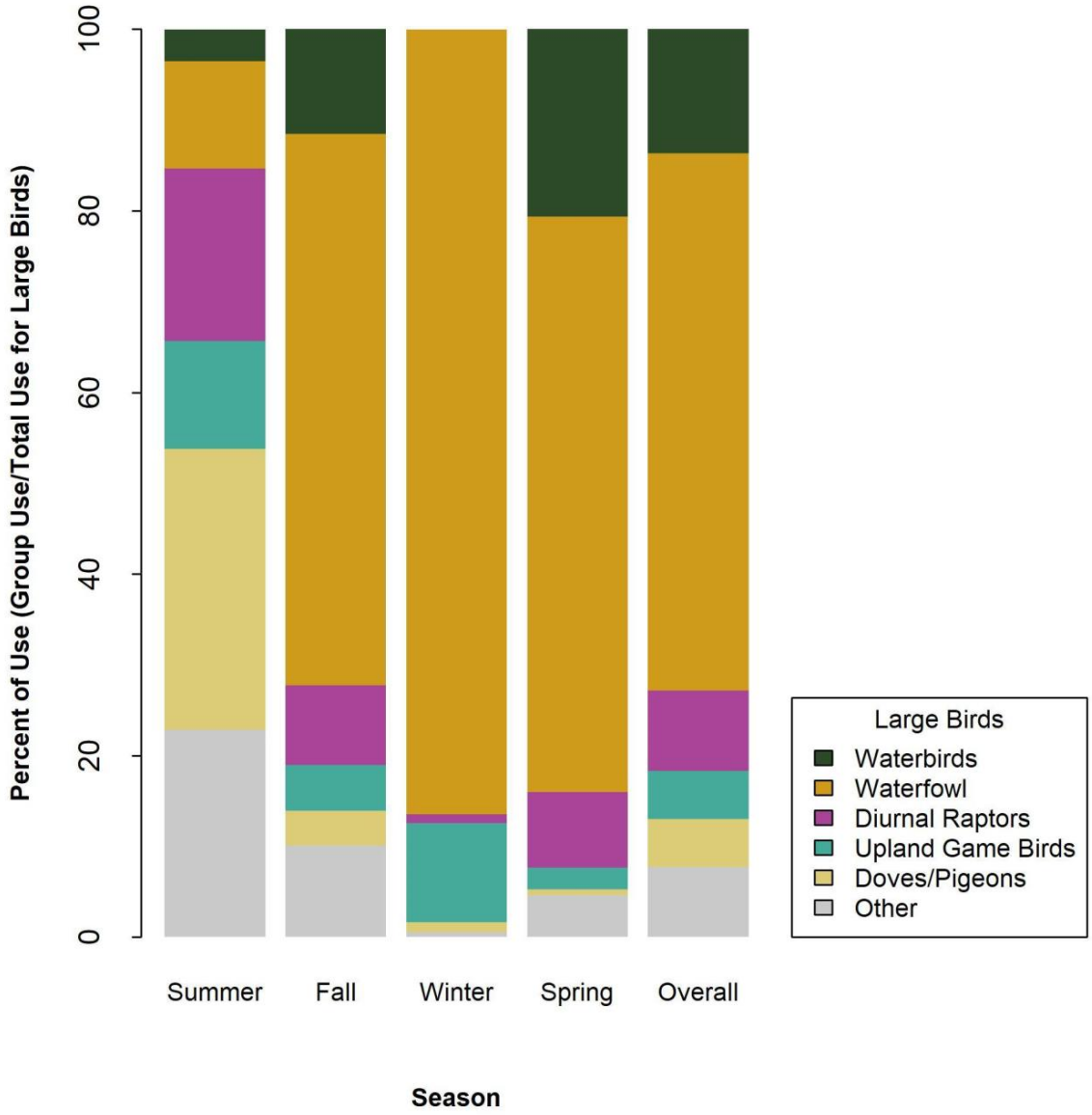

Figure 5b. Large bird[1] percent of use by season and bird type within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

[1.] 800-meter (2,625-foot) radius plot and 60-minute survey for large birds. Only select bird types included in figure. See Appendix B for complete list and details.

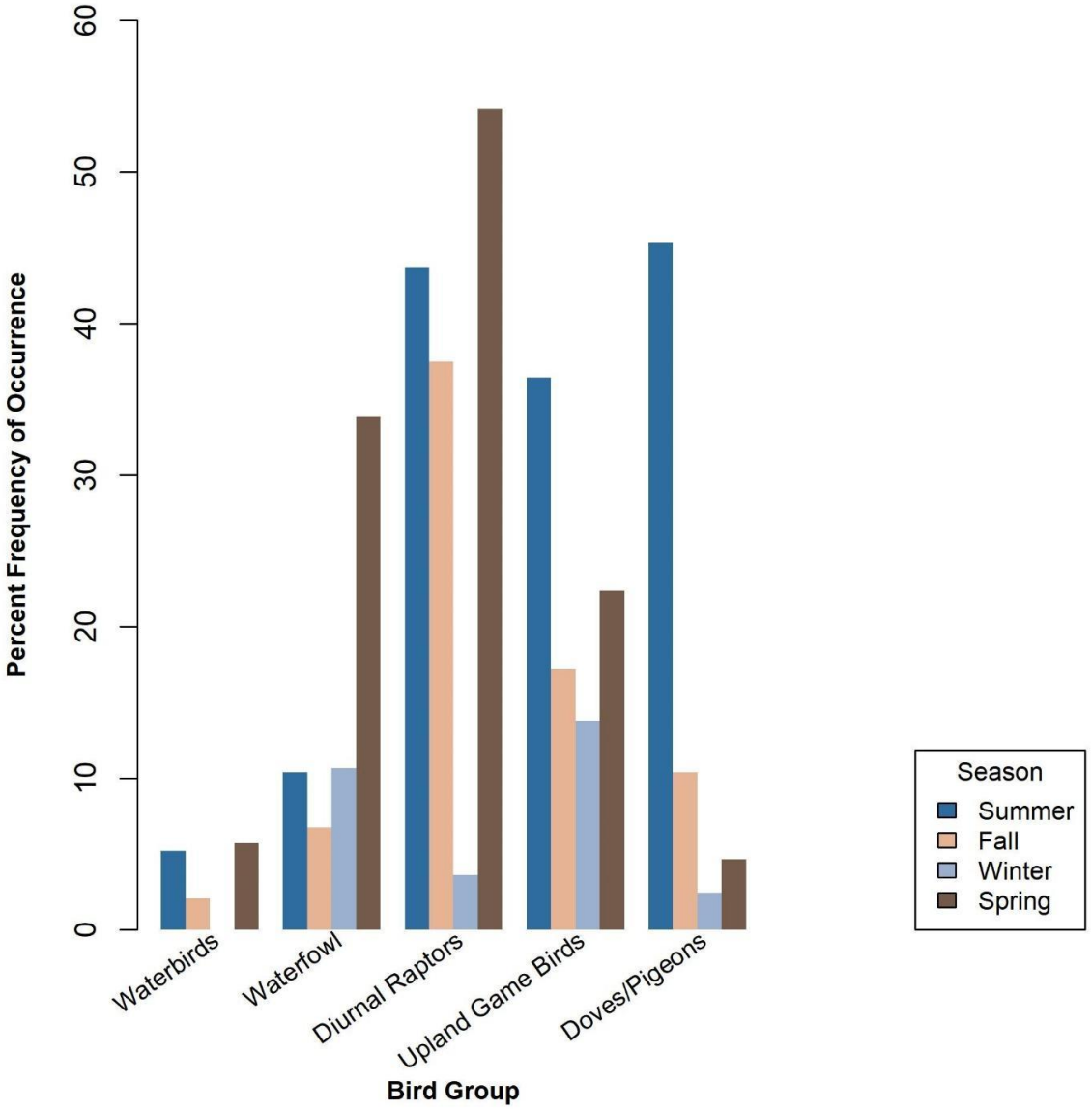

Figure 5c. Large bird[1] frequency of occurrence by season and bird type within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

[1.] 800-meter (2,625-foot) radius plot and 60-minute survey for large birds. Only select bird types included in figure. See Appendix B for complete list and details.

Flight Height

Mean large bird flight heights ranged from 4.0 m (13.1 ft) for upland game birds to 246.7 m (809.4 ft) for waterbirds (Table 4). Gulls/terns (89.8%) and vultures (67.9%) were recorded mostly within RSH. Owls (100%) were recorded exclusively below RSH, while upland game birds (95.6%), doves/pigeons (91.3%), and shorebirds (86.5%) were recorded mostly below RSH. Waterbirds (88.6%) were recorded mostly above RSH (Table 4). Raptors flight heights generally were within RSH for most species groups, including eagles, although northern harriers and falcons flew mostly below RSH range (74.4% and 66.7%, respectively; Table 4).

Spatial Use

Mean Use by Survey Point

Large bird use ranged from 0.83–43.25 observations/60-min survey across survey points and was highest at Survey Point 9, in the northern portion of the Study Area, compared to any other survey point, due mostly to waterfowl use (Figure 6; Appendix C). Waterfowl and waterbirds consistently comprised the majority of use at survey points where they were observed; waterfowl use was observed at 49 of the 64 survey points, ranging from 0.08 at Survey Point 52 to 39.25 at Survey Point 9, while waterbird use was recorded at 20 survey points and ranged from 0.08–18.33 (Figure 6, Appendix C).

Diurnal raptor use was observed at all survey points and ranged from 0.17 at Survey Point 41 to 2.08 at Survey Point 59, due exclusively to use by buteos at this point (Appendix C). In general, buteos and northern harriers contributed to the majority of diurnal raptor use across survey points. Buteo use was highest at Survey Point 59 and ranged from 0.08–1.58 at all other survey points; northern harrier use was highest at survey points 7 and 9 (0.58) and ranged from 0.08–0.45 at other survey points where use by northern harriers was recorded (Appendix C).

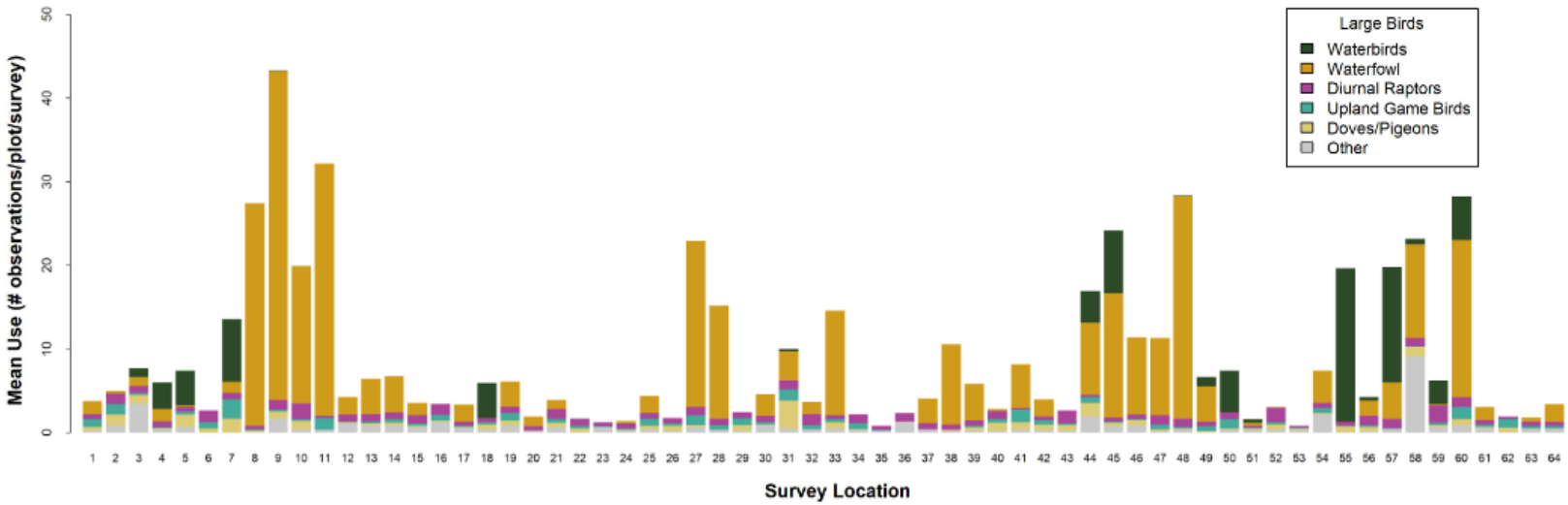

Figure 6. Large bird[1] mean use by survey point by bird type within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

[1.] Only select bird types included in figure. See Appendix C for complete list and details.

SUMMARY

The principal objectives of the study were to gather information on spatial and temporal use in the Study Area by large birds and document incidental wildlife observations. Overall eagle use resulted in 0.03 observations/800-m plot/60-min survey. Both golden and bald eagles were recorded during standardized surveys, with 28 total eagle observations during standardized surveys resulting in 153 eagle minutes and 49 exposure minutes. Eagle use was not widespread throughout the Study Area and was only observed at 15 of the 64 survey points. The highest eagle mean use was recorded at survey points 47 and 48, located in the southeastern portion of the Study Area in an area of cultivated croplands and grassland/herbaceous vegetation in the vicinity of Square Butte Creek.

No federal-listed species were recorded during the standardized large bird use surveys or incidentally; however, nine SOC were recorded within the Study Area. A review of eBird location data (eBird 2020) indicated all SOC observed during the 2019 – 2020 survey year have been recorded throughout Oliver and Mercer Counties, indicating they are not unique to the Study Area or Project. A total of two golden eagles and 28 bald eagle observations were recorded during the 2019 – 2020 survey year; bald eagles are commonly observed in central North Dakota year-round (eBird 2020). Suitable foraging habitats for migrating or wintering golden eagles would primarily encompass the grasslands (i.e., herbaceous, hay/pasture) which account for more than half of the Study Area; large deciduous trees associated with wetland and riparian vegetation could provide suitable nesting, foraging, and roosting habitat for bald eagles. Eagle use is likely to occur year-round at the Project; however, it is likely to be relatively low based on the use observed during the 2019 – 2020 survey year within the Study Area.

Large bird use and frequency of occurrence showed seasonal variation. Seven waterfowl and four waterbird species were recorded during the 2019 – 2020 survey year, with a high seasonal turnover. Waterfowl comprised the majority of large bird use during fall, winter, and spring, with Canada goose making up the majority of this use; green-winged teal and gadwall were only recorded in the summer, snow goose only in the fall, and cackling goose and northern shoveler only in spring. Given observations of sandhill cranes were only recorded in the fall and spring seasons, it is likely these groups were migrating through the Project.

Diurnal raptor use was highest in spring compared to any other season and lowest in winter. With some seasonal turnover in species, red-tailed hawk and northern harrier made up the majority of raptor observations across all seasons.

Flying observations of gulls/terns and vultures were recorded mostly within the RSH. Raptor flight heights generally were within RSH for most species groups, including eagles. Eagle flight paths were observed within the Study Area, but no pattern was evident. Spatial variation in large bird use was observed, with the majority of large bird use recorded at Survey Point 9, with waterfowl comprising the majority of large bird use at this survey point. Survey Point 9, located in the northern portion of the Study Area, was positioned in area with croplands interspersed by

grasslands and adjacent wetlands. The combination of habitats at this survey point likely provides suitable roosting and foraging areas for a broad suite of birds.

REFERENCES

81 Federal Register (FR) 242: 91494-91554. 2016. Eagle Permits; Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests; Final Rule. Department of the Interior Fish and Wildlife Service. 81 FR 91494. December 16, 2016. Available online: https://www.gpo.gov/fdsys/pkg/FR-2016-12-16/pdf/2016-29908.pdf

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) Section (§) 668-668d. Bald Eagle Protection Act of 1940, June 8, 1940, Chapter 278, § 2, 54 Statute (Stat.) 250; Expanded to include the related species of the golden eagle October 24, 1962, Public Law (PL) 87-884, 76 Stat. 1246. [as amended: October 23, 1972, PL 92-535, § 2, 86 Stat. 1065; November 8, 1978, PL 95-616, § 9, 92 Stat. 3114.].

Dyke, S. R., S. K. Johnson, and P. T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department, Bismarck, North Dakota. Available online: https://gf.nd.gov/wildlife/swap

eBird. 2020. Ebird: An Online Database of Bird Distribution and Abundance. eBird, Cornell Lab of Ornithology, Ithaca, New York. Accessed March 2020. Information online: http://ebird.org/content/ebird/

Endangered Species Act (ESA). 1973. 16 United States Code (USC) §§ 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 et seq.]; 50 Code of Federal Regulations (CFR) 402.

Griffith, G. 2010. Level III North American Terrestrial Ecoregions: United States Descriptions. Prepared for North American Commission for Environmental Cooperation.

Multi-Resolution Land Characteristics (MRLC). 2019. National Land Cover Database (NLCD) 2016. Multi-Resolution Land Characteristics (MRLC) Consortium. US Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, MRLC Project, Sioux Falls, North Dakota. May 10, 2019. Information online: https://www.mrlc.gov/data

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. Condor 82(3): 309-313.

Sayler, K. 2016. Contemporary Land Cover Change in the Northwestern Great Plains Ecoregion. Page last modified July 7, 2016. US Geological Service (USGS) Earth Resources Observation and Science Center. Sioux Falls, South Dakota. Available online: https://landcovertrends.usgs.gov/gp/eco43Report.html

US Environmental Protection Agency (USEPA). 2017. Ecoregion Download Files by State - Region 8: North Dakota. Ecoregions of the United States, Ecosystems Research, USEPA. Last updated February 8, 2017. Accessed July 2020. Information online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-48

US Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. December 2008. Division of Migratory Bird Management, Arlington, Virginia. Available online: https://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf

US Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online: http://www.fws.gov/cno/pdf/Energy/2012_Wind_Energy_Guidelines_final.pdf

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. 103 pp. + frontmatter. Available online: https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf

US Fish and Wildlife Service (USFWS) North Dakota Field Office. 2013. Species of Habitat Fragmentation Concern. North Dakota Field Office, Mountain-Prairie Region, USFWS. February 2013.

US Geological Survey (USGS). 2019. 3D Elevation Program (3DEP). 3D elevation data from Light Detection and Ranging (LIDAR) data: conterminous United States, Hawaii, and the US territories. USGS, Reston, Virginia. Accessed August 2020. Information online: https://www.usgs.gov/core-science-systems/ngp/3dep

US Geological Survey (USGS) Protected Areas Database of the United States (PAD-US). 2019. Protected Areas Data. USGS National Gap Analysis Program (GAP) - Protected Areas Data Portal. Accessed March 2020. Information online: http://gapanalysis.usgs.gov/padus/data/

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. doi: 10.1016/j.isprsjprs.2018.09.006.

Appendix A. All Bird Types and Species Observed within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Appendix A. Numbers of large bird groups (grps) and observations (obs), regardless of distance from observer, by bird type, raptor subtype, and species, for 60-minute large bird use surveys conducted at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Type/Species	Scientific Name	Summer		Fall		Winter		Spring		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Waterbirds		**11**	**30**	**4**	**193**	**0**	**0**	**12**	**705**	**27**	**928**
sandhill crane	*Antigone canadensis*	0	0	2	180	0	0	11	704	13	884
great blue heron	*Ardea herodias*	1	1	1	1	0	0	1	1	3	3
American white pelican	*Pelecanus erythrorhynchos*	8	21	0	0	0	0	0	0	8	21
double-crested cormorant	*Phalacrocorax auritus*	2	8	1	12	0	0	0	0	3	20
Waterfowl		**31**	**101**	**24**	**1,017**	**25**	**674**	**113**	**2,165**	**193**	**3,957**
green-winged teal	*Anas crecca*	1	2	0	0	0	0	0	0	1	2
mallard	*Anas platyrhynchos*	24	41	1	9	0	0	24	62	49	112
snow goose	*Anser caerulescens*	0	0	1	24	0	0	0	0	1	24
Canada goose	*Branta canadensis*	5	56	22	984	25	674	81	1,871	133	3,585
cackling goose	*Branta hutchinsii*	0	0	0	0	0	0	6	81	6	81
gadwall	*Mareca strepera*	1	2	0	0	0	0	0	0	1	2
northern shoveler	*Spatula clypeata*	0	0	0	0	0	0	1	1	1	1
unidentified goose		0	0	0	0	0	0	1	150	1	150
Shorebirds		**94**	**110**	**2**	**2**	**0**	**0**	**4**	**8**	**100**	**120**
upland sandpiper	*Bartramia longicauda*	60	68	0	0	0	0	0	0	60	68
killdeer	*Charadrius vociferus*	30	38	2	2	0	0	4	8	36	48
Wilson's snipe	*Gallinago delicata*	4	4	0	0	0	0	0	0	4	4
Gulls/Terns		**6**	**7**	**2**	**103**	**0**	**0**	**15**	**49**	**23**	**159**
ring-billed gull	*Larus delawarensis*	6	7	2	103	0	0	5	10	13	120
unidentified gull		0	0	0	0	0	0	10	39	10	39
Diurnal Raptors		**139**	**164**	**126**	**147**	**7**	**7**	**254**	**287**	**526**	**605**
Accipiters		*0*	*0*	*1*	*1*	*1*	*1*	*15*	*15*	*17*	*17*
Cooper's hawk	*Accipiter cooperii*	0	0	1	1	0	0	10	10	11	11
sharp-shinned hawk	*Accipiter striatus*	0	0	0	0	1	1	5	5	6	6
Buteos		*107*	*127*	*89*	*106*	*2*	*2*	*163*	*186*	*361*	*421*
red-tailed hawk	*Buteo jamaicensis*	77	86	58	58	0	0	142	164	277	308

Appendix A. Numbers of large bird groups (grps) and observations (obs), regardless of distance from observer, by bird type, raptor subtype, and species, for 60-minute large bird use surveys conducted at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Type/Species	Scientific Name	Summer		Fall		Winter		Spring		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
rough-legged hawk	*Buteo lagopus*	0	0	1	1	2	2	3	3	6	6
broad-winged hawk	*Buteo platypterus*	0	0	7	19	0	0	0	0	7	19
ferruginous hawk	*Buteo regalis*	0	0	0	0	0	0	4	4	4	4
unidentified buteo		0	0	4	4	0	0	0	0	4	4
Swainson's hawk	*Buteo swainsoni*	30	41	19	24	0	0	14	15	63	80
Northern Harrier		*28*	*31*	*28*	*30*	*0*	*0*	*25*	*29*	*81*	*90*
northern harrier	*Circus hudsonius*	28	31	28	30	0	0	25	29	81	90
Eagles		*3*	*3*	*6*	*6*	*4*	*4*	*15*	*15*	*28*	*28*
golden eagle	*Aquila chrysaetos*	0	0	1	1	0	0	1	1	2	2
bald eagle	*Haliaeetus leucocephalus*	3	3	5	5	4	4	14	14	26	26
Falcons		*1*	*3*	*2*	*4*	*0*	*0*	*14*	*15*	*17*	*22*
merlin	*Falco columbarius*	0	0	1	3	0	0	0	0	1	3
American kestrel	*Falco sparverius*	1	3	1	1	0	0	14	15	16	19
Other Raptors		*0*	*0*	*0*	*0*	*0*	*0*	*22*	*27*	*22*	*27*
unidentified raptor		0	0	0	0	0	0	22	27	22	27
Owls		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**
great horned owl	*Bubo virginianus*	0	0	0	0	0	0	1	1	1	1
Vultures		**53**	**72**	**11**	**12**	**0**	**0**	**22**	**47**	**86**	**131**
turkey vulture	*Cathartes aura*	53	72	11	12	0	0	22	47	86	131
Upland Game Birds		**99**	**101**	**44**	**84**	**25**	**83**	**52**	**80**	**220**	**348**
wild turkey	*Meleagris gallopavo*	0	0	3	3	1	1	0	0	4	4
gray partridge	*Perdix perdix*	1	1	2	9	4	27	0	0	7	37
ring-necked pheasant	*Phasianus colchicus*	98	100	32	41	19	41	45	54	194	236
sharp-tailed grouse	*Tympanuchus phasianellus*	0	0	7	31	1	14	7	26	15	71
Doves/Pigeons		**157**	**264**	**34**	**64**	**5**	**8**	**9**	**23**	**205**	**359**
rock pigeon	*Columba livia*	2	5	2	6	3	6	4	13	11	30
Eurasian collared-dove	*Streptopelia decaocto*	2	2	0	0	1	1	0	0	3	3
mourning dove	*Zenaida macroura*	153	257	32	58	1	1	5	10	191	326

Appendix A. Numbers of large bird groups (grps) and observations (obs), regardless of distance from observer, by bird type, raptor subtype, and species, for 60-minute large bird use surveys conducted at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Type/Species	Scientific Name	Summer		Fall		Winter		Spring		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Large Corvids		**6**	**6**	**12**	**52**	**4**	**4**	**19**	**53**	**41**	**115**
American crow	*Corvus brachyrhynchos*	5	5	7	46	0	0	3	27	15	78
black-billed magpie	*Pica hudsonia*	1	1	5	6	4	4	16	26	26	37
Overall		**596**	**855**	**259**	**1,674**	**66**	**776**	**501**	**3,418**	**1,422**	**6,723**

Appendix B. Bird Use, Percent of Use, and Frequency of Occurrence for Large Birds Observed during Avian Use Surveys within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Appendix B. Mean use (number of birds/800-meter plot/60-minute survey), percent (%) of use, and frequency of occurrence (%) for each large bird type, raptor subtype, and species, by season, during the avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Mean Use				% of Use				% Frequency			
Type/Species	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**
Waterbirds	**0.16**	**1.01**	**0**	**3.67**	**3.5**	**11.5**	**0**	**20.6**	**5.2**	**2.1**	**0**	**5.7**
sandhill crane	0	0.94	0	3.67	0	10.8	0	20.6	0	1.0	0	5.2
great blue heron	0.01	0.01	0	0.01	0.1	0.1	0	<0.1	0.5	0.5	0	0.5
American white pelican	0.11	0	0	0	2.5	0	0	0	3.6	0	0	0
double-crested cormorant	0.04	0.06	0	0	0.9	0.7	0	0	1.0	0.5	0	0
Waterfowl	**0.53**	**5.30**	**3.96**	**11.28**	**11.8**	**60.8**	**86.5**	**63.4**	**10.4**	**6.8**	**10.7**	**33.9**
green-winged teal	0.01	0	0	0	0.2	0	0	0	0.5	0	0	0
mallard	0.21	0.05	0	0.32	4.8	0.5	0	1.8	9.4	0.5	0	10.9
snow goose	0	0.13	0	0	0	1.4	0	0	0	0.5	0	0
Canada goose	0.29	5.13	3.96	9.74	6.6	58.8	86.5	54.8	1.6	6.3	10.7	26.6
cackling goose	0	0	0	0.42	0	0	0	2.4	0	0	0	3.1
gadwall	0.01	0	0	0	0.2	0	0	0	0.5	0	0	0
northern shoveler	0	0	0	0.01	0	0	0	<0.1	0	0	0	0.5
unidentified goose	0	0	0	0.78	0	0	0	4.4	0	0	0	0.5
Shorebirds	**0.57**	**0.01**	**0**	**0.04**	**12.9**	**0.1**	**0**	**0.2**	**34.4**	**1.0**	**0**	**2.1**
upland sandpiper	0.35	0	0	0	8.0	0	0	0	25.5	0	0	0
killdeer	0.20	0.01	0	0.04	4.5	0.1	0	0.2	14.1	1.0	0	2.1
Wilson's snipe	0.02	0	0	0	0.5	0	0	0	2.1	0	0	0
Gulls/Terns	**0.04**	**0.54**	**0**	**0.26**	**0.8**	**6.2**	**0**	**1.4**	**2.6**	**1.0**	**0**	**5.7**
ring-billed gull	0.04	0.54	0	0.05	0.8	6.2	0	0.3	2.6	1.0	0	2.6
unidentified gull	0	0	0	0.20	0	0	0	1.1	0	0	0	3.1
Diurnal Raptors	**0.84**	**0.77**	**0.04**	**1.49**	**19.0**	**8.8**	**0.9**	**8.4**	**43.8**	**37.5**	**3.6**	**54.2**
Accipiters	*0*	*0.01*	*0.01*	*0.08*	*0*	*0.1*	*0.1*	*0.4*	*0*	*0.5*	*0.6*	*6.8*
Cooper's hawk	0	0.01	0	0.05	0	0.1	0	0.3	0	0.5	0	5.2
sharp-shinned hawk	0	0	0.01	0.03	0	0	0.1	0.1	0	0	0.6	2.6
Buteos	*0.66*	*0.55*	*0.01*	*0.97*	*14.9*	*6.3*	*0.3*	*5.4*	*39.1*	*28.6*	*1.2*	*47.9*
red-tailed hawk	0.45	0.30	0	0.85	10.1	3.5	0	4.8	29.7	21.9	0	43.2
rough-legged hawk	0	0.01	0.01	0.02	0	0.1	0.3	0.1	0	0.5	1.2	1.6

Appendix B. Mean use (number of birds/800-meter plot/60-minute survey), percent (%) of use, and frequency of occurrence (%) for each large bird type, raptor subtype, and species, by season, during the avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Mean Use				% of Use				% Frequency			
Type/Species	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**
broad-winged hawk	0	0.10	0	0	0	1.1	0	0	0	1.6	0	0
ferruginous hawk	0	0	0	0.02	0	0	0	0.1	0	0	0	2.1
unidentified buteo	0	0.02	0	0	0	0.2	0	0	0	2.1	0	0
Swainson's hawk	0.21	0.13	0	0.08	4.8	1.4	0	0.4	13.0	9.4	0	5.2
Northern Harrier	*0.16*	*0.16*	*0*	*0.15*	*3.6*	*1.8*	*0*	*0.8*	*11.5*	*13.0*	*0*	*11.5*
northern harrier	0.16	0.16	0	0.15	3.6	1.8	0	0.8	11.5	13.0	0	11.5
Eagles	*0.01*	*0.03*	*0.02*	*0.07*	*0.1*	*0.4*	*0.5*	*0.4*	*0.5*	*2.1*	*1.8*	*4.7*
golden eagle	0	0.01	0	0.01	0	0.1	0	<0.1	0	0.5	0	0.5
bald eagle	0.01	0.03	0.02	0.07	0.1	0.3	0.5	0.4	0.5	1.6	1.8	4.2
Falcons	*0.02*	*0.02*	*0*	*0.08*	*0.4*	*0.2*	*0*	*0.4*	*0.5*	*1.0*	*0*	*6.8*
merlin	0	0.02	0	0	0	0.2	0	0	0	0.5	0	0
American kestrel	0.02	0.01	0	0.08	0.4	0.1	0	0.4	0.5	0.5	0	6.8
Other Raptors	*0*	*0*	*0*	*0.14*	*0*	*0*	*0*	*0.8*	*0*	*0*	*0*	*10.4*
unidentified raptor	0	0	0	0.14	0	0	0	0.8	0	0	0	10.4
Owls	**0**	**0**	**0**	**0.01**	**0**	**0**	**0**	**<0.1**	**0**	**0**	**0**	**0.5**
great horned owl	0	0	0	0.01	0	0	0	<0.1	0	0	0	0.5
Vultures	**0.38**	**0.06**	**0**	**0.24**	**8.4**	**0.7**	**0**	**1.4**	**19.8**	**5.7**	**0**	**10.9**
turkey vulture	0.38	0.06	0	0.24	8.4	0.7	0	1.4	19.8	5.7	0	10.9
Upland Game Birds	**0.53**	**0.44**	**0.50**	**0.42**	**11.8**	**5.0**	**11.0**	**2.3**	**36.5**	**17.2**	**13.8**	**22.4**
wild turkey	0	0.02	0.01	0	0	0.2	0.1	0	0	1.0	0.6	0
gray partridge	0.01	0.05	0.16	0	0.1	0.5	3.5	0	0.5	1.0	2.4	0
ring-necked pheasant	0.52	0.21	0.25	0.28	11.7	2.4	5.4	1.6	36.5	13.5	10.2	19.8
sharp-tailed grouse	0	0.16	0.09	0.14	0	1.9	1.9	0.8	0	2.6	0.6	3.1
Doves/Pigeons	**1.38**	**0.33**	**0.05**	**0.12**	**30.9**	**3.8**	**1.1**	**0.7**	**45.3**	**10.4**	**2.5**	**4.7**
rock pigeon	0.03	0.03	0.04	0.07	0.6	0.4	0.8	0.4	1.0	1.0	1.3	2.1
Eurasian collared-dove	0.01	0	0.01	0	0.2	0	0.1	0	1.0	0	0.6	0
mourning dove	1.34	0.30	0.01	0.05	30.1	3.5	0.1	0.3	43.8	9.4	0.6	2.6

Appendix B. Mean use (number of birds/800-meter plot/60-minute survey), percent (%) of use, and frequency of occurrence (%) for each large bird type, raptor subtype, and species, by season, during the avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Mean Use				% of Use				% Frequency			
Type/Species	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**
Large Corvids	**0.03**	**0.27**	**0.02**	**0.28**	**0.7**	**3.1**	**0.5**	**1.6**	**3.1**	**4.7**	**2.5**	**8.3**
American crow	0.03	0.24	0	0.14	0.6	2.7	0	0.8	2.6	2.1	0	1.6
black-billed magpie	0.01	0.03	0.02	0.14	0.1	0.4	0.5	0.8	0.5	2.6	2.5	6.8
Overall[1]	**4.44**	**8.72**	**4.57**	**17.80**	**100**	**100**	**100**	**100**	**NA**	**NA**	**NA**	**NA**

[1.] Sums of values may not equal totals shown due to rounding.

Appendix C. Mean Use by Point for All Large Birds, Bird Types, and Diurnal Raptor Subtypes during Avian Use Surveys within the Avian Use Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

Appendix C. Large bird mean use[1] by point by bird type and diurnal raptor subtype observed at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Survey Point										
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Waterbirds	**0**	**0**	**1.00**	**3.18**	**4.17**	**0**	**7.50**	**0**	**0.08**	**0**	**0**
Waterfowl	**1.50**	**0.33**	**1.08**	**1.45**	**0.17**	**0**	**1.33**	**26.58**	**39.25**	**16.42**	**30.17**
Shorebirds	**0.08**	**0.42**	**0.17**	**0.18**	**0.42**	**0**	**0**	**0**	**0.17**	**0.42**	**0**
Gulls/Terns	**0**	**0**	**0.08**	**0.18**	**0.17**	**0**	**0**	**0**	**1.00**	**0**	**0**
Diurnal Raptors	**0.67**	**1.25**	**0.83**	**0.73**	**0.58**	**1.42**	**0.75**	**0.42**	**1.17**	**1.92**	**0.25**
Accipiters	*0.08*	*0*	*0*	*0.09*	*0*	*0*	*0*	*0*	*0*	*0.17*	*0*
Buteos	*0.42*	*0.83*	*0.50*	*0.36*	*0.58*	*0.83*	*0.17*	*0.17*	*0.42*	*1.33*	*0.25*
Northern Harrier	*0.08*	*0*	*0.25*	*0.09*	*0*	*0.25*	*0.58*	*0.17*	*0.58*	*0.25*	*0*
Eagles	*0*	*0*	*0*	*0.09*	*0*	*0.17*	*0*	*0*	*0.17*	*0*	*0*
Falcons	*0.08*	*0.33*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*	*0.08*	*0*
Other Raptors	*0*	*0.08*	*0*	*0.09*	*0*	*0.17*	*0*	*0.08*	*0*	*0.08*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0.08**	**0.33**	**0**	**0**	**0.08**	**0**	**0**	**0**	**0.50**	**0**	**0.33**
Upland Game Birds	**0.92**	**1.25**	**0.25**	**0.09**	**0.33**	**0.75**	**2.33**	**0.17**	**0.25**	**0.17**	**1.42**
Doves/Pigeons	**0.42**	**1.33**	**1.08**	**0.18**	**1.50**	**0.50**	**1.67**	**0.17**	**0.83**	**1.00**	**0**
Large Corvids	**0.08**	**0.08**	**3.17**	**0**	**0**	**0**	**0**	**0.08**	**0**	**0**	**0**
All Large Birds[2]	**3.75**	**5.00**	**7.67**	**6.00**	**7.42**	**2.67**	**13.58**	**27.42**	**43.25**	**19.92**	**32.17**

1. 800-meter (2,625-foot) radius plot and 60-minute survey.

2. Sums of values may not equal totals shown due to rounding.

Appendix C. Large bird mean use[1] by point by bird type and diurnal raptor subtype observed at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Survey Point										
Bird Type	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Waterbirds	**0**	**0**	**0**	**0**	**0**	**0**	**4.17**	**0**	**0**	**0**	**0.08**
Waterfowl	**2.08**	**4.17**	**4.33**	**1.50**	**0**	**2.00**	**0**	**3.00**	**1.17**	**1.09**	**0**
Shorebirds	**0.08**	**0.25**	**0**	**0.25**	**0.67**	**0.17**	**0.08**	**0.67**	**0.08**	**0.09**	**0.08**
Gulls/Terns	**0**	**0.25**	**0**	**0**	**0.33**	**0.08**	**0**	**0**	**0**	**0**	**0**
Diurnal Raptors	**0.83**	**0.92**	**0.83**	**1.00**	**1.33**	**0.50**	**0.50**	**0.78**	**0.50**	**1.18**	**0.75**
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.08*
Buteos	*0.75*	*0.67*	*0.50*	*0.67*	*0.44*	*0.50*	*0.17*	*0.78*	*0.25*	*0.73*	*0.50*
Northern Harrier	*0.08*	*0.17*	*0.17*	*0.17*	*0.33*	*0*	*0.17*	*0*	*0.08*	*0.45*	*0.08*
Eagles	*0*	*0.08*	*0.08*	*0.17*	*0*	*0*	*0.17*	*0*	*0.17*	*0*	*0*
Falcons	*0*	*0*	*0*	*0*	*0.44*	*0*	*0*	*0*	*0*	*0*	*0*
Other Raptors	*0*	*0*	*0.08*	*0*	*0.11*	*0*	*0*	*0*	*0*	*0*	*0.08*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0.83**	**0.33**	**0.75**	**0.33**	**0.22**	**0.25**	**0.33**	**0.11**	**0.17**	**0.45**	**0**
Upland Game Birds	**0.08**	**0.25**	**0.42**	**0.25**	**0.67**	**0.17**	**0.25**	**0.89**	**0**	**0.45**	**0.33**
Doves/Pigeons	**0.17**	**0.25**	**0.25**	**0.17**	**0.11**	**0.08**	**0.58**	**0.67**	**0**	**0.55**	**0.42**
Large Corvids	**0.17**	**0**	**0.17**	**0.08**	**0.11**	**0.08**	**0**	**0**	**0**	**0.09**	**0**
All Large Birds[2]	**4.25**	**6.42**	**6.75**	**3.58**	**3.44**	**3.33**	**5.92**	**6.11**	**1.92**	**3.91**	**1.67**

1. 800-meter (2,625-foot) radius plot and 60-minute survey.

2. Sums of values may not equal totals shown due to rounding.

Appendix C. Large bird mean use[1] by point by bird type and diurnal raptor subtype observed at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Survey Point									
Bird Type	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Waterbirds	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.25**	**0**
Waterfowl	**0**	**0.33**	**2.08**	**0**	**19.83**	**13.50**	**0**	**2.58**	**3.50**	**1.42**
Shorebirds	**0**	**0**	**0.08**	**0.08**	**0.17**	**0.17**	**0.09**	**0.17**	**0**	**0.17**
Gulls/Terns	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.17**	**0**	**0**
Diurnal Raptors	**0.50**	**0.58**	**0.67**	**0.67**	**1.00**	**0.75**	**0.73**	**0.75**	**1.08**	**1.33**
Accipiters	*0*	*0*	*0*	*0.17*	*0*	*0.08*	*0*	*0*	*0*	*0*
Buteos	*0.42*	*0.50*	*0.42*	*0.50*	*0.92*	*0.42*	*0.64*	*0.33*	*1.08*	*1.25*
Northern Harrier	*0.08*	*0*	*0.25*	*0*	*0.08*	*0.17*	*0*	*0.25*	*0*	*0*
Eagles	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.17*	*0*	*0.08*
Falcons	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Other Raptors	*0*	*0.08*	*0*	*0*	*0*	*0.08*	*0.09*	*0*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0.08**	**0.25**	**0.33**	**0.08**	**0.42**	**0.08**	**0.09**	**0.42**	**0.50**	**0.25**
Upland Game Birds	**0.08**	**0.17**	**0.83**	**0.25**	**1.17**	**0.58**	**0.82**	**0.25**	**1.33**	**0.50**
Doves/Pigeons	**0**	**0.08**	**0.42**	**0.67**	**0.25**	**0**	**0.73**	**0.08**	**3.33**	**0**
Large Corvids	**0.58**	**0**	**0**	**0**	**0.08**	**0.08**	**0**	**0.17**	**0**	**0**
All Large Birds[2]	**1.25**	**1.42**	**4.42**	**1.75**	**22.92**	**15.17**	**2.45**	**4.58**	**10.00**	**3.67**

1. 800-meter (2,625-foot) radius plot and 60-minute survey.

2. Sums of values may not equal totals shown due to rounding.

Appendix C. Large bird mean use[1] by point by bird type and diurnal raptor subtype observed at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Survey Point										
Bird Type	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
Waterbirds	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Waterfowl	**12.50**	**0**	**0**	**0**	**3.00**	**9.58**	**4.36**	**0.25**	**5.25**	**2.08**	**0**
Shorebirds	**0.08**	**0.22**	**0.25**	**0.11**	**0**	**0.08**	**0.27**	**0**	**0.33**	**0**	**0.08**
Gulls/Terns	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Diurnal Raptors	**0.50**	**1.11**	**0.50**	**1.00**	**0.70**	**0.67**	**0.64**	**1.00**	**0.17**	**0.42**	**1.58**
Accipiters	*0*	*0*	*0*	*0*	*0.10*	*0.08*	*0*	*0.08*	*0*	*0.08*	*0*
Buteos	*0.50*	*1.00*	*0.42*	*0.78*	*0.50*	*0.50*	*0.45*	*0.75*	*0.17*	*0.17*	*1.08*
Northern Harrier	*0*	*0*	*0.08*	*0.11*	*0.10*	*0.08*	*0*	*0.08*	*0*	*0.17*	*0.25*
Eagles	*0*	*0*	*0*	*0.11*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0*	*0.11*	*0*	*0*	*0*	*0*	*0.09*	*0*	*0*	*0*	*0.25*
Other Raptors	*0*	*0*	*0*	*0*	*0*	*0*	*0.09*	*0.08*	*0*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0**	**0**	**0**	**0.33**	**0.40**	**0.08**	**0**	**0.08**	**0.08**	**0.08**	**0**
Upland Game Birds	**0.33**	**0.67**	**0.08**	**0**	**0**	**0**	**0.18**	**0.42**	**1.50**	**0.50**	**0.17**
Doves/Pigeons	**0.75**	**0.11**	**0**	**0**	**0**	**0.17**	**0.36**	**1.00**	**0.83**	**0.67**	**0.75**
Large Corvids	**0.42**	**0.11**	**0**	**0.89**	**0**	**0**	**0**	**0.08**	**0**	**0.25**	**0.08**
All Large Birds[2]	**14.58**	**2.22**	**0.83**	**2.33**	**4.10**	**10.58**	**5.82**	**2.83**	**8.17**	**4.00**	**2.67**

1. 800-meter (2,625-foot) radius plot and 60-minute survey.

2. Sums of values may not equal totals shown due to rounding.

Appendix C. Large bird mean use[1] by point by bird type and diurnal raptor subtype observed at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Survey Point									
Bird Type	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**
Waterbirds	**3.75**	**7.50**	**0**	**0**	**0.08**	**1.17**	**5.00**	**0.42**	**0**	**0**
Waterfowl	**8.67**	**14.83**	**9.25**	**9.25**	**26.58**	**4.17**	**0**	**0.33**	**0.08**	**0**
Shorebirds	**0**	**0.33**	**0.08**	**0**	**0.33**	**0.08**	**0.08**	**0.08**	**0.17**	**0.25**
Gulls/Terns	**1.75**	**0**	**0.25**	**0**	**0.08**	**0**	**0**	**0**	**0**	**0**
Diurnal Raptors	**0.25**	**0.50**	**0.58**	**1.08**	**1.00**	**0.58**	**0.83**	**0.25**	**1.75**	**0.25**
Accipiters	*0*	*0*	*0*	*0.08*	*0*	*0*	*0.08*	*0*	*0*	*0*
Buteos	*0.17*	*0.50*	*0.50*	*0.58*	*0.17*	*0.42*	*0.42*	*0.17*	*1.58*	*0.17*
Northern Harrier	*0*	*0*	*0.08*	*0.17*	*0.08*	*0*	*0.33*	*0*	*0.08*	*0*
Eagles	*0*	*0*	*0*	*0.25*	*0.25*	*0.08*	*0*	*0*	*0*	*0*
Falcons	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*	*0.08*	*0*	*0.08*
Other Raptors	*0*	*0*	*0*	*0*	*0.50*	*0.08*	*0*	*0*	*0.08*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0.17**	**0.25**	**0.42**	**0**	**0**	**0**	**0.08**	**0.25**	**0.08**	**0**
Upland Game Birds	**0.67**	**0.17**	**0.08**	**0.58**	**0.17**	**0.58**	**1.08**	**0.08**	**0.25**	**0.08**
Doves/Pigeons	**1.67**	**0.42**	**0.67**	**0.25**	**0.08**	**0.08**	**0.17**	**0.17**	**0.67**	**0.17**
Large Corvids	**0**	**0.17**	**0.08**	**0.17**	**0**	**0**	**0.17**	**0**	**0.08**	**0.08**
All Large Birds[2]	**16.92**	**24.17**	**11.42**	**11.33**	**28.33**	**6.67**	**7.42**	**1.58**	**3.08**	**0.83**

1. 800-meter (2,625-foot) radius plot and 60-minute survey.

2. Sums of values may not equal totals shown due to rounding.

Appendix C. Large bird mean use[1] by point by bird type and diurnal raptor subtype observed at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from June 6, 2019 – May 31, 2020.

	Survey Point										
Bird Type	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**
Waterbirds	**0**	**18.33**	**0.42**	**13.82**	**0.67**	**2.83**	**5.20**	**0**	**0**	**0**	**0**
Waterfowl	**3.83**	**0**	**1.83**	**4.36**	**11.17**	**0.17**	**18.80**	**1.58**	**0**	**0.50**	**2.10**
Shorebirds	**0.25**	**0**	**0**	**0.09**	**0.17**	**0.58**	**0.70**	**0.25**	**0.08**	**0.25**	**0.20**
Gulls/Terns	**0**	**0**	**0.17**	**0**	**8.67**	**0**	**0.10**	**0**	**0**	**0**	**0.10**
Diurnal Raptors	**0.67**	**0.50**	**1.08**	**1.09**	**1.00**	**2.08**	**1.10**	**0.50**	**0.33**	**0.58**	**0.50**
Accipiters	*0*	*0.08*	*0.08*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.42*	*0.08*	*0.33*	*0.91*	*0.75*	*2.08*	*0.80*	*0.50*	*0.33*	*0.50*	*0.40*
Northern Harrier	*0.17*	*0.33*	*0.33*	*0*	*0*	*0*	*0.30*	*0*	*0*	*0.08*	*0.10*
Eagles	*0*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0.08*	*0*	*0*	*0.09*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*
Other Raptors	*0*	*0*	*0.25*	*0.09*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0.10**	**0**	**0**	**0**	**0**
Vultures	**0**	**0**	**0**	**0.36**	**0.25**	**0**	**0**	**0.33**	**0**	**0.17**	**0.20**
Upland Game Birds	**0.58**	**0.08**	**0.25**	**0.09**	**0.08**	**0.25**	**1.50**	**0.33**	**1.00**	**0.25**	**0.30**
Doves/Pigeons	**0.08**	**0.67**	**0.50**	**0**	**1.17**	**0.25**	**0.70**	**0.08**	**0.50**	**0**	**0**
Large Corvids	**2.00**	**0.08**	**0**	**0**	**0**	**0.08**	**0**	**0**	**0**	**0.08**	**0**
All Large Birds[2]	**7.42**	**19.67**	**4.25**	**19.82**	**23.17**	**6.25**	**28.20**	**3.08**	**1.92**	**1.83**	**3.40**

1. 800-meter (2,625-foot) radius plot and 60-minute survey.

2. Sums of values may not equal totals shown due to rounding.

Appendix B8. Avian Use Study (2022-2023)

Avian Use Study

March 2022 – February 2023

Oliver Wind IV Project

Oliver and Mercer Counties, North Dakota

Final Report

Prepared for:

Oliver Wind IV, LLC

Prepared by:

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4007 State Street, Suite 109
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Report Date: August 22, 2023

Privileged and Confidential – Not For Distribution

EXECUTIVE SUMMARY

Oliver Wind IV, LLC (Company) is evaluating the potential for wind energy development at the Oliver Wind IV Project and Transmission Line (collectively, the Project) in Oliver and Mercer Counties, North Dakota. The principal objectives of the study were to gather information on spatial and temporal use by large birds and document incidental wildlife observations in the Study Area.

A total of 478 avian use surveys were completed across 49 survey plots within the Study Area, and 30 species (2,762 individual large birds) were observed during the 2022-2023 surveys. and Species richness was highest in spring, followed by fall, summer, and winter. The most abundant large bird species were Canada goose (726; *Branta canadensis*) and sandhill crane (461; *Antigone canadensis*). The most abundant diurnal raptor species were red-tailed hawk (128; *Buteo jamaicenis*). Large bird mean use ranged from 2.86 to 14.94 observations/800-meter (m; 2,625-foot [ft]) radius plot/60-minute (min) survey among seasons and was highest during spring, followed by fall, summer, and winter. Waterbirds composed the majority of observations and use during spring, shorebirds during summer, waterfowl during the fall, and upland game birds during winter. Diurnal raptors were the most frequently observed group during the spring and fall, shorebirds during the summer, and upland game birds in the winter. Overall, large bird use did not appear to be associated with any features on the ground.

Overall bald (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) mean use was less than 0.05 observations/800-m radius plot/60-min survey. Combined eagle mean use ranged from zero to 0.05 among seasons. Bald eagle mean use ranged from 0.04 in the spring followed by summer and fall seasons (0.02 each). There were no bald eagle observations during winter. Golden eagle mean use was 0.01 in the spring and summer seasons each with no observations in the fall or winter.

Eagle exposure minutes per survey hour ranged from zero to 0.20 across seasons. Eagle exposure minutes per survey hour were highest in spring, followed by fall and summer. There were no eagle minutes recorded during the winter. Eagle exposure minutes per survey hour ranged from zero to 0.45 across months, peaking in April. The majority of non-exposure eagle minutes were due to perched activity.

Ten special status avian species were observed during the study. These were defined as federally listed threatened and endangered species, eagles (protected by Bald and Golden Eagle Protection Act), and Level 1 and 2 Species of Conservation Priority according to North Dakota Game and Fish Department. Special status species were only observed during surveys and included six diurnal raptors, one water bird, one gull, one shore bird, and one upland gamebird. No federally threatened or endangered avian species were recorded within the Study Area.

STUDY PARTICIPANTS

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INTRODUCTION

NextEra Energy Resources LLC (NextEra) is considering development of a wind energy facility in Oliver and Mercer Counties, North Dakota, referred to as the Oliver Wind IV Project (Project; Figure 1). The Project is expected to include wind turbines, access roads, underground collection lines, a substation, an operations and maintenance building, and other associated infrastructure typical of a utility-scale wind energy project. NextEra contracted Western EcoSystems Technology, Inc. (WEST) to conduct a second year of pre-construction baseline avian use studies at the Project. Study methodology was based upon the recommendations in the US Fish and Wildlife Service's (USFWS) 2012 *Final Land-Based Wind Energy Guidelines* (WEG), Appendix C(1)(a) of the 2013 USFWS *Eagle Conservation Plan Guidelines* (ECPG), and the USFWS *Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests* (2016 Final Eagle Rule [81 Federal Regulation 91494 (2016)]).

The objectives of the studies were to gather information on spatial and temporal large bird use within the Project Study Area, and record incidental wildlife observations. This report summarizes results from surveys from March 2022 to February 2023 at the Project.

STUDY AREA

The approximately 70,543-acres (28,548-hectares) Study Area (defined as the minimum convex polygon [MCP] surrounding proposed turbine locations) located in Oliver and Mercer Counties, North Dakota, is approximately four miles (six kilometers) west of the town of Center (Figure 1). The Project MCP is located within the Level III Northwestern Glaciated Plains Ecoregion, a transitional region characterized by significant surface irregularity and high concentrations of seasonal and semi-permanent wetlands (US Environmental Protection Agency 2012, 2013) that create favorable conditions for duck nesting and migrating. Historically dominated by grasslands, this area has been partially converted to agricultural use with crop production the primary practice (Griffith 2010, Sayler 2016). Trees and shrubs can be found around farmsteads, within planted shelterbelts, and along/within drainages.

Based on review of the 2019 National Land Cover Database (2019), the majority (49.9%) of the Study Area is herbaceous, followed by cultivated crops (35.5%; Table 1, Figure 2). Hay/Pasture and developed represent 10.47% and 2.7% of the Study Area, respectively; all other land covers represent 1.0% or less of the Study Area each (Table 1, Figure 2). Topography within Study Area is almost level to slightly rolling, with elevations ranging from 600–727 meters (m; 1,969–2,385 feet [ft]) above sea level (Figure 3; US Geological Survey 2023).

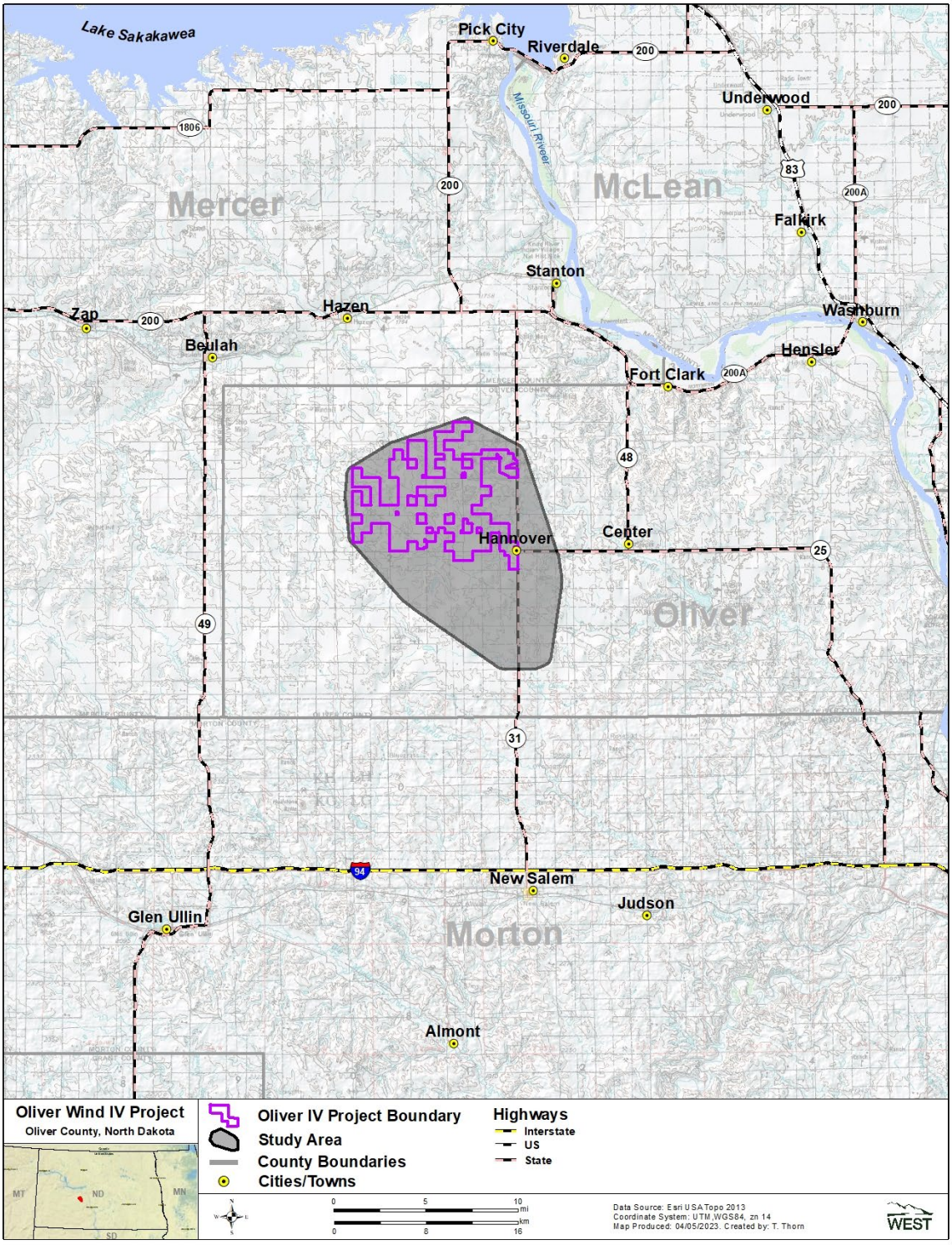

Figure 1. Location of the Oliver Wind IV Project Study Area, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

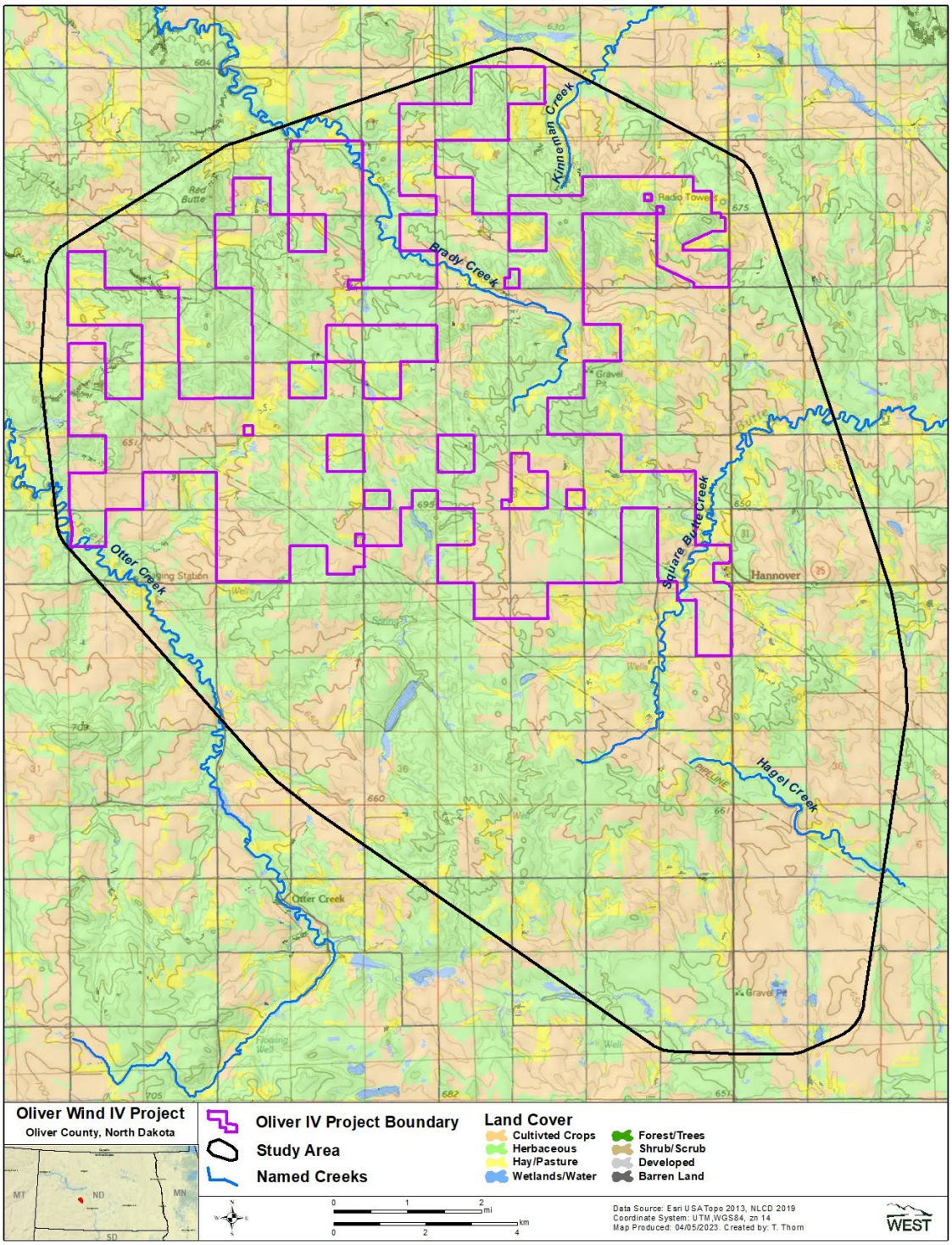

Figure 2. Land cover types within the Oliver Wind IV Project Study Area, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

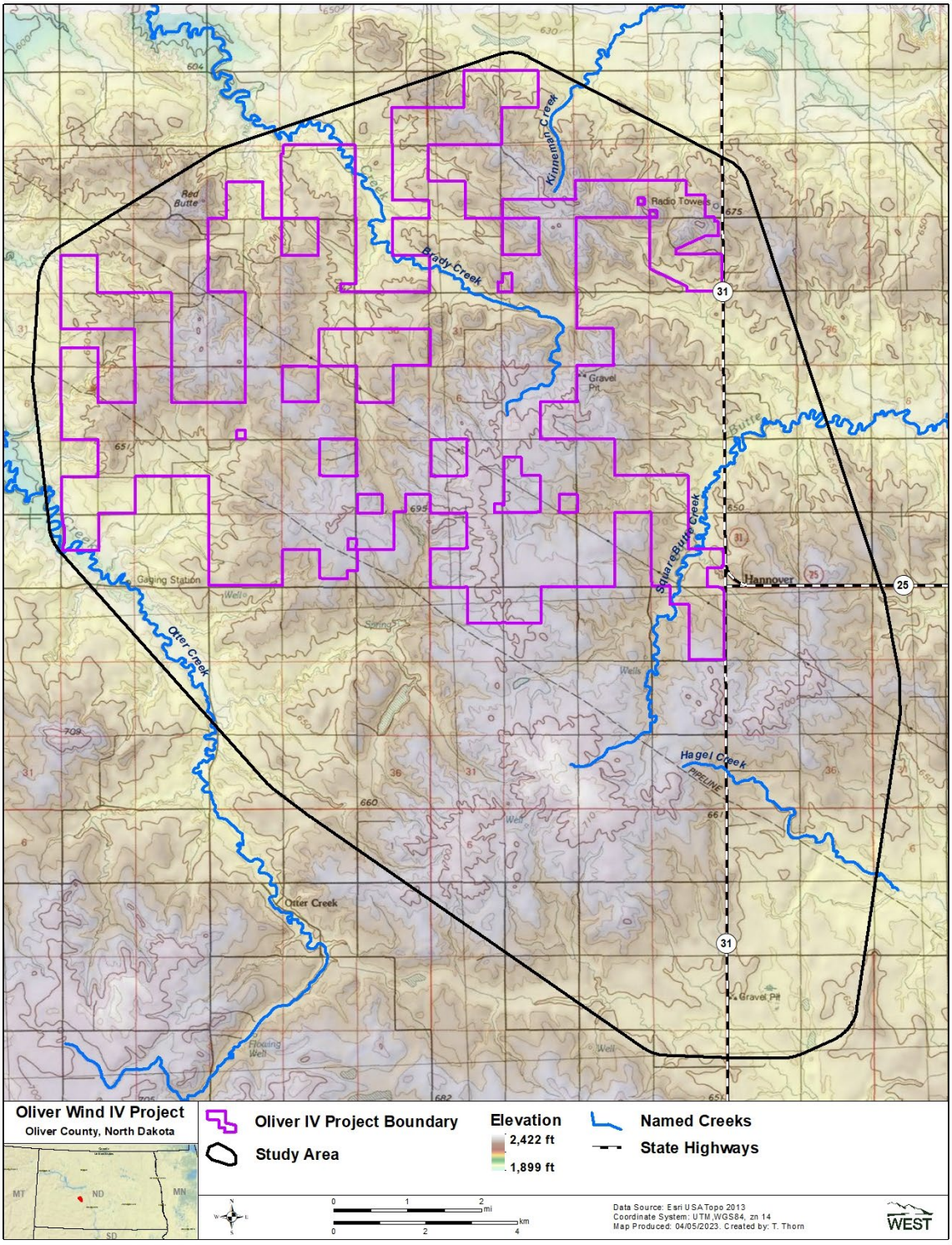

Figure 3. Elevation of the Oliver Wind IV Project Study Area, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Table 1. Land cover, coverage, and percent (%) composition within the Study Area at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Land Cover	Coverage (Acres)	% Composition
Herbaceuous	35,211.1	49.9
Cultivated Crops	25,041.4	35.5
Hay/Pasture	7,387.4	10.5
Developed	1,887.4	2.7
Water/Wetland	622.3	0.9
Forest/Trees	269.5	0.4
Shrub/Scrub	107.5	0.2
Barren Land	16.5	<0.1
Total[1]	**70,543.1**	**100**

[1.] Totals may not sum due to rounding.

Source: National Land Cover Database (2019)

METHODS

The avian use study design and survey methods primarily followed guidance in the ECPG and the 2016 Final Eagle Rule because of the need to collect information on eagles, while also following guidance from the WEG to collect information on other special status bird species. Large birds were defined as waterbirds, waterfowl, shorebirds, gulls/terns, diurnal raptors (i.e., kites, accipiters, buteos, eagles, falcons, northern harrier, and osprey [*Pandion haliaetus*]), owls, vultures, upland game birds, doves/pigeons, nightjars, large corvids (e.g., magpies, crows, and ravens). Special status large bird species are defined as any species listed as an endangered, threatened or candidate species under the Endangered Species Act (ESA; 1973) or subject to the Bald and Golden Eagle Protection Act (BGEPA; 1940).

Large Bird Surveys

Forty-nine survey points were included in the year-long study. Large bird use surveys were conducted at these 49 survey points for the entire year and provided 31.9% coverage of the MCP. All of the survey points were selected using a spatially balanced sampling method referred to as Balance Acceptance Sampling (Robertson et al. 2013; Figure 4) as recommended in the 2016 Final Eagle Rule (USFWS 2016). Areas within the MCP that were not being considered for development (i.e., non-leased lands) were excluded from sampling but were still included when determining the amount of survey coverage within the MCP. This report presents data from the 12 consecutive months of large bird use surveys beginning in March 2022 and ending in February 2023 at 49 survey points. Each point was centered in a circular survey plot with an 800-m (2,625-ft) radius for large birds (Reynolds et al. 1980, ECPG, 2016 Final Eagle Rule).

Surveys were conducted once per month from March 15, 2022, to February 27, 2023, during daylight hours. Start times for survey points were randomized to cover all daylight hours during a season. Surveys were conducted under all weather conditions except when visibility was less than 800 m horizontally and 200 m (656 ft) vertically (2016 Final Eagle Rule). Seasons were

defined as winter (December 1 to February 28), spring (March 1 to May 31), summer (June 1 to August 31), and fall (September 1 to November 30).

Surveys at each point were conducted for a period of 60 minutes (min), with only large birds recorded during the survey period. While birds may have been recorded irrespective of distance from the observer, only large birds within 800 m were included in analyses. Biologists recorded the following information for each survey: date, start and end time, and weather (i.e., temperature, wind speed, wind direction, precipitation, and percent cloud cover). Additionally, the following data were recorded for each group of birds observed:

- Observation number
- Species (or best possible identification)
- Number of individuals
- Sex and age class (if possible)
- Distance from survey plot center to the nearest 5-m (16-ft) interval (first and closest)
- Flight height above ground level (AGL) to the nearest 5-m interval (first, lowest, and highest)
- Flight direction (first observed)
- Habitat
- Activity (e.g., flying, perched)
- Observation type (visual or aural)
- Flight paths and perch locations of eagles

Eagles

Data were collected based on the recommendations in the ECPG and the 2016 Final Eagle Rule if a golden eagle, bald eagle, or unidentified eagle was observed during the survey period. Biologists recorded eagle behavior (i.e., flight height, distance from observer, activity) each minute, at the top of the minute, to provide an instantaneous count for every eagle observed, whether or not the eagle was flying below 200 m AGL and within 800 m of the survey location at any time during the minute, and age class (juvenile [first year], immature or sub-adult [second to fourth year], adult [at least fifth year]).

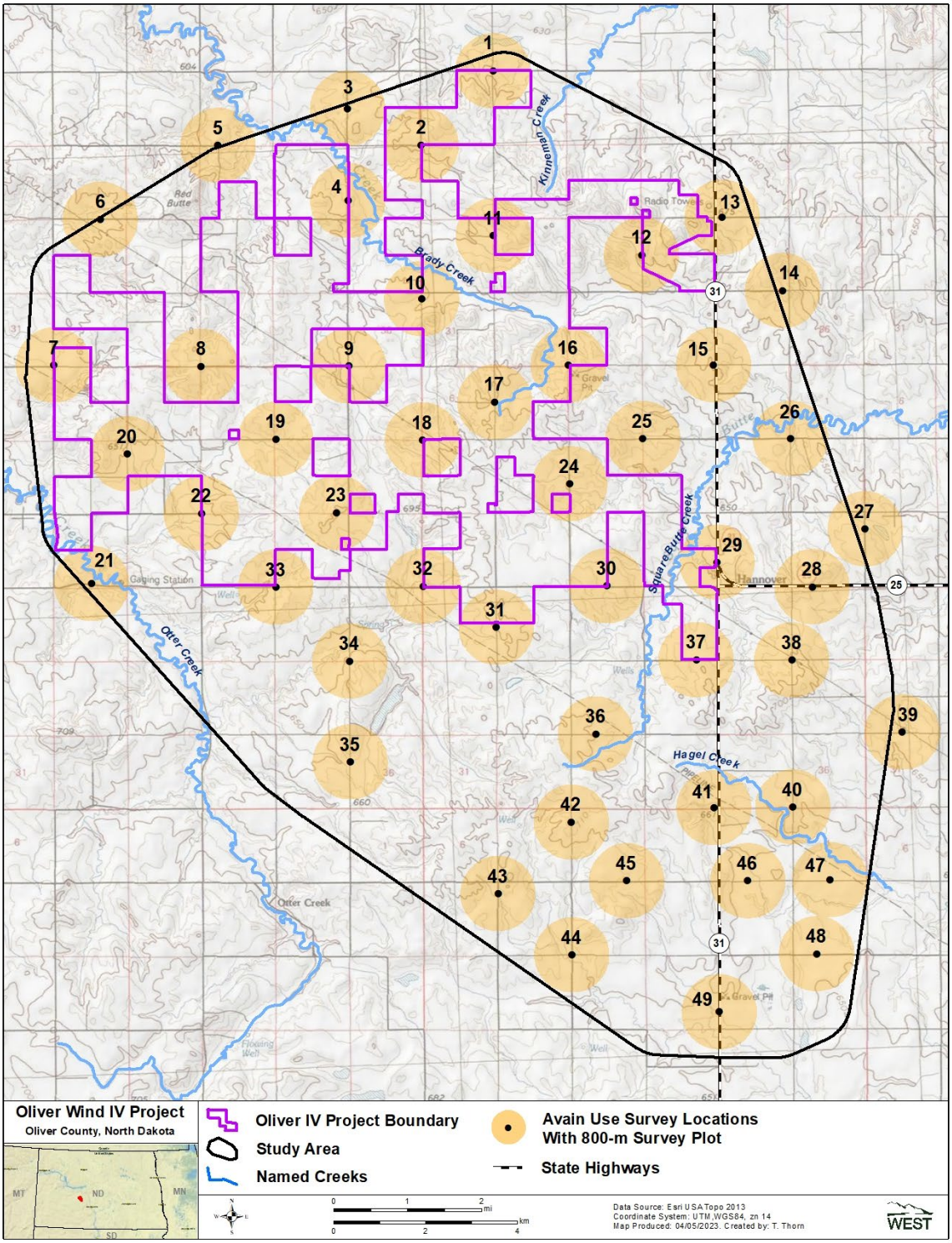

Figure 4. Avian use survey points and plots at the Oliver Wind IV Project Study Area, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Special Status Species

Observation of special status large bird species were recorded while observers were within the Project MCP conducting avian surveys. Special status large bird species include any species listed as an endangered, threatened or candidate species under the ESA, subject to the BGEPA, or Species of Conservation Priority (SCP; Level 1 and 2 only; SCP; Dyke et al. 2015). The observation date, time, species, number of individuals, sex/age class, location, activity, height AGL (for bird species), topographic characteristics, and habitat were recorded.

Incidental Observations

Incidental wildlife observations were recorded while observers were within the Project MCP conducting the avian surveys. Sightings of federally listed threatened and endangered species, eagles and special status species were recorded. The observation date, time, species, number of individuals, sex/age class, location, activity, height AGL (for bird species), topographic characteristics, and habitat were recorded.

Data Management

Quality Assurance and Quality Control

WEST implemented quality assurance and quality control (QA/QC) measures at all stages of the study, including in the field, during data entry and analysis, and report writing. Following surveys, biologists were responsible for inspecting data forms for completeness, accuracy, and legibility. If errors or anomalies were found within the data, follow-up measures were implemented including discussions and review of field data with field technicians and/or Project managers. If any errors, omissions, or problems were identified to the raw data forms, appropriate changes and measures were implemented, no matter what stage of analyses. Multiple reviews were conducted as QA/QC measures.

Data Compilation and Storage

A Microsoft® SQL database was specifically developed to store, organize, and retrieve survey data. Project data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. WEST retained all data forms and electronic data files for reference.

Statistical Analysis

A visit was defined as surveying all of the survey plots once within the Project MCP and could occur across multiple dates, but had to be completed in a single season (e.g., spring). If extreme weather conditions prevented all plots from being surveyed during a visit, then a visit might not have constituted a complete survey of all plots. A survey was defined as a single 60-min count of large birds. In some cases, a count of bird observations may represent repeated observations of the same individual. Only observations within the survey plot were included for data analyses.

Species Richness

Species richness was defined as the mean number of bird species observed per plot per survey for large birds. The seasonal Index to Species Richness was the mean number of species observed per survey plot per visit within seasons (species observed/plot/visit/season). This metric was calculated by summing the total number of species observed within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within a season.

Mean Use, Percent of Use, and Frequency of Occurrence

Mean use was the average number of birds observed per plot per survey. Large bird use (per 800-m radius plot per 60-min survey) was calculated by summing birds per plot per visit, averaging number of birds over plots within a visit, and averaging number of birds across visits within a season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season. *Percent of use* was calculated as the percentage of large bird use attributable to a particular bird type or species. *Frequency of occurrence* was calculated as the percent of surveys in which a particular bird type or species was observed.

Mean use and frequency of occurrence describe different aspects of relative abundance, in that mean use was based on the number of birds (i.e., large groups can produce high estimates) and frequency of occurrence was based on the number of groups (i.e., it is not influenced by group size). Qualitative comparisons were made with these metrics among bird types, seasons, and survey points to help one understand how birds are using the Project MCP over time and space.

Flight Height

Bird flight heights are important metrics to assess relative potential exposure to turbine blades and were used to calculate the percentage of large birds including eagles observed flying within the rotor-swept height (RSH) of proposed turbines. A RSH of 25–150 m (82–492 ft) AGL was assumed for the purpose of the analysis. Flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH.

Spatial Use

Mean use was calculated by survey plot for large birds, diurnal raptors, and eagles to make spatial comparisons among the survey plots. Additionally, flight paths of large birds were mapped during large bird use surveys to qualitatively show flight path location compared to landscape characteristics (e.g., topographic features) and identify if there were apparent areas of concentration or consistent flight patterns within the Project MCP.

Eagles

Eagle observations during surveys were summarized to provide flight heights (see *Eagle Flight Height*) and flight path maps (see *Flight Paths*). Data collected during each minute eagles were observed, were examined to count eagle exposure minutes, defined as the number of minutes an eagle was observed in flight within the risk cylinder (defined as the area within 800 m of the survey point and below 200 m AGL during the 60-min survey periods) and total minutes, defined as the amount of time eagles were observed inside and outside the risk cylinder. The eagle exposure minutes per observation hour were reported by survey plot, season, and month to enable spatial and temporal assessments of eagle exposure minutes recorded in the Project MCP. Data collected on perched eagles and those outside of survey plots were not considered eagle exposure minutes; however, they were considered in the total eagle minutes. The perch locations and flight paths of all eagles were mapped to qualitatively assess areas of eagle use within the Project MCP.

RESULTS

Overall, 478 avian use surveys were conducted for large birds within the Project MCP from March 15, 2022, to February 27, 2023 (Table 2). Surveys were not consistent through all seasons due primarily to inaccessible road conditions caused by no winter road maintenance and drifting snow (winter, Table 2). Additionally, surveys in the spring and fall season were reduced due to major snow events (e.g., April 2022) and periodic heavy rains causing dangerously muddy road conditions. Study results are summarized below, supplemented by the appendices, which present species-level detail on the following: scientific names and numbers of groups and observations seen during surveys irrespective of distance from observers (Appendices A1 and A2), mean use, percent of use, frequency of occurrence by season (Appendices B1 and B2), and mean use by survey point (Appendices C1 and C2).

Large Birds

There were 2,762 large birds observed in 935 groups during the yearlong study (Appendix A1); 30 species of large birds were observed. Species richness was highest in spring, followed by fall, summer, and winter (Table 2). The most abundant large bird species were Canada goose (726) and sandhill crane (461; Appendix A1). The most abundant diurnal raptor species was red-tailed hawk (128; Appendix A1).

Table 2. Summary of species richness (species/plot[1]/60-minute survey), and sample size by season and overall during avian use surveys at the Oliver Wind IV Project Study Area, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Season	# Visits	# Surveys Conducted	Species Richness Large Birds
Spring	3	114	27
Summer	3	145	17
Fall	3	126	18
Winter	3	93	7
Overall	**12**	**478**	**30**

Species richness was defined as a count of species observed within a survey plot during avian use surveys. Groups of unidentified species were included in species richness if a species from that group was not otherwise recorded.

= number.

1. 800-meter (2,625-foot) radius plot for large birds.

Mean Use, Percent of Use, and Frequency of Occurrence

Mean use, percent of use, and frequency of occurrence were calculated by season for large bird types (Table 3; Figures 5a, 5b, and 5c) and species (Appendices B). Large bird mean use ranged from 2.86 to 14.94 observations/800-m radius plot/60-min survey among seasons and was highest during spring, followed by fall, summer, and winter (Table 3; Figure 5a). Waterbirds were the most common non-raptor observed during spring, shorebirds during summer, and waterfowl during fall and upland game birds during the winter (Table 3; Figures 5a and 5b). Diurnal raptors were the most frequently observed groups during spring and fall, upland game birds during the summer and winter (Table 3; Figure 5c).

Overall eagle mean use ranged from zero during the winter to 0.05 observations/800-m radius plot/60-min survey during the spring (Table 3) based on 10 bald eagle and two golden eagle observations during the yearlong study. Bald eagle mean use ranged from zero to 0.04 observations/800-m radius plot/60-min and golden eagle ranged from zero to 0.01 observations/800-m radius plot/60-min among seasons (Appendix B). Bald eagles were not observed in the winter and golden eagles were not observed in the fall or winter (Appendix B).

Table 3. Mean use (number of birds/plot[1]/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each bird type and subtype by season during avian use surveys at the Oliver Wind IV Project Study Area, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Mean Use				% of Use				% Frequency			
Type/Subtype	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**7.15**	**0**	**0**	**0**	**47.9**	**0**	**0**	**0**	**13.6**	**0**	**0**	**0**
Waterfowl	**3.29**	**0.09**	**1.81**	**0.96**	**22.0**	**2.5**	**37.4**	**33.5**	**28.0**	**2.7**	**5.9**	**2.2**
Shorebirds	**0.63**	**0.96**	**0.07**	**0**	**4.2**	**26.9**	**1.5**	**0**	**33.0**	**48.2**	**2.1**	**0**
Gulls/Terns	**1.80**	**0.07**	**0**	**0**	**12.1**	**1.9**	**0**	**0**	**32.1**	**5.5**	**0**	**0**
Diurnal Raptors	**0.94**	**0.61**	**0.47**	**0.01**	**6.3**	**17.3**	**9.7**	**0.4**	**50.5**	**44.9**	**31.0**	**1.1**
Buteos	*0.64*	*0.54*	*0.31*	*0.01*	*4.3*	*15.2*	*6.4*	*0.4*	*37.9*	*39.4*	*21.0*	*1.1*
Northern Harrier	*0.11*	*0.04*	*0.13*	*0*	*0.7*	*1.2*	*2.6*	*0*	*10.5*	*4.2*	*9.8*	*0*
Eagles	*0.05*	*0.03*	*0.02*	*0*	*0.3*	*0.8*	*0.3*	*0*	*5.1*	*2.1*	*1.7*	*0*
Falcons	*0.14*	*0.01*	*0.02*	*0*	*1.0*	*0.2*	*0.3*	*0*	*12.0*	*0.7*	*1.7*	*0*
Owls	**0.01**	**0**	**0**	**0**	**<0.1**	**0**	**0**	**0**	**0.7**	**0**	**0**	**0**
Vultures	**0.07**	**0.35**	**0.19**	**0**	**0.5**	**9.7**	**4.0**	**0**	**6.0**	**22.8**	**7.1**	**0**
Upland Game Birds	**0.44**	**0.75**	**1.49**	**1.72**	**2.9**	**21.1**	**30.7**	**60.2**	**34.0**	**45.3**	**18.9**	**18.3**
Doves/Pigeons	**0.41**	**0.72**	**0.70**	**0.13**	**2.7**	**20.2**	**14.5**	**4.5**	**11.8**	**36.6**	**11.5**	**4.3**
Large Corvids	**0.20**	**0.01**	**0.11**	**0.04**	**1.3**	**0.4**	**2.2**	**1.5**	**8.0**	**0.7**	**9.5**	**4.3**
Large Birds Overall	**14.94**	**3.55**	**4.84**	**2.86**	**100**	**100**	**100**	**100**	**NA**	**NA**	**NA**	**NA**

[1] 800-meter (2,625-foot) radius plot for large birds.

Sums of values may not equal totals shown due to rounding.

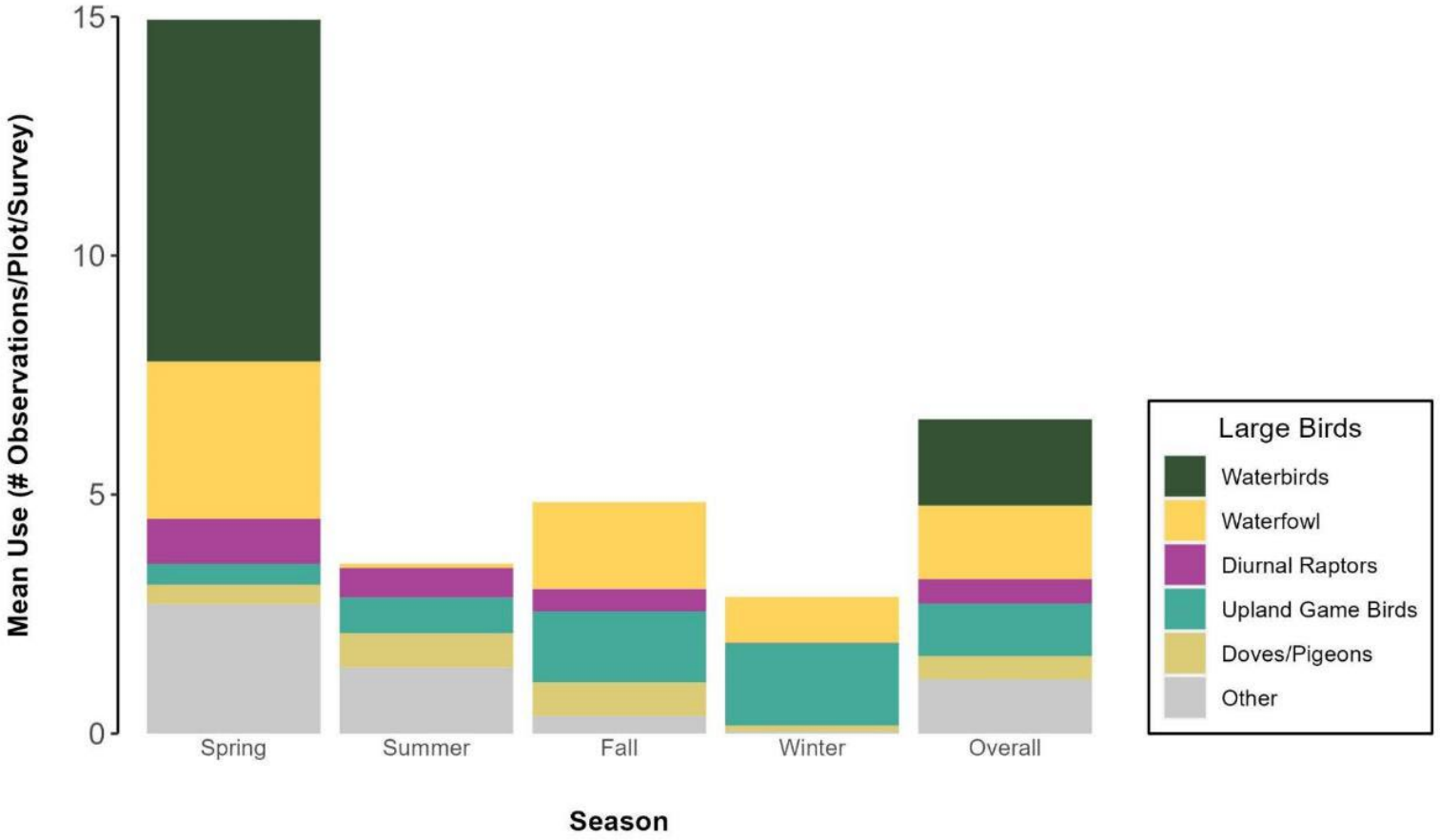

Figure 5a. Large bird mean use (observations/plot/60-minute survey) by season and bird type at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

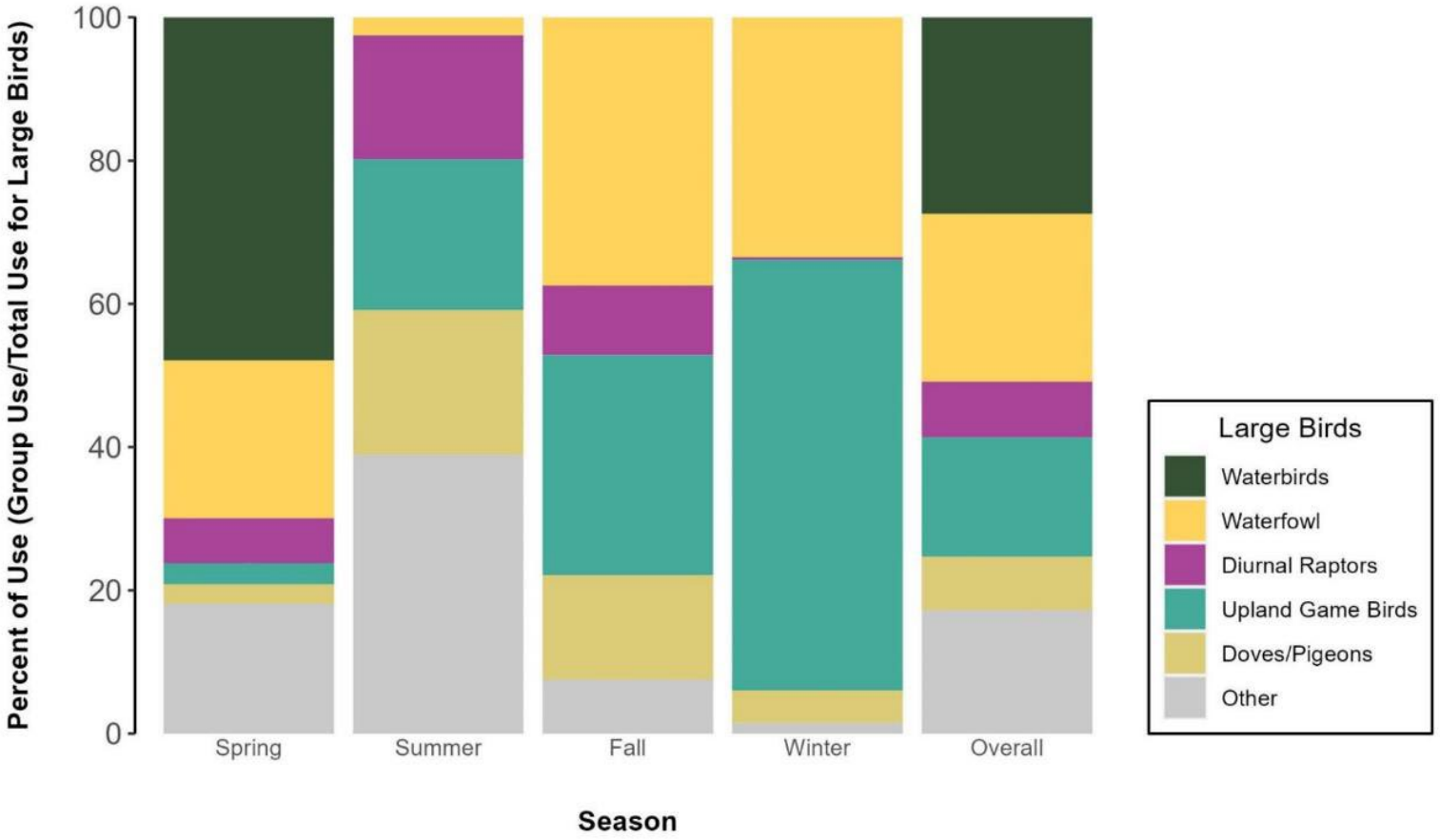

Figure 5b. Large bird percent of use by season and bird type at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

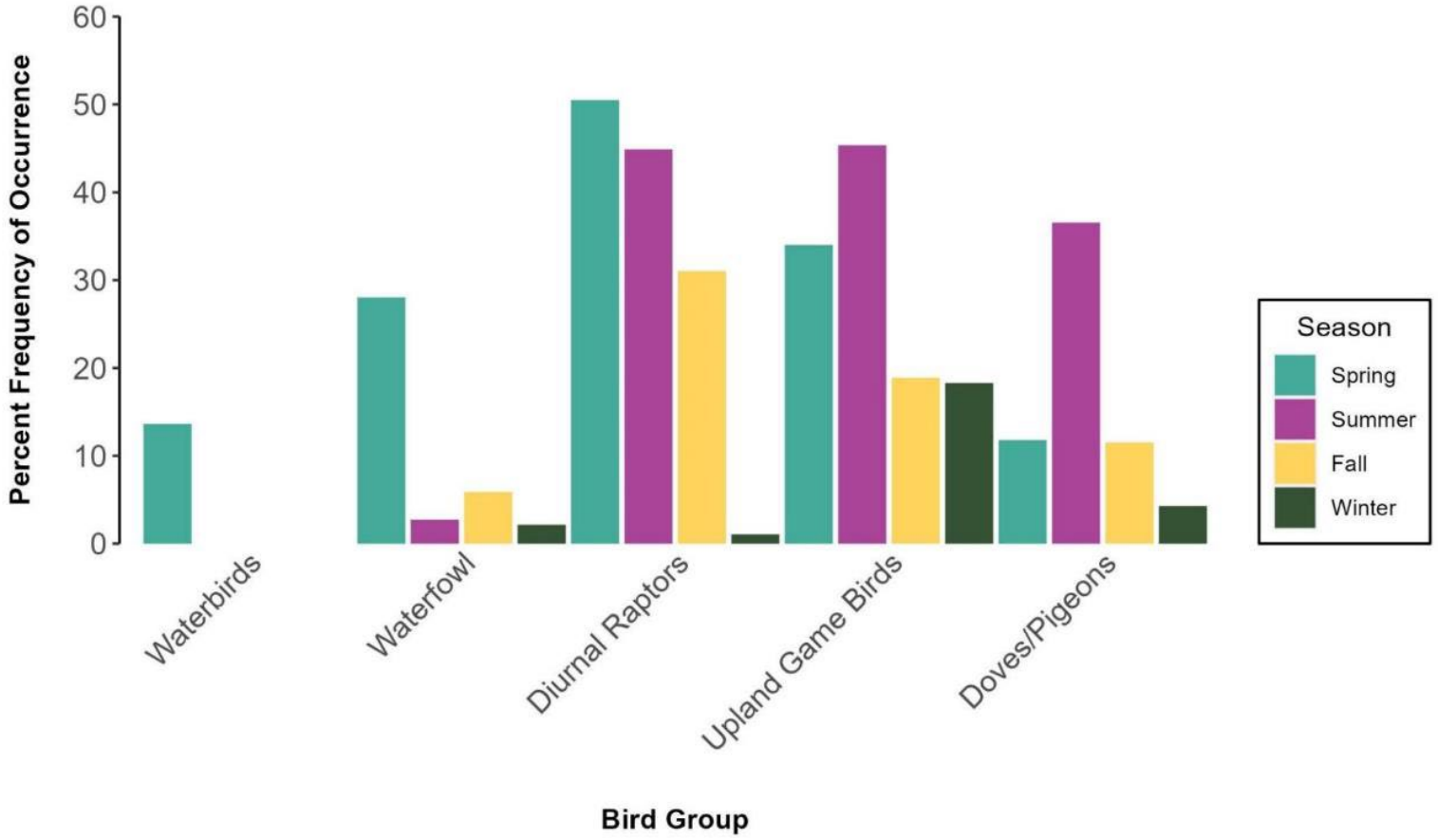

Figure 5c. Large bird frequency of occurrence by season and bird type at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Bird Flight Height

Mean large bird flight heights (for first recorded flight height and for bird groups with at least three observations) ranged from 4.0 m (13.1 ft) for upland game birds, to 134 m (440 ft) for eagles (Table 4). Waterbirds, waterfowl, gulls/terns, and vultures were recorded most frequently within 25–200 m (Table 4). Diurnal raptors were observed 71.3% of the time within 25–200 m (Table 4).

Spatial Variation

Large bird use ranged from 0.82 to 18.08 at survey plots (Appendix C). The highest use values were at survey plots 13, 30, and 41 (Figure 6; Appendix C). Survey plots 30, 33, and 41 were influenced by relatively high waterbird use, while plots 11, 13, and 28 were influenced by relatively high waterfowl use (Appendix C). High mean use by waterbirds and waterfowl did not appear to be associated with any features on the ground; rather was primarily due to large flocks of flying birds. Diurnal raptor mean use ranged from zero at survey plots 18 and 40 to 1.67 at Point 39 (Figure 7; Appendix C). In general, diurnal raptor use was slightly higher across the northern and eastern portions of the Study Area (Figure 7). Mean eagle use ranged from zero to 0.33 at survey plot 36 (Figure 8; Appendix C). Eagle use appeared to be highest through the central portion of the Study Area (Figure 8).

Flight Paths

Flight paths of bald eagle and golden eagle (Figure 9) were mapped within the survey plots. Spatial patterns from the 10 mapped bald eagle flight paths showed potential concentrated use along Square Butte Creek with a few additional flight paths distributed throughout the Study Area (Figure 9). There were two golden eagle flight paths recorded and no discernable patterns were identified (Figure 9).

Table 4. Group and individual observation flight height characteristics by bird type[1] during avian use surveys at the Oliver Wind IV Project Study Area, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Bird Type	# Groups Flying	# Obs Flying	% Obs Flying	Mean Flight Height (m)	% within Flight height Categories		
					<25 m	25–200 m[2]	>200 m
Waterbirds	**15**	**464**	**98.3**	**103**	**0**	**100**	**0**
Waterfowl	**61**	**674**	**98.5**	**45**	**11.3**	**88.7**	**0**
Shorebirds	**46**	**70**	**33.7**	**18**	**88.6**	**11.4**	**0**
Gulls/Terns	**30**	**127**	**87.6**	**41**	**26.0**	**74.0**	**0**
Diurnal Raptors	**183**	**195**	**80.2**	**65**	**25.6**	**71.3**	**3.1**
Buteos	*137*	*147*	*79.9*	*70*	*19.0*	*78.2*	*2.7*
Northern Harrier	*26*	*27*	*84.4*	*33*	*51.9*	*48.1*	*0*
Eagles	*10*	*10*	*83.3*	*134*	*0*	*80.0*	*20.0*
Falcons	*10*	*11*	*73.3*	*21*	*72.7*	*27.3*	*0*
Owls	**0**	**0**	**0**	**NA**	**NA**	**NA**	**NA**
Vultures	**55**	**83**	**98.8**	**86**	**14.5**	**81.9**	**3.6**
Upland Game Birds	**28**	**153**	**32.2**	**4**	**98.0**	**2.0**	**0**
Doves/Pigeons	**43**	**127**	**50.8**	**20**	**63.0**	**37.0**	**0**
Large Corvids	**25**	**40**	**90.9**	**12**	**95.0**	**5.0**	**0**
Large Birds Overall	**486**	**1,933**	**74.2**	**50**	**25.9**	**73.6**	**0.5**

1. 800-meter (m; 2,625-foot [ft]) radius plot for large birds

2. The assumed rotor-swept height for potential collision with a turbine blade, or 25 to 200 m (82 to 656 ft) above ground level.

Zeroes and NA values indicate that the species was observed but was not flying.

obs = observations; # = number; % = percent; m = meter.

All metrics are developed based on First Activity and First Flight Height.

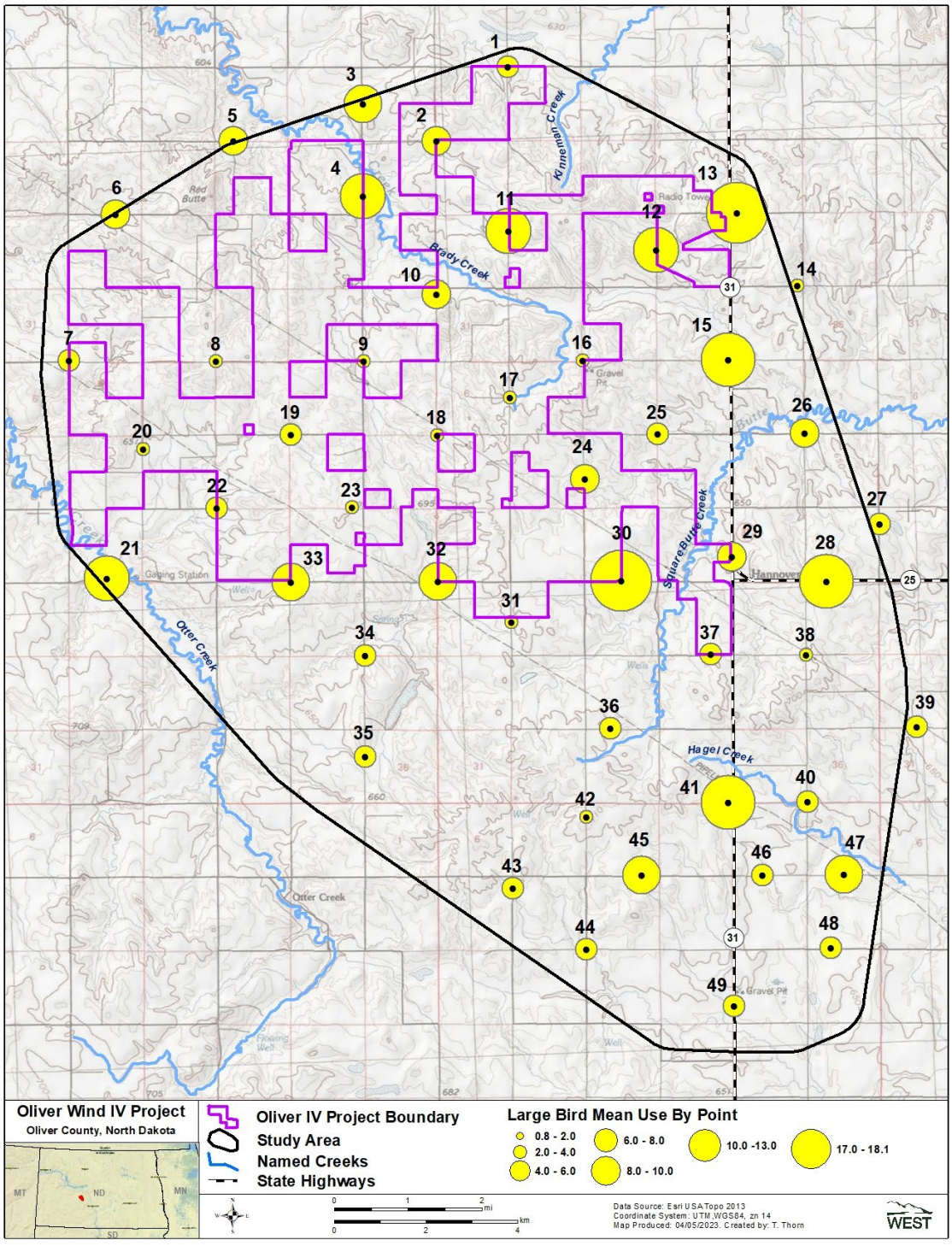

Figure 6. Large bird mean use by point by bird type at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

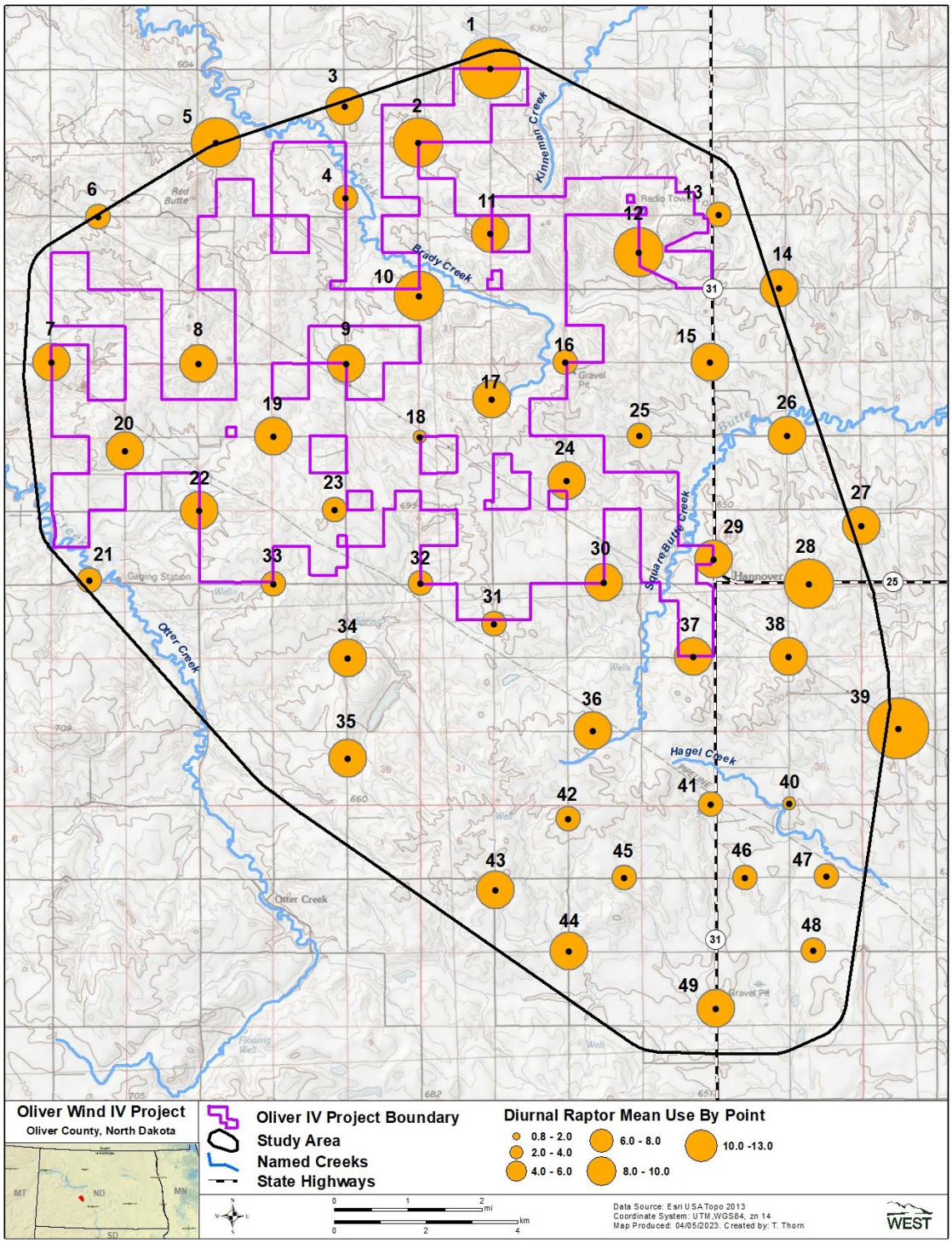

Figure 7. Diurnal raptor mean use by point at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

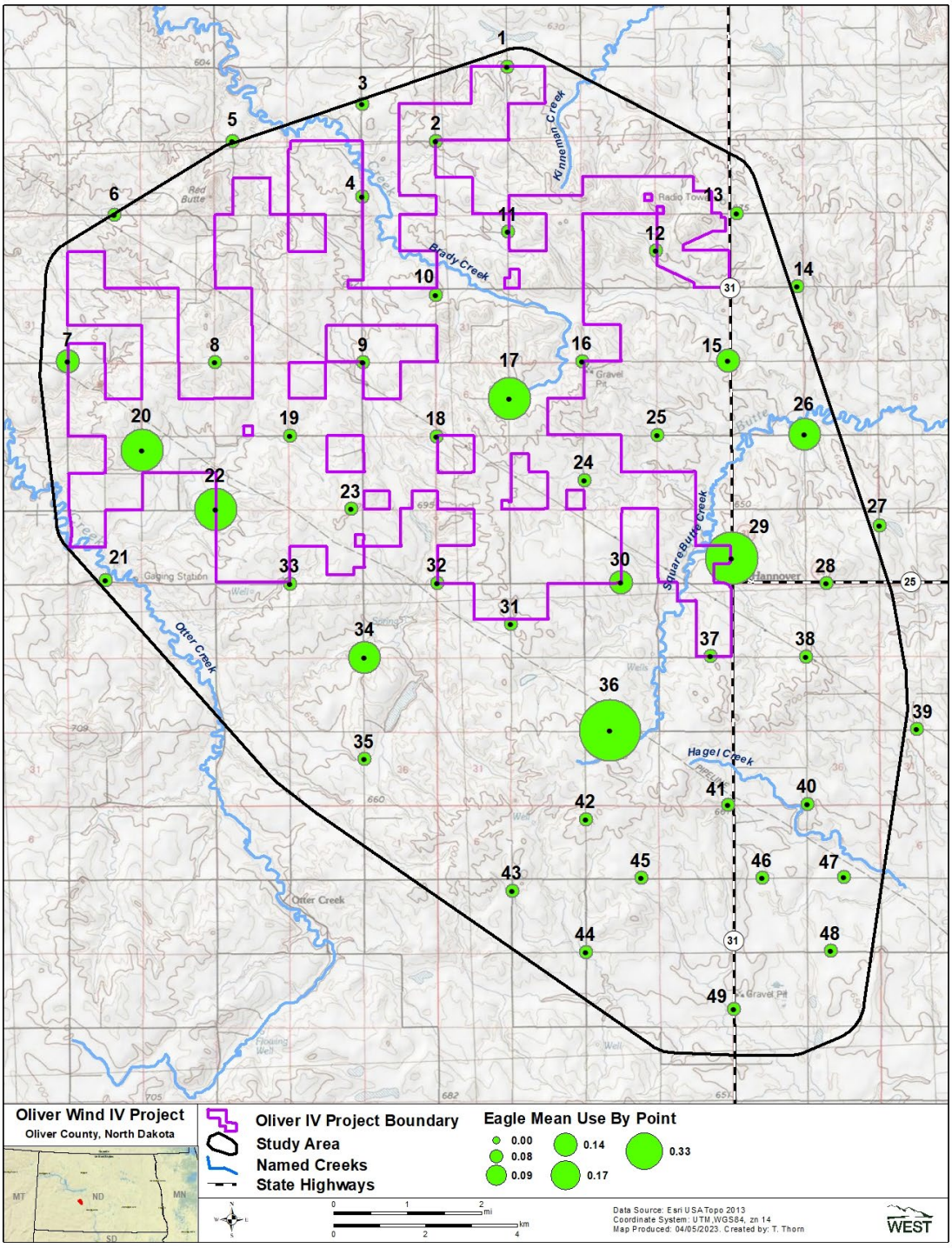

Figure 8. Bald eagle mean use by point at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

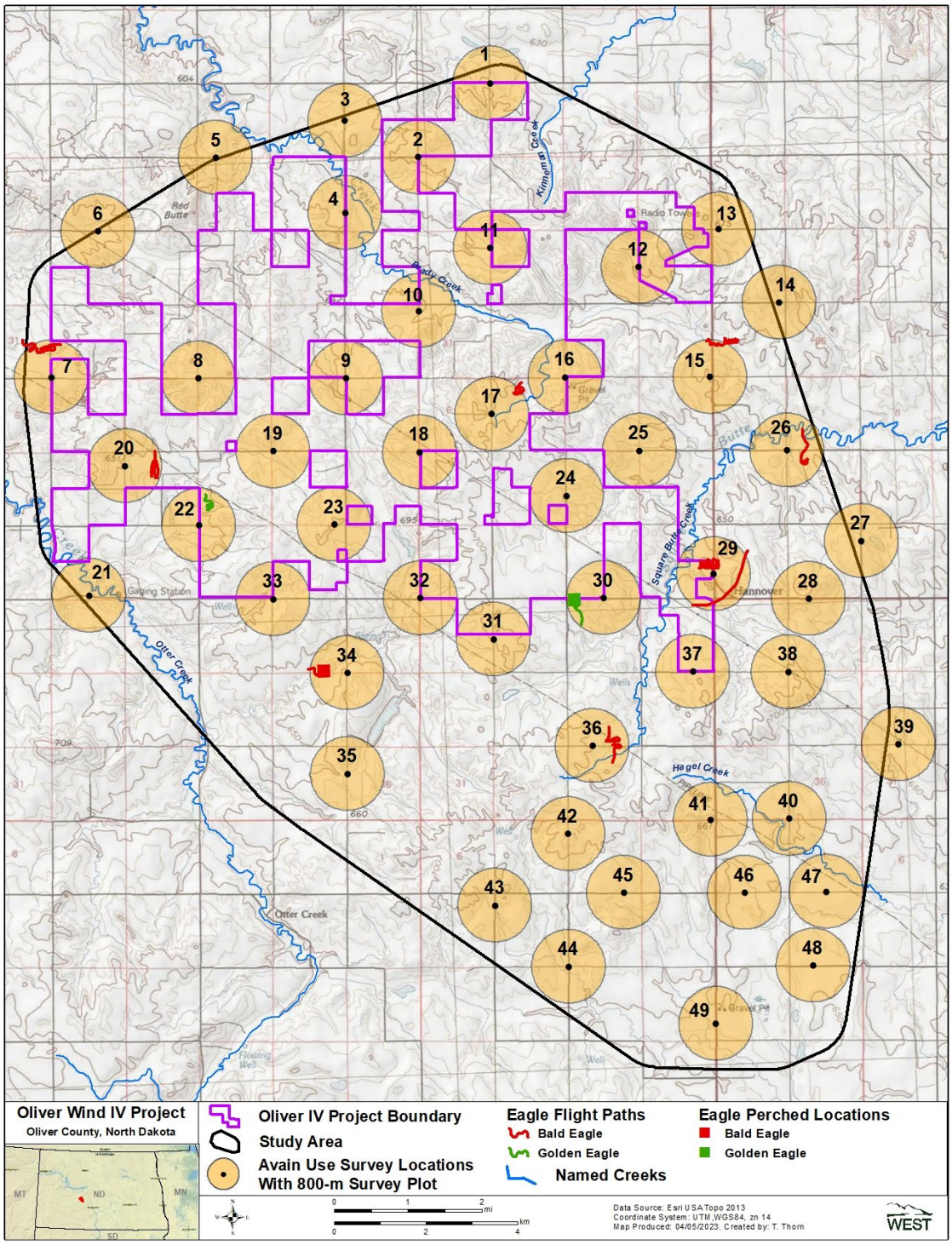

Figure 9. Eagle flight paths and perched locations at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Eagles

Exposure minutes

Thirty-two eagle exposure minutes were recorded during nine observations out of 69 total eagle minutes recorded during 10 observations (Tables 5 and 6). Eagle exposure minutes per survey hour ranged from zero to 0.20 across seasons and were highest in spring, followed by fall and summer with no exposure during winter (Table 5). Eagles were recorded during seven of the 12 months of survey (Table 6). Bald eagle exposure minutes per survey hour ranged from zero to 0.45 across all months, and were highest in April (12 min) and March (10 min;Table 6). For golden eagle, there were two observations totaling six minutes within the risk cylinder with one minute in the spring and five minutes during the summer. Golden eagle exposure was for the spring was 0.0088 eagle exposure mins/survey hr and a May exposure of 0.1111. Golden eagle exposure in summer was 0.0345 eagle exposure mins/ survey hr and a July exposure of 0.0208.

Table 5. The bald eagle minutes and observations recorded during avian use surveys at the Oliver Wind IV Project Study Area, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Eagle Minutes[1]		Eagle Observations[2]		Survey	Eagle Exposure
Season	Within Risk Cylinder[4]	Total	Within Risk Cylinder	Total	Hours	Mins[3]/Survey Hr
Spring	23	55	5	5	114	0.2018
Summer	4	8	2	3	145	0.0276
Fall	5	6	2	2	126	0.0397
Winter	0	0	0	0	93	0
Total	**32**	**69**	**9**	**10**	**478**	**0.0669**

1. Eagle minutes = minutes of eagles within the risk cylinder; total = minutes inside and outside the risk cylinder.
2. Eagle observations within the risk cylinder; total = observations inside and outside the risk cylinder.
3. Eagle exposure minutes = minutes eagles are within the risk cylinder.
4. Risk cylinder is the areas within 800 meters (m) of the survey point and below 200 m AGL during the 60-min survey period.

mins = minutes; Hr = hour.

Table 6. The bald eagle minutes and observations recorded during avian use surveys at the Oliver Wind IV Project Study Area, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Eagle Minutes[1]		Eagle Observations[2]		Survey	Eagle Exposure
Month/Year	Within Risk Cylinder[4]	Total	Within Risk Cylinder	Total	Hours	Mins[3]/Survey Hr
March 2022	12	42	3	3	47	0.2553
April 2022	10	11	1	1	22	0.4545
May 2022	1	2	1	1	45	0.0222
June 2022	0	0	0	0	49	0
July 2022	1	3	1	2	48	0.0208
August 2022	3	5	1	1	48	0.0625
September 2022	3	4	1	1	47	0.0638
October 2022	0	0	0	0	45	0
November 2022	2	2	1	1	34	0.0588

Table 6. The bald eagle minutes and observations recorded during avian use surveys at the Oliver Wind IV Project Study Area, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Month/Year	Eagle Minutes[1]		Eagle Observations[2]		Survey Hours	Eagle Exposure Mins[3]/Survey Hr
	Within Risk Cylinder[4]	Total	Within Risk Cylinder	Total		
December 2022	0	0	0	0	31	0
January 2023	0	0	0	0	31	0
February 2023	0	0	0	0	31	0
Total	**32**	**69**	**9**	**10**	**478**	**0.0669**

1. Eagle minutes = minutes of eagles within the risk cylinder; total = minutes inside and outside the risk cylinder.
2. Eagle observations within the risk cylinder; total = observations inside and outside the risk cylinder.
3. Eagle exposure minutes = minutes eagles are within the risk cylinder.
4. Risk cylinder is the areas within 800 meters (m) of the survey point and below 200 m AGL during the 60-min survey period.

Bald eagle exposure minutes per survey hour were highest at survey Plot 36 (0.33), followed by survey Plot 29 (0.17; Figure 10). Eagle exposure minutes per survey hour ranged from zero to 0.14 at the remaining survey plots (Figure 10). Bald eagle exposure minutes per survey hour appeared to be highest in the east-central portion of the Study Area (Figure 10). Golden eagle exposure minutes were only recorded from two observations one at survey Plot 22 (0.14) and another at survey Plot 30 (0.42; Figure 11). There were no discernable spatial patterns for golden eagles.

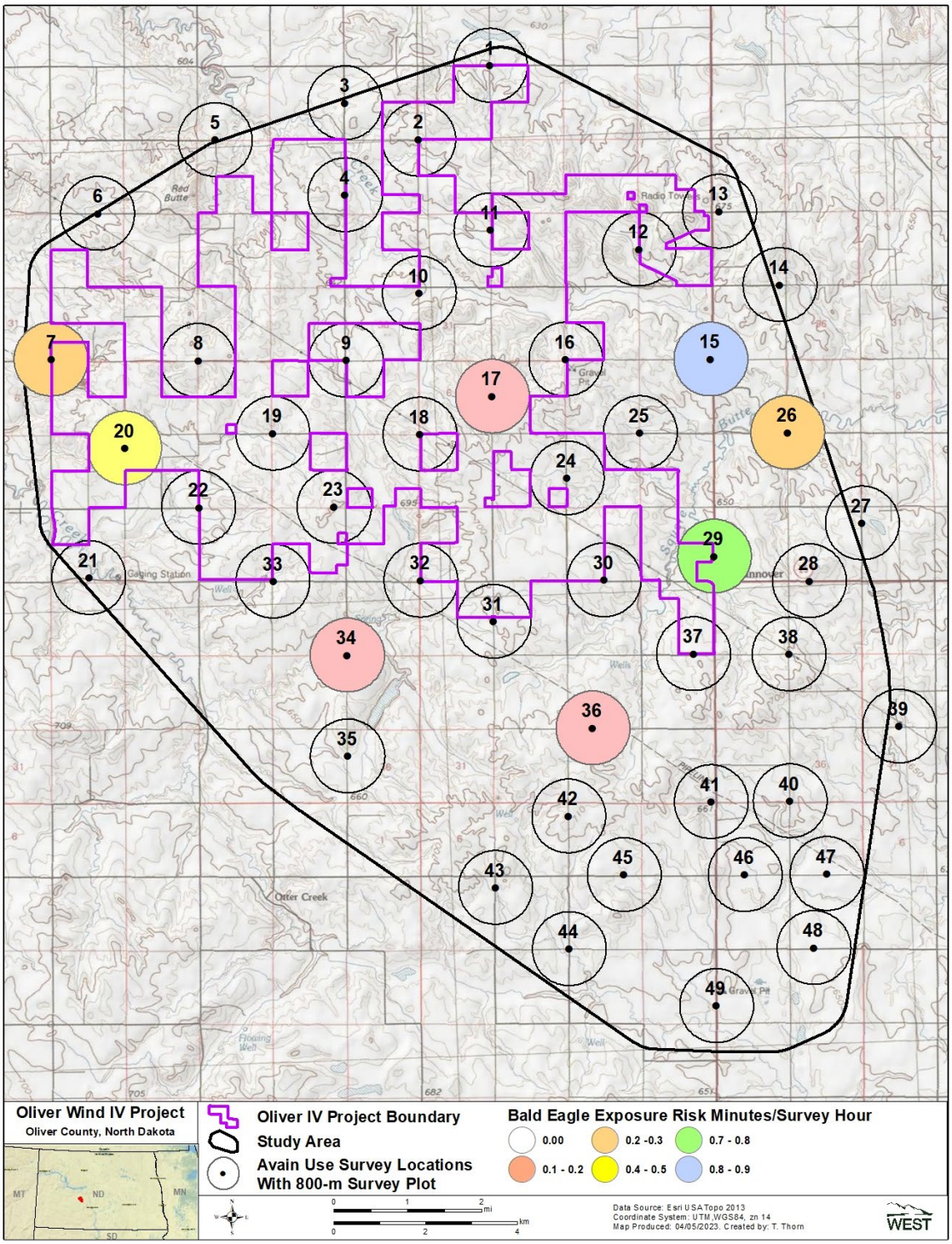

Figure 10. Bald eagle exposure minutes per survey hour by point at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

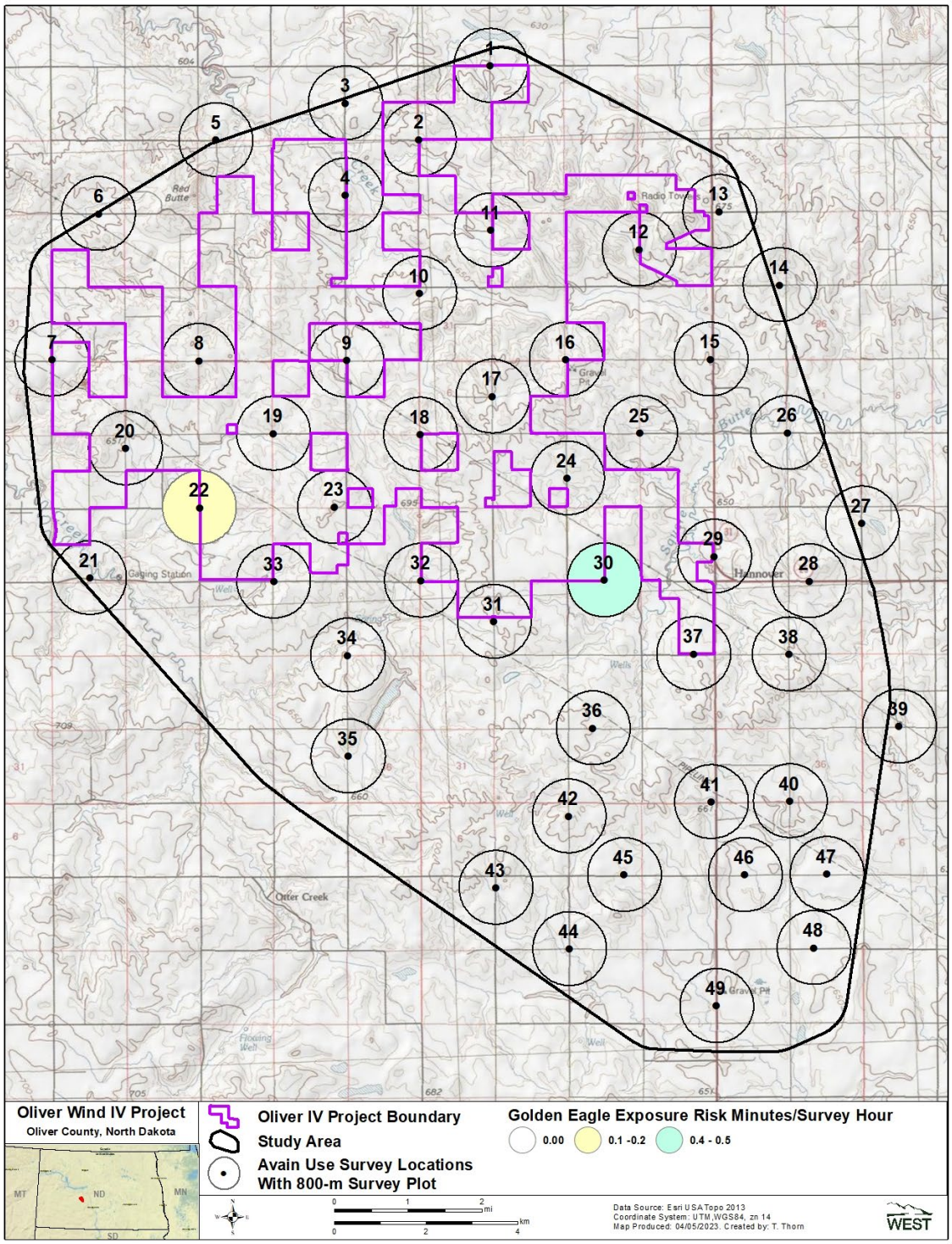

Figure 11. Golden eagle exposure minutes per survey hour by point at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Special Status Species

No federally threatened or endangered species were recorded within the Study Area. Ten special status species were observed during the study (Table 7). All special status species were observed during surveys (Table 7).

Table 7. Special status species groups and individuals observed during and outside scheduled avian use surveys at the Oliver Wind IV Project Study Area, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Species	Scientific Name	Status	Surveys		Incidental		Total	
			# grps	# obs	# grps	# obs	# grps	# obs
American kestrel	*Falco sparverius*	LEVEL 2;SCP	13	14	0	0	13	14
American white pelican	*Pelecanus erythrorhynchos*	LEVEL 2;SCP	1	11	0	0	1	11
bald eagle	*Haliaeetus leucocephalus*	LEVEL 2;SCP;BGEPA	10	10	0	0	10	10
ferruginous hawk	*Buteo regalis*	LEVEL 1;SCP	2	2	0	0	2	2
Franklin's gull	*Leucophaeus pipixcan*	LEVEL 1;SCP	7	50	0	0	7	50
golden eagle	*Aquila chrysaetos*	LEVEL 2;SCP;BGEPA	2	2	0	0	2	2
northern harrier	*Circus hudsonius*	LEVEL 2;SCP	31	32	0	0	31	32
sharp-tailed grouse	*Tympanuchus phasianellus*	LEVEL 2;SCP	4	19	0	0	4	19
Swainson's hawk	*Buteo swainsoni*	LEVEL 1;SCP	49	52	0	0	49	52
upland sandpiper	*Bartramia longicauda*	LEVEL 2;SCP	90	105	0	0	90	105
Total	**10 species**		**209**	**297**	**0**	**0**	**209**	**297**

LEVEL 2 = Level II: North Dakota Game and Fish Department will use SWG funding to implement conservation actions to benefit these species if SWG funding for Level I species is sufficient or conservation needs have been met. These species are those having a moderate level of conservation priority or high level of conservation priority but a substantial level of non-SWG funding is available to them.

LEVEL 1 = Level I: These are species which are in decline and receive little or no monetary support or conservation efforts. North Dakota Game and Fish Department has a clear obligation to use SWG funding to implement conservation actions that directly benefit these species. These species are those having a high level of conservation priority because of declining status either here or across their range or high rate of occurrence in North Dakota constituting the core of the species breeding range (i.e. "responsibility" species) but are at-risk range wide.

BGEPA = Bald and Golden Eagle Protection Act; SCP = Species of Conservation Priority; grps = groups; obs = observations.

Incidental Observations

There were no incidental observations recorded between survey points. All observations of special status species were recorded during the 60-min large bird surveys.

SUMMARY

The principal objectives of the study was to gather information on the spatial and temporal use in the Study Area by large birds and document incidental wildlife observations that may be used in Project planning. Species richness of large birds was highest in spring, followed by fall, summer, and winter, and the most abundant large bird species were Canada goose and sandhill crane. Waterbirds were the most prevalent non-raptor group/type during spring; shorebirds during summer; waterfowl during fall; and upland game birds during the winter. Overall, diurnal raptors were the most frequently observed groups during spring and fall (the most abundant diurnal raptor species was red-tailed hawk) and upland game birds during the summer and winter.

Eagle use was not widespread and appeared to be highest through the central portion of the Study Area, with a mean eagle use range of zero to 0.33 (survey plot 36). Overall eagle mean use ranged from zero (winter) to 0.05 observations/800-m radius plot/60-min survey (spring), with 10 bald eagle and two golden eagle observations during the yearlong study. Bald eagle mean use ranged from zero to 0.04 observations/800-m radius plot/60-min and golden eagle ranged from zero to 0.01 observations/800-m radius plot/60-min among seasons. Thirty-two eagle exposure minutes were recorded during nine observations out of 69 total eagle minutes recorded during 10 observations, with most being bald eagles. Eagle exposure minutes per survey hour ranged from zero to 0.45 across months, peaking in April. There were two observations of golden eagles totaling six minutes within the risk cylinder with one minute in the spring and five minutes during the summer.

No federally threatened or endangered species were recorded within the Study Area. Ten special status species were observed during the study, and all were observed during survey periods.

REFERENCES

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) Sections (§§) 668-668d. Bald Eagle Protection Act of 1940, June 8, 1940, Chapter 278, § 2, 54 Statute (Stat.) 250; Expanded to include the related species of the golden eagle October 24, 1962, Public Law (PL) 87-884, 76 Stat. 1246. [as amended: October 23, 1972, PL 92-535, § 2, 86 Stat. 1065; November 8, 1978, PL 95-616, § 9, 92 Stat. 3114.].

Dyke, S. R., S. K. Johnson, and P. T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department, Bismarck, North Dakota. Available online: https://gf.nd.gov/wildlife/swap

Endangered Species Act (ESA). 1973. 16 United States Code (USC) Sections (§§) 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 et seq.]; 50 Code of Federal Regulations (CFR) 402.

Esri. 2023. World Imagery and Aerial Photos (World Topo). ArcGIS Resource Center. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California. Accessed April 2023. Available online: https://www.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=10df2279f9684e4a9f6a7f08febac2a9

Griffith, G. 2010. Level III North American Terrestrial Ecoregions: United States Descriptions. Prepared for North American Commission for Environmental Cooperation.

National Land Cover Database (NLCD). 2019. National Land Cover Database 2019 - Landcover & Imperviousness (NLCD2019). Available online: https://www.mrlc.gov/data. As cited includes:

Dewitz, J., and US Geological Survey. 2021. National Land Cover Database (NLCD) 2019 Products (ver. 2.0, June 2021): US Geological Survey data release. doi: 10.5066/P9KZCM54.

Homer, C., J. Dewitz, S. Jin, G. Xian, C. Costello, P. Danielson, L. Gass, M. Funk, J. Wickham, S. Stehman, R. Auch, and K. Riitters. 2020. Conterminous United States Land Cover Change Patterns 2001–2016 from the 2016 National Land Cover Database. ISPRS Journal of Photogrammetry and Remote Sensing 162(5): 184-199. doi: 10.1016/j.isprsjprs.2020.02.019.

Jin, S., C. Homer, L. Yang, P. Danielson, J. Dewitz, C. Li, Z. Zhu, G. Xian, and D. Howard. 2019. Overall Methodology Design for the United States National Land Cover Database 2016 Products. Remote Sensing. 2971. doi: 10.3390/rs11242971.

Wickham, J., S. V. Stehman, D. G. Sorenson, L. Gass, and J. A. Dewitz. 2021, Thematic Accuracy Assessment of the NLCD 2016 Land Cover for the Conterminous United States: Remote Sensing of Environment 257: 112357. doi: 10.1016/j.rse.2021.112357.

and

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. doi: 10.1016/j.isprsjprs.2018.09.006.

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. Condor 82(3): 309-313.

Robertson, B. L., J. A. Brown, T. McDonald, and P. Jaksons. 2013. Bas: Balanced Acceptance Sampling of Natural Resources. Biometrics 69: 776-784. doi: 10.1111/biom.12059.

Sayler, K. 2016. Contemporary Land Cover Change in the Northwestern Great Plains Ecoregion. Page last modified July 7, 2016. US Geological Survey (USGS) Earth Resources Observation and Science Center, Sioux Falls, South Dakota. Available online: https://landcovertrends.usgs.gov/gp/eco43Report.html

US Environmental Protection Agency (USEPA). 2012. Level III and Level IV Ecoregions of North Dakota. Ecoregions of the United States. USEPA Office of Research and Development (ORD) - National Health and Environmental Effects Research Laboratory (NHEERL), Corvallis, Oregon. May 8, 2012. Accessed May 2023. Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-32

US Environmental Protection Agency (USEPA). 2013. Level III and Level IV Ecoregions of the Continental United States. Ecosystems Research, USEPA. April 16, 2013. Accessed May 2023. Available online: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

US Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online: https://www.fws.gov/sites/default/files/documents/WEG_final.pdf

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Frontmatter + 103 pp. Available online: https://www.fws.gov/sites/default/files/documents/eagle-conservation-plan-guidance.pdf

US Fish and Wildlife Service (USFWS). 2016. Eagle Permits; Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests; Final Rule. 50 CFR 13 and 22. Department of the Interior Fish and Wildlife Service. 81 Federal Register (FR) 242: 91494-91554. December 16, 2016.

US Geological Survey (USGS). 2023. The National Map. TNM Download V2.0. Topo Map data, 3DEP products, Lidar, IfSAR, NHD (Hydrography Dataset), NAIP Plus Imagery, National Structures Dataset. Accessed May 2023. Available online: https://apps.nationalmap.gov/downloader/#/

USA Topo. 2013. USA Topo Maps. US Geological Survey (USGS) topographical maps for the United States. ArcGIS. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California.

World Geodetic System (WGS) Sphere Mercator. 1984. WGS 84/Pseudo Mercator. Mercator variation projection data.

Appendix A. All Bird Types and Species Observed at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Appendix A. Summary of all large bird groups and individual observations, regardless of distance from observer, by bird type and species during avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**19**	**472**	**0**	**0**	**0**	**0**	**0**	**0**	**19**	**472**
American white pelican	*Pelecanus erythrorhynchos*	1	11	0	0	0	0	0	0	1	11
sandhill crane	*Antigone canadensis*	18	461	0	0	0	0	0	0	18	461
Waterfowl		**54**	**542**	**6**	**13**	**7**	**185**	**3**	**89**	**70**	**829**
Canada goose	*Branta canadensis*	30	481	4	11	6	145	3	89	43	726
green-winged teal	*Anas crecca*	2	6	0	0	0	0	0	0	2	6
Mallard	*Anas platyrhynchos*	19	47	1	1	1	40	0	0	21	88
unidentified duck		1	3	0	0	0	0	0	0	1	3
unidentified waterfowl		2	5	1	1	0	0	0	0	3	6
Shorebirds		**49**	**59**	**115**	**139**	**3**	**10**	**0**	**0**	**167**	**208**
killdeer	*Charadrius vociferus*	37	44	34	46	2	9	0	0	73	99
upland sandpiper	*Bartramia longicauda*	10	13	79	91	1	1	0	0	90	105
Wilson's snipe	*Gallinago delicata*	2	2	2	2	0	0	0	0	4	4
Gulls/Terns		**38**	**136**	**9**	**10**	**0**	**0**	**0**	**0**	**47**	**146**
Bonaparte's gull	*Chroicocephalus philadelphia*	2	3	0	0	0	0	0	0	2	3
Franklin's gull	*Leucophaeus pipixcan*	7	50	0	0	0	0	0	0	7	50
ring-billed gull	*Larus delawarensis*	1	1	0	0	0	0	0	0	1	1
unidentified gull		28	82	9	10	0	0	0	0	37	92
Diurnal Raptors		**91**	**95**	**84**	**89**	**60**	**64**	**1**	**1**	**236**	**249**
Buteos		*61*	*63*	*73*	*78*	*40*	*43*	*1*	*1*	*175*	*185*
ferruginous hawk	*Buteo regalis*	2	2	0	0	0	0	0	0	2	2
red-tailed hawk	*Buteo jamaicensis*	42	44	52	56	27	28	0	0	121	128
rough-legged hawk	*Buteo lagopus*	1	1	0	0	1	1	1	1	3	3
Swainson's hawk	*Buteo swainsoni*	16	16	21	22	12	14	0	0	49	52
Northern Harrier		*9*	*9*	*6*	*6*	*16*	*17*	*0*	*0*	*31*	*32*
northern harrier	*Circus hudsonius*	9	9	6	6	16	17	0	0	31	32
Eagles		*6*	*6*	*4*	*4*	*2*	*2*	*0*	*0*	*12*	*12*
bald eagle	*Haliaeetus leucocephalus*	5	5	3	3	2	2	0	0	10	10
golden eagle	*Aquila chrysaetos*	1	1	1	1	0	0	0	0	2	2
Falcons		*11*	*12*	*1*	*1*	*2*	*2*	*0*	*0*	*14*	*15*
American kestrel	*Falco sparverius*	11	12	1	1	1	1	0	0	13	14
merlin	*Falco columbarius*	0	0	0	0	1	1	0	0	1	1
Other Raptors		*4*	*5*	*0*	*0*	*0*	*0*	*0*	*0*	*4*	*5*

Appendix A. Summary of all large bird groups and individual observations, regardless of distance from observer, by bird type and species during avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
unidentified raptor		4	5	0	0	0	0	0	0	4	5
Owls		**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
great horned owl	*Bubo virginianus*	1	1	0	0	0	0	0	0	1	1
Vultures		**9**	**10**	**36**	**51**	**15**	**27**	**0**	**0**	**60**	**88**
turkey vulture	*Cathartes aura*	9	10	36	51	15	27	0	0	60	88
Upland Game Birds		**46**	**51**	**92**	**109**	**30**	**155**	**26**	**160**	**194**	**475**
gray partridge	*Perdix perdix*	0	0	0	0	3	42	2	29	5	71
ring-necked pheasant	*Phasianus colchicus*	45	50	92	109	25	99	22	126	184	384
sharp-tailed grouse	*Tympanuchus phasianellus*	0	0	0	0	2	14	2	5	4	19
wild turkey	*Meleagris gallopavo*	1	1	0	0	0	0	0	0	1	1
Doves/Pigeons		**16**	**40**	**67**	**104**	**26**	**94**	**4**	**12**	**113**	**250**
mourning dove	*Zenaida macroura*	6	8	62	92	15	38	0	0	83	138
rock pigeon	*Columba livia*	10	32	5	12	11	56	4	12	30	112
Large Corvids		**12**	**27**	**1**	**2**	**11**	**11**	**4**	**4**	**28**	**44**
American crow	*Corvus brachyrhynchos*	6	19	0	0	0	0	0	0	6	19
black-billed magpie	*Pica hudsonia*	6	8	1	2	11	11	4	4	22	25
Overall		**335**	**1,433**	**410**	**517**	**152**	**546**	**38**	**266**	**935**	**2,762**

grps = groups; obs = observations.

Appendix B. Bird Use, Percent of Use, and Frequency of Occurrence for Large Observed during Standardized Avian Use Surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Appendix B. Mean large birds use (number of large birds/plot[1]/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type, subtype, and species by season during avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Mean Use				% of Use				% Frequency			
Type/Subtype/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**7.15**	**0**	**0**	**0**	**47.9**	**0**	**0**	**0**	**13.6**	**0**	**0**	**0**
American white pelican	0.17	0	0	0	1.1	0	0	0	1.5	0	0	0
sandhill crane	6.98	0	0	0	46.8	0	0	0	13.6	0	0	0
Waterfowl	**3.29**	**0.09**	**1.81**	**0.96**	**22.0**	**2.5**	**37.4**	**33.5**	**28.0**	**2.7**	**5.9**	**2.2**
Canada goose	2.52	0.07	1.42	0.96	16.9	2.1	29.3	33.5	17.6	1.4	4.9	2.2
green-winged teal	0.08	0	0	0	0.6	0	0	0	2.3	0	0	0
mallard	0.60	0.01	0.39	0	4.0	0.2	8.1	0	15.0	0.7	1.0	0
unidentified duck	0.05	0	0	0	0.3	0	0	0	1.5	0	0	0
unidentified waterfowl	0.04	0.01	0	0	0.2	0.2	0	0	0.7	0.7	0	0
Shorebirds	**0.63**	**0.96**	**0.07**	**0**	**4.2**	**26.9**	**1.5**	**0**	**33.0**	**48.2**	**2.1**	**0**
killdeer	0.52	0.32	0.06	0	3.5	8.9	1.3	0	29.3	17.2	1.4	0
upland sandpiper	0.10	0.63	0.01	0	0.6	17.6	0.1	0	6.7	41.3	0.7	0
Wilson's snipe	0.01	0.01	0	0	0.1	0.4	0	0	0.7	1.4	0	0
Gulls/Terns	**1.80**	**0.07**	**0**	**0**	**12.1**	**1.9**	**0**	**0**	**32.1**	**5.5**	**0**	**0**
Bonaparte's gull	0.04	0	0	0	0.3	0	0	0	2.3	0	0	0
Franklin's gull	0.69	0	0	0	4.6	0	0	0	7.5	0	0	0
ring-billed gull	0.01	0	0	0	<0.1	0	0	0	0.7	0	0	0
unidentified gull	1.07	0.07	0	0	7.2	1.9	0	0	26.2	5.5	0	0
Diurnal Raptors	**0.94**	**0.61**	**0.47**	**0.01**	**6.3**	**17.3**	**9.7**	**0.4**	**50.5**	**44.9**	**31.0**	**1.1**
Buteos	*0.64*	*0.54*	*0.31*	*0.01*	*4.3*	*15.2*	*6.4*	*0.4*	*37.9*	*39.4*	*21.0*	*1.1*
ferruginous hawk	0.03	0	0	0	0.2	0	0	0	3.0	0	0	0
red-tailed hawk	0.43	0.39	0.20	0	2.9	10.9	4.1	0	31.9	31.7	17.2	0
rough-legged hawk	0.01	0	0.01	0.01	<0.1	0	0.2	0.4	0.7	0	1.0	1.1
Swainson's hawk	0.17	0.15	0.10	0	1.2	4.3	2.0	0	13.5	11.1	6.4	0
Northern Harrier	*0.11*	*0.04*	*0.13*	*0*	*0.7*	*1.2*	*2.6*	*0*	*10.5*	*4.2*	*9.8*	*0*
northern harrier	0.11	0.04	0.13	0	0.7	1.2	2.6	0	10.5	4.2	9.8	0
Eagles	*0.05*	*0.03*	*0.02*	*0*	*0.3*	*0.8*	*0.3*	*0*	*5.1*	*2.1*	*1.7*	*0*
bald eagle	0.04	0.02	0.02	0	0.3	0.6	0.3	0	4.4	1.4	1.7	0
golden eagle	0.01	0.01	0	0	<0.1	0.2	0	0	0.7	0.7	0	0
Falcons	*0.14*	*0.01*	*0.02*	*0*	*1.0*	*0.2*	*0.3*	*0*	*12.0*	*0.7*	*1.7*	*0*
American kestrel	0.14	0.01	0.01	0	1.0	0.2	0.1	0	12.0	0.7	0.7	0
merlin	0	0	0.01	0	0	0	0.2	0	0	0	1.0	0
Owls	**0.01**	**0**	**0**	**0**	**<0.1**	**0**	**0**	**0**	**0.7**	**0**	**0**	**0**

Appendix B. Mean large birds use (number of large birds/plot[1]/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type, subtype, and species by season during avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Mean Use				% of Use				% Frequency			
Type/Subtype/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
great horned owl	0.01	0	0	0	<0.1	0	0	0	0.7	0	0	0
Vultures	**0.07**	**0.35**	**0.19**	**0**	**0.5**	**9.7**	**4.0**	**0**	**6.0**	**22.8**	**7.1**	**0**
turkey vulture	0.07	0.35	0.19	0	0.5	9.7	4.0	0	6.0	22.8	7.1	0
Upland Game Birds	**0.44**	**0.75**	**1.49**	**1.72**	**2.9**	**21.1**	**30.7**	**60.2**	**34.0**	**45.3**	**18.9**	**18.3**
gray partridge	0	0	0.41	0.31	0	0	8.5	10.9	0	0	2.9	2.2
ring-necked pheasant	0.43	0.75	0.94	1.35	2.9	21.1	19.4	47.4	34.0	45.3	15.0	14.0
sharp-tailed grouse	0	0	0.14	0.05	0	0	2.8	1.9	0	0	2.0	2.2
wild turkey	0.01	0	0	0	<0.1	0	0	0	0.7	0	0	0
Doves/Pigeons	**0.41**	**0.72**	**0.70**	**0.13**	**2.7**	**20.2**	**14.5**	**4.5**	**11.8**	**36.6**	**11.5**	**4.3**
mourning dove	0.06	0.63	0.27	0	0.4	17.8	5.6	0	3.7	33.1	7.8	0
rock pigeon	0.35	0.08	0.43	0.13	2.3	2.3	9.0	4.5	8.1	3.5	4.4	4.3
Large Corvids	**0.20**	**0.01**	**0.11**	**0.04**	**1.3**	**0.4**	**2.2**	**1.5**	**8.0**	**0.7**	**9.5**	**4.3**
American crow	0.14	0	0	0	1.0	0	0	0	5.1	0	0	0
black-billed magpie	0.06	0.01	0.11	0.04	0.4	0.4	2.2	1.5	2.9	0.7	9.5	4.3
Overall	**14.94**	**3.55**	**4.84**	**2.86**	**100**	**100**	**100**	**100**	**NA**	**NA**	**NA**	**NA**

[1.] 800-meter (2,625-foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C. Mean Use by Point for All Birds, Bird Types, and Diurnal Raptor Subtypes during Standardized Avian Use Surveys at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

Appendix C1. Mean use (number of birds/60-minute survey) by point for all birds[1] and bird types observed during avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Survey Point									
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Waterbirds	**0**	**0**	**3.67**	**0**	**0.17**	**0**	**0**	**0**	**0**	**0**
Waterfowl	**0**	**1.29**	**0.67**	**0.92**	**1.00**	**0.08**	**0.25**	**0**	**0.08**	**0.18**
Shorebirds	**0.33**	**0.57**	**0.17**	**0.92**	**0**	**0.67**	**0.17**	**0.43**	**0.58**	**0.45**
Gulls/Terns	**0.25**	**0**	**0.33**	**5.42**	**0.17**	**0.08**	**0.08**	**0**	**0**	**0.09**
Diurnal Raptors	**1.25**	**1.14**	**0.67**	**0.17**	**1.17**	**0.33**	**0.67**	**0.43**	**0.42**	**0.82**
Buteos	*1.08*	*1.14*	*0.58*	*0.08*	*0.83*	*0.17*	*0.50*	*0.43*	*0.33*	*0.82*
Northern Harrier	*0.08*	*0*	*0.08*	*0.08*	*0*	*0*	*0*	*0*	*0.08*	*0*
Eagles	*0*	*0*	*0*	*0*	*0*	*0*	*0.08*	*0*	*0*	*0*
Falcons	*0.08*	*0*	*0*	*0*	*0.33*	*0.17*	*0.08*	*0*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0.08**	**1.71**	**0.17**	**0**	**0.33**	**0.08**	**0**	**0.43**	**0.17**	**0.36**
Upland Game Birds	**0.42**	**0.86**	**0.25**	**0.33**	**0.50**	**2.92**	**1.92**	**0.29**	**0.42**	**3.09**
Doves/Pigeons	**0.75**	**0**	**0.08**	**0.33**	**0.83**	**0.25**	**0.25**	**0**	**0.17**	**0.18**
Large Corvids	**0**	**0**	**0.17**	**0.17**	**0.17**	**0.25**	**0.08**	**0**	**0**	**0.09**
All Large Birds	**3.08**	**5.57**	**6.17**	**8.25**	**4.33**	**4.67**	**3.42**	**1.57**	**1.83**	**5.27**

[1] 800-meter (2,625-foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C2. Mean use (number of birds/60-minute survey) by point for all birds[1] and bird types observed during avian use surveys at the Oliver Wind IV Project, in Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Survey Point									
Bird Type	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Waterbirds	**0**	**0**	**2.17**	**0**	**0.42**	**0**	**0**	**0**	**0**	**0**
Waterfowl	**8.57**	**3.27**	**13.17**	**0**	**7.08**	**0**	**0**	**0**	**0.13**	**0**
Shorebirds	**0.29**	**0.18**	**0.67**	**0.09**	**0.17**	**0.67**	**0.57**	**1.25**	**0.50**	**0.29**
Gulls/Terns	**0**	**0.64**	**0.33**	**0.18**	**1.17**	**0**	**0**	**0**	**0**	**0.14**
Diurnal Raptors	**0.57**	**0.82**	**0.25**	**0.64**	**0.58**	**0.33**	**0.43**	**0**	**0.75**	**0.57**
Buteos	*0.57*	*0.82*	*0.25*	*0.45*	*0.33*	*0.33*	*0*	*0*	*0.63*	*0.29*
Northern Harrier	*0*	*0*	*0*	*0.09*	*0*	*0*	*0.14*	*0*	*0.13*	*0.14*
Eagles	*0*	*0*	*0*	*0*	*0.08*	*0*	*0.14*	*0*	*0*	*0.14*
Falcons	*0*	*0*	*0*	*0.09*	*0.17*	*0*	*0.14*	*0*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0.14**	**0.27**	**0.17**	**0.27**	**0**	**0.33**	**0**	**0**	**0.38**	**0.71**
Upland Game Birds	**0.14**	**3.09**	**1.00**	**0.36**	**0.50**	**0**	**0.14**	**0.50**	**0.25**	**0.29**
Doves/Pigeons	**0**	**1.36**	**0.08**	**0.18**	**0.33**	**0**	**0**	**0**	**0.50**	**0**
Large Corvids	**0**	**0.27**	**0.25**	**0**	**1.08**	**0**	**0**	**0.25**	**0.13**	**0**
All Large Birds	**9.71**	**9.91**	**18.08**	**1.73**	**11.33**	**1.33**	**1.14**	**2.00**	**2.63**	**2.00**

[1.] 800-meter (2,625-foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C3. Mean use (number of birds/60-minute survey) by point for all birds[1] and bird types observed during avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Survey Point								
Bird Type	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**
Waterbirds	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.08**	**0**
Waterfowl	**2.17**	**0.86**	**0**	**0**	**0.09**	**0**	**0.36**	**6.50**	**3.67**
Shorebirds	**0.92**	**0.43**	**0.64**	**0.45**	**0.45**	**0.18**	**0.36**	**0.25**	**0.25**
Gulls/Terns	**0.08**	**0.14**	**0**	**0**	**0**	**0**	**0.18**	**1.75**	**0**
Diurnal Raptors	**0.17**	**0.57**	**0.09**	**0.64**	**0.36**	**0.55**	**0.55**	**1.00**	**0.75**
Buteos	*0.17*	*0.14*	*0.09*	*0.64*	*0.27*	*0.36*	*0.45*	*0.83*	*0.58*
Northern Harrier	*0*	*0*	*0*	*0*	*0.09*	*0.09*	*0.09*	*0.17*	*0*
Eagles	*0*	*0.14*	*0*	*0*	*0*	*0.09*	*0*	*0*	*0.17*
Falcons	*0*	*0.29*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.08**	**0**
Vultures	**0**	**0**	**0**	**0.09**	**0**	**0.45**	**0.18**	**0.17**	**0.08**
Upland Game Birds	**0.17**	**0.57**	**0**	**2.73**	**1.73**	**3.18**	**0.27**	**1.92**	**0.58**
Doves/Pigeons	**5.83**	**0.86**	**0.09**	**0.64**	**0.64**	**0.27**	**1.45**	**0.25**	**0.17**
Large Corvids	**0**	**0.29**	**0**	**0.18**	**0.36**	**0**	**0.09**	**0**	**0**
All Large Birds	**9.33**	**3.71**	**0.82**	**4.73**	**3.64**	**4.64**	**3.45**	**12.00**	**5.50**

[1.] 800-meter (2,625-foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C4. Mean use (number of birds/##-minute survey) by point for all birds[1] and bird types observed during avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Survey Point									
Bird Type	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**
Waterbirds	**12.58**	**0**	**3.33**	**6.25**	**0**	**0**	**0**	**0**	**0**	**0**
Waterfowl	**2.50**	**0**	**1.50**	**0**	**1.00**	**1.14**	**0**	**0**	**0**	**0.17**
Shorebirds	**0.50**	**0**	**0.25**	**0.17**	**0.45**	**0**	**0.50**	**0.08**	**0.38**	**1.17**
Gulls/Terns	**0.08**	**0.13**	**0.25**	**0**	**0.18**	**0**	**0**	**0**	**0**	**0**
Diurnal Raptors	**0.67**	**0.13**	**0.25**	**0.25**	**0.55**	**0.57**	**0.67**	**0.42**	**0.50**	**1.67**
Buteos	*0.42*	*0.13*	*0.08*	*0.25*	*0.45*	*0.57*	*0.33*	*0.33*	*0.38*	*0.67*
Northern Harrier	*0.17*	*0*	*0.17*	*0*	*0*	*0*	*0*	*0*	*0.13*	*1.00*
Eagles	*0.08*	*0*	*0*	*0*	*0.09*	*0*	*0.33*	*0*	*0*	*0*
Falcons	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.08*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0.42**	**0.25**	**0.25**	**0.08**	**0**	**0.14**	**0**	**0.33**	**0.13**	**0**
Upland Game Birds	**0.50**	**0.25**	**0.75**	**1.00**	**1.18**	**0.14**	**0.50**	**2.92**	**0.38**	**0**
Doves/Pigeons	**0.42**	**0.50**	**0.08**	**0**	**0.45**	**0.29**	**0.50**	**0.25**	**0.38**	**0**
Large Corvids	**0.17**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
All Large Birds	**17.83**	**1.25**	**6.67**	**7.75**	**3.82**	**2.29**	**2.17**	**4.00**	**1.75**	**3.00**

[1] 800-meter (2,625-foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C5. Mean use (number of birds/##-minute survey) by point for all birds[1] and bird types observed during avian use surveys at the Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota, from March 15, 2022, to February 27, 2023.

	Survey Point									
Bird Type	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**
Waterbirds	**0**	**10.75**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Waterfowl	**0.40**	**0.83**	**0**	**0**	**0.25**	**2.92**	**1.50**	**0**	**0.73**	**0**
Shorebirds	**1.20**	**0.42**	**0.57**	**0.17**	**0.42**	**0**	**0.75**	**1.17**	**1.18**	**0.50**
Gulls/Terns	**0**	**0.17**	**0**	**0.17**	**0.08**	**0**	**0.08**	**0**	**0**	**0.25**
Diurnal Raptors	**0**	**0.08**	**0.29**	**0.50**	**0.42**	**0.08**	**0.25**	**0.33**	**0.27**	**0.67**
Buteos	*0*	*0.08*	*0.29*	*0.25*	*0.42*	*0*	*0.17*	*0*	*0.27*	*0.42*
Northern Harrier	*0*	*0*	*0*	*0.08*	*0*	*0.08*	*0.08*	*0.33*	*0*	*0.25*
Eagles	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0*	*0*	*0*	*0.17*	*0*	*0*	*0*	*0*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0**	**0**	**0**	**0.33**	**0.08**	**0.17**	**0**	**0.50**	**0.09**	**0**
Upland Game Birds	**1.20**	**0.33**	**0.14**	**1.25**	**0.25**	**2.83**	**0.33**	**0.33**	**0.18**	**1.08**
Doves/Pigeons	**0.80**	**0.08**	**0**	**0.08**	**0.67**	**0.25**	**0.17**	**5.33**	**0**	**0.25**
Large Corvids	**0**	**0**	**0**	**0**	**0**	**0.08**	**0**	**0**	**0**	**0.08**
All Large Birds	**3.60**	**12.67**	**1.00**	**2.50**	**2.17**	**6.33**	**3.08**	**7.67**	**2.45**	**2.83**

[1.] 800-meter (2,625-foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix B9. Sharp-tailed Grouse Lek Surveys (May 2019)

Sharp-tailed Grouse Lek Surveys
Completed May 2019

Oliver Wind IV Project
Oliver and Mercer Counties, North Dakota

Final Report

Prepared for:

Oliver Wind IV, LLC

Prepared by:

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4007 State Street, Suite 109
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Report Date: August 24, 2023

Privileged and Confidential – Contains Sensitive Biological Information

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INTRODUCTION

Oliver Wind IV, LLC (Company) is evaluating the potential for wind energy development at the proposed Oliver Wind IV Project and Transmission Line (referred to as the Project) in Oliver and Mercer counties, North Dakota (Figure 1). The Company contracted Western EcoSystems Technology, Inc. (WEST) to conduct sharp-tailed grouse (*Tympanuchus phasianellus*; STGR) lek surveys in the Study Area. The primary objective of these surveys was to document the status of sharp-tailed grouse leks including the search for previously undocumented STGR leks, as well as determine the number of STGR present at each lek in the Study Area. This report presents the results of the lek surveys conducted in May of 2019.

STUDY AREA

The Study Area is located approximately 3.7 miles (mi; 6.0 kilometers [km]) west of the town of Center, in central North Dakota, within both Oliver and Mercer counties (Figure 1). The Study Area (54,358-acre [ac]; 21,998-hectare [ha]) was established with a 1.0-mi (1.6-km) buffer encompassing the anticipated Project footprint associated with the 2019 turbine layout and Transmission Line rather than the Project Area (Figure 1).

The Study Area is within the Northwestern Glaciated Plains Level III Ecoregion, in an area historically dominated by grasslands but extensively converted to agricultural use (e.g., row crops and livestock grazing; Bryce et al. 1996, US Environmental Protection Agency 2017). The terrain within the Study Area is gently rolling with interspersed level areas, and elevations of 1,663–2,385 feet (ft; 507– 727 meters [m]) above sea level (US Geological Survey 2019).

METHODS

Two rounds of surveys (one ground and one aerial) were conducted in May of 2019 ,during the North Dakota peak lekking period for STGR (March 15 – May 15; North Dakota Game and Fish Department 2021). Aerial surveys were deployed to address weather-caused limited road access that reduced survey coverage in the Study Area. Surveys began 30 minutes (min) prior to sunrise when winds were less than 20 mi (32 km) per hour and there was little or no rain. Surveys ended approximately two hours after sunrise.

The ground-based survey design was modeled after the South Dakota Department of Game, Fish and Parks (SDGFP) *Wildlife Survey Manual 2009 – 2015* (SDGFP 2009) because a written methodology specifically for North Dakota was not publicly available. During the ground-based survey, observers visited survey points from public roads or section lines for a minimum of five min to listen and look for displaying STGR. If a lek was located, the observer would then map the location, to the best of their ability, from the road. Observers also assessed the status of previously known lek locations (identified in prior years) within the Study Area.

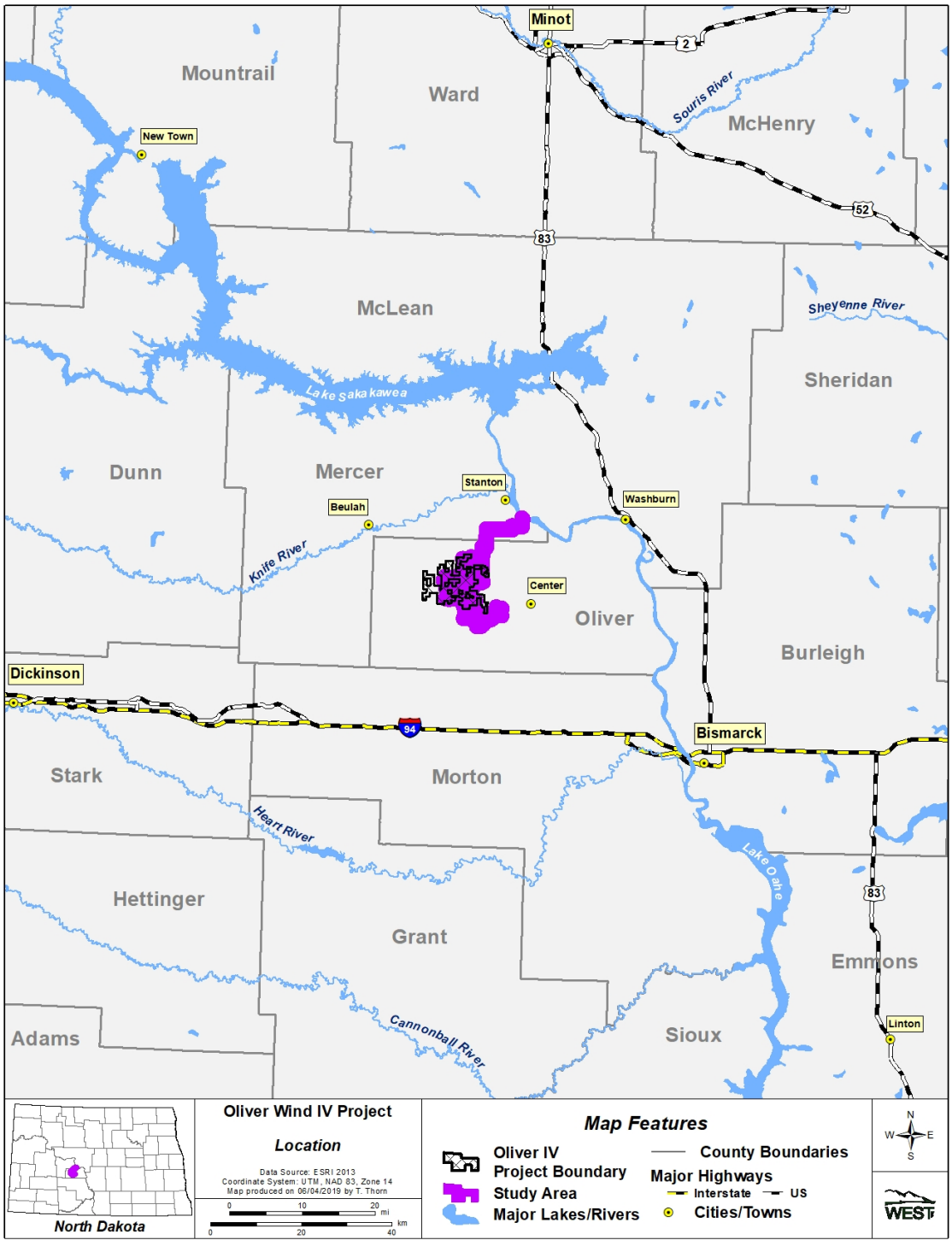

Figure 1. Location of the proposed Oliver Wind IV Project Area and Study Area in Oliver and Mercer counties, North Dakota.

Given limited road access and potential snow cover conditions, aerial surveys were conducted to complement the ground-based survey, to achieve full spatial coverage of the Study Area. Aerial surveys were conducted following guidelines of Martin and Knopf (1981). Pre-flight planning included identifying the locations of previously known lek locations, a review of topographic maps and aerial photographs, and building mobile Geographic Information Systems files. Aerial line-transects, spaced approximately every 1,312 ft (400 m; Figure 2), were flown at approximately 164–328 ft (50–100 m) above ground level using a fixed-wing aircraft (e.g., Cessna 172). The selected spacing of aerial transects provided for complete visual survey coverage of the areas where construction impacts from the Project may occur. An onboard flight Global Positioning System (GPS) unit was used to assist the pilot in navigating transects; lek locations (i.e., approximate center point) were recorded using a hand-held GPS unit.

For the purposes of this survey, a lek was defined as a location where two or more male STGR were detected (visually or aurally). Leks were classified according to their activity status. "Confirmed" leks were those where two or more STGR males were seen or heard displaying courtship behavior at the same location during more than one survey round. Leks were classified as "probable" when visual and/or auditory observations of two or more STGR males were detected during just one survey round. All leks located during ground-based and aerial surveys, regardless of their activity status, were assigned a unique identification number (Lek ID). The date, time, estimated number of STGR (males, females, and unknown), and any relevant comments were also recorded for each lek.

RESULTS

Round 1 (ground-based) was conducted May 2 – 6, 2019, and Round 2 (aerial) was conducted May 9 – 12, 2019. During the 2019 surveys, STGR were observed displaying at one previously known and four previously unknown lek locations within the Study Area (Figure 2). One lek (Lek ID 5) was classified as "confirmed" and the remaining four leks were classified as "probable" (Table 1, Figure 2). All five leks were located within grassland/herbaceous habitat (Figure 2).

Separate counts of males and females were not possible during the aerial survey (Round 2) due to the speed and distance of the aircraft. The only previously documented lek (Lek ID 1), located in the northeastern portion of the Study Area within the Transmission Line buffer (Figure 2), had the highest number (38) of STGR, followed by Lek ID 5, in the central portion of the Study Area, with 28 STGR (Table 1, Figure 2). The total number of STGR recorded at other leks ranged from two (Lek ID 4) to 12 (Lek ID 3; Table 1).

Table 1. Number[1] of sharp-tailed grouse and activity status of leks within the Study Area of the proposed Oliver Wind IV Project in Oliver and Mercer counties, North Dakota, during lek surveys conducted from May 2 – 12, 2019.

	Survey Round 1 - Ground (May 2 – 6)				Survey Round 2 - Aerial (May 9 – 12)					
Lek ID	M	F	U	T	M	F	U	T	Survey Total	Activity Status
1*	0	0	16	16	0	0	22	22	38	Probable
2	NA	NA	NA	NA	0	0	6	6	6	Probable
3	NA	NA	NA	NA	0	0	12	12	12	Probable
4	0	0	2	2	0	0	0	0	2	Probable
5	12	0	1	13	0	0	15	15	28	Confirmed

[1.] Number of males (M), females (F), unknown (U), and total (T) sharp-tailed grouse from each survey round.

* Previously known lek location.

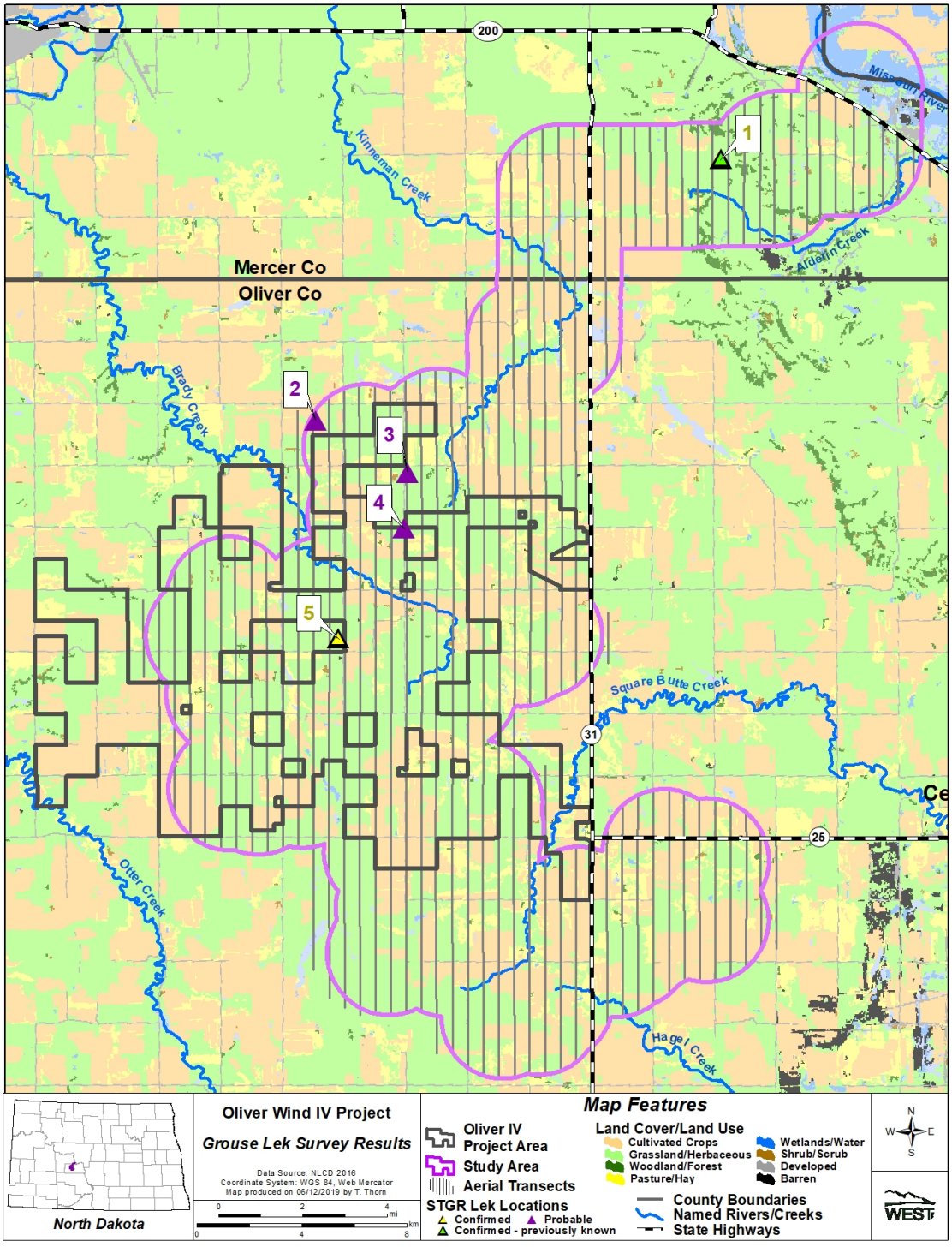

Figure 2. Location and activity status of sharp-tailed grouse (STGR) leks within the Study Area of the proposed Oliver Wind IV Project in Oliver and Mercer counties, North Dakota (surveys conducted from May 2 – 12, 2019).

SUMMARY

The survey results indicate STGR occur in the north-central portion of the Study Area during the breeding season. The number and location of STRG leks, as well as the relative abundance of STGR attending the leks, provides baseline information for STGR occurrence in the Study Area which can be an aid in siting Project infrastructure and operation.

REFERENCES

Bryce, S. A., J. M. Omernik, D. A. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S. H. Azevedo. 1996. Ecoregions of North Dakota and South Dakota. (Color poster with map, descriptive text, summary tables, and photographs.) US Geological Survey (USGS) map (map scale 1:1,500,000). USGS, Reston, Virginia. US Environmental Protection Agency (USEPA). Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-39

ESRI. 2013. World Topographic Map. ArcGIS Resource Center. ESRI, producers of ArcGIS software. ESRI, Redlands, California. Last modified January 10, 2019. Available online: http://www.arcgis.com/home/item.html?id=30e5fe3149c34df1ba922e6f5bbf808f

Martin, S. A., and F. L. Knopf. 1981. Aerial Survey of Greater Prairie Chicken Leks. Wildlife Society Bulletin 9(3): 219-221.

National Land Cover Database (NLCD). 2016. *As cited* includes:

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. doi: 10.1016/j.isprsjprs.2018.09.006.

and

Multi-Resolution Land Characteristics (MRLC). 2019. National Land Cover Database (NLCD) 2016. Multi-Resolution Land Characteristics (MRLC) Consortium. US Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, MRLC Project, Sioux Falls, South Dakota. May 10, 2019. Available online: https://www.mrlc.gov/data North American Datum (NAD). 1983. NAD83 Geodetic Datum.

North Dakota Game and Fish Department (NDGFD). 2021. Key Wind Energy Development in North Dakota Best Management Practices. Appendix D. *In*: Wind Energy Development in North Dakota Best Management Practices. NDGFD, Bismarck, North Dakota. June 2021. Available online: https://gf.nd.gov/node/4800

South Dakota Department of Game, Fish and Parks (SDGFP). 2009. Wildlife Survey Manual 2009-2015. Division of Wildlife, Pierre, South Dakota. 187 pp.

US Environmental Protection Agency (USEPA). 2017. Ecoregion Download Files by State - Region 5: North Dakota. Ecoregions of the United States, Ecosystems Research, USEPA. Last updated February 8, 2017. Accessed June 2019. Information and maps online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-32

US Geological Survey (USGS). 2019. 3D Elevation Program (3DEP). 3D Elevation Data from Light Detection and Ranging (LIDAR) data: Conterminous United States, Hawaii, and the US Territories. USGS, Reston, Virginia. Accessed June 2019. Information online: https://www.usgs.gov/core-science-systems/ngp/3dep

Appendix B10. Sharp-tailed Grouse Lek Surveys (April 2020)

Sharp-tailed Grouse Lek Surveys
Completed April 2020

Oliver Wind IV Project
Oliver and Mercer Counties, North Dakota

Final Report

Prepared for:

Oliver Wind IV, LLC

Prepared by:

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Report Date: August 24, 2023

Privileged and Confidential – Contains Sensitive Biological Information

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REPORT REFERENCE

Shelley, K., T. Thorn, and C. Derby. 2023. Sharp-tailed Grouse Lek Surveys, Completed April 2020, Oliver Wind IV Project, Oliver and Mercer counties, North Dakota. Final Report. Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 24, 2023. 9 pp.

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INTRODUCTION

Oliver Wind IV, LLC (Company) is evaluating the potential for wind energy development at the proposed Oliver Wind IV Project and Transmission Line (referred to as the Project) in Oliver and Mercer counties, North Dakota (Figure 1). The Company contracted Western EcoSystems Technology, Inc. (WEST) to conduct sharp-tailed grouse (*Tympanuchus phasianellus*; STGR) lek surveys to collect baseline environmental information. The objectives of these surveys were to document the status of sharp-tailed grouse leks in the 2020 Study Area, including the search for previously unknown STGR leks, as well as determine the number of individual STGR present at each lek in the vicinity of the Project. This report presents the results of the lek surveys conducted in April of 2020.

STUDY AREA

The Project is located approximately 3.7 miles (mi; 6.0 kilometers [km]) west of the town of Center, in central North Dakota, within both Oliver and Mercer counties (Figure 1). The 2020 Study Area (127,607-acre [ac]; 51,640-hectare [ha]) more than doubled in size compared to the 2019 Study Area to encompass the entire Project Area and additional lands to the east (Figure 1).

The Study Area is within the Northwestern Glaciated Plains Level III Ecoregion, in an area historically dominated by grasslands but extensively converted to agricultural use (e.g., row crops and livestock grazing; Bryce et al. 1996, US Environmental Protection Agency 2017). The terrain within the Study Area is gently rolling with interspersed level areas, and elevations of 1,663–2,385 feet (ft; 507– 727 meters [m]) above sea level (US Geological Survey 2019).

METHODS

Three rounds of aerial surveys were conducted in April of 2020 within the Study Area, during the North Dakota peak lekking period for STGR (March 15 – May 15; North Dakota Game and Fish Department 2021). Surveys began 30 minutes (min) prior to sunrise when winds were less than 20 mi [32 km] per hour and there was little or no rain. Surveys ended approximately two hours after sunrise.

Due to limited road access and potential snow cover conditions, aerial surveys were conducted to achieve full spatial coverage of the Study Area, following guidelines of Martin and Knopf (1981). Pre-flight planning included identifying the locations of previously known lek locations, a review of topographic maps and aerial photographs, and building mobile Geographic Information Systems files. Aerial line-transects, spaced approximately every 1,312 ft (400 m; Figure 2), were flown at approximately 164–328 ft (50–100 m) above ground level using a fixed-wing aircraft (e.g., Cessna 172). The selected spacing of aerial transects provided for complete visual survey coverage of the areas where construction impacts from the Project may occur. An onboard flight Global Positioning System (GPS) unit was used to assist the pilot in navigating transects; lek locations (i.e., approximate center point) were recorded using a hand-held GPS unit.

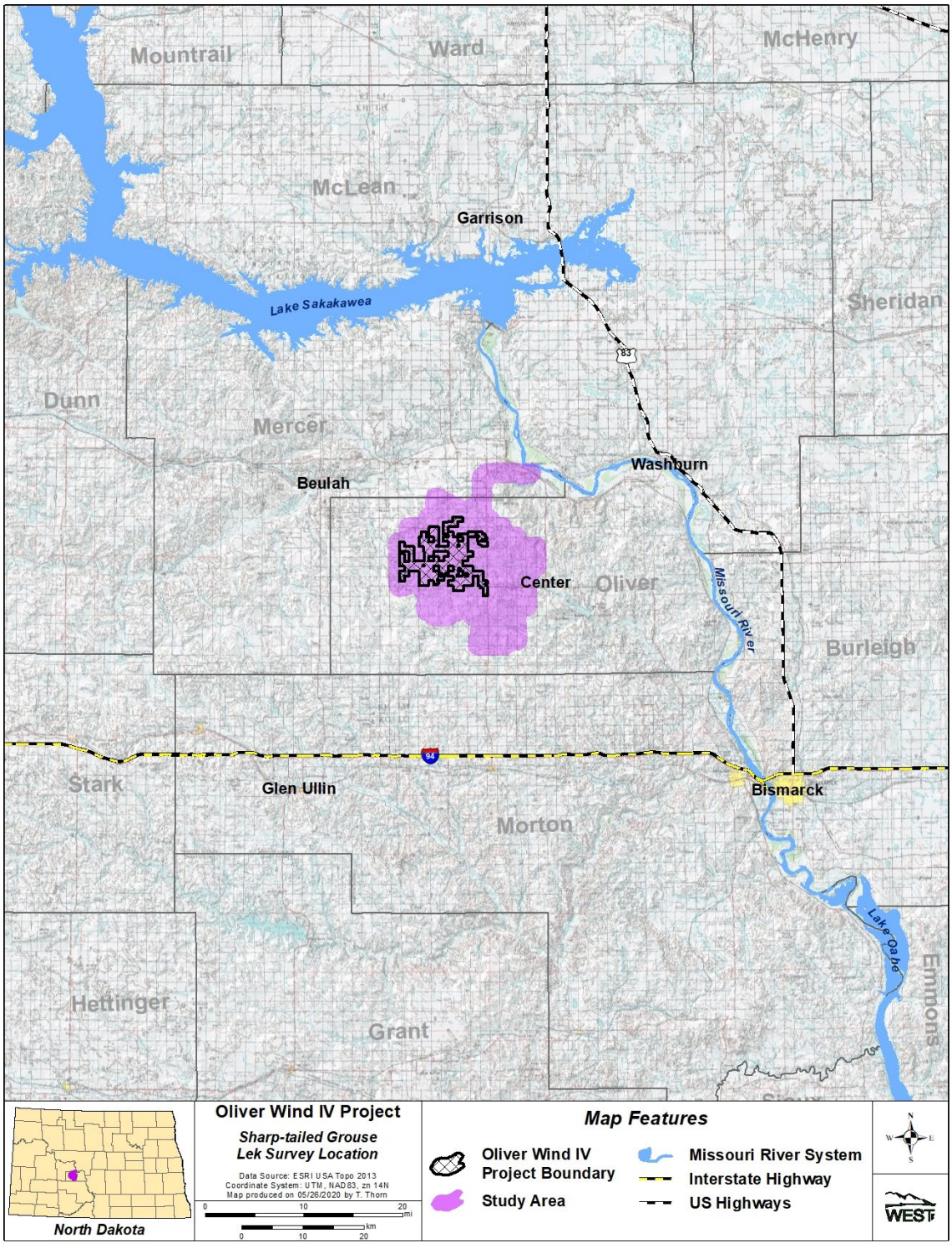

Figure 1. Location of the proposed Oliver Wind IV Project Area and Study Area in Oliver and Mercer counties, North Dakota.

For the purposes of this survey, a lek was defined as a location where two or more male STGR were observed lekking, either visually or aurally. Leks were categorized based on their activity status. Leks that had two or more STGR males displaying courtship behavior at the same location during multiple survey rounds were classified as "confirmed" leks. Leks where visual and/or auditory observations of two or more STGR males were detected during only one survey round were classified as "probable" leks.

All leks located, regardless of their activity status, were assigned a unique identification number (Lek ID). The date, time, estimated number of STGR (males, females, and unknown), and any relevant comments were also recorded for each lek.

RESULTS

Survey Round 1 was conducted on April 7, 2020; Round 2 was conducted April 17 – 19, 2020, and Round 3 was conducted April 26 – 30, 2020 (Table 1). During the 2020 surveys, STGR were observed lekking at five previously unknown locations (Lek IDs 6–10) and five previously known locations (Lek IDs 1 – 5; Figure 2) documented during surveys conducted in 2019 (Shelley et al. 2023). Separate counts of males and females were not always possible during the aerial surveys due to the speed and distance of the aircraft.

Two of the previously unknown leks (Lek ID 9 and Lek ID 10; Figure 2, Table 1) were classified as “confirmed” and the remaining three (Lek IDs 6 – 8) were classified as “probable.” Lek IDs 6 and 7 were located within cultivated lands and Lek IDs 8, 9, and 10 were in grassland/herbaceous habitat (Figure 2). Lek IDs 9 and 10, located in the eastern portion of the Study Area, had the highest peak number of STGR observed in 2020, with 16 STGR in Round 3 (Table 1). Lek IDs 6, 7, and 8 had peak numbers of nine, two, and nine STGR, respectively (Table 1).

The five previously known STGR leks documented within the 2019 Study Area (Shelley et al. 2023) were revisited in 2020 and classified as follows: Lek IDs 1, 2 and 3 were classified as “probable” and Lek IDs 4 and 5 were “confirmed.” Of these previously known leks, Lek IDs 4 and 5 both were observed with the most STGR (16; Table 2), and all five previously known leks were located in grasslands/herbaceous habitat (Figure 2).

Table 1. Number[1] of sharp-tailed grouse and activity status of previously unknown leks within the 2020 Study Area of the proposed Oliver Wind IV Project in Mercer and Oliver counties, North Dakota during lek surveys conducted from April 7 – 30, 2020.

	Survey Round 1 (April 7)				Survey Round 2 (April 17 – 19)				Survey Round 3 (April 26 – 30)				Survey	Activity
Lek ID	M	F	U	T	M	F	U	T	M	F	U	T	Total	Status
6	0	0	0	0	0	0	0	0	1	0	8	9	9	Probable
7	0	0	6	6	0	0	0	0	1	0	1	2	8	Probable
8	0	0	0	0	0	0	0	0	6	0	3	9	9	Probable
9	0	0	0	0	2	0	11	13	4	0	12	16	29	Confirmed
10	0	0	0	0	5	2	4	11	8	0	8	16	27	Confirmed

[1.] Number of males (M), females (F), unknown (U), and total (T) sharp-tailed grouse from each survey round.

Table 2. Summary[1] of sharp-tailed grouse lek surveys conducted in 2019 and 2020 within the Study Area of the proposed Oliver Wind IV Project in Oliver and Mercer counties, North Dakota.

	2019					2020				
Lek ID	M	F	U	T	Status	M	F	U	T	Status
1*	0	0	38	38	Probable	1	0	8	9	Probable
2*	0	0	6	6	Probable	1	0	1	2	Probable
3*	0	0	12	12	Probable	6	0	3	9	Probable
4*	0	0	2	2	Probable	6	0	25	31	Confirmed
5*	12	0	16	28	Confirmed	13	2	12	27	Confirmed
6	-	-	-	-	-	1	0	8	9	Probable
7	-	-	-	-	-	1	0	7	7	Probable
8	-	-	-	-	-	6	0	3	3	Probable
9	-	-	-	-	-	6	0	23	23	Confirmed
10	-	-	-	-	-	13	2	12	12	Confirmed

[1.] Overall number of males (M), females (F), unknown (U), and total (T) sharp-tailed grouse from all the survey rounds.

* Previously known leks documented during the 2019 lek surveys within the Study Area (Shelley et al. 2023).

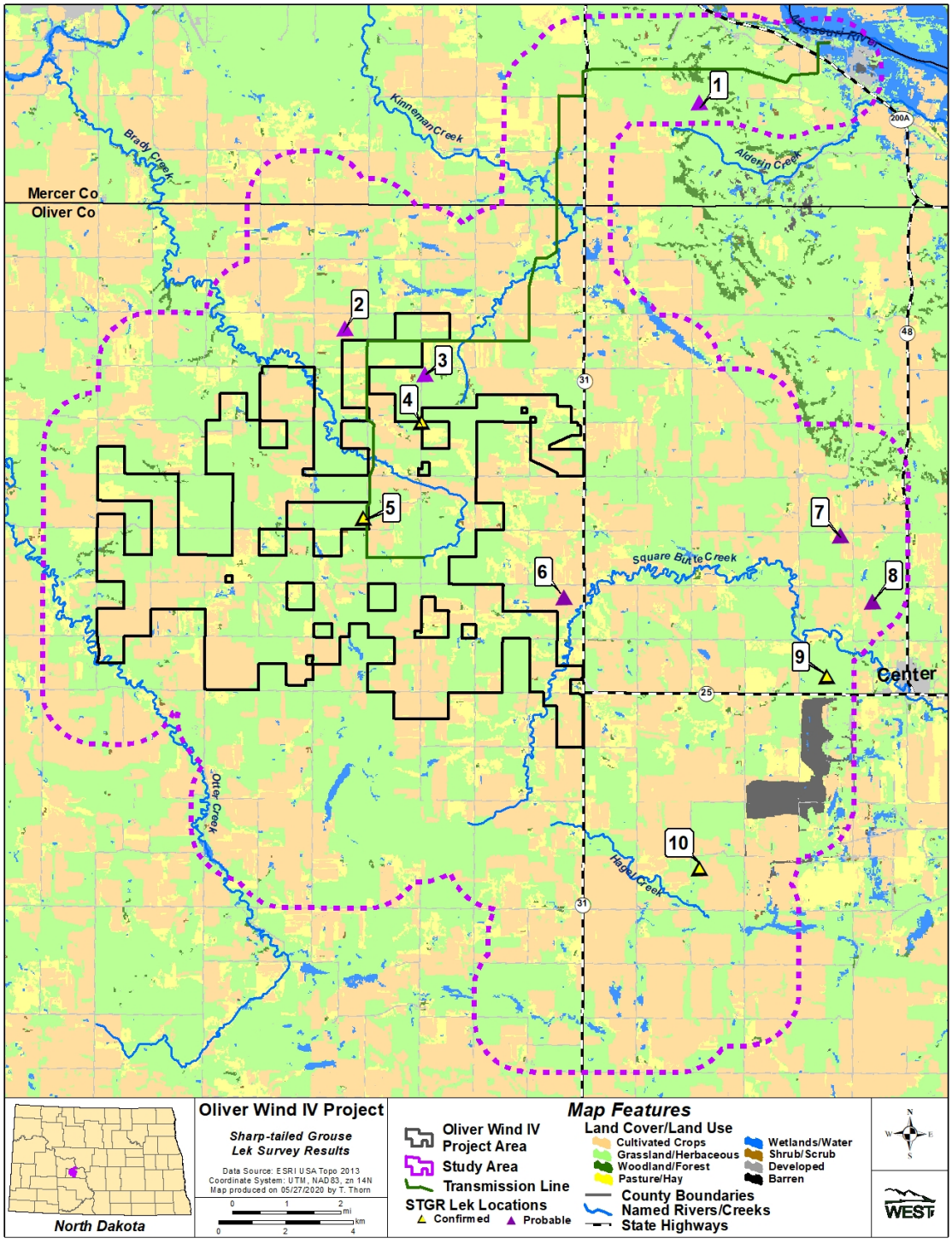

Figure 2. Location and activity status of sharp-tailed grouse leks within the Study Area of the Oliver Wind IV Project in Oliver and Mercer counties, North Dakota (surveys conducted from April 7 – 30, 2020).

SUMMARY

The documentation of previously unknown leks in 2020 and the change in activity status between 2019 and 2020 suggest lek locations and STGR abundance at each lek vary year to year. These results provide an overall understanding of the spatial extent of breeding STGR within the landscape of the Study Area, which can aid in Project development.

REFERENCES

Bryce, S. A., J. M. Omernik, D. A. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S. H. Azevedo. 1996. Ecoregions of North Dakota and South Dakota. (Color poster with map, descriptive text, summary tables, and photographs.) US Geological Survey (USGS) map (map scale 1:1,500,000). USGS, Reston, Virginia. US Environmental Protection Agency (USEPA). Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-39

ESRI. 2013. World Topographic Map. ArcGIS Resource Center. ESRI, producers of ArcGIS software. ESRI, Redlands, California. Last modified January 10, 2019. Available online: http://www.arcgis.com/home/item.html?id=30e5fe3149c34df1ba922e6f5bbf808f

Martin, S. A., and F. L. Knopf. 1981. Aerial Survey of Greater Prairie Chicken Leks. Wildlife Society Bulletin 9(3): 219-221.

National Land Cover Database (NLCD). 2016. *As cited* includes:

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. doi: 10.1016/j.isprsjprs.2018.09.006.

and

Multi-Resolution Land Characteristics (MRLC). 2019. National Land Cover Database (NLCD) 2016. Multi-Resolution Land Characteristics (MRLC) Consortium. US Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, MRLC Project, Sioux Falls, South Dakota. May 10, 2019. Available online: https://www.mrlc.gov/data North American Datum (NAD). 1983. NAD83 Geodetic Datum.

North Dakota Game and Fish Department (NDGFD). 2021. Key Wind Energy Development in North Dakota Best Management Practices. Appendix D. *In*: Wind Energy Development in North Dakota Best Management Practices. NDGFD, Bismarck, North Dakota. June 2021. Available online: https://gf.nd.gov/node/4800

Shelley, K., T. Thorn, and C. Derby. 2023. 2019 Sharp-tailed Grouse Lek Surveys, Oliver Wind IV Project, Oliver and Mercer counties, North Dakota. Draft Report: May 2019 . Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. July 11, 2023. 8 pp.

US Environmental Protection Agency (USEPA). 2017. Ecoregion Download Files by State - Region 5: North Dakota. Ecoregions of the United States, Ecosystems Research, USEPA. Last updated February 8, 2017. Accessed June 2019. Information and maps online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-32

US Geological Survey (USGS). 2019. 3D Elevation Program (3DEP). 3D Elevation Data from Light Detection and Ranging (LIDAR) data: Conterminous United States, Hawaii, and the US Territories. USGS, Reston, Virginia. Accessed June 2019. Information online: https://www.usgs.gov/core-science-systems/ngp/3dep

Appendix B11. Raptor Nest Survey (2020)

Raptor Nest Surveys

Completed February – July 2020

Oliver Wind IV Project
Oliver and Mercer Counties, North Dakota

Final Report

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Report Revised: August 23, 2023

Privileged and Confidential – Not For Distribution

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REPORT REFERENCE

Agudelo, S and C. Derby. 2023. Raptor Nest Surveys, Completed February – July 2020. Oliver IV Wind Project. Oliver and Mercer Counties, North Dakota. Final Draft Report. Prepared for Oliver IV Wind, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 23, 2023. 16pp.

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Appendix A. Photographs of Eagle Nests Located during the Eagle and General Raptor Nest Surveys Conducted in 2020 for the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota, and associated buffers

INTRODUCTION

Oliver Wind IV, LLC (Company) is evaluating the potential for wind energy development at the Oliver Wind IV Project and Transmission Line (referred to as the Project) in Oliver and Mercer Counties, North Dakota. The Company contracted Western EcoSystems Technology, Inc. (WEST) to conduct raptor nest surveys, with a focus on bald (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) the Project and associated Study Area (Figure 1).

Raptor nest surveys were conducted following guidance provided in the US Fish and Wildlife Service's (USFWS) *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013), *Interim Golden Eagle Inventory and Monitoring Protocols* (Pagel et al. 2010), and Region 6 *Recommended Protocol for Conducting Pre-construction Eagle Nest Surveys at Wind Energy Projects* published in January of 2020 (USFWS 2020a). Although the surveys were conducted prior to the issuance of the *Updated Eagle Nest Protocol* issued on April 21, 2020 (USFWS 2020b), the surveys were consistent with the protocol.

The overall objective of the raptor nest surveys was to provide a comprehensive assessment of nest occupancy as well as to track nest success and productivity within the Study Area. Results from this survey provide information on the nesting status of eagles and other raptor species within the Study Area.

STUDY AREA

The Study Area is located approximately 3.7 miles (mi; 6.0 kilometers [km]) west of the town of Center, in central North Dakota (Figure 1). The Study Area occurs within the Northwestern Glaciated Plains Level III Ecoregion - an area historically dominated by grasslands but extensively converted to agricultural use, with crop production and livestock grazing the primary uses (Griffith 2010, Sayler 2016). Topography is gently rolling to flat, with elevations ranging from 1,663–2,385 feet (ft; 507–727 meters [m]) above sea level (USGS 2019).

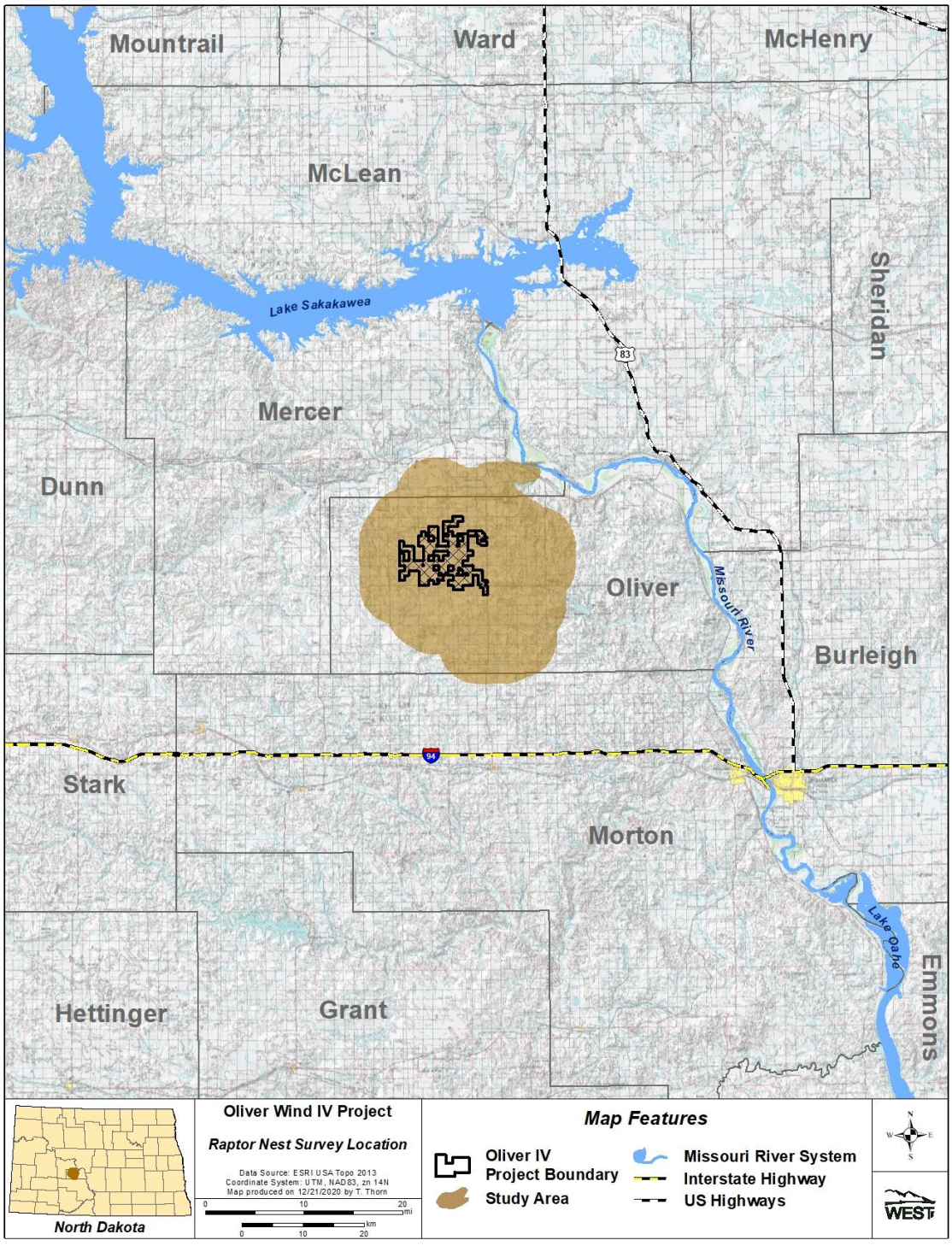

Figure 1. Location of the Oliver Wind IV Project and raptor nest Study Area in Oliver and Mercer Counties, North Dakota.

METHODS

Pre-survey planning included the creation of field maps and mobile Geographic Information System (commonly, GIS) files, and the review of relevant background information such as topographic maps and aerial photographs to identify suitable eagle and raptor nesting habitat within Study Area. Raptor nest locations identified in prior surveys or provided by the North Dakota Game and Fish Department (NDGFD) were also mapped prior to the onset of surveys.

Aerial and ground-based surveys were conducted following the timeframes recommended by the USFWS Region 6 protocol (USFWS 2020a). The general schedule suggested for this effort, per direction from the USFWS Region 6 office on application of the ECPG, is outlined below.

- Visit 1: Ground-based survey to check known eagle nest locations between January 1 – February 21.
- Visit 2: Aerial survey to check known eagle nest locations and to search for new eagle and non-eagle raptor nests between February 22 – March 21.
- Visit 3: Ground-based survey to check known eagle nest locations, including new eagle nests found during Survey 2 between March 22 – April 30.
- Visit 4: Aerial survey to check known eagle nest locations, including new eagle nests found during Survey 2, and to search for new eagle and non-eagle raptor nests between April 21 – May 31.
- Visit 5: Ground-based survey to check known eagle nest locations, including those found during Surveys 2 and 4 between June 1 – July 7.
- Visit 6: Ground-based survey to check known eagle nest locations between July 8 – August 31.

Aerial Surveys

Aerial surveys were used to locate eagle and non-eagle raptor nests within the Study Area as they allowed for a quick and thorough visual inspection of suitable nesting habitat. Suitable nesting habitat included riparian corridors, woodlands and forested areas, large trees, cliffs or rocky outcrops, and anthropogenic structures such as power poles. Pre-flight planning included a desktop review of aerial imagery and land cover data to develop a survey route and to identify potential eagle and other raptor nesting habitats within the Study Area. These potential nesting habitats for eagles and other raptors were included in surveys.

Aerial surveys occurred before trees/vegetation produced leaves and when eagles and raptors would be actively tending to a nest or incubating eggs (USFWS 2007). Aerial surveys were conducted to check known eagle nests and to search for new nests. All potential eagle and raptor nest habitat was surveyed by flying meandering transects at speeds of 60–75 mi (97–121 km) per hour throughout the Study Area and associated buffers. Surveys were concentrated over likely eagle and other raptor nesting habitat (e.g., large trees, human structures such as power poles,

wooded areas, riparian corridors, forested margins of waterbodies, and any cliffs or rocky outcrops).

Aerial raptor nest surveys were conducted by an experienced WEST biologist in a Robinson R44 helicopter (Pagel et al. 2010, USFWS 2013). The first aerial survey was conducted on March 13 - 14, 2020. A second round of aerial raptor nest surveys were completed on April 26 – 28, 2020.

During the second aerial survey, each nest detected during the first round of aerial surveys was rechecked to confirm/update the nest status. This survey also included a comprehensive search of the Study Area for new nests and was used to record information on raptors that initiate nesting later in the breeding season. The same methods used during the first survey were repeated during the second aerial survey.

During the survey, the pilot positioned the helicopter to allow a thorough visual inspection of stick nest structures. The survey team took great care to minimize disturbance to breeding eagles and raptors. When nests were located, the pilot reduced speed and adjusted the flight track such that the biologist could clearly see the nest to document the nest accurately. The pilot approached the nest slowly and maintained the greatest possible distance at which the nest status could be documented. The survey flight path was recorded using a hand-held Global Positioning System (GPS)-enabled tablet running Gaia GPS software to ensure the Study Area was covered adequately.

Ground Based Surveys

The ground-based survey methods allowed for a determination of occupancy status of any known/historic eagle nests (ground surveys one and two) and visitation of any occupied active nests to determine nest success/productivity (ground surveys three and four). The first two ground surveys were conducted to provide additional information on the occupancy status of known/historic eagle nests. Ground surveys were no longer conducted once a nest was determined to be unoccupied or if an occupied nest was determined to be inactive or failed.

Ground-based surveys were conducted from public roads and lands where permission was granted by the landowner prior to surveys. The biologist used the closest location and/or best vantage point to observe the nest; in some cases, nest locations were inaccessible and could not be surveyed.

One experienced WEST biologist conducted the ground-based raptor nest surveys on February 21, March 31, June 26, and July 17, 2020. Conducting the survey early in the season ensured the search effort coincided with the period when eagles were likely incubating eggs or tending young and was based on chronology for nesting eagles in the region (Pagel et al. 2010, Isaacs and Anthony 2011, USFWS 2013).

After locating each nest, the biologist completed a thorough visual inspection of the habitat to provide views of the nest from several different angles. Known/historic eagle nests were observed for four hours per survey, or until occupancy was confirmed. The biologist took great care to

minimize disturbance to breeding eagles and raptors. The survey was conducted between 07:00 hours and 16:00 hours. Ground surveys were conducted in areas where access was available to view the nest.

Data Collection Methods and Terminology

Biologists searched for stick nests with a large bowl or flat platform-shape, made of intertwined large sticks; known locations of nests were also surveyed for current nest status and condition. Data on raptor species, nest status, nest condition and substrate, nest type, nest coordinates, whether or not the nest was consistent with an eagle nest, and any other additional relevant information about the nest were recorded at each nest location to the extent possible. Raptor sightings and behavior nearby nests were also recorded. All occupied eagle nests and unoccupied nests potentially used by eagles were photographed.

Each nest was assigned a unique nest identification (ID) number, location was recorded with a GPS and attribute data including species, substrate, status, condition, and relative nest size and nest characteristics were documented. Below are detailed descriptions of nest attributes and applicable definitions and terms. A table detailing information about raptor nests recorded during the raptor nest survey is presented in Appendix A.

Nest Condition – Nest condition was categorized using descriptions ranging from poor to good, which provided a general sense of when a nest or nest site may have been last used.

- Poor (P): a nest appearing dilapidated (e.g., in disrepair, sloughing, or sagging heavily) and required major repair to be suitable for successful nesting
- Fair (F): a nest in generally good condition with fairly well-defined bowl, minor sagging, may require some repair in order to be used
- Good (G): a nest in excellent condition with a well-defined bowl, no sagging or sloughing, and was considered suitable for nesting
- Unknown (UNK): nest condition is unknown

Nest Characteristics – Each nest was recorded according to two general categories: 1) large stick nests (potentially suitable for eagle use) and 2) non-eagle size nests.

Nest Location – Coordinates for all the raptor nests located during surveys were recorded using a hand-held Global Positioning System (GPS); coordinates were set at Universal Transverse Mercator North American Datum 83 unit (UTM NAD 83).

Nest Status – Nest status was categorized using definitions originally proposed by Postupalsky (1974) and these definitions are still largely followed today in the ECPG (USFWS 2013).

- Occupied (O): a nest was classified as occupied if any of the following were observed at the nest structure: 1) an adult in an incubating position; 2) eggs; 3) nestlings or fledglings; 4) presence of an adult (sometimes sub-adults); 5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed earlier in

the breeding season; or 6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on the nest rim or underneath.

- Occupied active (OA): nest had eggs, nestlings, and/or an adult in incubating/brooding position at the time of the survey
- Occupied inactive (OI): nest had evidence of recent tending of the nest or presence by an adult, but there were no eggs, nestlings, or adult in incubating/brooding position
- Unoccupied (U): nest with no evidence of occupancy for at least two consecutive surveys
- Undetermined (UND): nest with no evidence of occupancy during only one survey
- Missing (M): nest is completely missing or couldn't be found
- Unknown (UNK): nest may or may not be present; status could not be determined

*Nest S*ubstrate – Nest substrate included anthropogenic structures (e.g., power line poles and nest platforms), cliffs and rock outcrops, and trees.

Nest Success – Nesting success is defined as the proportion of OA nests resulting in at least one young fledged, or the minimum acceptable age for determining success. Nest success for eagles means at least one nestling survived to greater than 56 days for golden eagles and greater than 67 days for bald eagles (Steenhof and Newton 2007, USFWS 2013). Nest success was only documented if subsequent surveys were completed to evaluate the nests.

Productivity – Nest productivity is defined as the average number of young that reached fledging age (or minimum age for success, as described above) per Occupied Active nest in a particular breeding period.

Raptor Nest – Raptor and eagle nests were defined as structures made or locations used by raptors, for laying their eggs and sheltering their young (Steenhof and Newton 2007).

All raptor nests (including eagle nests) detected within the Study Area and a 4.0-mi (6.4-km) buffer of the Study Area were recorded (Figure 1) during the first aerial survey (Visit 2) and within a 2.0-mi (3.2-km) buffer of the Study Area during the second aerial survey (Visit 4). The reduction of the Study Area from a 4.0-mi (Visit 2) to a 2.0-mi aerial survey buffer (Visit 4) was implemented due to updated guidance from the USFWS in 2020. The Study Area with a 4.0-mi buffer extended slightly into Morton County but the Study Area with a 2.0-mi buffer was fully contained in Oliver County (Figure 1). Raptors were defined as kites, accipiters, buteos, harriers, falcons, owls, and eagles. Two aerial and four ground-based surveys were completed in 2020, pursuant to USFWS Region 6 protocol (USFWS 2020a), as summarized in Table 1.

For all occupied eagle nests detected during Visits 1–4, ground-based follow-up visits were conducted during Visits 5 and 6. Follow-up visits were limited to only occupied eagle nests to determine eagle nest success per USFWS Region 6 recommendations. The following eagle nest status definitions were used: (1) successful nests were defined as nests where chicks were observed and were at least 70% feathered at the time of observation (Steenhof 1987, 2007 as

Table 1. Survey effort for eagle and raptor nest surveys conducted within the Project, 2.0-mile (mi), and 4.0-mi survey areas of the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota, from February 21 – July 17, 2020.

Visit Number	Type of Survey	Survey Objective	Survey Dates
1	Ground	Visit known eagle nests within 4.0-mi survey area	February 21, 2020
2	Aerial	Revisit known eagle nests and search for new eagle nests within 4.0-mi survey area; search for all raptor nests within 1.0-mi survey area	March 13 – 14, 2020
3	Ground	Revisit known eagle nests and new eagle nests observed in Survey 2 within 4.0-mi survey area	March 31, 2020
4	Aerial	Revisit known eagle nests and search for new eagle nests within 2.0-mi survey area; revisit all previously recorded raptor nests and search for new raptor nests within 1.0-mi survey area	April 26 – 28, 2020
5	Ground	Check status of occupied eagle nests	June 26, 2020
6	Ground	Check status of occupied eagle nests	July 17, 2020

cited in USFWS 2013); (2) unsuccessful nests were defined as nests where it was clearly determined that no chicks had survived; and (3) undetermined nests were defined as nests that were not visited, nests that could not be adequately viewed, or nests in which the chicks were less than 70% feathered during the ground visit.

Data Management

Quality Assurance and Quality Control

WEST implemented quality assurance and quality control (QA/QC) measures at all stages of the surveys, including in the field, during data entry and analysis, and report writing. All WEST field biologists were trained in proper survey techniques and all data collected were recorded on paper. Data were reviewed before they were submitted for data entry and after data were entered. If errors or anomalies were found, follow-up measures were implemented including discussions and review of field data with the biologist and/or Project manager.

Data Compilation and Storage

WEST data entry staff were trained on proper data entry procedures, which included an independent review of the field data. System controls were implemented to ensure correct data were entered; however, if any errors, omissions, or problems were identified in later stages of analysis, they were traced back to the raw data where appropriate changes and measures were implemented.

Reporting and Review Process

WEST's reporting and review process included technical editing and content review, senior technical review, senior management review, and a final review by the Project manager before delivery to the client.

RESULTS

One hundred thirty-five stick nest structures were detected (Table 2, Figure 2) and 85 nests were classified as active (occupied) within the Study Area and associated buffers in 2020. The number and associated species of active nests included: two occupied/active Swianson's hawk (*Buteo swainsoni*) nests (Nest 94 and Nest 121), 21 occupied/active great horned owl (*Bubo virginianus*) nests, and 57 occupied/active red-tailed hawk (*Buteo jamaicensis*) nests. There were two (non-eagle) raptor nests that were active (Nest 91 and Nest 114) where the species could not be confirmed and 51 raptor nests that were inactive. Additionally, there was one stick nest occupied by Canada geese (*Branta canadensis*; Table 2, Figure 2).

One known bald eagle nest (BE397; location provided by the NDGFD) was included in the 2020 survey effort but was not detected during Visit 1 (February 21, 2020) or Visit 2 (March 13-14, 2020; Table 2; Figure 2), and therefore was removed from the follow-up Visits 3-6. One active bald eagle nest (Nest 85), located in the east-central portion of the Study Area, was recorded for the first time during aerial surveys conducted in 2020 (Table 2; Figure 2). Nest 85 was revisited during Visits 5 and 6, and adult eagle activity was observed in the vicinity of the nest location. However, nest ID 85 was obscured by vegetative cover during Visit 5 and no adult or juvenile eagle activity was subsequently recorded in the vicinity during Visit 6. Thus, nest ID 85 success was "undetermined" according to the definitions used in this report. No additional eagle nests or large stick nest structures consistent with an eagle nest were recorded within the Study Area during the 2020 survey period (Table 2; Figure 2). Appendix A includes photos for the eagle nest documented in 2020.

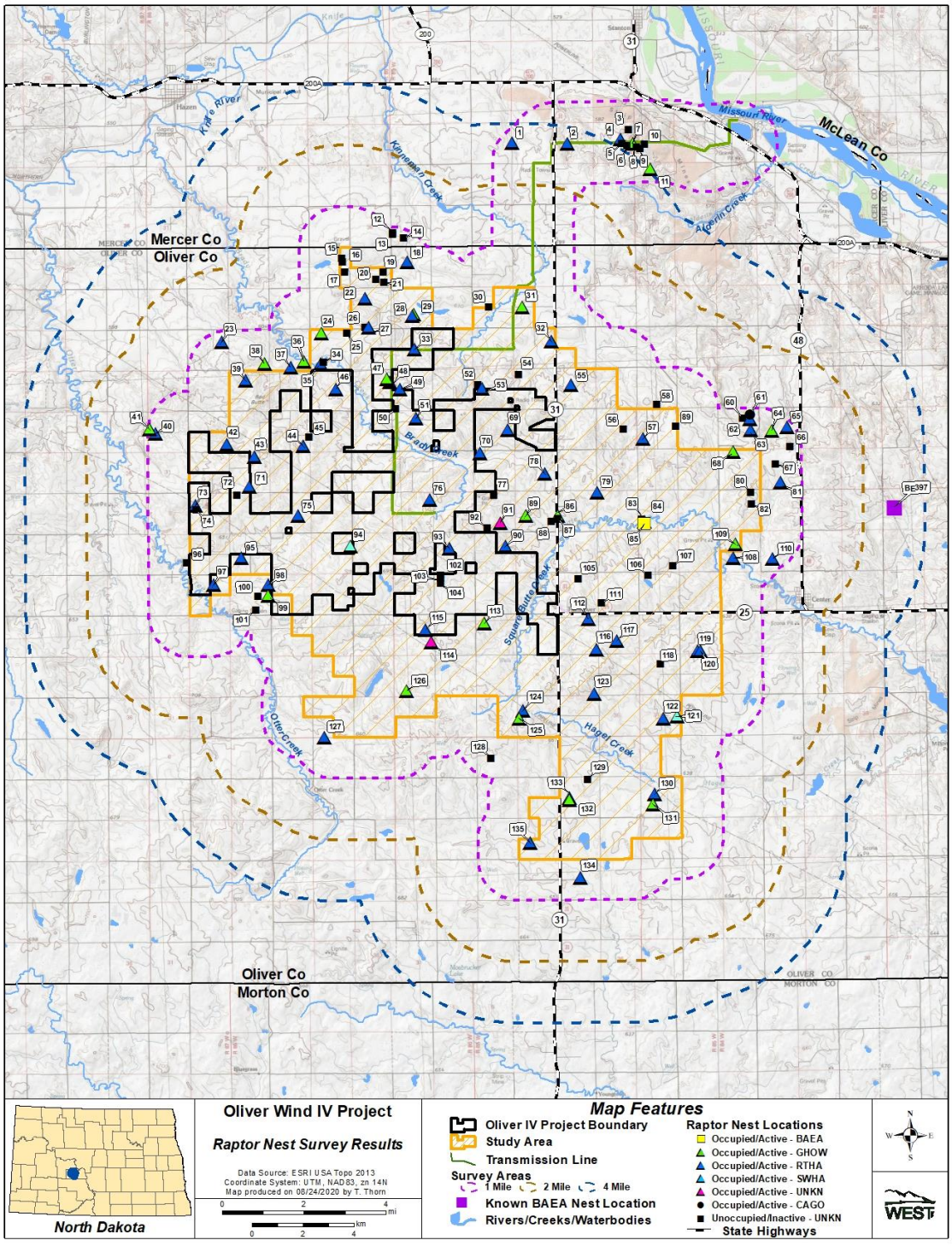

Figure 2. Status of nest structures located during eagle and general raptor nest surveys conducted in 2020 within the Oliver Wind IV Project Oliver and Mercer Counties, North Dakota, and associated buffers.

Table 2. Summary of features associated with nest structures located during raptor nest surveys conducted in 2020 within the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota, and associated buffers.

Nest ID[1]	Species[2]	Easting[3]	Northing[3]	Nest Status	Nest Condition	Comments
BE397	BAEA	329343	5224069	Not detected	Unknown	Known nest
1	RTHA	314857	5238959	Occupied/Active	Fair	1 adult
2	RTHA	317004	5238839	Occupied/Active	Good	1 adult
3	UNKN	319443	5239286	Unoccupied/Inactive	Fair	
4	RTHA	319115	5238934	Occupied/Active	Fair	1 adult; 2 eggs
5	UNKN	319149	5238758	Unoccupied/Inactive	Fair	
6	UNKN	319365	5238662	Unoccupied/Inactive	Fair	
7	GHOW	319572	5238748	Occupied/Active	Good	1 adult
8	UNKN	319720	5238605	Unoccupied/Inactive	Good	
9	UNKN	319858	5238545	Unoccupied/Inactive	Good	
10	UNKN	320051	5238694	Unoccupied/Inactive	Good	
11	GHOW	320244	5237717	Occupied/Active	Good	1 adult
12	UNKN	310015	5235608	Unoccupied/Inactive	Fair	
13	UNKN	310008	5235550	Unoccupied/Inactive	Fair	
14	UNKN	310447	5235388	Unoccupied/Inactive	Fair	
15	UNKN	307980	5234678	Unoccupied/Inactive	Fair	
16	UNKN	308022	5234526	Unoccupied/Inactive	Good	
17	UNKN	308084	5234118	Unoccupied/Inactive	Good	
18	RTHA	310538	5234441	Occupied/Active	Good	1 adult
19	UNKN	309605	5234060	Unoccupied/Inactive	Good	
20	UNKN	309290	5233784	Unoccupied/Inactive	Good	
21	UNKN	309593	5233683	Unoccupied/Inactive	Good	
22	RTHA	308828	5233064	Occupied/Active	Good	1 adult
23	RTHA	303152	5231570	Occupied/Active	Good	1 adult
24	GHOW	307082	5231762	Occupied/Active	Good	1 adult
25	UNKN	308067	5231730	Unoccupied/Inactive	Good	
26	UNKN	308797	5231920	Unoccupied/Inactive	Good	
27	RTHA	308933	5231912	Occupied/Active	Good	1 adult
28	RTHA	310683	5232302	Occupied/Active	Good	1 adult
29	GHOW	310734	5232368	Occupied/Active	Good	1 adult
30	UNKN	313683	5232528	Unoccupied/Inactive	Good	
31	GHOW	314983	5232497	Occupied/Active	Good	1 adult; 2 nestlings
32	RTHA	316092	5231102	Occupied/Active	Good	1 adult
33	RTHA	310718	5231000	Occupied/Active	Good	1 adult
34	UNKN	307126	5230612	Unoccupied/Inactive	Fair	
35	RTHA	307012	5230567	Occupied/Active	Good	1 adult
36	GHOW	306341	5230682	Occupied/Active	Good	1 adult
37	RTHA	305832	5230457	Occupied/Active	Good	1 adult

Table 2. Summary of features associated with nest structures located during raptor nest surveys conducted in 2020 within the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota, and associated buffers.

Nest ID[1]	Species[2]	Easting[3]	Northing[3]	Nest Status	Nest Condition	Comments
38	GHOW	304789	5230657	Occupied/Active	Good	1 adult
39	RTHA	304030	5230017	Occupied/Active	Good	1 adult
40	RTHA	300407	5228068	Occupied/Active	Good	1 adult
41	GHOW	300198	5228266	Occupied/Active	Good	1 adult
42	RTHA	303202	5227529	Occupied/Active	Good	1 adult
43	RTHA	304261	5227018	Occupied/Active	Good	1 adult
44	RTHA	306196	5227362	Occupied/Active	Good	1 adult
45	UNKN	306423	5227701	Unoccupied/Inactive	Good	
46	RTHA	307555	5229551	Occupied/Active	Good	1 adult
47	GHOW	309578	5229867	Occupied/Active	Good	1 adult
48	RTHA	309678	5229754	Occupied/Active	Good	1 adult
49	RTHA	310088	5229457	Occupied/Active	Good	1 adult
50	UNKN	309882	5228673	Unoccupied/Inactive	Good	
51	RTHA	310668	5228279	Occupied/Active	Good	1 adult
52	UNKN	313143	5229510	Unoccupied/Inactive	Fair	
53	RTHA	313292	5229343	Occupied/Active	Good	1 adult
54	UNKN	314753	5229845	Unoccupied/Inactive	Fair	
55	RTHA	316788	5229367	Occupied/Active	Good	
56	UNKN	318791	5227550	Unoccupied/Inactive	Fair	
57	RTHA	319552	5227124	Occupied/Active	Good	1 adult
58	UNKN	320122	5228448	Unoccupied/Inactive	Good	
60	UNKN	323481	5227800	Unoccupied/Inactive	Fair	
61	CAGO	323790	5227919	Occupied/Active	Good	1 adult
62	RTHA	323764	5227750	Occupied/Active	Good	1 adult
63	RTHA	323779	5227316	Occupied/Active	Good	Actively building nest
64	GHOW	324597	5227254	Occupied/Active	Good	1 adult; 3 nestlings
65	RTHA	325217	5227375	Occupied/Active	Good	1 adult
66	UNKN	325308	5226615	Unoccupied/Inactive	Good	
67	UNKN	324694	5225939	Unoccupied/Inactive	Fair	
68	GHOW	323061	5226488	Occupied/Active	Good	1 adult
69	RTHA	314249	5227675	Occupied/Active	Good	1 adult
70	RTHA	313132	5226810	Occupied/Active	Good	1 adult
71	RTHA	304026	5225833	Occupied/Active	Good	1 adult
72	UNKN	303524	5225523	Unoccupied/Inactive	Fair	
73	RTHA	301864	5225182	Occupied/Active	Good	1 adult
74	UNKN	301892	5225012	Unoccupied/Inactive	Fair	
75	RTHA	305894	5224626	Occupied/Active	Good	1 adult
76	RTHA	311092	5225050	Occupied/Active	Good	1 adult
77	UNKN	313601	5225147	Unoccupied/Inactive	Good	

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Table 2. Summary of features associated with nest structures located during raptor nest surveys conducted in 2020 within the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota, and associated buffers.

Nest ID[1]	Species[2]	Easting[3]	Northing[3]	Nest Status	Nest Condition	Comments
78	RTHA	315645	5225927	Occupied/Active	Good	1 adult
79	RTHA	317665	5225081	Occupied/Active	Good	1 adult
80	UNKN	323700	5224863	Unoccupied/Inactive	Fair	
81	RTHA	324885	5225221	Occupied/Active	Good	
82	UNKN	323687	5224411	Unoccupied/Inactive	Good	
83	UNKN	319366	5223982	Unoccupied/Inactive	Good	
84	GHOW	319484	5223892	Occupied/Active	Good	1 adult
85*	BAEA	319469	5223806	Occupied/Active	Good	2 adults
86	GHOW	316074	5224252	Occupied/Active	Good	1 adult; 2 nestlings
87	UNKN	316074	5224136	Unoccupied/Inactive	Good	
88	UNKN	315827	5224007	Unoccupied/Inactive	Fair	
89	GHOW	314835	5224278	Occupied/Active	Good	1 adult
89	UNKN	320835	5227582	Unoccupied/Inactive	Poor	Nest deteriorated
90	RTHA	313970	5223130	Occupied/Active	Good	1 adult
91	UNKN	313801	5224050	Occupied/Active	Good	2 nestlings
92	UNKN	313281	5223868	Unoccupied/Inactive	Good	
93	RTHA	311780	5223109	Occupied/Active	Good	1 adult
94	SWHA	307891	5223346	Occupied/Active	Good	1 adult
95	RTHA	303591	5223056	Occupied/Active	Good	1 adult
96	UNKN	301437	5222931	Unoccupied/Inactive	Fair	
97	RTHA	302466	5222058	Occupied/Active	Good	1 adult
98	RTHA	304608	5221948	Occupied/Active	Good	1 adult
99	GHOW	304579	5221533	Occupied/Active	Good	1 adult
100	UNKN	304183	5221534	Unoccupied/Inactive	Fair	
101	UNKN	304071	5220968	Unoccupied/Inactive	Fair	
102	UNKN	311387	5222085	Unoccupied/Inactive	Good	
103	UNKN	311383	5221951	Unoccupied/Inactive	Good	
104	UNKN	311381	5221769	Unoccupied/Inactive	Good	
105	UNKN	316798	5221709	Unoccupied/Inactive	Fair	
106	UNKN	319520	5221747	Unoccupied/Inactive	Fair	
107	UNKN	320512	5222081	Unoccupied/Inactive	Fair	
108	RTHA	322896	5222325	Occupied/Active	Good	1 adult
109	GHOW	322999	5222849	Occupied/Active	Good	1 adult; 2 nestlings
110	RTHA	324440	5222225	Occupied/Active	Good	
111	UNKN	317671	5220734	Unoccupied/Inactive	Fair	
112	RTHA	317126	5220138	Occupied/Active	Good	
113	GHOW	313046	5220126	Occupied/Active	Good	
114	UNKN	310922	5219454	Occupied/Active	Good	2 nestlings
115	RTHA	310722	5219965	Occupied/Active	Good	

Table 2. Summary of features associated with nest structures located during raptor nest surveys conducted in 2020 within the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota, and associated buffers.

Nest ID[1]	Species[2]	Easting[3]	Northing[3]	Nest Status	Nest Condition	Comments
116	RTHA	317402	5218935	Occupied/Active	Good	1 adult
117	RTHA	318198	5219240	Occupied/Active	Good	1 adult
118	UNKN	319877	5218262	Unoccupied/Inactive	Good	
119	RTHA	321364	5218719	Occupied/Active	Good	1 adult
120	RTHA	321472	5218711	Occupied/Active	Good	1 adult
121	SWHA	320458	5216184	Occupied/Active	Good	2 adults
122	RTHA	319927	5216095	Occupied/Active	Good	1 adult
123	RTHA	317255	5217190	Occupied/Active	Good	1 adult
124	RTHA	314418	5216645	Occupied/Active	Good	1 adult
125	GHOW	314254	5216325	Occupied/Active	Good	1 adult
126	GHOW	309880	5217571	Occupied/Active	Good	1 adult
127	RTHA	306574	5215871	Occupied/Active	Good	1 adult
128	UNKN	313096	5214795	Unoccupied/Inactive	Good	
129	UNKN	316850	5213821	Unoccupied/Inactive	Good	
130	RTHA	319451	5213156	Occupied/Active	Good	1 adult
131	GHOW	319380	5212744	Occupied/Active	Good	1 adult
132	GHOW	316118	5213062	Occupied/Active	Good	1 adult
133	RTHA	316115	5213145	Occupied/Active	Good	2 adults
134	RTHA	316432	5209985	Occupied/Active	Good	1 adult
135	RTHA	314502	5211424	Occupied/Active	Good	1 adult

[1.] Nest consistent with an eagle nest denoted by asterisk (*).

[2.] BAEA = bald eagle; CAGO = Canada goose; GHOW = great horned owl; RTHA = red-tailed hawk; SWHA = Swainson's hawk; UNKN = unknown species.

[3.] Easting and Northing coordinates given in UTM NAD 83, Zone 14N.

All nests were located on deciduous/coniferous trees.

REFERENCES

Esri. 2013. World Topographic Map. ArcGIS Resource Center. Esri, producers of ArcGIS software. Esri, Redlands, California. Last modified January 10, 2019. Information online: https://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9

Griffith, G. 2010. Level III North American Terrestrial Ecoregions: United States Descriptions. Prepared for North American Commission for Environmental Cooperation.

North American Datum (NAD). 1983. Nad83 Geodetic Datum.

Pagel, J. E., D. M. Whittington, and G. T. Allen. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. US Fish and Wildlife Service (USFWS). February 2010. Available online: https://tethys.pnnl.gov/sites/default/files/publications/Pagel-2010.pdf

Sayler, K. 2016. Contemporary Land Cover Change in the Northwestern Great Plains Ecoregion. Page last modified July 7, 2016. US Geological Service (USGS) Earth Resources Observation and Science Center. Sioux Falls, South Dakota. Available online: https://landcovertrends.usgs.gov/gp/eco43Report.html

US Fish and Wildlife Service (USFWS). 2007. National Bald Eagle Management Guidelines. May 2007. Available online: https://www.fws.gov/southdakotafieldoffice/NationalBaldEagleManagementGuidelines.pdf.

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. 103 pp. + frontmatter. Available online: https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf

US Fish and Wildlife Service (USFWS). 2020a. Region 6 Recommended Protocol for Conducting Pre-Construction Eagle Nest Surveys at Wind Energy Projects. USFWS, Region 6, Migratory Bird Management Office, Mountain-Prairie Region. January 14, 2020. Available online: https://www.fws.gov/mountain-prairie/migbirds/library/USFWS%20R6%20recommended%20Eagle%20Nest%20Survey%20Protocol%20for%20wind%20projects_14Jan2020.pdf

US Fish and Wildlife Service (USFWS). 2020b. Updated Eagle Nest Survey Protocol. 4 pp. Attachment to: USFWS. 2020. Eagle Surveys. Memorandum to Regional Directors, Regions 1-12. From J. Ford, Assistant Director for Migratory Birds. Ecological Services, United States Department of the Interior Fish and Wildlife Service, Washington, D.C. April 21, 2020. Available online: https://www.fws.gov/birds/management/managed-species/eagle-management.php

US Geological Survey (USGS). 2019. 3D Elevation Program (3DEP). 3D elevation data from Light Detection and Ranging (LIDAR) data: conterminous United States, Hawaii, and the US territories. USGS, Reston, Virginia. Accessed August 2020. Information online: https://www.usgs.gov/core-science-systems/ngp/3dep

Appendix A. Photographs of Eagle Nests Located during the Raptor Nest Surveys Conducted in 2020 for the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota, and associated buffers

Nest ID 85. Survey 2 conducted March 12, 2020: Bald eagle occupied/active.

Nest ID 85. Survey 4 conducted April 27, 2020: Bald eagle occupied/active.

Nest ID 85. Survey 5 conducted June 26, 2020: Bald eagle occupied/active.

Nest ID 85. Survey 6 conducted July 17, 2020: inactive.

Appendix B12. Raptor Nest Survey (2022)

Raptor Nest Surveys

Completed February – June 2022

Oliver Wind IV Project

Oliver County, North Dakota

Final Report

Prepared for:

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Confidential Business Information

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INTRODUCTION

Oliver Wind IV, LLC. (Company) is developing the Oliver Wind IV Project (Project) in Oliver County, North Dakota (Figure 1). The Company contracted Western EcoSystems Technology, Inc. (WEST) to conduct a Tier 3 raptor nest survey within the proposed Project and Study Area and an associated 3.2-kilometer (km; 2.0-mile [mi]) buffer. All surveys were conducted following recommendations from the US Fish and Wildlife Service (USFWS) *Land-Based Wind Energy Guidelines* (USFWS 2012), the USFWS *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013), the USFWS Region 6 *Recommended Eagle Nest Survey Protocol* (USFWS 2020a) and the updated protocol (USFWS 2020b).

The overall objective of the raptor nest surveys was to provide a comprehensive assessment of nest occupancy as well as to track nest success and productivity within the Study Area. Results from this survey provide information on the nesting status of eagles and other raptor species within the Study Area.

STUDY AREA

The 45,861-hectare (113,325-acre) Study Area is located 17.7 kilometers (11 miles) north of the city of New Salem in Oliver County, North Dakota (Figure 1). The Study Area is primarily composed of herbaceous grassland (47.8%), followed by cultivated crops (37.7%), hay/pasture (10.0%), developed open space (2.6%), and less than 1% of the other land categories (National Land Cover Database (NLCD) 2019; Figure 2, Table 1). The Study Area is in the Level IV Missouri Plateau and River Breaks of the Level III Northwestern Great Plains ecoregion (US Environmental Protection Agency 2013). The Northwestern Great Plains ecoregion is a large ecoregion that covers northeastern Wyoming, eastern Montana, western North Dakota, western South Dakota, and northern Nebraska. This ecoregion consists of semiarid rolling plains, punctuated by buttes and badlands, and primarily used as rangeland or cultivated cropland.

METHODS

In accordance with recommendations from the USFWS Region 6 guidance (USFWS 2020a), eagle and non-eagle raptor nest surveys were conducted within the Study Area Minimum Convex Polygon (MCP) and a 3.2-km buffer of the MCP at the time of survey. Surveys included two aerial surveys for all raptor nests, including eagles and four ground-based surveys for eagle nests with the first survey being ground-based and conducted at known/historic eagle nest locations.

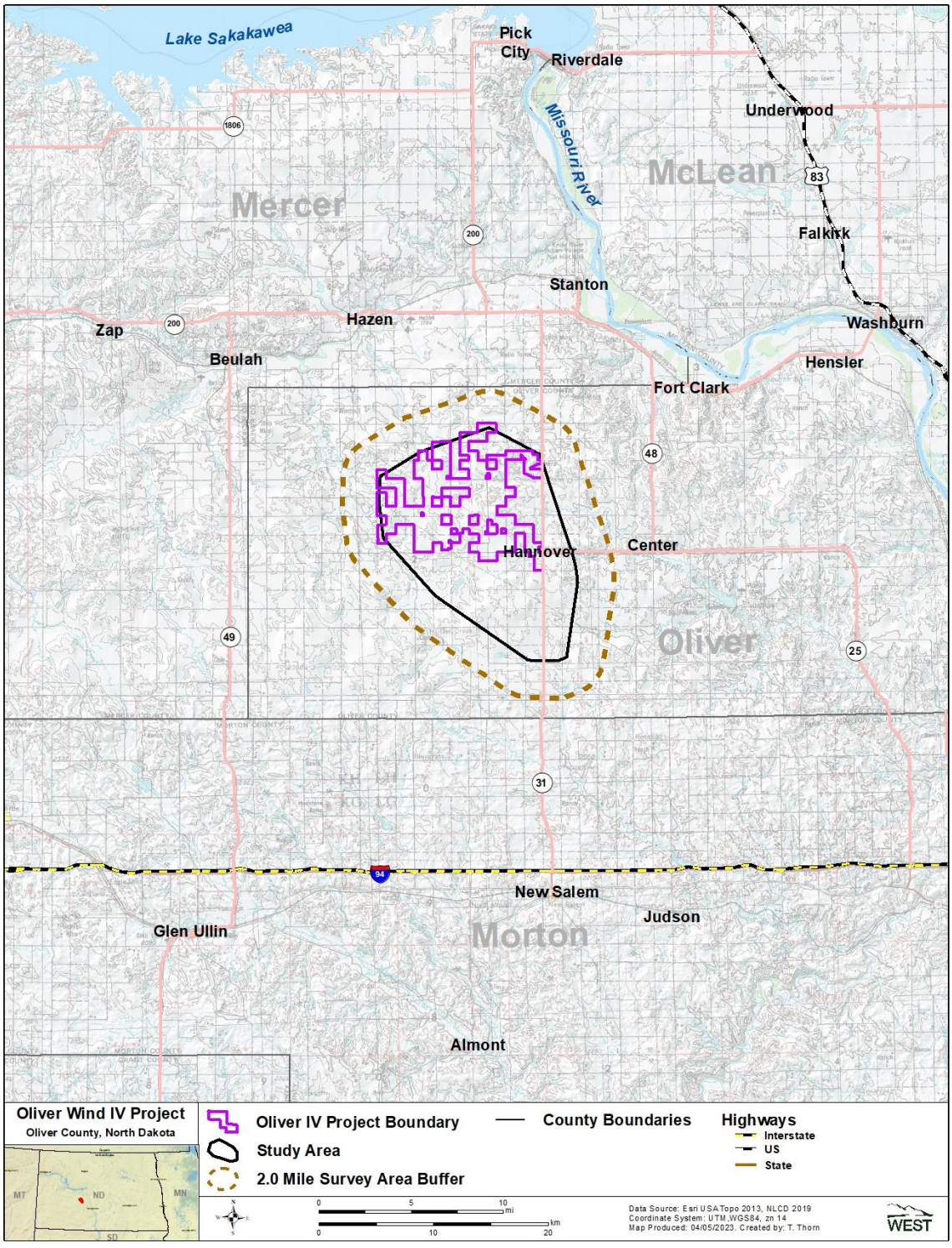

Figure 1. Location of the Oliver Wind IV Project Study Area and associated 3.2-kilometer (2.0-mile) buffer, Oliver County, North Dakota.

Table 1. Land cover types, coverage, and percent (%) composition within the Oliver Wind IV Project Study Area and 2-mi buffer , Oliver County, North Dakota.

Land Cover Type	Coverage (Hectares)	Coverage (Acres)	% Composition
Herbaceous	21,903.3	54,124.1	47.8%
Cultivated Crops	17,280.8	42,701.9	37.7%
Hay/Pasture	4,595.1	11,354.7	10.0%
Developed, Open Space	1,207.6	2,984.0	2.6%
Emergent Herbaceous Wetlands	409.0	1,010.7	0.9%
Deciduous Forest	178.8	441.8	0.4%
Woody Wetlands	70.2	173.4	0.2%
Barren Land	70.0	173.1	0.2%
Shrub/Scrub	67.8	167.5	0.1%
Open Water	40.5	100.0	0.1%
Developed, Low Intensity	31.0	76.5	0.1%
Mixed Forest	5.9	14.6	<0.1%
Developed, Medium Intensity	0.7	1.8	<0.1%
Evergreen Forest	0.5	1.3	<0.1%
Total[1]	**45,861.1**	**113,325.3**	**100**

Sources: National Land Cover Database 2019.

1. Sums of values may not add to the total value shown, due to rounding.

Aerial and ground-based surveys were conducted following the timeframes recommended by the USFWS Region 6 protocol (USFWS 2020a). The general schedule suggested for this effort, per direction from the USFWS Region 6 office on application of the ECPG, is outlined below.

- Visit 1: Ground-based survey to check known eagle nest locations between January 1 – February 21.
- Visit 2: Aerial survey to check known eagle nest locations and to search for new eagle and non-eagle raptor nests between February 22 – March 21.
- Visit 3: Ground-based survey to check known eagle nest locations, including new eagle nests found during Survey 2 between March 22 – April 30.
- Visit 4: Aerial survey to check known eagle nest locations, including new eagle nests found during Survey 2, and to search for new eagle and non-eagle raptor nests between April 21 – May 31.
- Visit 5: Ground-based survey to check known eagle nest locations, including those found during Surveys 2 and 4 between June 1 – July 7.
- Visit 6: Ground-based survey to check known eagle nest locations between July 8 – August 31.

Study Design for Aerial Surveys

Aerial surveys were used to locate eagle and non-eagle raptor nests within the Study Area and associated buffer as they allowed for a thorough visual inspection of suitable nesting habitat, including but not limited to riparian corridors, woodlands and forested areas, large trees, cliffs or

rocky outcrops, and anthropogenic structures such as power poles. Pre-flight planning included a desktop review of aerial imagery and land cover data to develop a survey route and to identify potential eagle and other raptor nesting habitats within the Study Area and associated buffer. These potential nesting habitats for eagles and other raptors were included in surveys.

The first round of aerial raptor nest surveys was conducted by an experienced WEST biologist and piloted by an experienced wildlife pilot using a Robinson R44 helicopter (Pagel et al. 2010, USFWS 2013). The first survey was conducted on March 3, 4, and 6, 2022. The survey period occurred when local raptor species were likely nesting; however, late-nesting species may not yet have been present.

The helicopter was flown at approximately 46–61 meters (151–200 feet) above ground level at an air speed of approximately 80 km per hour (50 mi per hour). During the survey, the pilot positioned the helicopter to allow a thorough visual inspection of stick nest structures. The survey team took great care to minimize disturbance to breeding eagles and raptors. When nests were located, the pilot reduced speed and adjusted the flight track such that the biologist could clearly see the nest to document the nest accurately. The pilot approached the nest slowly and maintained the greatest possible distance at which the nest status could be documented. The survey flight path was recorded using a hand-held Global Positioning System (GPS)-enabled tablet running Gaia GPS software to ensure the Study Area was covered adequately.

To determine the status of a nest, the biologist evaluated behavior of adults on or near the nest, and the presence of eggs, young, whitewash, or fresh building materials. Species, nest type, nest status, nest condition, and nest substrate were recorded at each nest location to the extent possible.

A second round of aerial raptor nest surveys was completed on May 11 and 15, 2022. During this survey, each nest observed during the first round of aerial surveys was rechecked to confirm/update the nest status. This survey also included a comprehensive search of the Study Area and associated buffer for new nests and was used to record information on raptors that initiate nesting later in the breeding season. The same methods used during the first survey were repeated during the second aerial survey.

Study Design for Ground Based Surveys

The ground-based survey methods allowed for a determination of occupancy status of any known/historic eagle nests (ground surveys one and two) and visitation of any occupied active nests to determine nest success/productivity (ground surveys three and four). The first two ground surveys were conducted to provide additional information on the occupancy status of known/historic eagle nests. Ground surveys were no longer conducted once a nest was determined to be unoccupied or if an occupied nest was determined to be inactive or failed.

One experienced WEST biologist conducted the ground-based raptor nest surveys on February 16, April 27, and June 30, 2022. Conducting the survey early in the season ensured the search effort coincided with the period when eagles were likely incubating eggs or tending young and

was based on chronology for nesting eagles in the region (Pagel et al. 2010, Isaacs and Anthony 2011, USFWS 2013).

The biologist focused on locating the nest and allowing for a thorough visual inspection of the habitat to provide views of the nest from several different angles. Known/historic eagle nests were observed for four hours per survey, or until occupancy was confirmed. The biologist took great care to minimize disturbance to breeding eagles and raptors. The survey was conducted between 07:00 hours and 16:00 hours. Ground surveys were conducted in areas where access was available to view the nest.

To determine the status of a nest, the biologist evaluated behavior of adults on or near the nest, and the presence of eggs, young, whitewash, or fresh building materials. Species, nest type, nest status, nest condition, and nest substrate were recorded at each nest location to the extent possible.

Data Collection Methods and Terminology

Each nest was assigned a unique nest identification (ID) number, location was recorded with a GPS and attribute data including species, substrate, status, condition, and relative nest size and nest characteristics were documented. Below are detailed descriptions of nest attributes and applicable definitions and terms. A table detailing information about raptor nests recorded during the 2022 raptor nest surveys is presented in Appendix A.

Nest Condition – Nest condition was categorized using descriptions ranging from poor to good, which provided a general sense of when a nest or nest site may have been last used.

- Poor (P): a nest appearing dilapidated (e.g., in disrepair, sloughing, or sagging heavily) and required major repair to be suitable for successful nesting
- Fair (F): a nest in generally good condition with fairly well-defined bowl, minor sagging, may require some repair in order to be used
- Good (G): a nest in excellent condition with a well-defined bowl, no sagging or sloughing, and was considered suitable for nesting
- Unknown (UNK): nest condition is unknown

Nest Characteristics – Each nest was recorded according to two general categories: 1) large stick nests (potentially suitable for eagle use) and 2) non-eagle size.

Nest Location – Coordinates for all the raptor nests located during surveys were recorded using a hand-held Global Positioning System (GPS); coordinates were set at Universal Transverse Mercator North American Datum 83 unit (UTM NAD 83).

Nest Status – Nest status was categorized using definitions originally proposed by Postupalsky (1974) and these definitions are still largely followed today in the ECPG (USFWS 2013).

- Occupied (O): a nest was classified as occupied if any of the following were observed at the nest structure: 1) an adult in an incubating position; 2) eggs; 3) nestlings or fledglings; 4) presence of an adult (sometimes sub-adults); 5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed earlier in the breeding season; or 6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on the nest rim or underneath;
- Occupied active (OA): nest had eggs, nestlings, and/or an adult in incubating/brooding position at the time of the survey;
- Occupied inactive (OI): nest had evidence of recent tending of the nest or presence by an adult, but there were no eggs, nestlings, or adult in incubating/brooding position;
- Unoccupied (U): nest with no evidence of occupancy for at least two consecutive surveys;
- Undetermined (UND): nest with no evidence of occupancy during only one survey;
- Missing (M): nest is completely missing or couldn't be found;
- Unknown (UNK): nest may or may not be present; status could not be determined.

*Nest S*ubstrate – Nest substrate included anthropogenic structures (e.g., power line poles and nest platforms), cliffs and rock outcrops, and trees.

Nest Success – Nesting success is defined as the proportion of OA nests resulting in at least one young fledged, or the minimum acceptable age for determining success. Nest success for eagles means at least one nestling survived to greater than 56 days for golden eagles (*Aquila chrysaetos*) and greater than 67 days for bald eagles (*Haliaeetus leucocephalus*; Steenhof and Newton 2007, USFWS 2013). Nest success was only documented if subsequent surveys were completed to evaluate the nests.

Productivity – Nest productivity is defined as the average number of young that reached fledging age (or minimum age for success, as described above) per OA nest in a particular breeding period.

Raptor Nest–Raptor nests were defined as structures made or the place used by raptors, for laying their eggs and sheltering their young (Steenhof and Newton 2007).

Data Management

Quality Assurance and Quality Control

WEST implemented quality assurance and quality control (QA/QC) measures at all stages of the surveys, including in the field, during data entry and analysis, and report writing. All WEST field biologists were trained in proper survey techniques and all data collected were recorded on paper. Data were reviewed before they were submitted for data entry and after data were entered. If errors or anomalies were found, follow-up measures were implemented including discussions and review of field data with the biologist and/or Project manager.

Data Compilation and Storage

WEST data entry staff were trained on proper data entry procedures, which included an independent review of the field data. System controls were implemented to ensure correct data were entered; however, if any errors, omissions, or problems were identified in later stages of analysis, they were traced back to the raw data where appropriate changes and measures were implemented.

Reporting and Review Process

WEST's reporting and review process included technical editing and content review, senior technical review, senior management review, and a final review by the Project manager before delivery to the client.

RESULTS

Seventy-three nests were recorded during surveys, including 38 occupied/active nests and 35 unoccupied (Figure 3, Table 2; Appendix A). Of the occupied active nests there was one bald eagle nest, one Canada goose (*Branta canadensis*) nest, 14 great horned owl (*Bubo virginianus*) nests, 16 red-tailed hawk (*Buteo jamaicensis*) nests, three Swainson's hawk (*B. swainsoni*) nests, and two unidentified raptor nests. One nest (Nest ID 18) was occupied by two difference species great horned owl during the first aerial survey and then red-tailed hawk during the second aerial survey (Appendix A).

One known/historic eagle nest location (Nest ID 73) was classified as unoccupied after two aerial surveys and two ground checks and showed no evidence of occupancy (Figure 2). A new occupied active bald eagle nest (nest ID 39), and a large stick nest (Nest ID 59) were documented (Figure 2). Nest ID 39 was successful and fledged two young bald eagles and nest ID 59 was occupied by a great horned owl (*Bubo virginanus*).

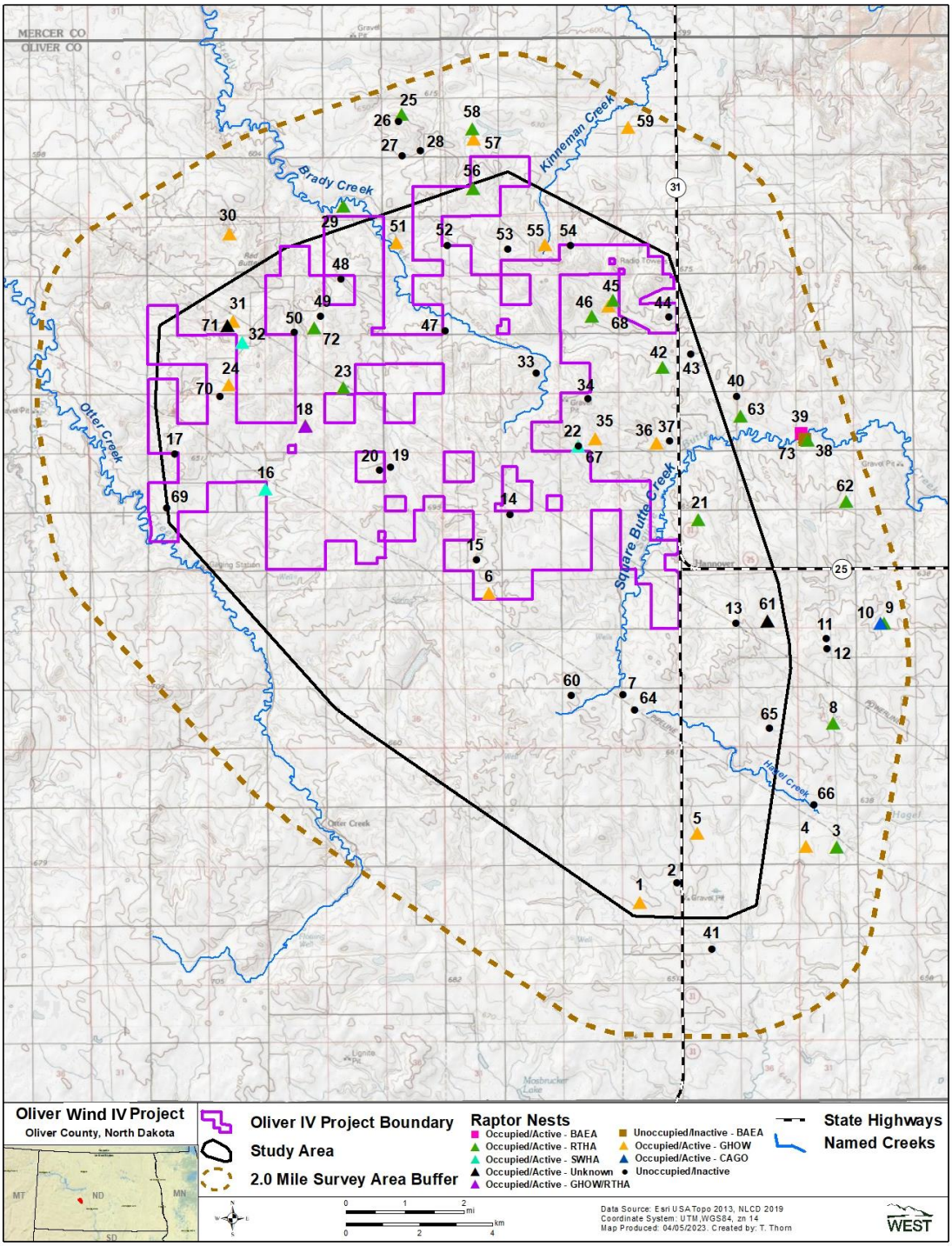

Figure 2. Location of eagle and non-eagle raptor nests documented during raptor nest surveys in 2022 within the Oliver Wind IV Project Study Area, Oliver County, North Dakota.

Table 2. Nest status, species, and location of eagle and non-eagle raptor nests documented during raptor nest surveys in 2022 within the Oliver Wind IV Project Study Area, Oliver County, North Dakota.

	Nest Location		
Nest Status	**Study Area**	**Two-mile buffer**	**Total**
O/A			
Bald Eagle	0	1	1
Canada Goose	0	1	1
Great Horned Owl	10	4	14
Red-tailed Hawk	7	9	16
Swainson's Hawk	3	0	3
Great Horned Owl/Red-tailed Hawk*	1	0	1
Unidentified Raptor	2	0	2
U			
Unidentified Raptor	25	10	35
Total	**48**	**25**	**73**

OA = Occupied/Active nests had eggs, nestlings, and/or an adult in incubating/brooding position at the time of the survey.

U = nest with no evidence of occupancy for at least two consecutive surveys.

MCP = minimum convex polygon

* Nest ID 18 is counted as one nest, but had occupancy of two different species.

LITERATURE CITED

Esri. 2022. World Imagery and Aerial Photos (World Topo). ArcGIS Resource Center. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California. Accessed June 2022. Available online: https://www.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=10df2279f9684e4a9f6a7f08febac2a9

Isaacs, F. B. and R. G. Anthony. 2011. Bald Eagles (Haliaeetus Leucocephalus) Nesting in Oregon and Along the Lower Columbia River, 1978-2007. Final Report, 18 March 2011. Oregon Cooperative Fish and Wildlife Research Unit. Department of Fisheries and Wildlife, Oregon State University, Corvallis Oregon. USA.

National Land Cover Database (NLCD). 2019. National Land Cover Database 2019 - Landcover & Imperviousness (NLCD2019). Available online: https://www.mrlc.gov/data. *As cited* includes:

Homer, C., J. Dewitz, S. Jin, G. Xian, C. Costello, P. Danielson, L. Gass, M. Funk, J. Wickham, S. Stehman, R. Auch, and K. Riitters. 2020. Conterminous United States Land Cover Change Patterns 2001–2016 from the 2016 National Land Cover Database. ISPRS Journal of Photogrammetry and Remote Sensing 162(5): 184-199. doi: 10.1016/j.isprsjprs.2020.02.019.

Jin, S., C. Homer, L. Yang, P. Danielson, J. Dewitz, C. Li, Z. Zhu, G. Xian, and D. Howard. 2019. Overall Methodology Design for the United States National Land Cover Database 2016 Products. Remote Sensing. 2971. doi: 10.3390/rs11242971.

Wickham, J., S. V. Stehman, D. G. Sorenson, L. Gass, and J. A. Dewitz. 2021, Thematic Accuracy Assessment of the NLCD 2016 Land Cover for the Conterminous United States: Remote Sensing of Environment 257: 112357. doi: 10.1016/j.rse.2021.112357

and

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. doi: 10.1016/j.isprsjprs.2018.09.006.

Pagel, J. E., D. M. Whittington, and G. T. Allen. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. U.S. Fish and Wildlife Service. February 2010. Available online: http://steinadlerschutz.lbv.de/fileadmin/www.steinadlerschutz.de/terimGoldenEagleTechnicalGuidanceProtocols25March2010_1_.pdf

Postupalsky, S. 1974. Raptor Reproductive Success: Some Problems with Methods, Criteria and Terminology. Pp. 21-31. In: F. N. Hamerstrom, Jr., B. E. Harrell, and R. R. Olendorff, eds. Management of Raptors. Raptor Research Foundation, Vermillion, South Dakota.

Steenhof, K., and I. Newton. 2007. Assessing Nesting Success and Productivity. In: D. M. Bird and K. Bildstein, eds. Raptor Research and Management Techniques. Hancock House, Blaine, Washington. Pp. 181-191.

US Environmental Protection Agency (USEPA). 2013. Level III and Level IV Ecoregions of the Continental United States. Ecosystems Research, USEPA. April 16, 2013. Accessed December 2022. Available online: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

US Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online: http://www.fws.gov/cno/pdf/Energy/2012_Wind_Energy_Guidelines_final.pdf

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Executive Summary and frontmatter + 103 pp. Available online: https://www.fws.gov/migratorybirds/pdf/management/eagleconservation planguidance.pdf

US Fish and Wildlife Service (USFWS). 2020a. Region 6 Recommended Protocol for Conducting Pre-Construction Eagle Nest Surveys at Wind Energy Projects. USFWS, Region 6, Migratory Bird Management Office, Mountain-Prairie Region. January 14, 2020. Available online: https://www.fws.gov/mountain-prairie/migbirds/library/USFWS%20R6%20recommended%20Eagle%20Nest%20Survey%20Protocol%20for%20wind%20projects_14Jan2020.pdf

US Fish and Wildlife Service (USFWS). 2020b. Updated Eagle Nest Survey Protocol. USFWS, Washington, D.C. 4 pp. Available online: https://www.fws.gov/media/updated-eagle-nest-survey-protocol

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Appendix A. Raptor Nests Documented During 2022 Raptor Nest Surveys within the Oliver Wind IV IV Project Study Area and associated 3.2-kilometer (2.0-mile) buffer, Oliver County, North Dakota.

Appendix A. Eagle and non-eagle raptor nests documented during 2022 nest surveys within the Oliver Wind IV Project Study Area and 3.2-kilometer (2.0-mile) buffer, Oliver County, North Dakota.

Nest ID	Species	Status	Substrate	Condition	Class	Two-mile Buffer
1	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
2	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
3	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
4	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
5	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
6	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
7	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
8	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
9	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
10	CAGO	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
11	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	X
12	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	X
13	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
14	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
15	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
16	SWHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
17	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
18	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
18	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
19	UNKN	Unoccupied/Inactive	Deciduous Tree	Poor	Non-Eagle	
20	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
21	RTHA	Occupied/Active	Deciduous Tree	Fair	Non-Eagle	
22	SWHA	Occupied/Active	Deciduous Tree	Fair	Non-Eagle	
23	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
24	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
25	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
26	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	X
27	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	X
28	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	X
29	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
30	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
31	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
32	SWHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
33	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
34	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
35	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
36	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
37	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	

Appendix A. Eagle and non-eagle raptor nests documented during 2022 nest surveys within the Oliver Wind IV Project Study Area and 3.2-kilometer (2.0-mile) buffer, Oliver County, North Dakota.

Nest ID	Species	Status	Substrate	Condition	Class	Two-mile Buffer
38	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
39	BAEA	Occupied/Active	Deciduous Tree	Good	Large Stick Nest	X
40	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	X
41	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	X
42	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
43	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
44	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
45	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
46	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
47	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
48	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
49	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
50	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
51	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
52	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
53	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
54	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
55	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
56	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
57	GHOW	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
58	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
59	GHOW	Occupied/Active	Deciduous Tree	Good	Large Stick Nest	X
60	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
61	UNKN	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
62	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
63	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	X
64	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
65	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	
66	UNKN	Unoccupied/Inactive	Deciduous Tree	Good	Non-Eagle	X
67	UNKN	Unoccupied/Inactive	Deciduous Tree	Poor	Non-Eagle	
68	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
69	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	X
70	UNKN	Unoccupied/Inactive	Deciduous Tree	Fair	Non-Eagle	
71	UNKN	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
72	RTHA	Occupied/Active	Deciduous Tree	Good	Non-Eagle	
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Appendix B13. Whooping Crane Habitat Review

Whooping Crane Habitat Review
Oliver Wind IV Project
Oliver and Mercer Counties, North Dakota

Final Report

Prepared for:

Oliver Wind IV, LLC

Prepared by:

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Report Date: August 17, 2023

Privileged and Confidential – Contains Sensitive Biological Information

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REPORT REFERENCE

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Figure 2. Location of the proposed Oliver Wind IV Project Whooping Crane Study Area in Oliver County, North Dakota, in relation to other wind energy projects within the whooping crane migration corridor, confirmed sightings through spring 2022, and potential whooping crane use deciles. 8

Figure 3. Whooping crane relative probability of use[1], sightings, and telemetry locations associated with the proposed Oliver Wind IV Project Whooping Crane Study Area in Oliver County, North Dakota, and four reference areas. 8

INTRODUCTION

Oliver Wind IV, LLC (Company) is evaluating the potential for wind energy development at the proposed Oliver Wind IV Project and Transmission Line (referred to as the Project) in Oliver and Mercer counties, North Dakota. The Company requested Western EcoSystems Technology, Inc. (WEST) to conduct a desktop review and analysis of potential whooping crane (*Grus americana*; WHCR) habitat use in the vicinity of the Project, in an area referred to in this report as the WHCR Study Area.

As part of the Transmission Line design, the Company has planned for the installation of bird flight diverters along the entire transmission line. This practice aligns with the recommendations by wildlife agencies to reduce the risk of WHCR collision. It is also a practice contained in the Avian Power Line Interaction Committee (APLIC) guidance in "*Reducing Avian Collisions with Power Lines*" (APLIC 2012). With installation of the bird flight diverters, WHCR collision risk with the Transmission Line is extremely unlikely to occur.

Considering the unlikely event of powerline collision with the installation of bird flight diverters, the objective of this analysis was to assess WHCR relative habitat suitability and likelihood of WHCR habitat use in the Project Area. compared to the surrounding landscape, with a focus on the WHCR Study Area as a proxy for the Project Area. The remainder of this report therefore focuses on addressing the objectives solely in Oliver County.

Whooping crane habitat reviews have typically involved both a qualitative and quantitative analyses of potential roosting and foraging habitats (i.e., wetlands, croplands, and grasslands), wetland types and densities, disturbance features, and other factors known or believed to affect use by WHCR. These reviews often included an analysis of a proposed project area and comparative adjacent areas. However, based on recommendations from the North Dakota Game and Fish Department and the US Fish and Wildlife Service (USFWS), the objective of this review was to evaluate the relative probability of WHCR habitat use within the WHCR Study Area using a regionally developed spatial model (Niemuth et al. 2018).

STUDY AREA

The 24,138-acre (ac; 9,768-hectare [ha]) WHCR Study Area was established to encompass the Project Area (i.e., excluding the Transmission Line) and immediately adjacent lands. The WHCR Study Area is located in Oliver County, North Dakota, within the 50% whooping crane migration corridor (USFWS CWCTP 2023, Figure 1).

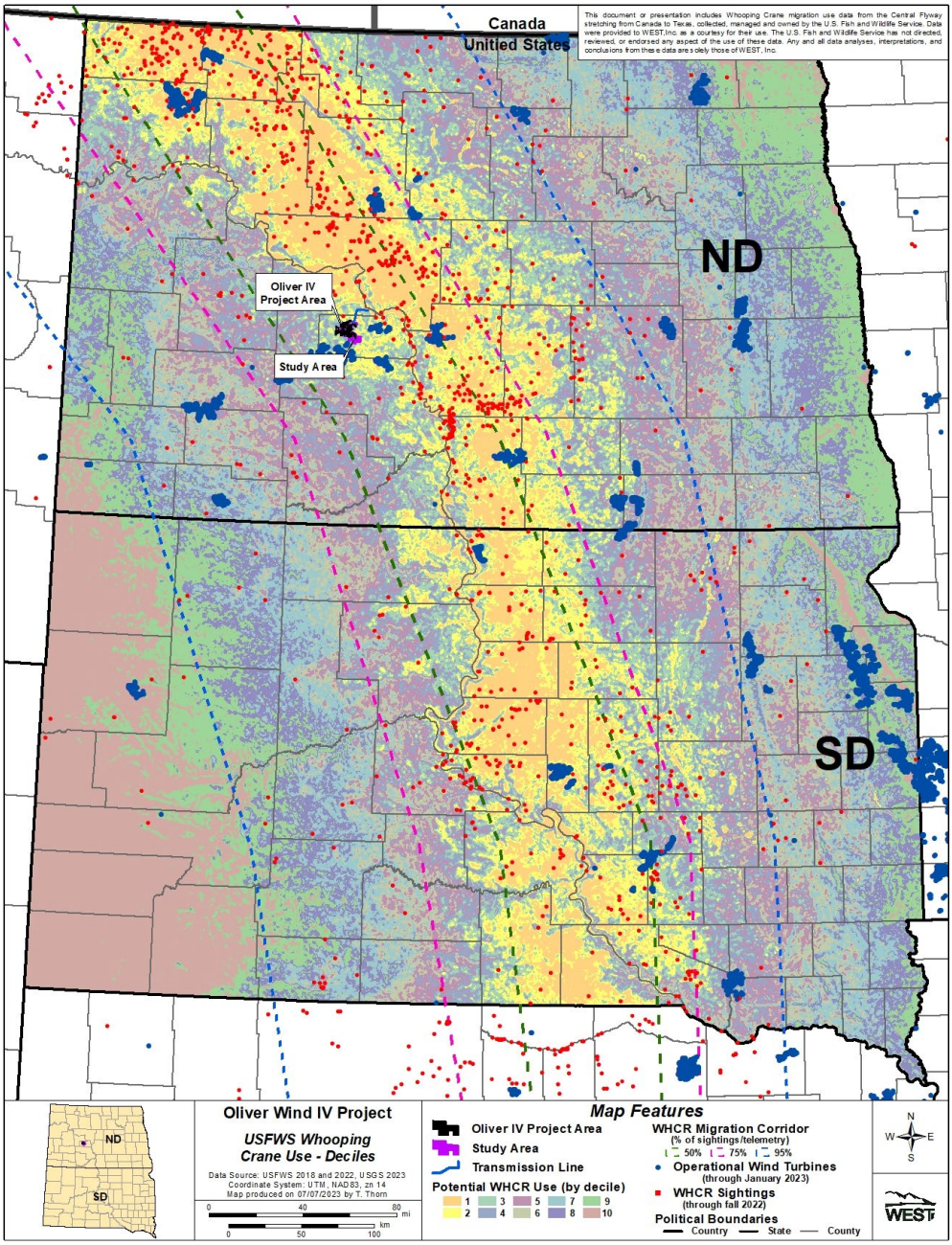

Figure 1. Location of the proposed Oliver Wind IV Project and Whooping Crane Study Areas in Oliver County, North Dakota, in relation to other operating wind energy projects within the whooping crane migration corridor, confirmed sightings through spring 2022[1], and potential whooping crane use deciles.[2]

[1] USFWS CWCTP 2023
[2] Niemuth et al. 2018

The WHCR Study Area is within the Northwestern Glaciated Plains Level III Ecoregion, in an area historically dominated by grasslands but extensively converted to agricultural use (e.g., row crops and livestock grazing; Bryce et al. 1996, US Environmental Protection Agency 2012; 2013). The terrain within the Study Area is gently rolling with interspersed level areas, and elevations of 1,663–2,385 feet (ft; 507– 727 meters [m]) above sea level (US Geological Survey 2019).

Based on National Land Cover Database (NLCD; 2016) spatial data, the WHCR Study Area is comprised of approximately 62.5% grassland/herbaceous lands (including 49.7% grasslands and 12.8% pasture/hay lands) and 33.3% cultivated croplands. Developed represents 2.7% and the remaining land cover types represent 0.9% (wetlands/open water) or less of the WHCR Study Area (Table 1).

Table 1. Area (acres) and percent (%) total cover of 2016 National Land Cover Database land cover types in the proposed Oliver Wind IV Project Whooping Crane Study Area in Oliver County, North Dakota.

Land Cover Types	Acres	Total Cover (%)
Grasslands	12,007	49.7
Cultivated crops	8,046	33.3
Pasture/Hay	3,079	12.8
Developed	651	2.7
Wetland/Open water	210	0.9
Forest/Trees	98	0.4
Shrub/Scrub	42	0.2
Barren land	6	<0.1
Total[1]	**24,138**	**100**

[1] Values do not add up to totals due to rounding.

METHODS

WEST completed the desktop review and analysis of the WHCR Study Area using ArcGIS, ArcMap 10.5.1 software (ArcMap 2017) and several spatial data layers including NLCD (2016), National Wetland Inventory (NWI) data (USFWS NWI 2018), and model outputs from Niemuth et al. (2018). The desktop analysis included a summary of land cover types to help describe conditions specific to the WHCR Study Area, as well as an assessment of the suitability of WHCR habitat within the WHCR Study Area and at four reference areas of the same dimensions located adjacent to the WHCR Study Area in the four cardinal directions. The analyses used two models developed by Niemuth et al. (2018) for comparison: the Predicted Habitat Use Model and the Decile Model.

Predicted Habitat Use Model

Niemuth et al. (2018) developed a predicted habitat use model for WHCR stopover habitat within North and South Dakota. This model (hereafter, Niemuth Model) provides a numerically continuous (0–1.0) prediction of the relative probability of habitat use by WHCR. The Niemuth Model was developed specifically for North and South Dakota. The Niemuth model considered 12 predictor variables that were analyzed and validated using Geographic Position System (GPS)

location data from WHCR equipped with radio-telemetry transmitters (Niemuth et al. 2018). This output is useful in evaluating potential WHCR use within a project or study area and comparing it with similar adjacent areas.

Decile Model

To aid in conservation planning, Niemuth et al. (2018) also developed a Decile Model by partitioning the Model outputs into 10 same-sized areas, referred as deciles, to provide a spatial probability gradient of high use areas (Decile 1) to low-use areas (Decile 10. (Figure 1). This output is useful for evaluating potential use across broad geographic areas, aiding in project planning.

Whooping Crane Public Sightings Records

A Federal/State effort to report migrating whooping cranes was organized in 1975 (Lewis 1992, USFWS 2009) to provide a mechanism for the public to report whooping cranes opportunistically sighted during the spring and fall migration periods. The effort continues to the present day and has yielded a long-term dataset that has documented that 75% of the whooping cranes sighted by the public occur within 40 miles of the migration corridor centerline (USFWS 2006; 2022). The sighting records adjacent to the Study Area were plotted as an additional information source to inform project planning (Figure 1).

RESULTS

The WHCR Study Area is located within the western half of the 50% WHCR migration corridor (Pearse et al. 2018) with a higher density of WHCR sightings (USFWS 2022) occurring north and east of the WHCR Study Area adjacent to the west side of Missouri River and within the prairie pothole region (Coteau), (Figure 1 and Figure 2).

Predicted Habitat Use Model

Predicted probability WHCR habitat use within the WHCR Study Area ranged from less than 0.0001–0.1. As expected, the higher probability of use was predicted in the North and East reference areas due to their closer proximity to the Missouri River and prairie pothole landscape. The highest predicted probability WHCR habitat use was the North reference area which ranged from less than 0.0001–0.3, while the East reference area had approximately 1.4 % (343 ac) of the area classified with a WHCR use-probability of 0.1 – 0.2. The West and South reference areas were classified with the same probability range as the WHCR Study Area (Table 2). The similarity in predicted probability of WHCR habitat use between the WHCR Study Area and among the four reference areas suggests the suitability of habitat in the Study Area is generally similar in the surrounding landscape, but tends to improve to the North and East of the Study Area (Table 2, Figure 2).

Table 2. Predicted probability of use for whooping cranes within the proposed Oliver Wind IV Project Whooping Crane Study Area in Oliver County[1], North Dakota, and the North, East, South, and West reference areas[1].

Relative Probability Ranges	Study Area		North		East		South		West	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0-0.1	24,138	100	22,157	91.8	23,796	98.6	24,138	100	24,138	100
0.1-0.2	0	0	1,895	7.9	343	1.4	0	0	0	0
0.2-0.3	0	0	86	0.4	0	0	0	0	0	0
0.3-0.4	0	0	0	0	0	0	0	0	0	0
0.4-0.5	0	0	0	0	0	0	0	0	0	0
0.5-0.6	0	0	0	0	0	0	0	0	0	0
0.6-0.7	0	0	0	0	0	0	0	0	0	0
0.7-0.8	0	0	0	0	0	0	0	0	0	0
0.8-0.9	0	0	0	0	0	0	0	0	0	0
0.9-1	0	0	0	0	0	0	0	0	0	0
Total[2]	**24,138**	**100**	**24,138**	**100**	**24,138**	**100**	**24,138**	**100**	**24,138**	**100**

[1] A portion of the North, South, and West reference areas intersected Morton and Mercer counties.

[2] Acres and percent (%) total area within each relative probability range are shown.

[3] Sums may not total values shown due to rounding.

Source: Niemuth et al.2018.

Decile Model

Deciles 2 through 5 are represented within the WHCR Study Area (Table 3, Figure 1). The highest use decile (Decile 1), as depicted in Figure 2, appears within the WHCR Study Area but no Decile 1 habitat was contained in the modeled output (Table 3). The highest acreage of WHCR habitat occurred in Decile 3 (66.1%) and Decile 4 (21.9%; Figure 2 and Table 3).

Table 3. Number of acres for each decile within the proposed Oliver Wind IV Project Whooping Crane Study Area in Oliver County, North Dakota.

Decile	Acres	Percent (%)
1	0	0
2	2,894	12.0
3	15,950	66.1
4	5,275	21.9
5	20	<0.1
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
Total[1]	**24,138**	**100**

[1.] Sums may not total values shown due to rounding.

Source: Niemuth et al. 2018.

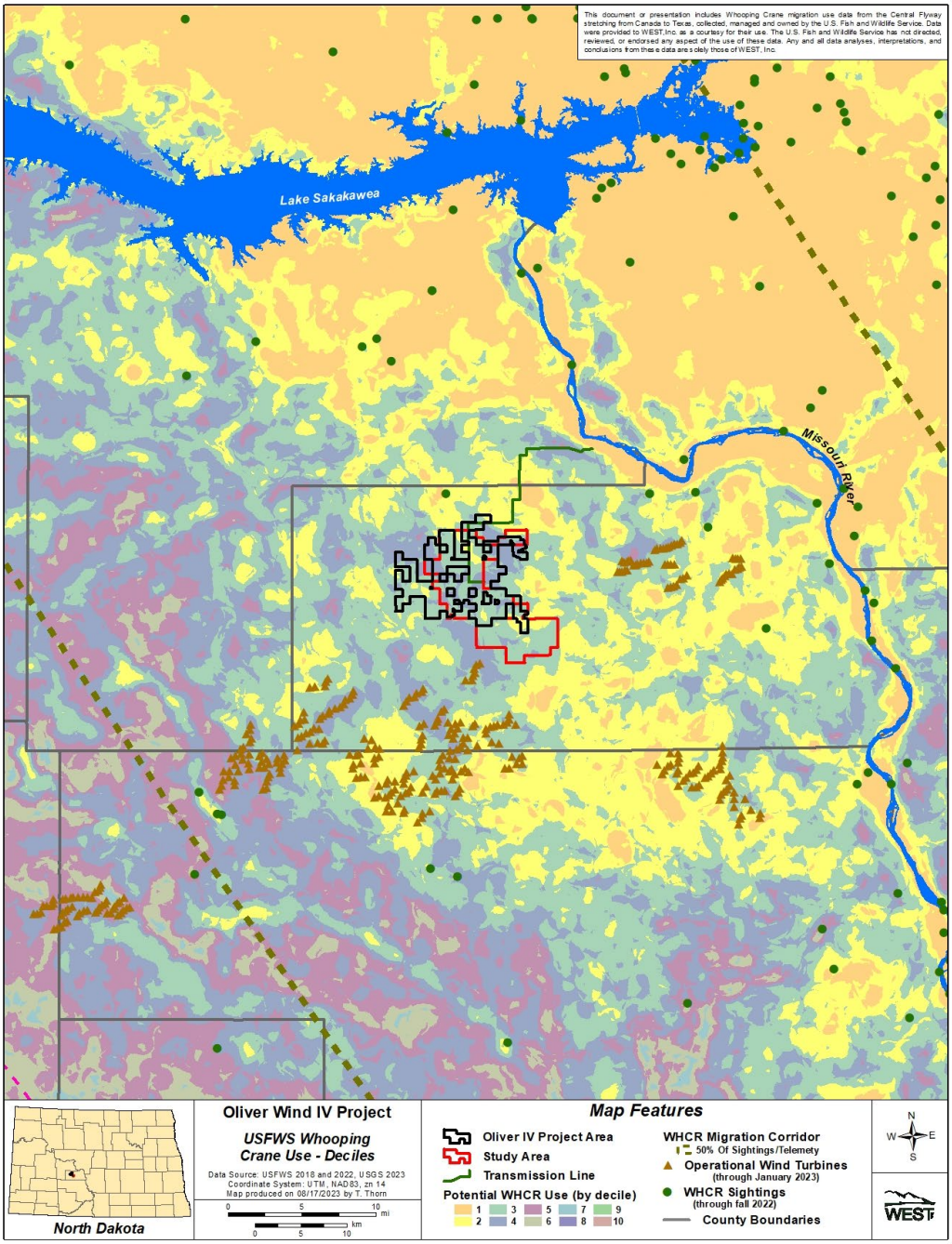

Figure 2. Location of the proposed Oliver Wind IV Project and Whooping Crane Study Areas in Oliver County, North Dakota, in the whooping crane migration corridor, including confirmed sightings through spring 2022[3] and potential whooping crane use deciles.[4]

[3] USFWS CWCTP 2023
[4] Niemuth et al. 2018

Whooping Crane Public Sightings Records

WEST plotted the USFWS WHCR sightings (through spring of 2022; USFWS CWCPT 2023) and telemetry data (2009 – 2018; Pearse et al. 2020) and found one record of a telemetered WHCR occurring within both the WHCR Study Area and the Oliver Wind IV Project Area, and additional records in or near the reference areas (Figure 2 and Figure 3).

DISCUSSION

The objective of this analysis was to assess WHCR relative habitat suitability and the overall likelihood of WHCR habitat use in the Study Area. Results indicate that both habitat suitability and probability of WHCR use increases to the north and east of the WHCR Study Area. In contrast, the WHCR Study Area is representative to the habitat suitability and lower probability of use associated with the landscapes to the south and west of the WHCR Study Area.

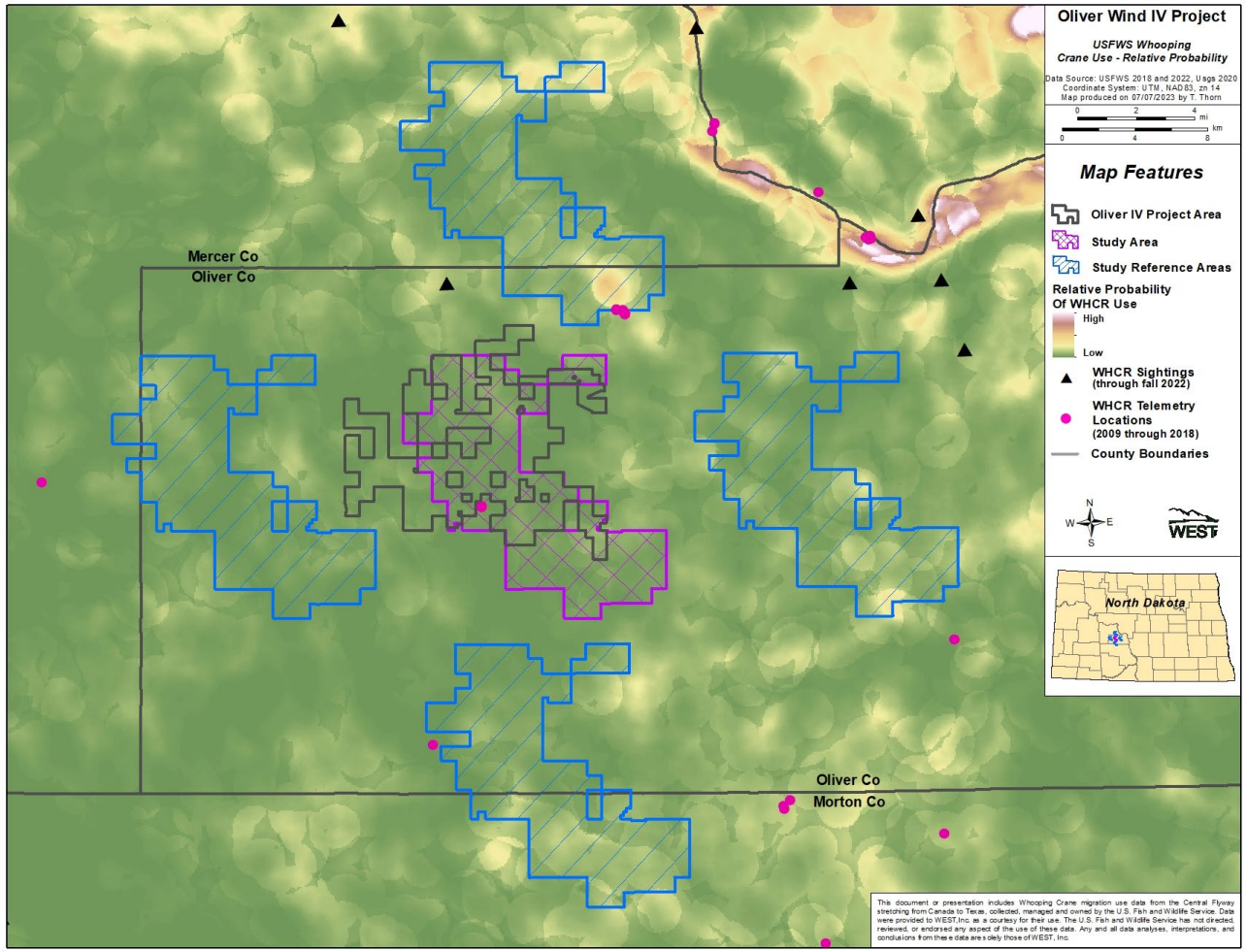

Figure 3. Whooping crane relative probability of use[1], sightings, and telemetry locations associated with the proposed Oliver Wind IV Project Whooping Crane Study Area in Oliver County, North Dakota, and four reference areas.

1. Relative probability of use ranges from 0–1 (low–high); probability of use within the Study Area ranges from 0–0.1 (Table 2).
Sources: Niemuth et al. 2018, USFWS CWCPT 2023

REFERENCES

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC, Washington, D.C.

ArcMAP. 2017. Esri GIS Software. ArcMAP 10.5. Environmental Systems Research Institute (ESRI), Redlands, California. Information online: http://desktop.argis.com/en/arcmap

Baasch, D. M., P. D. Farrell, S. Howlin, A. T. Pearse, J. M. Farnsworth, and C. B. Smith. 2019. Whooping Crane Use of Riverine Stopover Sites. PLoS ONE 14(1): e0209612. doi: 10.1371/journal.pone.0209612.

Bryce, S. A., J. M. Omernik, D. A. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S. H. Azevedo. 1996. Ecoregions of North Dakota and South Dakota. (Color poster with map, descriptive text, summary tables, and photographs.) US Geological Survey (USGS) map (map scale 1:1,500,000). USGS, Reston, Virginia. US Environmental Protection Agency (USEPA). Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-39Butler, C. R. Sanspree, J. A. Moon, and W. Harrell. 2022. Whooping Crane Survey Results: Winter 2021-2022. Technical Memo, May 2022. https://www.fws.gov/media/whooping-crane-update-winter-2021-2022

Caven, A. J., K. D. Koupal, D. M. Baasch, E. M. B. Buckley, J. Malzahn, M. I. L. Forsberg, and M. Lundgren. 2021. Whooping Crane (Grus Americana) Family Consumes a Diversity of Aquatic Vertebrates During Fall Migration Stopover at the Platte River, Nebraska. Western North American Naturalist 81(4): 592-607.

Griffith, G. 2010. Level III North American Terrestrial Ecoregions: United States Descriptions. Prepared for North American Commission for Environmental Cooperation.

Lewis, J.C. 1992. The contingency plan for Federal-State cooperative protection of whooping cranes. Pages 293-300 in D. A. Wood, ed. Proc. 1988 N. Am. Crane Workshop. Florida Game and Fresh Water Fish Commission, Tallahassee.

Montana Fish, Wildlife and Parks (MFWP). 2022. Whooping Crane (Grus Americana). Montana Field Guide, Montana Natural Heritage Program and MFWP. Accessed October 2022. Available online: http://fieldguide.mt.gov/detail_ABNMK01030.aspx

National Land Cover Database (NLCD). 2016. *As cited* includes:

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. Doi: 10.1016/j.isprsjprs.2018.09.006.

and

Multi-Resolution Land Characteristics (MRLC). 2019. National Land Cover Database (NLCD) 2016. Multi-Resolution Land Characteristics (MRLC) Consortium. US Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, MRLC Project, Sioux Falls, South Dakota. May 10, 2019. Available online: https://www.mrlc.gov/data

NatureServe. 2021. Natureserve Explorer. NatureServe Explorer: An online encyclopedia of life. Version 2.0. NatureServe, Arlington, Virginia. Updated March 2019. Accessed January 2022. Available online: http://explorer.natureserve.org

Niemuth, N. D., A. J. Ryba, A. T. Pearse, S. M. Kvas, D. A. Brandt, B. Wangler, J. E. Austin, and M. J. Carlisle. 2018. Opportunistically Collected Data Reveal Habitat Selection by Migrating Whooping Cranes in the U.S. Northern Plains. Condor 120(2): 343-356. doi: 10.1650/CONDOR-17-80.1. Available online: https://pubs.er.usgs.gov/publication/70196575

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

Pearse, A. T., D. A. Brandt, D. M. Baasch, M. T. Bidwell, J. A. Conkin, M. J. Harner, W. Harrell, and K. L. Metzger. 2020. Location Data for Whooping Cranes of the Aransas-Wood Buffalo Population, 2009-2018. US Geological Survey (USGS) data release. USGS, Reston, Virginia. May 15, 2020. doi: 10.5066/P9Y8KZJ9. Available online: https://www.sciencebase.gov/catalog/item/5ea3071582cefae35a19349a

Pearse, A. T., M. Rabbe, M. T. Bidwell, L. M. Juliusson, L. Craig-Moore, D. A. Brandt, and W. Harrell. 2018. Map of Whooping Crane Migration Corridor. U.S. Geological Survey (USGS) ScienceBase-Catalog, USGS Data Release Products. Available online: https://data.usgs.gov/datacatalog/data/USGS:5a314a72e4b08e6a89d707e0

Sayler, K. 2016. Contemporary Land Cover Change in the Northwestern Great Plains Ecoregion. Page last modified July 7, 2016. US Geological Service (USGS) Earth Resources Observation and Science Center. Sioux Falls, South Dakota. Available online: https://landcovertrends.usgs.gov/gp/eco43Report.html

US Environmental Protection Agency (USEPA). 2012. Level III and Level IV Ecoregions of North Dakota. Ecoregions of the United States. USEPA Office of Research and Development (ORD) - National Health and Environmental Effects Research Laboratory (NHEERL), Corvallis, Oregon. May 8, 2012. Accessed May 2023. Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-32

US Environmental Protection Agency (USEPA). 2013. Level III and Level IV Ecoregions of the Continental United States. Ecosystems Research, USEPA. April 16, 2013. Accessed May 2023. Available online: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

US Fish and Wildlife Service. 2008. Whooping Cranes and Wind Development – An Issue Paper. Mountain Prairie Region (Region 6) and Southwest Region (Region 2), Denver, CO and Albuquerque, NM. 27pp.

Accessed online at: https://ecos.fws.gov/ServCat/DownloadFile/168680?Reference=114480

US Fish and Wildlife Service (USFWS) North Dakota Field Office (NDFO). 2013. Whooping Crane (Grus Americana). Last Updated: February 19, 2013. Available Online: https://www.fws.gov/northdakotafieldoffice/endspecies/species/whooping_crane.htm

US Fish and Wildlife Service (USFWS). 2021. Whooping Crane (*Grus Americana*). Species Profile. USFWS Environmental Conservation Online System (ECOS). Accessed January 2022. Available online: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B003

US Fish and Wildlife Service (USFWS). 2023. Cooperative Whooping Crane Tracking Project (CWCTP). Whooping Crane Sightings through Fall 2022. GIS Layer from CWCTP database. USFWS Nebraska Ecological Services Field Office, Grand Island, Nebraska.

US Geological Survey (USGS). 2019. 3D Elevation Program (3DEP). 3D Elevation Data from Light Detection and Ranging (LIDAR) Data: Conterminous United States, Hawaii, and the US Territories. USGS, Reston, Virginia. Accessed September 2019. Information Online: https://www.usgs.gov/core-science-systems/ngp/3dep

US Geological Survey (USGS), Berkeley Lab, and American Wind Energy Association (AWEA). 2019. The U.S. Wind Turbine Database. Accessed November 2020. Information Online: https://eerscmap.usgs.gov/uswtdb/data/

Appendix B14. Bat Summer Presence/Absence Surveys (2019)

Northern Long Eared-Bat Presence/Absence Surveys

Oliver Wind IV Project

Oliver County, North Dakota

Surveys Conducted July 26 – August 16, 2019

Prepared for:

Oliver Wind IV, LLC

Prepared by:

Julia Wilson, Kevin Murray, and Clayton Derby

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Report Date: August 29, 2023

Privileged and Confidential, Not for Distribution

EXECUTIVE SUMMARY

Oliver Wind IV, LLC (Company) is developing the Oliver Wind IV Energy Center (Project) in Oliver County, North Dakota. The Company contracted Western EcoSystems Technology, Inc. (WEST) to conduct presence/absence surveys for the federally threatened northern long-eared bat (*Myotis septentrionalis;* NLEB) which has the potential to occur within the Project Study Area (Figure 1). WEST employed a combination of survey methods including acoustic and mist-net surveys to determine if the NLEB is present or absent within the Study Area during the summer maternity season.

Survey methods followed the US Fish and Wildlife Service (USFWS) 2019 *Range-Wide Indiana Bat Summer Survey Guidelines* (Guidelines) and were reviewed and approved by the South Dakota USFWS Field Office A total of 342.0 ha (845.1 ac) of potentially suitable NLEB summer habitat were identified through desktop analysis within the Study Area. This led to establishing 14 detector locations (corresponding to seven sites) within the Study Area to align with the 2019 Guidelines. Acoustic surveys were conducted at the seven sites (with two detector locations each) from July 26 to August 1, for a total of 82 detector-nights. Weather conditions or detector malfunctions resulted in conditions which did not meet the Guidelines survey criteria on 20 detector-nights; additional nights were surveyed to ensure the Guideline required effort of four valid detector-nights per station were completed, resulting in a total of 62 valid detector-nights.

All data were analyzed, including calls recorded on invalid nights, to determine whether NLEB were present or absent. Kaleidoscope identified 55 call files as potential NLEB calls, 44 calls on valid nights and 11 calls on invalid nights. Seven NLEB calls at two survey locations (4b, 5b) were confirmed by qualitative review, suggesting the presence of NLEB at these sites.

Presence/absence mist-net surveys were conducted at three survey locations from July 28 – August 3, 2019. WEST biologists captured a total of 20 bats, including 14 silver-haired bats (*Lasionycteris noctivagans*), three eastern red bats (*Lasiurus borealis*), and three hoary bats (*L. cinereus*). No NLEB were captured during the first (July 28 – Aug 3)mist-net survey effort in 2019.

WEST conducted follow-up mist netting from August 13 – 15, 2019, at the two acoustic survey sites (4b and 5b) to verify NLEB presence or probably absence where qualitative acoustic data indicated NLEB presence. Mist-netting at the acoustic survey sites resulted in the capture of eight bats captured, including four NLEB, two little brown bats (*Myotis lucifugus*), one silver-haired bat, and one eastern red bat. All captured NLEB were males (two juveniles and two adults). DNA analysis from one NLEB bat collection bag was inconclusive due to lack of genetic material in the bag.

STUDY PARTICIPANTS

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Julia Wilson	Permitted Bat Biologist; Report Writer
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Kelly Lutsch	Mist-Net Technician
Jeff Fruhwirth	GIS Specialist
Jolie Blevins	Bat Project Coordinator; Data Manager
Carissa Goodman	Technical Editor

REPORT REFERENCE

Wilson, J., K. Murray, and C. Derby. 2019. Bat Summer Presence/Absence Surveys, Oliver Wind IV Project, Oliver County, North Dakota: Surveys Conducted July 26 – August 19, 2019. Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. Report Revised August 29, 2023. 18pp.

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Appendix M. Representative Bat Calls

[1] The Appendices include documents referring to the Red Butte Wind Farm. The Project name was changed to Oliver Wind IV Project in 2022, making the information in the Appendices applicable to the Oliver Wind IV Project despite references to the Red Butt Wind Farm.

BACKGROUND AND PROJECT OVERVIEW

Oliver Wind IV, LLC (Company) contracted Western EcoSystems Technology, Inc. (WEST) to conduct presence/absence surveys for the federally threatened northern long-eared bat (*Myotis septentrionalis*; NLEB) which has the potential to occur within the Oliver Wind IV Project Study Area (Figure 1). The objectives of the 2019 summer bat surveys were to: 1) determine the presence or probable absence of NLEB within the Study Area during the summer maternity season, 2) determine sites where follow-up mist-net surveys for NLEB should be conducted if warranted, and 3) confirm sex, age, and reproductive status of individual NLEB if present.

Based on the US Fish and Wildlife Service (USFWS) and North Dakota Game and Fish Department (NDGFD) records for North Dakota, NLEB is considered rare in North Dakota. Recent research by North Dakota State University found that presence is unlikely throughout the state except potentially in badlands areas in the extreme western part of the state (Dr. E. Gillam, North Dakota State University, pers. com.). The Study Area is not in the badlands of western North Dakota, but acoustic monitoring by Dr. Gillam indicated potential for NLEB to occur within the Study Area. The objective of the acoustic and mist-net surveys was to determine if NLEB are present or absent in the Study Area during the summer maternity season.

The following report summarizes the results of acoustic and mist-net surveys conducted during the summer of 2019.

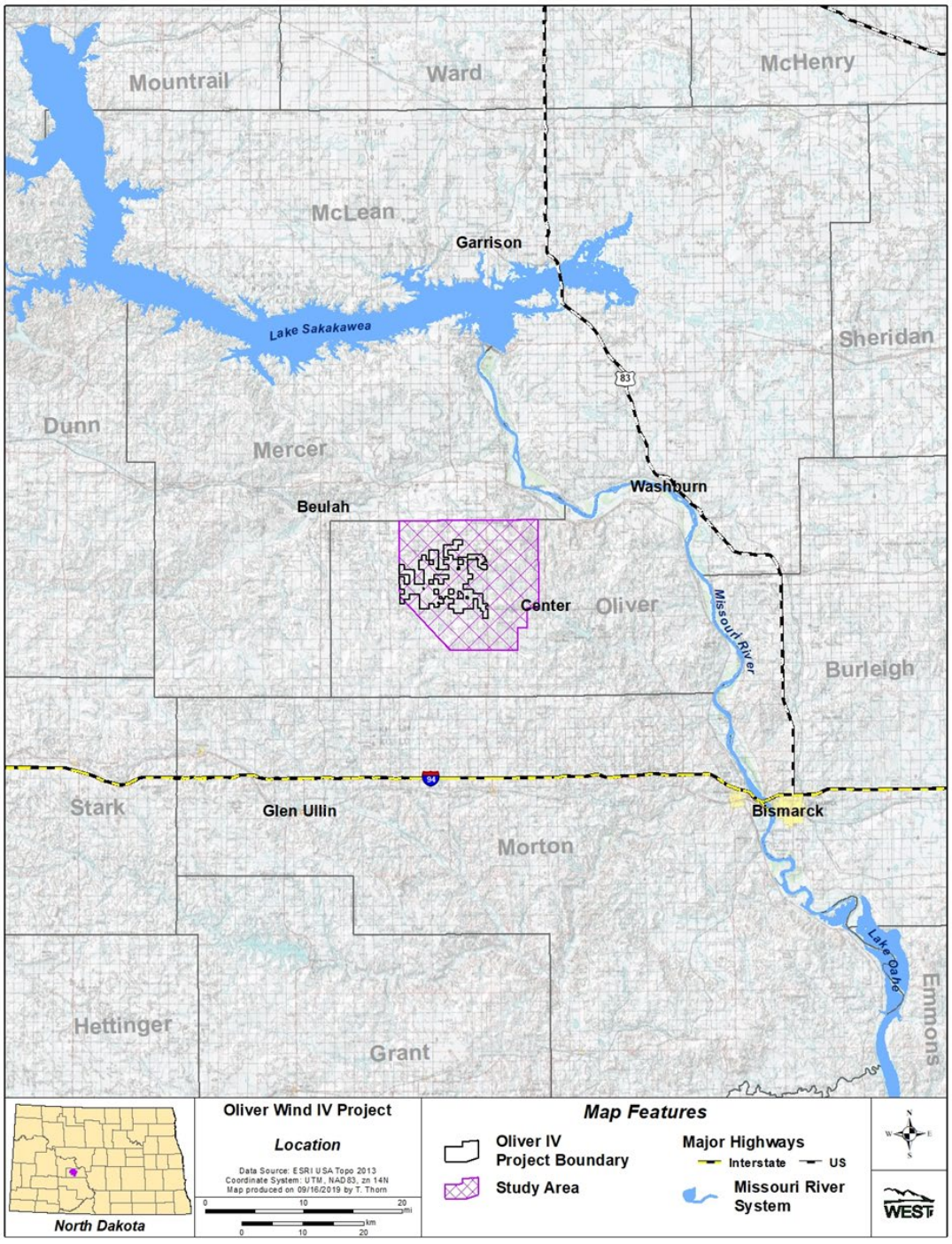


Figure 1. Location of the Oliver Wind IV Project and 2019 Study Area in Oliver County, North Dakota.

METHODS

All acoustic and mist-net surveys followed the current USFWS *Range-Wide Indiana Bat Summer Survey Guidelines* (Guidelines), which also apply to NLEB (USFWS 2019). The USFWS Guidelines (2019) for Indiana bat and NLEB surveys recommend: 1) desktop habitat assessment, 2) presence/probable absence acoustic surveys, and 3) follow-up mist-net and telemetry surveys. A study plan for the Project was provided to the USFWS on July 8, 2019, and site-specific authorization was provided by Scott Larson (USFWS South Dakota Field Office) in a letter dated July 11, 2019 (Appendix D).

Habitat Assessment and Survey Effort

The desktop habitat assessment indicated approximately 1,200 acres of potentially suitable habitat (USFWS 2019) within the 2019 Study Area. The USFWS (2019) defines suitable NLEB habitat as any forest (i.e., deciduous, coniferous, mixed) or forested landscape feature (e.g., woody wetlands, forested riparian areas, shelterbelts). The USFWS Guidelines (2019) recommend a minimum of one acoustic survey site per 123 acres of suitable bat habitat for non-linear projects. WEST initially surveyed ten sites using a mix of acoustic and mist-net surveys, and completed follow-up mist-net surveys at two of the prior acoustic survey sites where NLEB calls were qualitatively identified via acoustic signatures.

Acoustic Surveys

Acoustic survey sites were sampled using two detectors deployed at each site for a minimum of four nights, resulting in a total of eight detector nights per site. Bats were surveyed using Song Meter full-spectrum ultrasonic detectors (SM3 and SM4; Wildlife Acoustics, Inc.; http://www.wildlifeacoustics.com).

Acoustic surveys were conducted from July 26 – August 1. Two detectors were redeployed from August 13 – 16 to make up for incomplete nights during the initial survey period. Acoustic monitoring began before sunset and continued for the entire night. If weather conditions such as persistent rain (for 30 or more minutes [min]), strong sustained winds (greater than nine miles per hour [mph] for 30 or more min), or cold temperature (below 10 degrees Celsius [°C; 50 degrees Fahrenheit (°F)] for 30 or more min) occurred, then the site was surveyed for an additional night if any of these conditions occurred. Weather conditions were monitored with Weather Underground's Wundermap (http://www.wunderground.com/wundermap/: Rural Oliver County, KNDNEWSA2).

Omnidirectional detector microphones were positioned at least 3.0 meters (m; 9.8 feet [ft].) above ground, oriented horizontally. For each acoustic detector, the date, start and end time, site description, detector orientation, site coordinates, tree species composition, stand age, vegetation community type, and weather data were recorded. Representative photographs of each site were also taken. Standard settings used for each SM4 detector are shown in Figure 2. Field technicians verified that detectors were functioning properly by using internal SM3/SM4 microphone (mic) calibration and checking the status diagnostic screens. These tools allowed technicians to verify

that the mic was connected and functioning, that data cards were installed, that battery voltage was sufficient, and that the unit was programmed properly. In addition, the .sm4dump diagnostic file was saved at each station and used to verify proper functioning of detectors.

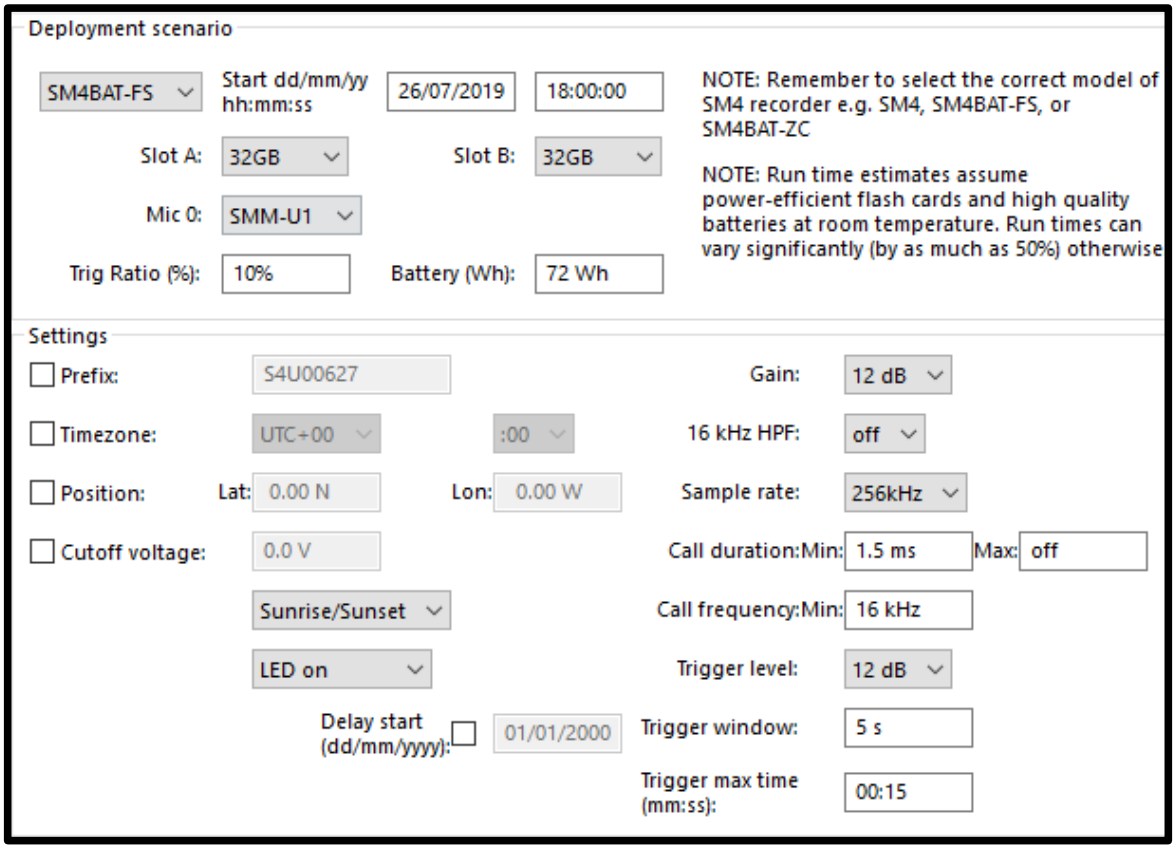


Figure 2. Standard settings for Song Meter 4 full-spectrum ultrasonic detectors used on the Oliver Wind IV Project in Oliver County, North Dakota.

Bat calls were identified using USFWS-approved quantitative identification methods (Kaleidoscope Pro© version 4.2.0; Wildlife Acoustics Inc.) from all nights, including nights considered invalid due to weather. The Bats of North America classifier 4.2.0 was used within Kaleidoscope. Kaleidoscope generated a list of species identified and a list of nightly maximum likelihood estimator (MLE) p-values for each species with the potential to occur in the Study Area. The following species were included in the Kaleidoscope model: big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), and NLEB. Minimum number of pulses was set to "2" and the bat classifier setting was set to "0 Balanced (Neutral)". Defaults were used for all other software settings. The only filter applied to the data set was a noise filter within Kaleidoscope that moved sound files with noise into a noise subfolder.

All calls identified as NLEB by automated identification software were examined and verified by a qualified biologist with extensive acoustic identification experience (Dr. K. Murray). All calls identified as NLEB and all calls from nights that the Kaleidoscope Pro considered NLEB presence likely per the Guidelines (MLE p-value < 0.05) were reviewed. Bat calls were identified using a known call library and published echolocation call parameters for bat species in the eastern US (Murray et al. 2001 [pg. 732], Britzke et al. 2011 [Table S1]). If call sequences were not characteristic of NLEB, contained distinct calls produced by species other than NLEB, or were of insufficient quality, they were reclassified.

Mist-Net Surveys

Mist-net surveys were conducted under federal endangered species recovery permit (TE03495B-2 [K. Hammond]; TE26854C-0 [B. Hyzy]; TE13580D-0 [J. Wilson]) and North Dakota Scientific Collection Licenses (GNF05044690 [K. Hammond-Rendon]; GNF05044694 [B. Hyzy]; GNF05044693 [J. Wilson]). A study plan for the Project was provided to the USFWS on July 8, 2019, and site-specific authorization was provided by Scott Larson (USFWS South Dakota Field Office) in a letter dated July 11, 2019 (Appendix D).

WEST conducted mist-net surveys at three sites from July 28 – August 3 and follow-up mist-net surveys from August 13 – 15 at two sites where NLEB calls were acoustically verified per the Guidelines (Figure 4). Initial mist-net surveys were conducted for nine net-nights at each site over the course of two calendar nights, and follow-up surveys were conducted for six net-nights at each site over the course of two calendar nights. Standard 2-ply, 50 denier, nylon mist-nets with a mesh size of 38.0 millimeters (mm; 1.3 inches [in]) were used at all mist-net sites. Mist-nets were placed in suitable bat habitat and positioned perpendicularly across flight corridors to fill the corridor from side-to-side and extended from ground-level up to the overhanging canopy, when possible. When forested corridors were unavailable, some nets were placed on forested field edges.

Mist-netting began at sunset and continued for at least five hours, and nets were checked every 10 minutes. Disturbance in the form of noise and movement was minimized at all net locations. If weather conditions, such as persistent rain, drizzle, or fog (more than 30 min in duration), strong winds (greater than nine mph for more than 30 min), or cold temperatures (below 50 °F [10 °C] for 30 or more min) occurred, then those net locations were resurveyed another night. An exception occurred for sites 4b and 5b, when rain persisted for 60 minutes. However, these were follow-up mist-net sites and NLEB had already been detected and captured and determined to be present.

For each mist-net night, the date, start and end times, site description, site coordinates, mist-net specifics, and weather data (temperature, cloud cover, wind speed, precipitation, and moon phase) were recorded. All captured bats were identified to species. In addition, sex, age, reproductive condition, body mass (grams), forearm length (mm), and capture status (recapture/new) were recorded.

To assess exposure to White-Nose Syndrome (WNS), a Reichard Index score (0-3) was recorded for all captured bats (Reichard 2009). USFWS WNS decontamination protocols were followed (USFWS 2016) to prevent cross-contamination of captured bats with *Pseudogymnoascus destructans*, the fungus that causes WNS. Captured bats were measured and processed immediately and released within 15 min. Forearm bands were attached to all captured *Myotis* species. Voucher photographs of each captured bat species were taken.

RESULTS

Acoustic Surveys

Locations and descriptions of acoustic survey sites within the Study Area are provided in Figure 3 and Table 1. Maps, photographs, and datasheets of acoustic survey sites are included in Appendices A, B, and C, respectively.

Acoustic surveys were conducted at seven acoustic survey sites (2 acoustic survey locations at each survey site for a total of 14 survey locations) within the Study Area from July 26 to August 1 (Figure 3). Cattle knocked over two acoustic detectors at two survey sites resulting in incomplete nights, so two detectors were redeployed from August 13 to August 16 resulting in a total of 82 detector-nights across all locations. Weather conditions and cattle disruptions resulted in a failure to meet 2019 Guideline criteria of 20 detector-nights. Additional nights were surveyed to ensure all survey locations were surveyed for a minimum of four valid detector nights per Guideline requirements, resulting in a total of 62 valid detector-nights (see weather logs in Appendix L).

Kaleidoscope detected a total of 8,721 bat calls and identified 7,193 of all calls to species, including all data from valid and invalid nights (82.5%; Table 1). Little brown bats were the most common species (2,490 calls [28.6%]), followed by silver-haired bats (1,720 calls [19.7%]), eastern red bats (1,103 calls [12.6%]), big brown bats (922 calls [10.6%]), hoary bats (903 calls [10.4%]), and NLEBs (55 calls [0.6%]; Table 2). Bat echolocation calls have a high level of variation within species causing overlap in call traits among species. Therefore, call identification is imperfect, and each identification has an associated error rate (USFWS 2013). In addition, the error rates associated with Kaleidoscope identifications of *unknown* bat calls have not been characterized. For these reasons, the results of the Kaleidoscope analysis can be misleading and should be viewed with caution.

Kaleidoscope identified 55 call files as potential NLEB calls at six sites, 10 survey locations, and on 23 survey nights, including valid and invalid nights. MLE p-values for NLEB presence met Guideline criteria ($p < 0.05$) on eight of these nights. A total of seven calls at two survey locations (4b, 5b) were confirmed as NLEB by a subsequent qualitative call analysis (Figure 3; Table 2; Appendix F). The remaining 48 potential NLEB calls identified by Kaleidoscope were reclassified as high-frequency unknowns, unknown *Myotis* species, little brown bats, and big brown bats by the qualitative call analysis. The Kaleidoscope analysis output is in Appendix E; a summary of the qualitative analysis is in Appendix F; and sonograms of representative bat calls have been archived but are upon request.

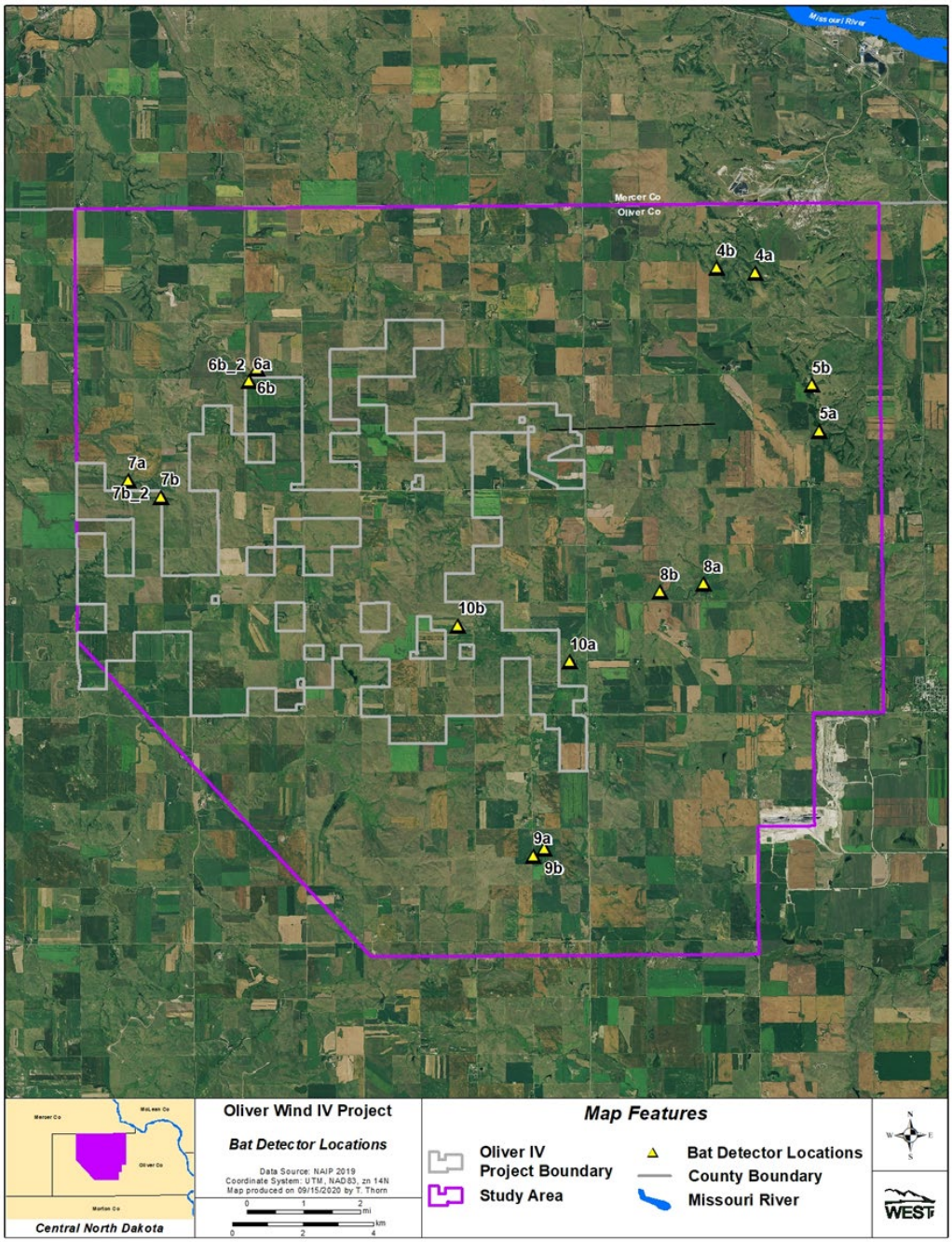


Figure 3. Location of acoustic survey sites for the summer 2019 bat presence/absence surveys within the Oliver Wind IV Project Study Area in Oliver County, North Dakota. ***(Note: Four male northern long-eared bats (Myotis septentrionalis*****; NLEB)** ***were captured in mist-nets at survey sites 4b (2 NLEB) and 5b (2 NLEB) in July/August 2019).***

Table 1. Acoustic survey site coordinates, descriptions, and results of Kaleidoscope* identification software from valid and invalid survey nights within the Oliver Wind IV Project Study Area in Oliver County, North Dakota.

Site ID	Easting**	Northing**	Site Description	Bat Calls Identified	Total Bat Calls	Valid Detector Nights	Invalid Detector Nights	Detector Type	Bat Calls per Detector Night
4a	321180	5232750	Forest Edge	835	1,061	4	1	SM3	212.2
4b	320105	5232934	Forest Edge	452	612	4	1	SM3	122.4
5a	322831	5228187	Upland Forest	851	1,025	4	1	SM3	205.0
5b	322664	5229499	Forest Edge	1,300	1,530	4	1	SM3	306.0
6a	306708	5230235	Forest Edge	92	123	4	1	SM3	24.6
6b	306952	5230564	Riparian Forest	513	654	3	3	SM3	109.0
6b_2‡	306948	5230573	Riparian Forest	352	444	3	1	SM4	111.0
7a	303186	5227539	Riparian Forest	307	395	4	1	SM3	79.0
7b	304090	5227029	Riparian Forest	217	289	3	3	SM3	48.2
7b_2‡	304079	5227022	Riparian Forest	271	313	3	1	SM4	78.3
8a	319382	5223965	Upland Forest	512	564	4	1	SM3	112.8
8b	318131	5223792	Riparian Forest	174	194	4	1	SM3	38.8
9a	314263	5216424	Forest Edge	87	105	5	1	SM3	17.5
9b	314566	5216617	Shelterbelt	88	108	5	1	SM3	18.0
10a	315502	5221911	Riparian Forest	999	1,114	4	1	SM3	222.8
10b	312366	5223046	Forest Edge	143	190	4	1	SM3	38.0
Totals				**7,193**	**8,721**	**62**	**20**		**106.4**

*Number of calls that were identified to species by Kaleidoscope Pro software.

**Coordinate system and datum: Universal Transverse Mercator North American Datum (NAD) 1983, Zone 14

‡6b and 7b were redeployed (6b_2 and 7b_2) to achieve 4 valid detector nights.

Table 2. Bat calls identified by Kaleidoscope Pro® Version 4.2.0 on valid and invalid nights within the Oliver Wind IV Project Study Area in Oliver County, North Dakota. Numbers in parentheses indicate number confirmed as northern long-eared bat (MYSE) calls by subsequent qualitative analysis.

Site ID	EPFU	LABO	LACI	LANO	MYLU	MYSE	NOID
4a	232	48	87	422	45	1 (0)	226
4b	57	49	152	120	53	21 (6)	160
5a	139	266	68	220	154	4 (0)	174
5b	106	53	198	834	101	8 (1)	230
6a	18	24	13	4	27	6 (0)	31
6b	43	60	72	23	313	2 (0)	141
6b_2	14	97	17	6	214	4 (0)	92
7a	49	81	27	25	121	4 (0)	88
7b	72	30	23	6	85	1 (0)	72
7b_2	8	42	13	17	190	1 (0)	42
8a	142	106	13	11	239	1 (0)	52
8b	8	13	17	10	126		20
9a	6	60	1	2	18		18
9b	4	56		1	27		20
10a	14	88	123	12	760	2 (0)	115
10b	10	30	79	7	17		47
Totals	**922**	**1,103**	**903**	**1,720**	**2,490**	**55 (7)**	**1,528**
	10.6%	**12.6%**	**10.4%**	**19.7%**	**28.6%**	**0.6%**	**17.5%**

EPFU = big brown bat (*Eptesicus fuscus*); LABO = eastern red bat (*Lasiurus borealis*); LACI = hoary bat (*Lasiurus cinereus*); LANO = silver-haired bat (*Lasionycteris noctivagans*); MYLU = little brown bat (*Myotis lucifugus*); MYSE = northern long-eared bat (*Myotis septentrionalis*); NOID = unknown or no identification.

Mist-Net Surveys

Mist-nest survey site locations, descriptions and results are provided in Tables 3-5. Appendices G, H, I, J, and K contain maps of mist-net survey sites, photographs of mist-net sites, bat capture details, representative photographs of bats captured, and datasheets, respectively.

Mist-net surveys were conducted at three survey locations from July 28 to August 3, 2019, including the two acoustic survey locations (4b and 5b) where NLEB were qualitatively confirmed during acoustic surveys (August 13 to August 15, 2019, Figure 4). During the first round of mist-net surveys, WEST biologists captured a total of 20 bats, including 14 silver-haired bats, three eastern red bats, and three hoary bats. Eight more bats were captured during the second round of mist-net surveys, including four NLEB, two little brown bats, one silver-haired bat, and one eastern red bat. All captured NLEB were males (two were juveniles and two were adults; Table 5).

WEST notified the USFWS South Dakota Field Office and North Dakota Game and Fish of the first three NLEB captured on August 15, 2019. USFWS biologist Natalie Gates requested that DNA be collected from any additional NLEB captured to verify the species identify. WEST biologists collected the processing bag that held the NLEB at site 4b on August 15, 2019, and sent it to Northern Arizona University for DNA extraction and analysis. Results of the analysis indicated insufficient DNA was in the collection bag to confirm species.

Table 3. Locations and site descriptions of mist-net surveys within the Oliver Wind IV Project Study Area in Oliver County, North Dakota.

Site ID	Net	Easting*	Northing*	Site Description
1 (presence/absence)	A	320949	5232216	Forest Edge
	B	320923	5232229	Forested Corridor
	C	320917	5232290	Forested Corridor
	D	320940	5232295	Forest Edge
	E	320962	5232311	Forest Edge
2 (presence/absence)	A	323129	5227701	Forested Corridor
	B	323134	5227736	Forested Corridor
	C	323098	5227765	Forested Corridor
	D	323035	5227776	Forest Edge
	E	323163	5227674	Forest Edge
3 (presence/absence)	A	301833	5225070	Forest Edge
	B	301876	5225025	Forested Corridor
	C	301793	5225012	Forest Edge
	D	301775	5225043	Forest Edge
	E	301809	5225097	Forested Corridor
4b (follow-up)	A	320093	5232912	Forested Corridor
	B	320095	5232925	Forested Corridor
	C	320071	5232943	Forested Corridor
5b (follow-up)	A	322775	5229511	Forested Corridor
	B	322609	5229472	Forested Corridor
	C	322670	5229409	Forest Edge

*Universal Transverse Mercator [UTM] Zone 14, NAD 1983

Table 4. Summary of bat mist-net captures within the Oliver Wind IV Project Study Area in Oliver County, North Dakota.

Site ID	LABO	LACI	LANO	MYLU	MYSE	Total
1		3	12			15
2	1		2			3
3	2					2
4b‡	1		1		2	4
5b‡				2	2	4
Total	**4**	**3**	**15**	**2**	**2**	**28**

LABO = eastern red bat (*Lasiurus borealis*); LACI = hoary bat (*Lasiurus cinereus*); LANO = silver-haired bat (*Lasionycteris noctivagans*); MYLU = little brown bat (*Myotis lucifugus*); MYSE = northern long-eared bat (*Myotis septentrionalis*).

‡Follow-up mist-net sites following call analysis and confirmation of NLEB (MYSE) at these locations.

Table 5. Details of *Myotis* species captured during summer bat mist-net surveys within the Oliver Wind IV Project Study Area in Oliver County, North Dakota.

Site ID	Species[4]	Capture Date	Capture Time	Band ID	Sex[1]	Age[2]	Reproductive Condition[3]	Forearm Length (mm)	Weight (g)
4b	MYSE	August 14	21:44	WEST B0315	M	A	N	35.5	6.00
4b	MYSE	August 15	01:20	WEST B0350	M	J	N	34.8	6.25
5b	MYSE	August 13	22:30	WEST A0214	M	J	N	36.2	6.50
5b	MYSE	August 13	22:30	WEST A0213	M	A	N	37.0	6.75
5b	MYLU	August 13	23:20	WEST A0212	F	A	PL	39.2	11.50
5b	MYLU	August 14	02:27	WEST A0211	M	A	N	39.2	11.25

[1]F=female; M=male.

[2]A=adult; J=juvenile.

[3]PL=post-lactating; N=non-reproductive.

4 MYSE = Northern long-eared bat (*Myotis septentrionalis*); MYLU = little brown bat (*Myotis lucifugus*).

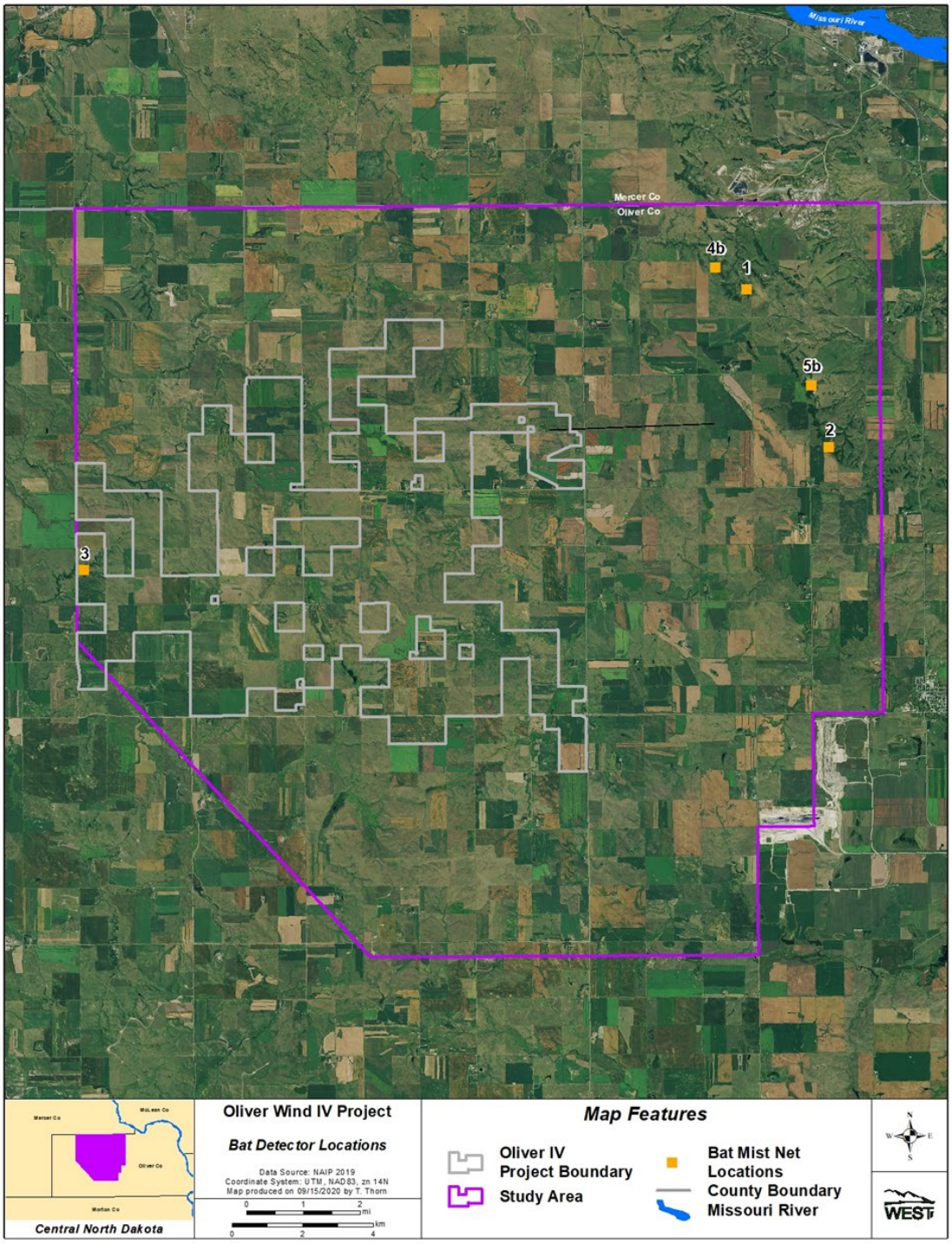


Figure 4. Location of 2019 summer bat mist-net survey sites within the Oliver Wind IV Project Study Area in Oliver County, North Dakota.

REFERENCES

Britzke, E. R., J. E. Duchamp, K. L. Murray, R. K. Swihart, and L. W. Robbins. 2011. Acoustic Identification of Bats in the Eastern United States: A Comparison of Parametric and Nonparametric Methods. Journal of Wildlife Management 75(3): 660-667.

ESRI. 2019. World Imagery and Aerial Photos. (World Topo). ArcGIS Resource Center. Environmental Systems Research Institute (ESRI), producers of ArcGIS software. Redlands, California. Information online: http://www.arcgis.com/home/webmap/viewer.html?useExisting=1

Murray, K. L., E. R. Britzke, and L. W. Robbins. 2001. Variation in Search-Phase Calls of Bats. Journal of Mammalogy 82: 728-737.

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

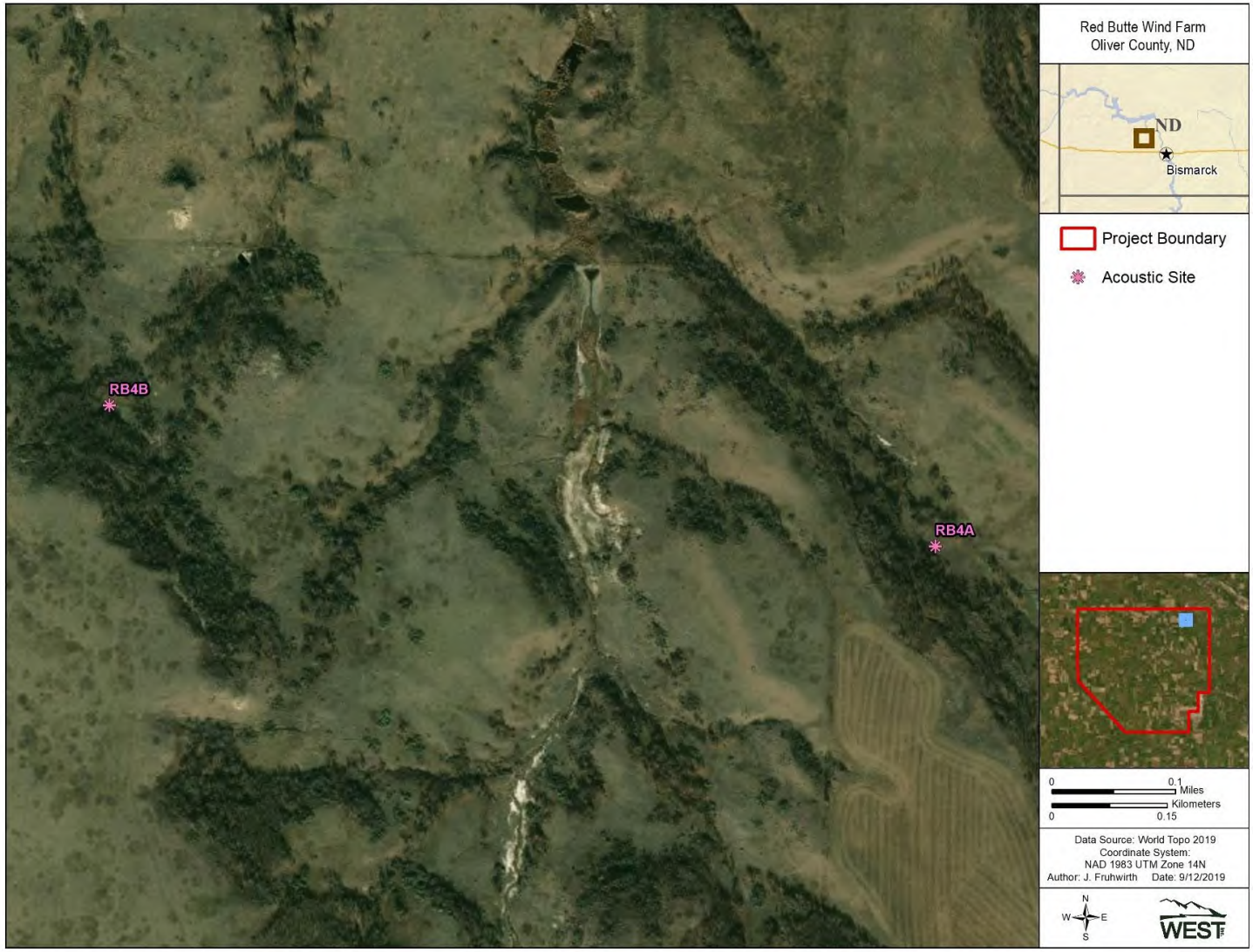
Reichard, J. E. 2009. Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-Nose Syndrome. Center for Ecology and Conservation, Boston University, Boston, Massachusetts.

US Fish and Wildlife Service (USFWS). 2013. Acoustic Bat Indetification Software Testing Criteria – Draft January 2013. Information available online at: https://www.fws.gov/midwest/endangered/mammals/MYSO/surveys/pdf/AcousticPrgrmDrftTestCriteria3Jan13.pdf

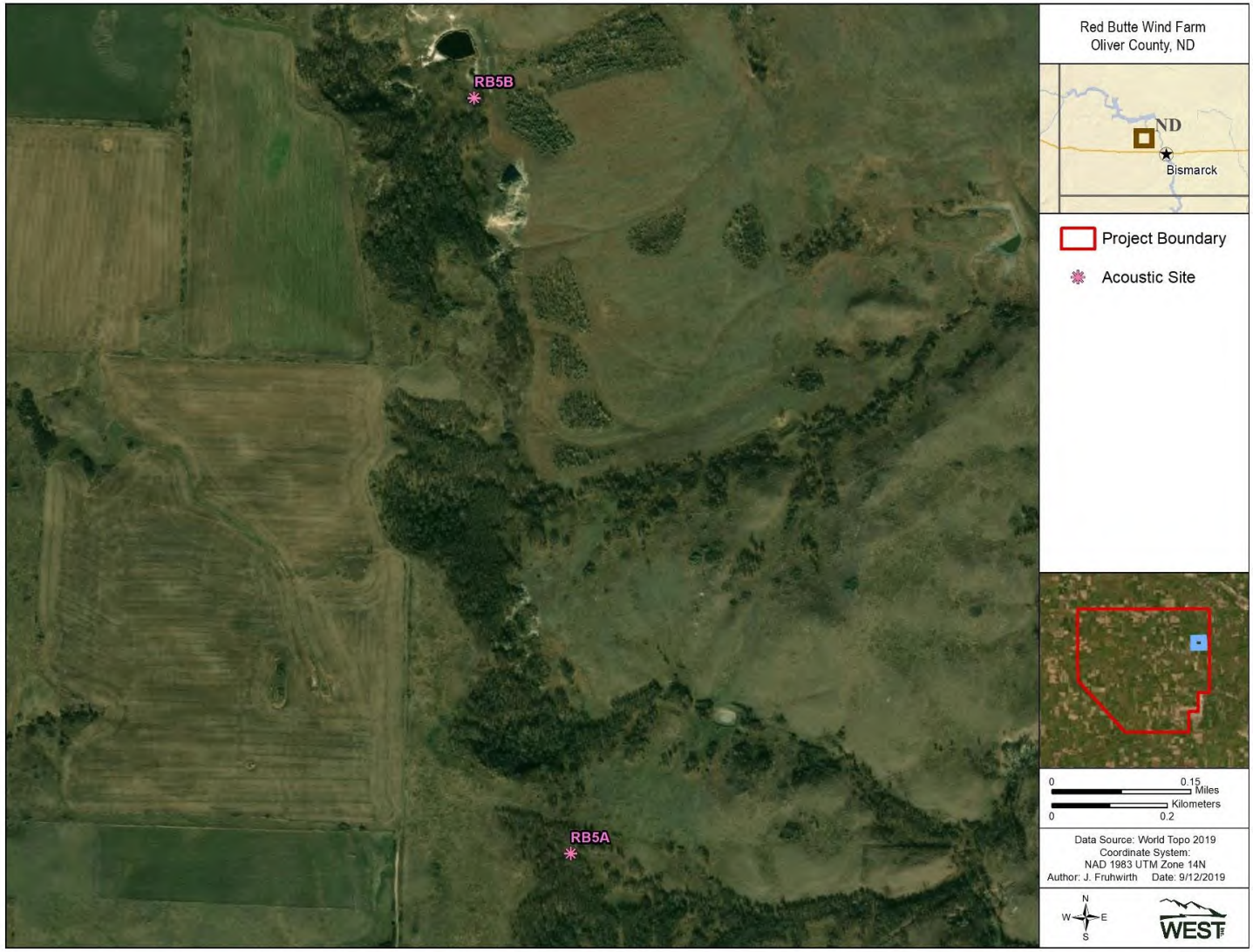
US Fish and Wildlife Service (USFWS). 2016. National White-Nose Syndrome Decontamination Protocol - Version 04.12.2016. White-Nose Syndrome.org, a partnership of federal, local, and state governmental agencies, non-governmental agencies, and universities.

US Fish and Wildlife Service (USFWS). 2019. Range-Wide Indiana Bat Summer Survey Guidelines. USFWS Region 3, Bloomington, Indiana. April 2019. 63 pp., including appendices. Available online: https://www.fws.gov/midwest/endangered/mammals/MYSO/surveys/pdf/2019_Rangewide_IBat_Survey_Guidelines.pdf

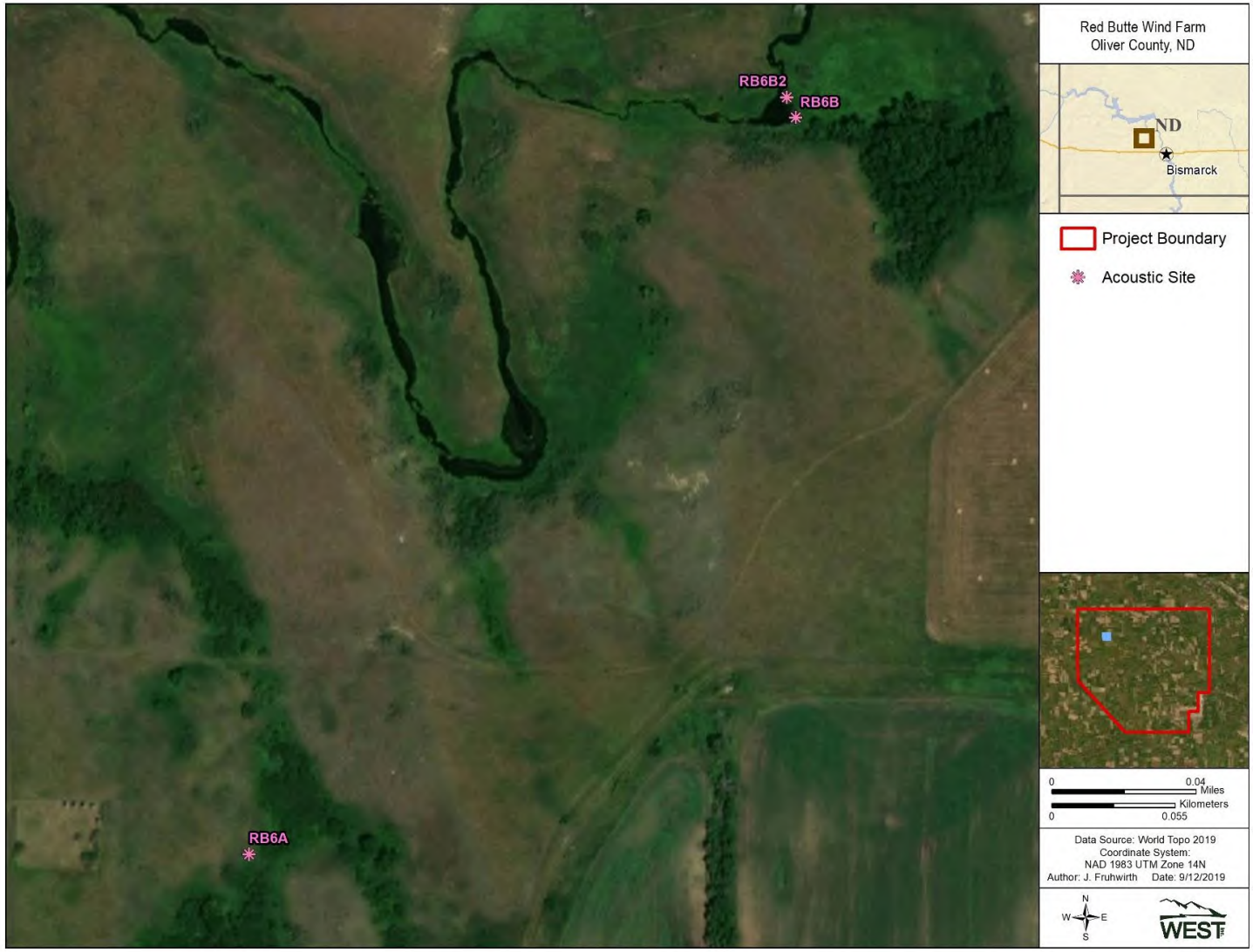
Appendix A. Maps of Acoustic Survey Sites



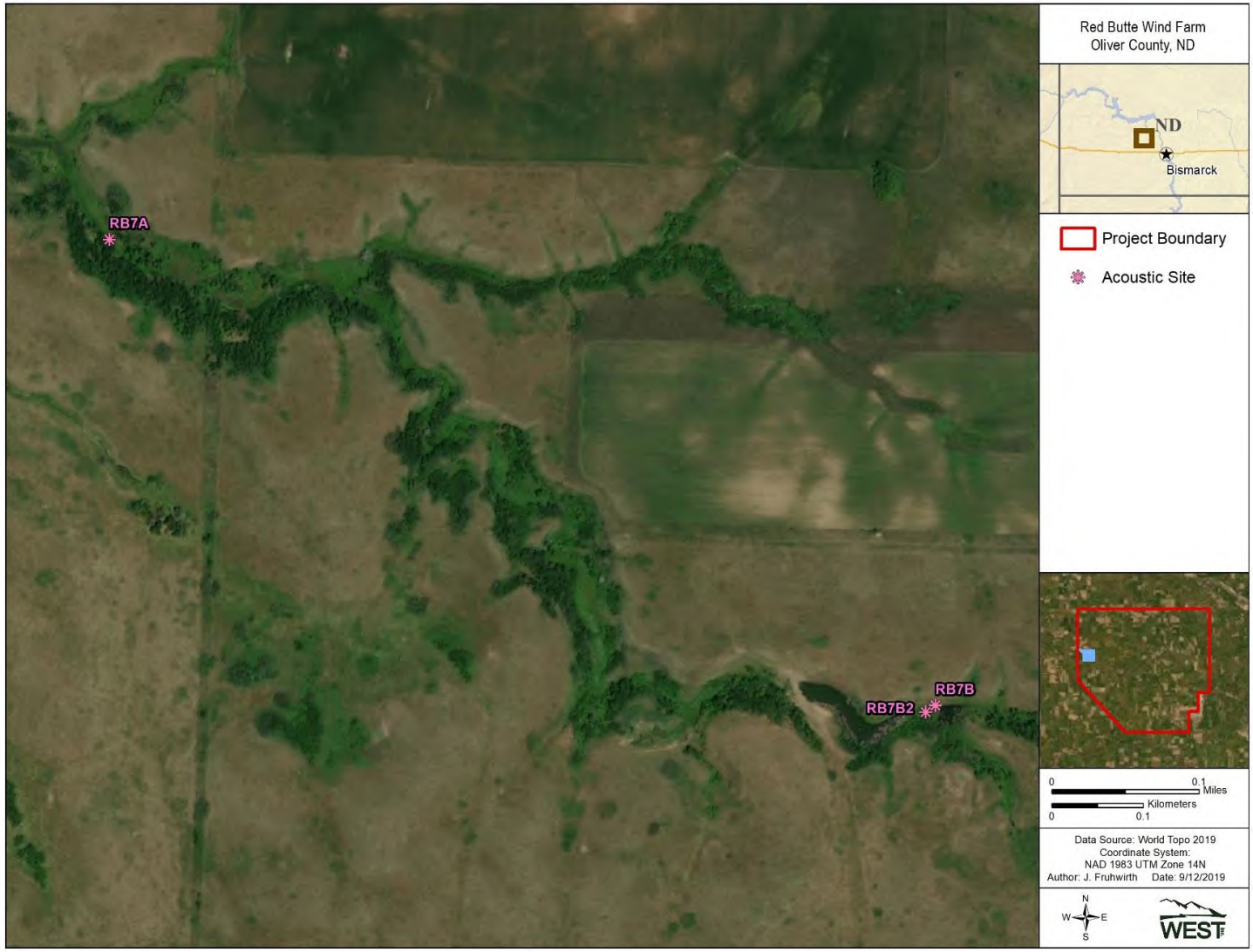
Appendix A1. Map of acoustic sites 4a and 4b at the Red Butte Wind Project.



Appendix A2. Map of acoustic sites 5a and 5b at the Red Butte Wind Project..

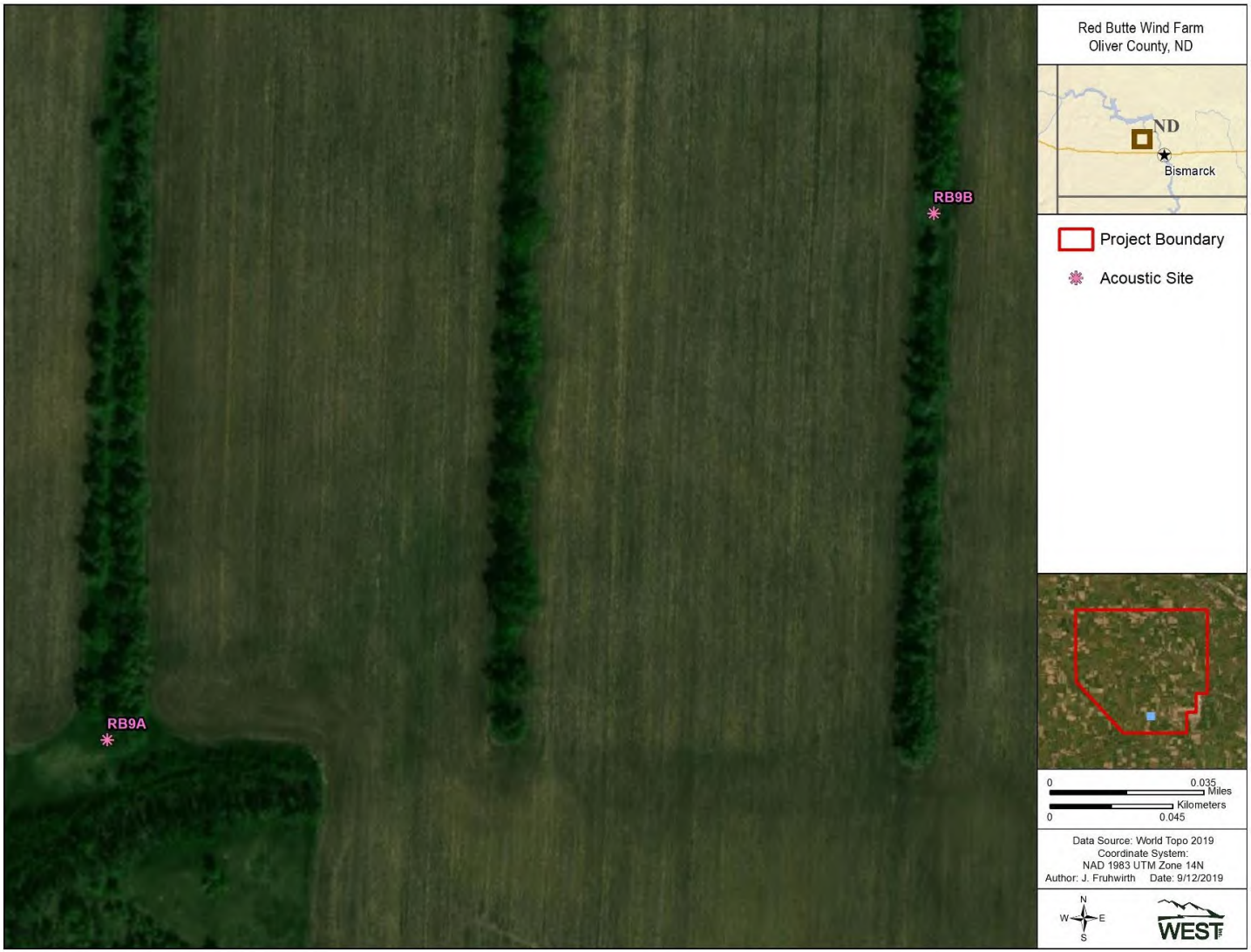


Appendix A3. Map of acoustic sites 6a, 6b, and 6b-2 at the Red Butte Wind Project..

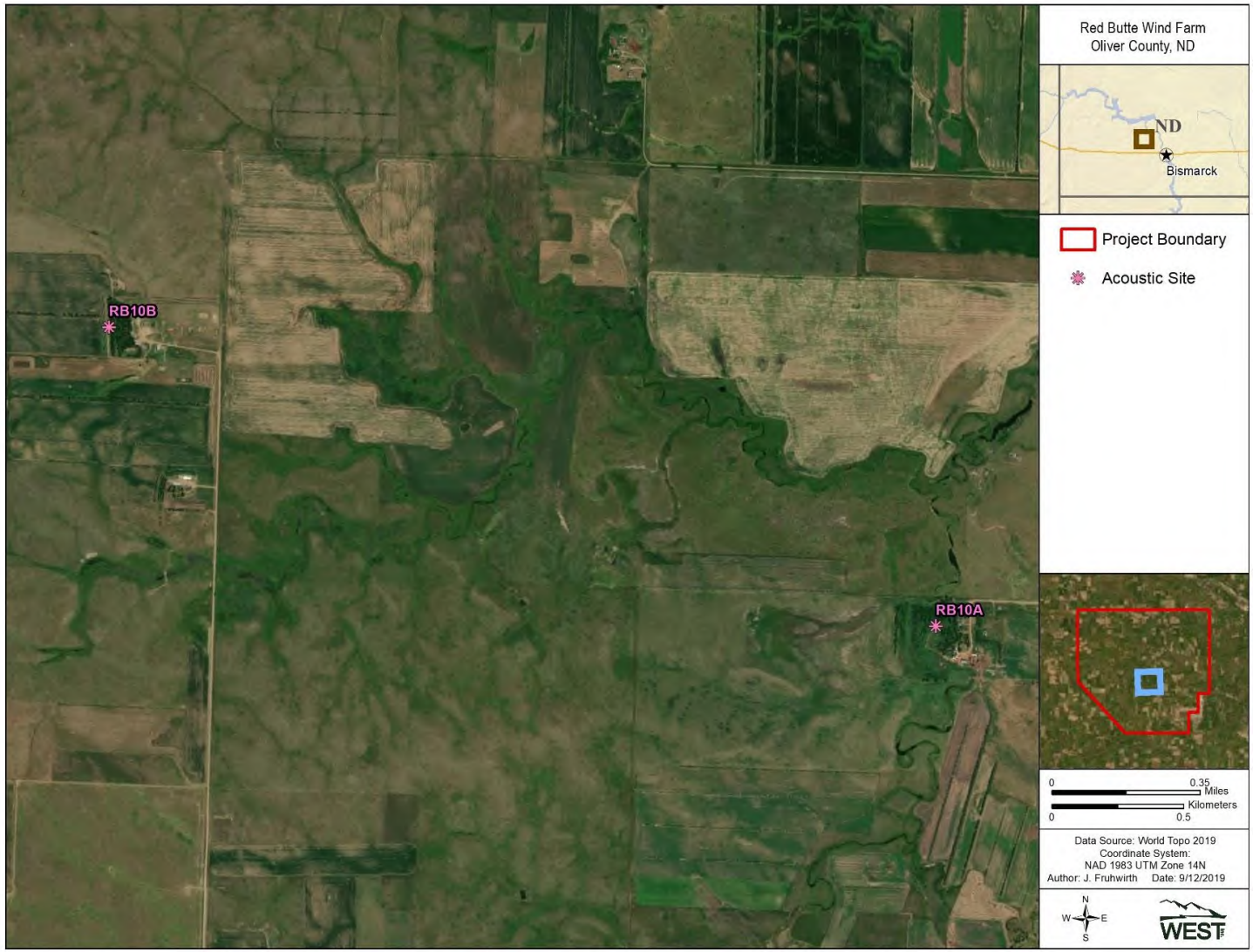


Appendix A4. Map of acoustic sites 7a, 7b, and 7b-2 at the Red Butte Wind Project..

Appendix A5. Map of acoustic sites 8a and 8b at the Red Butte Wind Project..



Appendix A6. Map of acoustic sites 9a and 9b at the Red Butte Wind Project..



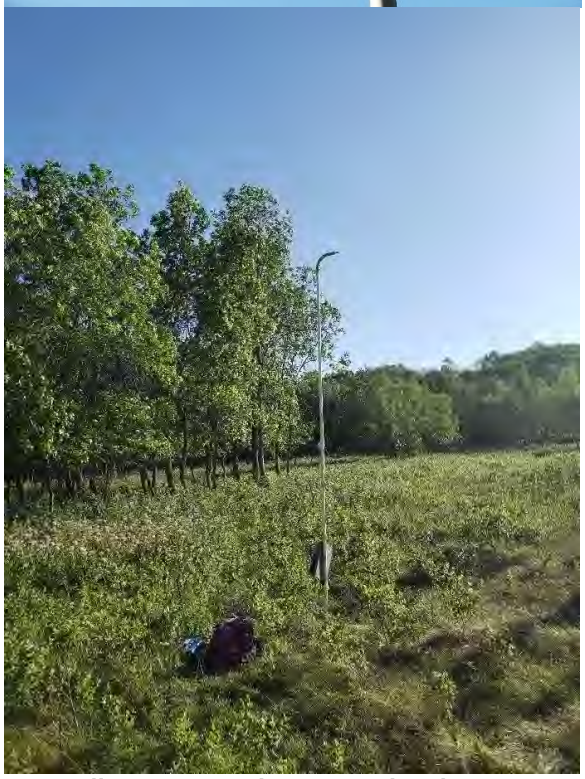
Appendix A7. Map of acoustic sites 10a and 10b at the Red Butte Wind Project..

Appendix B. Photographs of Acoustic Survey Sites

Appendix B1. Acoustic survey site 4a.

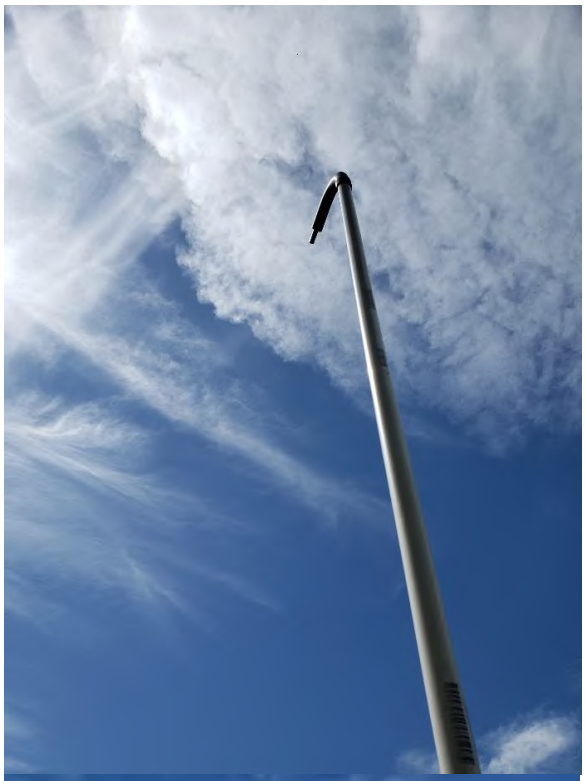
Appendix B1. Acoustic survey site 4b.

Appendix B1. Acoustic survey site 5a.



Appendix B1. Acoustic survey site 5b.

Appendix B1. Acoustic survey site 6a.



Appendix B1. Acoustic survey site 6b.

Appendix B1. Acoustic survey site 6b-2 (redeployment).

Appendix B1. Acoustic survey site 7a.

Appendix B1. Acoustic survey site 7b.

Appendix B1. Acoustic survey site 7b-2 (redeployment).

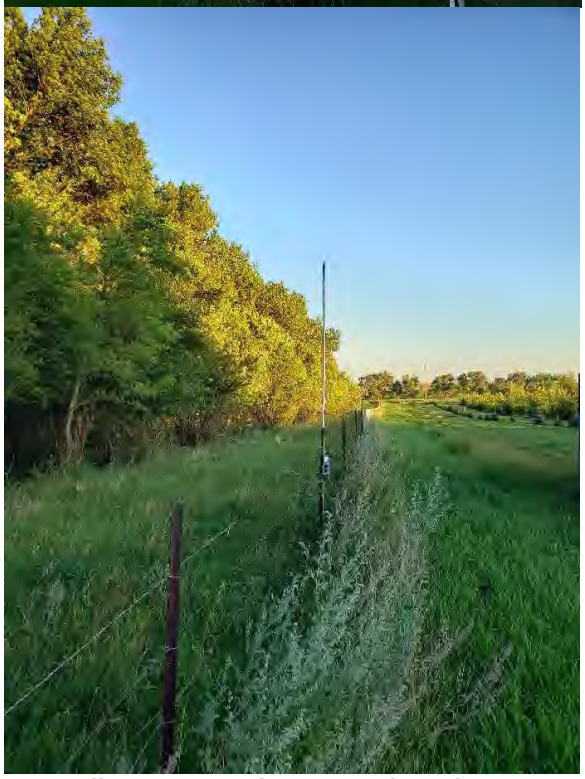
Appendix B1. Acoustic survey site 8a.

Appendix B1. Acoustic survey site 8b.

Appendix B1. Acoustic survey site 9a.

Appendix B1. Acoustic survey site 9b.

Appendix B1. Acoustic survey site 10a.



Appendix B1. Acoustic survey site 10b.

Appendix C. Acoustic Datasheets

Acoustic Presence/Probable Absence Data Form

WEST INC.

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): RB4 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-27	**End Date:** 2019-08-01	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1235	**End Time:** 1250	**Easting:** 321180	**Northing:** 5232750
*Use 24 hour time format	*Use yyyy-mm-dd date format	*Easting should be 6 digits	*Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 306307			
Detector Housing: None	**Mic Serial:** 706308	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 100		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-27	1235	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-29	1215	5.7	✓	✓			check				Record Status Data / Standby Error
2019-08-01	1250	5.3		✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 50
Forest Type: Deciduous	**% Open/Ag:** 50
Dominant Tree Species: Fraxinus pennsylvanica, Acer negundo	**% Water:** 0
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present: Fraxinus pennsylvanica (snag)	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Prairie edge, Fraxinus snags

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)

[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).

[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.

Acoustic Presence/Probable Absence Data Form

WEST

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): RB4 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-27	**End Date:** 2019-08-01	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1405	**End Time:** 1325	**Easting:** 320105	**Northing:** 5232934

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 304764			
Detector Housing: None	**Mic Serial:** 106415	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 92		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-27	1405	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-29	1310	5.6	✓	✓			check				Record Status Data / Standby Error
2019-08-01	1325	5.3	✓	✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 70
Forest Type: Deciduous	**% Open/Ag:** 30
Dominant Tree Species: Fraxinus pennsylvanica, Ulmus americana	**% Water:** 0
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present: Fraxinus pennsylvanica (snag)	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

In a valley, moved detector 15m from desktop selection to better capture potential flyway

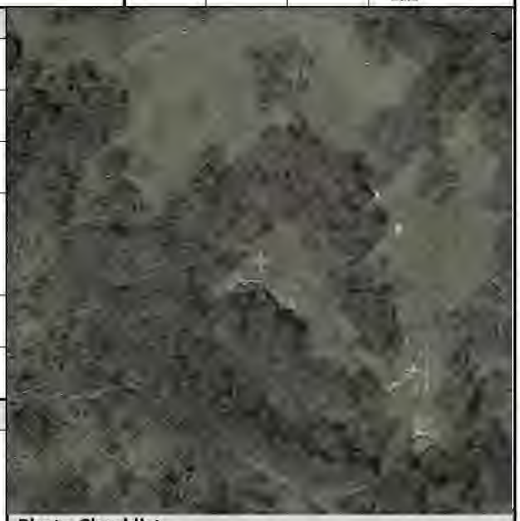


Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB5 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-26	**End Date:** 2019-07-31	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1750	**End Time:** 1517	**Easting:** 322831	**Northing:** 5228187

[4] Use 24 hour time format *[5] Use yyyy-mm-dd date format* *[6] Easting should be 6 digits* *[7] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 302827			
Detector Housing: None	**Mic Serial:** 102794	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 96		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-26	1750	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-28	1715	5.8	✓	✓			check				Record Status Data / Standby Error
2019-07-31	1517	4.8		✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Upland Forest	**% Forest:** 55
Forest Type: Deciduous	**% Open/Ag:** 45
Dominant Tree Species: Acer negundo, Fraxinus pennsylvanica	**% Water:** 0
Stand Age (DBH): Early-successional (0 - 12 cm)	
Preferred Roost Tree Species Present:	
Topography: Slope	

[3] Habitat Description within 100m (i.e. the sketched area)

Forest patch in pasture, all A. negundo and F. pennsylvanica. Detector set to MDT, datasheet in CDT.

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB5 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-26	**End Date:** 2019-07-31	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1750	**End Time:** 1605	**Easting:** 322664	**Northing:** 5229499

[4] Use 24 hour time format *[4] Use yyyy-mm-dd date format* *[4] Easting should be 6 digits* *[4] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 306451			
Detector Housing: None	**Mic Serial:** 100365	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 324		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-26	1750	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-28	1745	5.4	✓	✓	✓		check, replaced after downed by cows				Record Status Data / Standby Error
2019-07-31	1605	5.2		✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)	
[1] **Primary Habitat:** Field Edge	**% Forest:** 35
Forest Type: Deciduous	**% Open/Ag:** 55
Dominant Tree Species: Fraxinus pennsylvanica	**% Water:** 10
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present:	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Near pond in pasture edge. Reset on 7/28 after cows destroyed. Detector set to MDT, datasheet on CDT

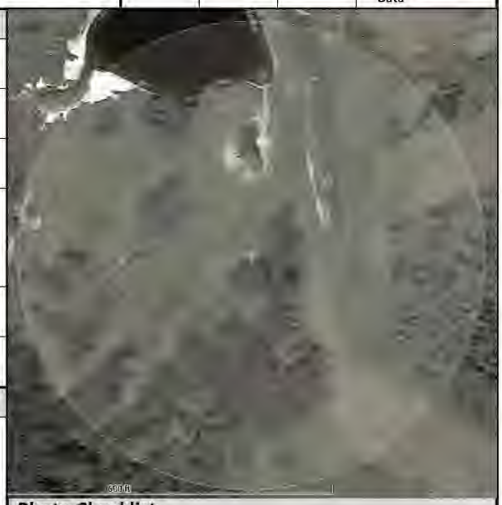


Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB6 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-27	**End Date:** 2019-08-01	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1615	**End Time:** 1450	**Easting:** 306708	**Northing:** 5230235

[1] Use 24 hour time format *[2] Use yyyy-mm-dd date format* *[4] Easting should be 6 digits* *[5] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 304900			
Detector Housing: None	**Mic Serial:** 110294	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 348		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-27	1615	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-28	1545	5.8	✓	✓	✓		data check				Record Status Data / Standby Error
2019-08-01	1450	5.3		✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 20
Forest Type: Deciduous	**% Open/Ag:** 80
Dominant Tree Species: Fraxinus pennsylvanica	**% Water:** 0
Stand Age (DBH): Early-successional (0 - 12 cm)	
Preferred Roost Tree Species Present:	
Topography: Low Point	

[3] Habitat Description within 100m (i.e. the sketched area)

Shrubby valley bottom with a few Fraxinus, original point was in tall shrubs so moved 15m. Swapped card 7/28

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB6 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-27	**End Date:** 2019-08-04	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1530	**End Time:** 1200	**Easting:** 306952	**Northing:** 5230564

[a] Use 24 hour time format [b] Use yyyy-mm-dd date format [c] Easting should be 6 digits [c] Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 305616			
Detector Housing: None	**Mic Serial:** 109981	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 276		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-27	1530	6.4	✓	✓	✓	✓	setup				Record Standby Status Error Data
2019-07-28	1525	5.8	✓	✓			data check				Record Standby Status Error Data
2019-08-01	1530			✓			detector did not turn on, knocked over, redeployed				Record Standby Status Error Data
2019-08-04	1200						pickup				Record Standby Status Error Data

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 20
Forest Type: Deciduous	**% Open/Ag:** 75
Dominant Tree Species: Fraxinus pennsylvanica	**% Water:** 5
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present:	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Tiny pond edge in cow pasture. Detector did not turn on, had data for all nights but need to check it, was knocked over by cows. Redeployed 8/1

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB- 6b	**Project:** Red Butte		**State:** North Dakota
	Surveyors: K. Hammond, K. Lutsch		**County:** Oliver
Start Date: 2019-08-13	**End Date:** 2019-08-14	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1800	**End Time:** 0800	**Easting:** 0306948	**Northing:** 5230573

[a] Use 24 hour time format *[b] Use yyyy-mm-dd date format* *[c] Easting should be 6 digits* *[d] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: s4u02834			
Detector Housing: None	**Mic Serial:** 110410	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 232		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-08-13	1230	6.2	✓	✓	✓	✓	Redeployed				Record Status Data / Standby Error
2019-08-17	1200						Picked up				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 20
Forest Type: Deciduous/Shrub	**% Open/Ag:** 75
Dominant Tree Species: Fraxinus pennsylvanica	**% Water:** 5
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present: none	
Topography: Low Point	

[3] Habitat Description within 100m (i.e. the sketched area)

Riparian area with shrub/forest and open cow pasture

Photo Checklist

Detector Location: ✓ *(Detector + All Surrounding Habitat)* Detector Orientation: ✓ *(Detector + Bat Feature Sampled)* Detection Cone: ✓ *(Air Space Sampled)*

[1] *Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)*
[2] *Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).*
[3] *Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).*

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB7 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-27	**End Date:** 2019-08-01	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1952	**End Time:** 1755	**Easting:** 303186	**Northing:** 5227539

[4] Use 24 hour time format *[4] Use yyyy-mm-dd date format* *[5] Easting should be 6 digits* *[5] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 303624			
Detector Housing: None	**Mic Serial:** 108213	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 340		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-27	1952	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-28	1415	5.8	✓	✓	✓		check				Record Status Data / Standby Error
2019-08-01	1755	-		✓			picked up, would not turn on but recorded full night of data				Record Status Data / Standby Error
									✓		Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 30
Forest Type: Deciduous	**% Open/Ag:** 69
Dominant Tree Species: Ulmus americana, Fraxinus pennsylvanica	**% Water:** 1
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present:	
Topography: Low Point	

[3] Habitat Description within 100m (i.e. the sketched area)

Small forested creek area surrounded by cow pasture. Moved further NW down creek bed as close as possible to desktop-selected location, desktop-selected location was too wet/swampy for detector placement. Swapped card 7/28

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB7 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-27	**End Date:** 2019-08-04	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1810	**End Time:** 1200	**Easting:** 304090	**Northing:** 5227029

[4] Use 24 hour time format *[4] Use yyyy-mm-dd date format* *[5] Easting should be 6 digits* *[5] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 304729 / 304882			
Detector Housing: None	**Mic Serial:** 110091	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 175		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Anabat Only: Test Indicators ("Data" lit and static heard)	Anabat Only: Set Volume (Lowest Setting)	Anabat Only: LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-27	1810	6.4	✓	✓	✓	✓	setup				Record Standby Status Error Data
2019-07-28	1250	5.8	✓	✓	✓		swapped out detectors				Record Standby Status Error Data
2019-08-01	2045	6.4	✓	✓	✓	✓	knocked over by cows, reset				Record Standby Status Error Data
2019-08-04	1200						pickup				Record Standby Status Error Data

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 25
Forest Type: Deciduous	**% Open/Ag:** 65
Dominant Tree Species: Populus deltoides, Fraxinus pennsylvanica	**% Water:** 10
Stand Age (DBH): Early-successional (0 - 12 cm)	
Preferred Roost Tree Species Present:	
Topography: Low Point	

[3] Habitat Description within 100m (i.e. the sketched area)

Mostly shrubby wetland/ephemeral creek. Detector replaced 7/28 because programmed start/end times were inconsistent with the rest of them in project. Downed by cows 8/1 and reset. Checked 8/2 and swapped card

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB- 7b	**Project:** Red Butte		**State:** North Dakota
	Surveyors: K. Hammond		**County:** Oliver
Start Date: 2019-08-13	**End Date:** 2019-08-14	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1800	**End Time:** 0800	**Easting:** 0304079	**Northing:** 5227022

[4]Use 24 hour time format *[4]Use yyyy-mm-dd date format* *[4]Easting should be 6 digits* *[4]Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: s4u02775			
Detector Housing: None	**Mic Serial:**	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 133		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-08-13	1051	6.3	✓	✓	✓	✓	redeployed				Record Status Data / Standby Error
2019-08-17	1200						picked up				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 40
Forest Type: Shrub/hardwood forest	**% Open/Ag:** 40
Dominant Tree Species: Populus deltoides, Fraxinus pennsylvanica	**% Water:** 20
Stand Age (DBH): Early-successional (0 - 12 cm)	
Preferred Roost Tree Species Present: none	
Topography: Low Point	

[3]Habitat Description within 100m (i.e. the sketched area)

riparian creek area surrounded by shrub forest and open cow pasture

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB8 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-26	**End Date:** 2019-07-31	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1445	**End Time:** 1701	**Easting:** 319382	**Northing:** 5223965

[4] Use 24 hour time format *[5] Use yyyy-mm-dd date format* *[6] Easting should be 6 digits* *[7] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 302841			
Detector Housing: None	**Mic Serial:** 104116	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 17		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-26	1445	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2019-07-28	1840	5.7	✓	✓			check				Record Status Data / Standby Error
2019-07-31	1701	5.3		✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Upland Forest	**% Forest:** 20
Forest Type: Deciduous	**% Open/Ag:** 75
Dominant Tree Species: Platanus occidentalis	**% Water:** 5
Stand Age (DBH): Mature (38 cm or greater)	
Preferred Roost Tree Species Present:	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Mostly hayfield with mature cottonwoods. Adjacent to small creek. Detector set to MDT, datasheet in CDT

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB8 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-26	**End Date:** 2019-07-31	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1540	**End Time:** 1740	**Easting:** 318131	**Northing:** 5223792

*Use 24 hour time format *Use yyyy-mm-dd date format *Easting should be 6 digits *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 304914			
Detector Housing: None	**Mic Serial:** 106739	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 80		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-26	1540	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-28	1910	5.8	✓	✓			check				Record Status Data / Standby Error
2019-07-31	1740	5.1		✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 35
Forest Type: Deciduous	**% Open/Ag:** 62
Dominant Tree Species: Acer negundo, Crataegus mollis	**% Water:** 3
Stand Age (DBH): Early-successional (0 - 12 cm)	
Preferred Roost Tree Species Present:	
Topography: Slope	

[3] Habitat Description within 100m (i.e. the sketched area)

Boxelder and thorny shrubbed edge of creek, more shrub than forest. Trees under 20ft in height. Detector set to MDT, datasheet in CDT

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat) | Detector Orientation: ✓ (Detector + Bat Feature Sampled) | Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB9 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-27	**End Date:** 2019-08-02	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 2050	**End Time:** 1500	**Easting:** 314263	**Northing:** 5216424

[4] Use 24 hour time format *[4] Use yyyy-mm-dd date format* *[5] Easting should be 6 digits* *[5] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 302803			
Detector Housing: None	**Mic Serial:** 106188	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 210		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-27	2050	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-28	1730	5.5		✓	✓		check, swapped card				Record Status Data / Standby Error
2019-08-02	1500	-	✓	✓			pickup, see notes				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 25
Forest Type: Deciduous	**% Open/Ag:** 75
Dominant Tree Species: Ulmus parvifolia, Fraxinus pennsylvanica	**% Water:** 0
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present:	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Edge of soy field. Picked up a day late because thunderstorms on 8/1, batteries dead on pickup.

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB9 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-27	**End Date:** 2019-08-02	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 2120	**End Time:** 1440	**Easting:** 314566	**Northing:** 5216617

[1]Use 24 hour time format *[2]Use yyyy-mm-dd date format* *[3]Easting should be 6 digits* *[4]Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 306316			
Detector Housing: None	**Mic Serial:** 103614	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 270		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-27	2120	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-29	1640	5.7	✓	✓	✓		check, card swap				Record Status Data / Standby Error
2019-08-02	1440	-		✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 10
Forest Type: Deciduous	**% Open/Ag:** 90
Dominant Tree Species: Ulmus parvifolia	**% Water:** 0
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Flat	

[3]Habitat Description within 100m (i.e. the sketched area)

Treeline in soy field. Picked up a day late because thunderstorms on 8/1, batteries dead on pickup

Photo Checklist

Detector Location: ✓ *(Detector + All Surrounding Habitat)* Detector Orientation: ✓ *(Detector + Bat Feature Sampled)* Detection Cone: ✓ *(Air Space Sampled)*

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB10 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-26	**End Date:** 2019-07-31	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1900	**End Time:** 1820	**Easting:** 315502	**Northing:** 5221911

[4] Use 24 hour time format *[4] Use yyyy-mm-dd date format* *[4] Easting should be 6 digits* *[4] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 303530			
Detector Housing: None	**Mic Serial:** 102507	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 182		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-26	1900	6.4	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2019-07-29	1845	5.4	✓	✓			check				Record Status Data / Standby Error
2019-07-31	1820	5.1		✓			pickup				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 30
Forest Type: Deciduous	**% Open/Ag:** 65
Dominant Tree Species: Platanus occidentalis, Salix nigra	**% Water:** 5
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark, Fraxinus pennsylvanica (snag)	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Pasture with creek and trees in backyard. Detector set to MDT, datasheet in CDT.

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat) | Detector Orientation: ✓ (Detector + Bat Feature Sampled) | Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): RB10 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: J. Wilson, A. Green		**County:** Oliver
Start Date: 2019-07-26	**End Date:** 2019-07-31	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1955	**End Time:** 1855	**Easting:** 312366	**Northing:** 5223046

[4] Use 24 hour time format *[4] Use yyyy-mm-dd date format* *[4] Easting should be 6 digits* *[4] Northing should be 7 digits*

Detector Information	Microphone Information		Anabat Only
Detector Model: SM3	**Sound Reception:** None		**Audio Div** *(Should be 16)*
Detector Serial: 306252			
Detector Housing: None	**Mic Serial:** 106727	**Mic Height (m):** 3	**Data Div** *(Should be 16)*
	Mic Horizontal Orientation (0-360°): 275		
Battery Source: Internal	**Mic Vertical Orientation (°):** 90		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2019-07-26	1955	6.4	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2019-07-28	1933	5.5	✓	✓			check				Record Status Data / Standby Error
2019-07-31	1855	5.2		✓			picked up				Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 45
Forest Type: Deciduous	**% Open/Ag:** 55
Dominant Tree Species: Acer negundo	**% Water:** 0
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present:	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

In forest edge adjacent to planted baby tree rows. Detector set to MDT, datasheet in CDT

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] *Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)*
[2] *Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).*
[3] *Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).*

Appendix D. Site-Specific Authorization and Resume of Acoustic Analyst

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Dakota Ecological Services

420 South Garfield Avenue, Suite 400
Pierre, South Dakota 57501-5408

IN REPLY REFER TO:
WEST Site Specific
Authorization # 2
NLEB Permit

July 11, 2019

Mr. Kevin Lager Murray
Research Biologist
Western Ecosystems Technology, Inc.
408 West Sixth Street
Bloomington, Indiana 47404

Dear Mr. Murray:

This letter provides your site specific authorization per condition I.1 of the following Federal Endangered Species Permits:

TE26854C-0 Brenna Hyzy
TE81968B-0 Curtis Hart
TE75774C-0 Wesley Conway
TE21829B-2 Larisa Bishop-Boros
TE03495B-2 Kristina Hammond
TE99051B-1 Goniela Iskali
TE19208C-0 Ashley Matteson
TE13580D Julia Wilson
TE234121-9 Wester Ecosystems Technology (includes Kevin Murray, T. Travis Brown, Tim Sichmeller, Donald Solick, Jason Ritzert)

Under this condition you are to notify the U.S. Fish and Wildlife Service (Service) Field Supervisor for the state in which activities are proposed to occur at least 30 days prior to conducting any activities.

The information required under condition I and H6 was provided to the Service in an email dated July 8, 2019. In summary, bats, including northern long-eared bats (NLEB), will be captured in mist nests and harp traps at the Red Butte Wind Project in Oliver County, North Dakota. The objective of the survey is to determine presence/probable absence of the NLEB. Captured bats will be placed in clean cloth bags and assessed for morphometric data (mass, length of forearm, and other metrics need for identification if necessary). Once processed, bats will be released at the site of capture. As a reminder, bats cannot be held for more than 30 minutes.

A North Dakota Scientific Collectors permit from the North Dakota Game and Fish Department is also required for this type of work.

All activities will take place as part of a presence/absence survey for the Red Butte Wind Project. All survey activities should conform to the conditions of your Service permit.

Please report your data from this survey to the USFWS South Dakota Field Office utilizing the 2016 Bat Reporting spreadsheets for Region 6, to fulfill condition L of your permit. The spreadsheet and instructions can be found on the Service's website http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html.

As stated in your permit, your concurrence letter must be carried with this permit to authorize site-specific activities. If you have any questions, please feel free to call Charlene Bessken at 605-224-8693 x 231.

Sincerely,

Scott V. Larson
Field Supervisor
South Dakota Field Office

Cc: Kathy Konishi, USFWS, Denver
Jerry Reinisch, USFWS, North Dakota Field Office

Kevin Murray, Ph.D., *Consulting Ecologist*

PROFESSIONAL EXPERIENCE

2010-Present	*Consulting Ecologist and Project Manager,* WEST, Inc., Bloomington, Indiana
2009	*Lead Biological Science Technician,* National Park Service, Ozark Scenic Riverways
2006-2008	*Research Assistant*, University of Miami, Coral Gables, FL
2002-2006	*Doctoral Fellow,* University of Miami, Coral Gables, FL
2001-2002	*Lead Biological Science Technician,* Missouri State University, Springfield, Missouri
2000	*Biological Science Technician,* Oregon State University, Corvallis, Oregon
1998-2000	*Biological Science Technician,* Missouri State University, Springfield, Missouri

EDUCATION

Ph.D.
University of Miami
Coral Gables, Florida
2008
Biology

M.S.
Missouri State University
Springfield, Missouri
2001
Biology

B.S.
Missouri State University
Springfield, Missouri
1998
Biology

SCIENTIFIC ORGANIZATION MEMBERSHIPS

American Society of Mammalogists

North American Society for Bat Research

Midwest Bat Working Group

SPECIALTY AREAS

Dr. Murray has extensive research experience in bat ecology. He has experience in capture and identification of over fifteen species of bats in North America, including work with endangered species (*Myotis sodalis*, *Myotis grisescens*, *Myotis septentrionalis* [proposed]). He has managed projects and conducted bat surveys all over the eastern U.S. including numerous Missouri projects.

Dr. Murray has 18 years of experience in acoustic identification of bat echolocation calls in North America, Central America, and the Caribbean, including extensive experience with *M. septentrionalis*, *M. sodalis* and *M. grisescens*.

Dr. Murray has conducted 5 acoustic ID workshops (1998 to present) training individuals from federal and state agencies, universities, and consulting companies.

Dr. Murray has 19 publications, including 17 on bat research and 10 on bat echolocation, and numerous presentations on bat research at scientific conferences.

SELECTED PROFESSIONAL PUBLICATIONS

Clement, M.J., **K.L. Murray**, D.I. Solick, and J.C. Gruver. 2014. The effect of call libraries and acoustic filters on the identification of bat echolocation. Ecology and Evolution 4:3482-3493.

Britzke, E.R., E.H. Gillam and **K.L. Murray**. 2013. Current state of understanding of ultrasonic detectors for the study of bat ecology. Acta Theriologica 58:109-117.

Britzke, E.R., J.E. Duchamp, **K.L. Murray**, R.K. Swihart, and L.W. Robbins. 2011. Acoustic identification of bats in the eastern United States: a comparison of parametric and nonparametric methods. Journal of Wildlife Management 75:660-667.

Murray, K.L., E. Fraser, C. Davy, T.H. Fleming, and M.B. Fenton. 2009. Characterization of the echolocation calls of bats from Exuma, Bahamas. Acta Chiropterologica 11:415-424.

Robbins, L.W., **K.L. Murray**, and P. McKenzie. 2008. Evaluating the effectiveness of the standard mist netting protocol for the endangered Indiana bat (*Myotis sodalis*). Northeastern Naturalist.

Britzke, E.R., K.L. Murray, J.S. Heywood and L. W. Robbins. 2002. Acoustic identification. Pg. 221-225 *in* The Indiana Bat: Biology and Management of an Endangered Species (A. Kurta and J. Kennedy eds.). Bat Conservation International. Austin, TX.

Murray, K.L., E.R. Britzke, and L.W. Robbins. 2001. Variation in search-phase calls of bats. Journal of Mammalogy 82:728-737.

Murray, K.L., E.R. Britzke, B.M. Hadley, and L.W. Robbins. 1999. Surveying bat communities: a comparison between mist nets and the Anabat II bat detector system. Acta Chiropterologica 1:105-112.

HONORS AND AWARDS

National Science Foundation Education Fellowship, University of Miami, 2008

National Geographic Society Committee for Research and Exploration Grant (Biology), 2006

University Doctoral Fellowship, University of Miami, 2002-2005

Distinguished Thesis Award, Midwestern Association of Graduate Schools, 2002

Basil and Joann Boritzki Award for Outstanding Graduate Work, Missouri State University, 2000.

Appendix E. Kaleidoscope (version 4.2.0) Output

Appendix E1. Kaleidoscope (version 4.2.0) analysis output (26 July – 1 August).

		Number of Files							P-Values					
Site	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**	**NOID**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**
4a	20190727	7	11	23	79	7		35	1.000	0.000	0.000	0.000	0.011	1.000
4a	20190728	100	11	18	125	12		89	0.000	0.000	0.104	0.000	0.000	1.000
4a	20190729	13	5	21	25	7	1	21	0.005	0.000	0.000	0.000	0.000	0.175
4a	20190730	46	7	11	94	5		51	0.000	0.000	0.334	0.000	0.030	1.000
4a	20190731	66	14	14	99	14		30	0.000	0.000	0.137	0.000	0.000	1.000
4a	**4a**	**232**	**48**	**87**	**422**	**45**	**1**	**226**						
4b	20190727	3	7	25	17	5	4	24	1.000	0.000	0.000	0.004	0.031	0.000
4b	20190728	25	15	33	23	30	14	50	0.000	0.000	0.000	0.007	0.000	0.000
4b	20190729	12	13	38	20	4	2	28	0.019	0.000	0.000	0.030	0.374	0.002
4b	20190730	4	8	24	28	9	1	15	1.000	0.000	0.000	0.000	0.000	0.215
4b	20190731	13	6	32	32	5		43	0.043	0.000	0.000	0.000	0.019	1.000
4b	**4b**	**57**	**49**	**152**	**120**	**53**	**21**	**160**						
5a	20190726	23	115	7	24	26		21	0.000	0.000	0.037	0.000	0.053	1.000
5a	20190727	31	41	21	60	29	1	36	0.000	0.000	0.000	0.000	0.000	0.516
5a	20190728	46	50	25	23	66	3	53	0.000	0.000	0.000	0.008	0.000	0.094
5a	20190729	18	33	2	11	13		33	0.000	0.000	0.821	0.002	0.008	1.000
5a	20190730	21	27	13	102	20		31	0.176	0.000	0.075	0.000	0.000	1.000
5a	**5a**	**139**	**266**	**68**	**220**	**154**	**4**	**174**						
5b	20190726	24	15	39	59	23	5	29	0.001	0.000	0.000	0.000	0.000	0.000
5b	20190727	18	9	61	340	18		66	1.000	0.000	0.000	0.000	0.000	1.000
5b	20190728	8	12	36	141	17	2	40	1.000	0.000	0.000	0.000	0.000	0.045
5b	20190729	35	5	28	62	23		54	0.000	0.012	0.000	0.000	0.000	1.000
5b	20190730	21	12	34	232	20	1	41	1.000	0.000	0.000	0.000	0.000	0.440
5b	**5b**	**106**	**53**	**198**	**834**	**101**	**8**	**230**						
6a	20190727	2	7	1		4		3	0.031	0.000	0.267	1.000	0.099	1.000
6a	20190728	12	7	8	1	9	3	9	0.000	0.000	0.000	1.000	0.000	0.001
6a	20190729		2	1	1	5	2	3	1.000	0.069	0.197	0.622	0.001	0.006
6a	20190730	2	3	3	1	6	1	13	0.158	0.011	0.004	0.991	0.000	0.158
6a	20190731	2	5		1	3		3	0.072	0.000	1.000	0.594	0.162	1.000
6a	**6a**	**18**	**24**	**13**	**4**	**27**	**6**	**31**						
6b	20190727	1	13	1		157	2	24	0.284	0.044	0.149	1.000	0.000	0.950
6b	20190728	12	6	37	12	16		28	0.003	0.000	0.000	0.746	0.000	1.000
6b	20190729	4	12	10		33		17	0.047	0.000	0.000	1.000	0.000	1.000
6b	20190730	6	6	6	3	41		30	0.002	0.027	0.000	0.826	0.000	1.000
6b	20190731	4	9	13	3	28		19	0.122	0.000	0.000	1.000	0.000	1.000
6b	20190801	16	14	5	5	38		23	0.000	0.000	0.012	0.591	0.000	1.000
6b	**6b**	**43**	**60**	**72**	**23**	**313**	**2**	**141**						
7a	20190727	1	5	5	4	8	3	9	0.966	0.000	0.000	0.214	0.000	0.000
7a	20190728	15	5	12	7	13		14	0.000	0.001	0.000	0.552	0.000	1.000
7a	20190729	16	16	5	1	18		16	0.000	0.000	0.007	1.000	0.000	1.000
7a	20190730	4	28		3	43		19	0.013	0.000	1.000	0.102	0.000	1.000
7a	20190731	13	27	5	10	39	1	30	0.000	0.000	0.021	0.006	0.000	0.685
7a	**7a**	**49**	**81**	**27**	**25**	**121**	**4**	**88**						

Appendix E1. Kaleidoscope (version 4.2.0) analysis output (26 July – 1 August).

		Number of Files							P-Values					
Site	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**	**NOID**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**
7b	20190727	1	4			9		13	0.126	0.003	1.000	1.000	0.000	1.000
7b	20190728	9	3	3	2	23		16	0.000	0.209	0.048	0.974	0.000	1.000
7b	20190729	16	1	6	1	27		11	0.000	1.000	0.001	1.000	0.000	1.000
7b	20190730	4	9			1		9	0.000	0.000	1.000	1.000	1.000	1.000
7b	20190731	18	6	14	3	8		20	0.000	0.000	0.000	1.000	0.000	1.000
7b	20190801	24	7			17	1	3	0.000	0.000	1.000	1.000	0.000	0.386
7b	**7b**	**72**	**30**	**23**	**6**	**85**	**1**	**72**						
8a	20190726		43	11	5	14		14	1.000	0.000	0.000	0.521	0.022	1.000
8a	20190727	98	11		1	177	1	13	0.000	0.292	1.000	1.000	0.000	1.000
8a	20190728	5	14		2	14		6	0.001	0.000	1.000	0.453	0.000	1.000
8a	20190729	4	20	2	2	23		12	0.009	0.000	0.112	0.656	0.000	1.000
8a	20190730	35	18		1	11		7	0.000	0.000	1.000	1.000	0.001	1.000
8a	**8a**	**142**	**106**	**13**	**11**	**239**	**1**	**52**						
8b	20190726	7	3	6	5	14		5	0.001	0.073	0.000	0.311	0.000	1.000
8b	20190727		5	1	1	72		10	1.000	0.446	0.197	0.622	0.000	1.000
8b	20190728	1	1	6	4	12		4	0.980	0.778	0.000	0.295	0.000	1.000
8b	20190729		2	4		5		0	1.000	0.068	0.000	1.000	0.001	1.000
8b	20190730		2			23		1	1.000	0.578	1.000	1.000	0.000	1.000
8b	**8b**	**8**	**13**	**17**	**10**	**126**		**20**						
9a	20190727		4			1		1	1.000	0.000	1.000	1.000	0.859	1.000
9a	20190728	1	9		1			3	0.390	0.000	1.000	0.396	1.000	1.000
9a	20190729		38	1		4		7	1.000	0.000	0.064	1.000	1.000	1.000
9a	20190730		4			3		2	1.000	0.000	1.000	1.000	0.110	1.000
9a	20190731					4		2	1.000	1.000	1.000	1.000	0.000	1.000
9a	20190801	5	5		1	6		3	0.000	0.000	1.000	0.922	0.002	1.000
9a	**9a**	**6**	**60**	**1**	**2**	**18**		**18**						
9b	20190727		1			3		1	1.000	0.300	1.000	1.000	0.013	1.000
9b	20190728		1			3		1	1.000	0.300	1.000	1.000	0.013	1.000
9b	20190729	2	44		1	7		9	0.072	0.000	1.000	0.594	0.883	1.000
9b	20190730		6			5		3	1.000	0.000	1.000	1.000	0.019	1.000
9b	20190731		3			3		3	1.000	0.003	1.000	1.000	0.067	1.000
9b	20190801	2	1			6		3	0.015	0.501	1.000	1.000	0.000	1.000
9b	**9b**	**4**	**56**		**1**	**27**		**20**						
10a	20190726		34	76	3	25		20	1.000	0.000	0.000	1.000	0.000	1.000
10a	20190727	1	2	1	3	24		3	0.785	0.605	0.474	0.066	0.000	1.000
10a	20190728	6	26	30	4	606	1	60	0.200	0.739	0.000	1.000	0.000	1.000
10a	20190729	2	12	14	1	78	1	17	0.742	0.001	0.000	1.000	0.000	0.971
10a	20190730	5	14	2	1	27		15	0.000	0.000	0.097	1.000	0.000	1.000
10a	**10a**	**14**	**88**	**123**	**12**	**760**	**2**	**115**						
10b	20190726	4	8	18	1	5		13	0.214	0.000	0.000	1.000	0.043	1.000
10b	20190727	2	2	23	4			12	0.989	0.002	0.000	1.000	1.000	1.000
10b	20190728		6	10		3		7	1.000	0.000	0.000	1.000	0.222	1.000
10b	20190729	4	3	22	2	3		5	0.343	0.003	0.000	1.000	0.067	1.000
10b	20190730		11	6		6		10	1.000	0.000	0.000	1.000	0.037	1.000

Appendix E1. Kaleidoscope (version 4.2.0) analysis output (26 July – 1 August).

	Number of Files								P-Values					
Site	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**	**NOID**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**
10b	**10b**	**10**	**30**	**79**	**7**	**17**		**47**						

Appendix E1. Kaleidoscope (version 4.2.0) analysis output for redeployed detectors (13 – 16 August).

	Number of Files								P-Values					
Site	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**	**NOID**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYLU**	**MYSE**
6b	20190813		23	4	1	23	1	14	1.000	0.000	0.000	0.999	0.000	0.459
6b	20190814	1	8			18		10	0.129	0.000	1.000	1.000	0.000	1.000
6b	20190815	11	35	7		113	1	41	0.000	0.000	0.000	1.000	0.000	1.000
6b	20190816	2	31	6	5	60	2	27	0.670	0.000	0.000	0.149	0.000	0.341
6b	**6b**	**14**	**97**	**17**	**6**	**214**	**4**	**92**						
7b	20190813	4	23	4	4	61		10	0.050	0.000	0.005	0.251	0.000	1.000
7b	20190814	3	3		4	95		11	0.107	1.000	1.000	0.013	0.000	1.000
7b	20190815		6	1	1	24	1	9	1.000	0.003	0.197	0.622	0.000	0.513
7b	20190816	1	10	8	8	10		12	1.000	0.000	0.000	0.017	0.000	1.000
7b	**7b**	**8**	**42**	**13**	**17**	**190**	**1**	**42**						

Appendix F. Qualitative Analysis Summary

Appendix F1. Summary of qualitative acoustic analysis of call identified as Indiana bats (MYSO) and northern long-eared bats (MYSE) by Kaleidoscope Pro (version 4.2.0) at Red Butte Wind Project in Oliver County, North Dakota.

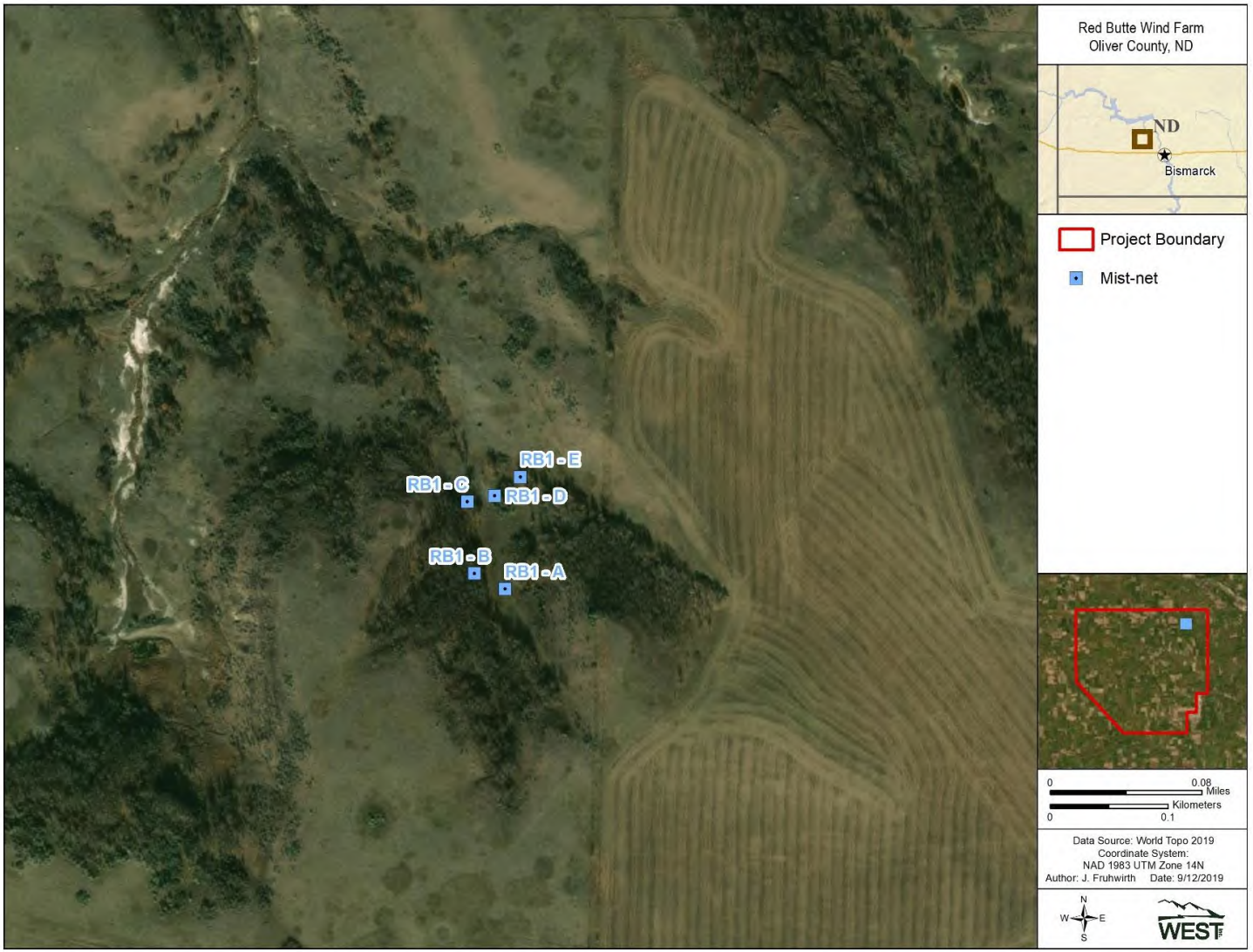
Station	Night	Filename	Kaleidoscope ID	Qualitative ID	Justification
4a	7/29/2019	T7292237.48#	MYOSEP	HF	LABO or MYLU; slope, bandwidth and Fmax all too low for MYSE
4b	7/27/2019	T7272242.39#	MYOSEP	MYSP	approach-phase calls; slope low for MYSE
4b	7/27/2019	T7272323.49#	MYOSEP	MYSE	some approach-phase calls
4b	7/27/2019	T7280119.45#	NoID	MYSP	approach-phase calls; slope low for MYSE
4b	7/27/2019	T7280307.03#	MYOSEP	LF	big brown or silver-haired bat harmonics misidentified as MYSE calls
4b	7/27/2019	T7280352.14#	NoID	MYSE	none
4b	7/27/2019	T7280402.41#	MYOSEP	MYSP	Myotis species approach-phase calls
4b	7/28/2019	T7282305.54#	MYOSEP	MYSE	none
4b	7/28/2019	T7290002.25#	MYOSEP	MYLU	MYLU approach-phase calls; low slope; curvilinear
4b	7/28/2019	T7290025.04#	MYOSEP	MYSP	unknown Myotis species; slope low for MYSE
4b	7/28/2019	T7290122.25#	NoID	MYSP	unknown Myotis species; slope low for MYSE
4b	7/28/2019	T7290131.09#	MYOSEP	HF	call fragments; cannot ID to species; bandwidth, Fmax, slope all too low for MYSE
4b	7/28/2019	T7290131.25#	MYOSEP	HF	call fragments; cannot ID to species; bandwidth, Fmax, slope all too low for MYSE
4b	7/28/2019	T7290132.29#	MYOSEP	HF	3 pulses; cannot ID to species
4b	7/28/2019	T7290142.50#	MYOSEP	MYLU	MYLU approach-phase calls; low slope; curvilinear
4b	7/28/2019	T7290149.56#	MYOSEP	MYLU	FM MYLU calls
4b	7/28/2019	T7290203.06#	MYOSEP	MYLU	FM MYLU calls
4b	7/28/2019	T7290216.38#	MYOSEP	HF	call fragments; cannot ID to species; bandwidth, Fmax, slope all too low for MYSE
4b	7/28/2019	T7290239.50#	MYOSEP	HF	3 pulses; cannot ID to species
4b	7/28/2019	T7290245.13#	MYOSEP	MYSP	low bandwidth and Fmax
4b	7/28/2019	T7290309.06#	NoID	MYSE	two bats (+ LACI)
4b	7/28/2019	T7290404.46#	MYOSEP	MYSE	none
4b	7/28/2019	T7290506.25#	MYOSEP	MYLU	low slope, slightly curvilinear
4b	7/29/2019	T7292357.48#	MYOSEP	HF	call fragments; cannot ID to species; bandwidth, Fmax, slope all too low for MYSE
4b	7/29/2019	T7300029.14#	MYOSEP	MYSP	unknown Myotis species; slope low for MYSE
4b	7/30/2019	T7310539.36#	MYOSEP	MYSE	none
5a	7/27/2019	T7280245.17#	MYOSEP	HF	only 2 pulses; cannot ID to species; bandwidth and Fmax too low for MYSE
5a	7/28/2019	T7282300.11#	MYOSEP	MYSP	slope too low
5a	7/28/2019	T7290230.01#	MYOSEP	MYSP	low bandwidth and Fmax

5a	7/28/2019	T7290230.25#	MYOSEP	MYSP	low slope, bandwidth, Fmax
5b	7/26/2019	T7262145.21#	MYOSEP	MYLU	low slope, bandwidth, Fmax
5b	7/26/2019	T7262319.15#	MYOSEP	MYLU	little brown approach-phase calls; low slope and Fmax
5b	7/26/2019	T7270153.11#	MYOSEP	MYSP	low slope; approach-phase calls
5b	7/26/2019	T7270155.48#	MYOSEP	HF	fragmentary calls; cannot ID to species; Fmax, Fmin and slope too low for MYSE
5b	7/26/2019	T7270156.18#	MYOSEP	MYLU	little brown approach-phase calls; low slope and Fmax
5b	7/28/2019	T7282205.04#	MYOSEP	HF	low slope, bandwidth, Fmax and Fmin to low for MYSE; EPFU or MYLU
5b	7/28/2019	T7290134.13#	MYOSEP	MYSE	none
5b	7/30/2019	T7302140.00#	MYOSEP	MYSP	approach-phase calls; unknown Myotis species
6a	7/28/2019	T7282239.12#	MYOSEP	HF	fragmentary and poor-quality calls; slope, bandwidth, Fmin and Fmax too low
6a	7/28/2019	T7282317.29#	MYOSEP	MYSP	unknown Myotis species; slope low for MYSE
6a	7/28/2019	T7290547.43#	MYOSEP	MYSP	unknown Myotis species; slope low for MYSE
6a	7/29/2019	T7292243.13#	MYOSEP	EPFU	low slope and Fmin
6a	7/29/2019	T7292246.16#	MYOSEP	EPFU	low slope and Fmin
6a	7/30/2019	T7302326.53#	MYOSEP	HF	fragmentary calls; cannot ID to species; slope, bandwidth, Fmin and Fmax all too low for MYSE
6b	7/27/2019	T7280047.31#	MYOSEP	MYSP	lots of MYLU foraging calls at the site; slope and Fmin too low for MYSE
6b	7/27/2019	T7280101.10#	MYOSEP	MYSP	lots of MYLU foraging calls at the site; bandwidth and Fmax too low for MYSE
6b (redeploy)	8/13/2019	T8132341.57#	MYOSEP	MYLU	MYLU approach-phase calls; low slope; curvilinear
6b (redeploy)	8/15/2019	T8160117.52#	MYOSEP	MYLU	low slope, bandwidth, and Fmax
6b (redeploy)	8/16/2019	T8170204.22#	MYOSEP	MYLU	MYLU approach-phase calls; low slope; curvilinear
6b (redeploy)	8/16/2019	T8170234.29#	MYOSEP	HF	fragmentary calls; cannot ID to species; bandwidth, Fmax, and slope too low for MYSE
7a	7/27/2019	T7272321.05#	MYOSEP	HF	low slope, bandwidth, Fmax
7a	7/27/2019	T7280458.00#	MYOSEP	HF	approach-phase calls; low slope; MYLU with low Fmin or EPFU with high Fmin
7a	7/27/2019	T7280458.54#	MYOSEP	HF	fragmentary and poor-quality calls; low slope; MYLU with low Fmin or EPFU with high Fmin
7a (redeploy)	7/31/2019	T7312324.34#	MYOSEP	MYSP	unknown Myotis species; slope low for MYSE
7b	8/1/2019	T8020419.49#	MYOSEP	HF	low slope, bandwidth and Fmax
7b (redeploy)	8/15/2019	T8160156.34#	MYOSEP	MYLU	MYLU approach-phase calls; low slope; curvilinear
8a	7/27/2019	T7272229.19#	MYOSEP	HF	Fmin too low; approach-phase calls
10a	7/28/2019	T7290414.26#	MYOSEP	HF	fragmentary calls; cannot ID to species; bandwidth, Fmax, and slope too low for MYSE
10a	7/29/2019	T7292258.21#	MYOSEP	HF	fragmentary calls; cannot ID to species; bandwidth, Fmax, and slope too low for MYSE

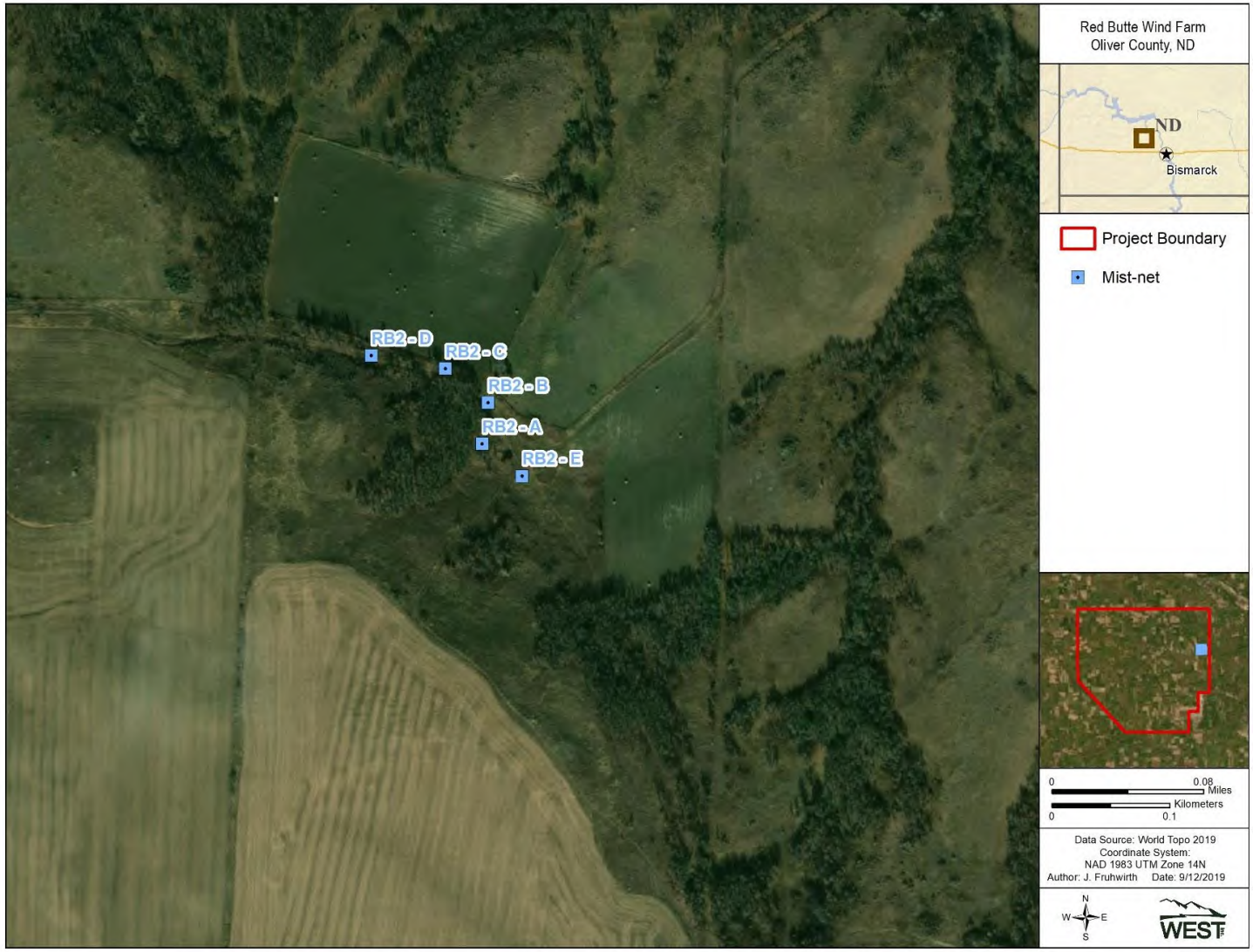
LABO = eastern red bat (*Lasiurus borealis*); MYLU = little brown bat (*Myotis lucifugus*); MYSE = northern long-eared bat (*Myotis septentrionalis*); MYSO = Indiana bat (*Myotis sodalis*); HF Unknown = high frequency unknown; Myotis Sp. = unknown Myotis species; No ID = no identification

Fmin = minimum call frequency; Fmax = maximum call frequency; slope = minimum call slope; bandwidth = call frequency range

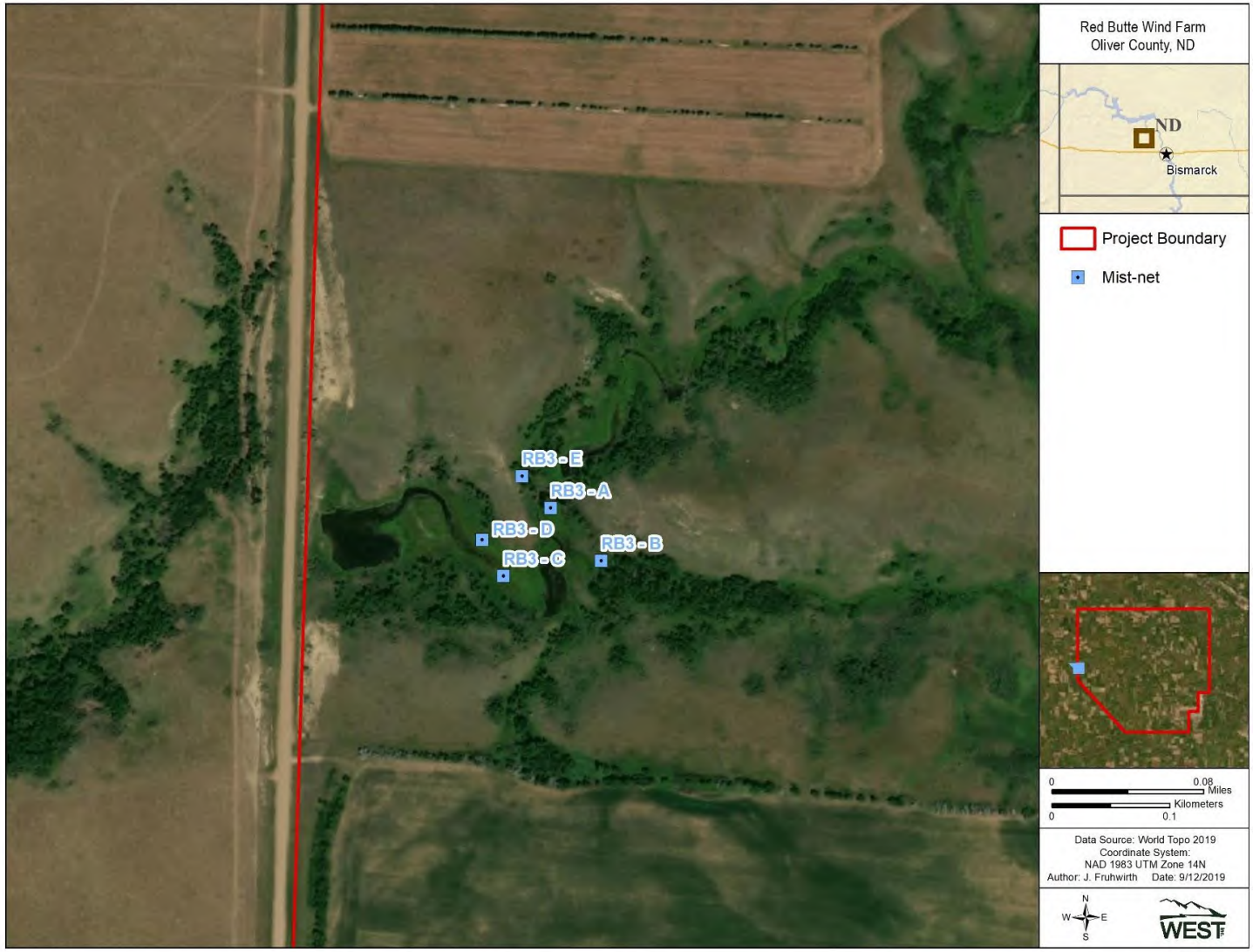
Appendix G. Maps of Mist-Net Survey Sites



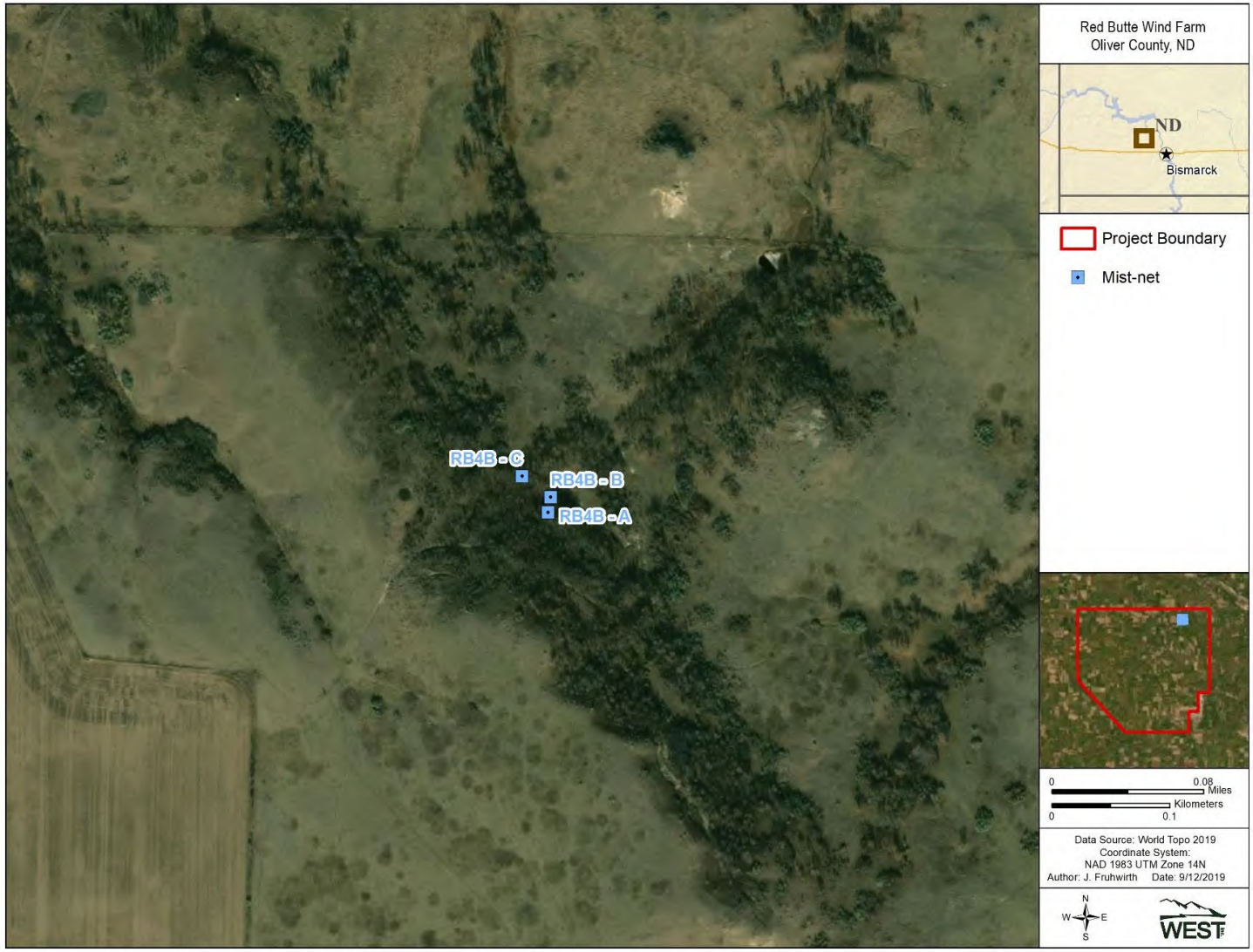
Appendix G1. Map of mist-net site RB-1 at the Red Butte Wind Project.



Appendix G2. Map of mist-net site RB-2 at the Red Butte Wind Project.



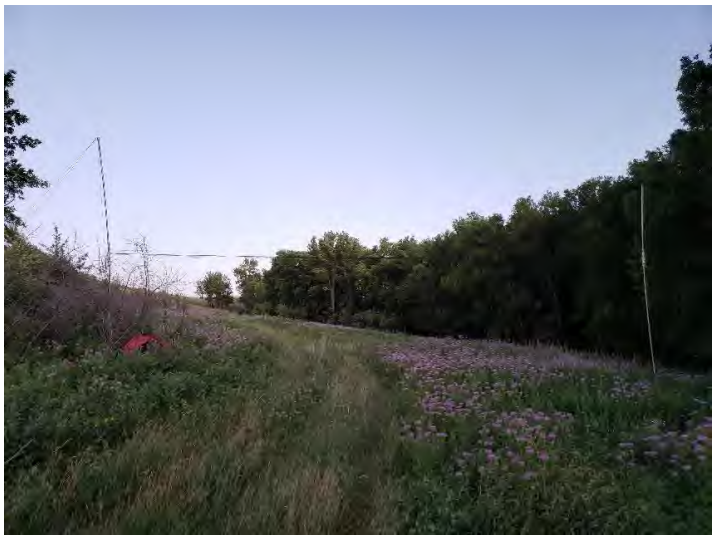
Appendix G3. Map of mist-net site RB-3 at the Red Butte Wind Project.

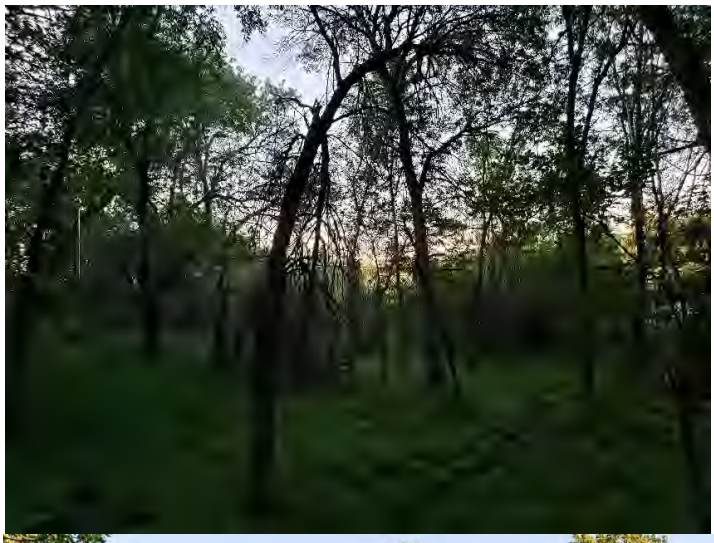


Appendix G4. Map of follow-up mist-net site RB-4b at the Red Butte Wind Project.

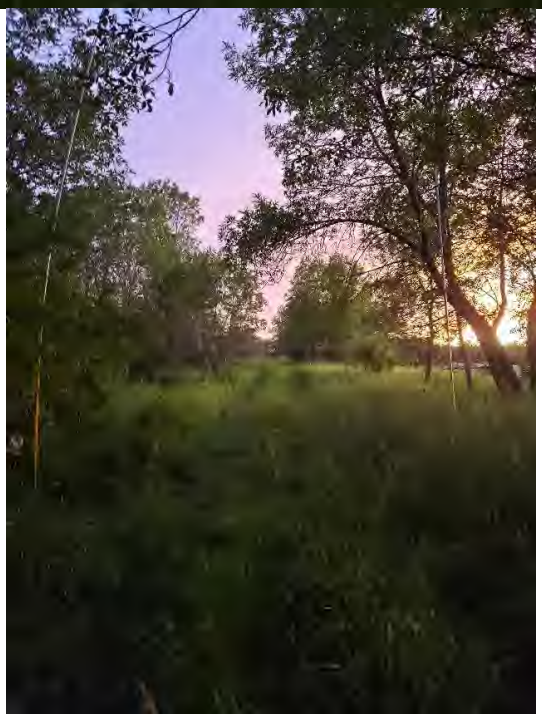
Appendix G5. Map of follow-up mist-net site RB-5b at the Red Butte Wind Project.

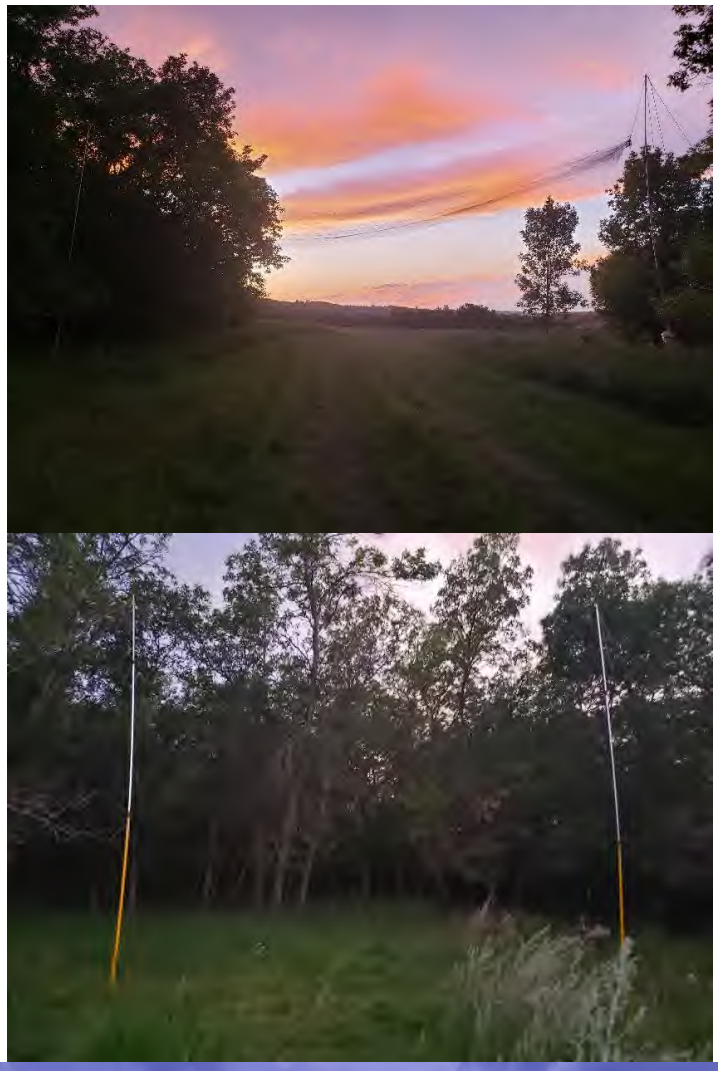
Appendix H. Photographs of Mist-Net Survey Sites





Appendix H1. Mist-net site 1, nets A – E (top to bottom).





Appendix H2. Mist-net site 2, nets A – E (top to bottom).

Appendix H3. Mist-net site 3, nets A – E (top to bottom).

Appendix H4. Mist-net site 4b, nets A – E (top to bottom).

Appendix H5. Mist-net site 5b, nets A – E (top to bottom).

Appendix I. Details of All Bat Captures

Appendix I1. Details of bats captured at Site RB1 (July 28 – 30) at the Red Butte Wind Project.

Site	Survey Night	Time	Species[1]	Sex[2]	Age[3]	Reproductive Status[4]	Reichard Score	Forearm Length (mm)	Weight (g)
1	7/29/2019	22:15	LANO	F	J	N	0	41.3	11
1	7/29/2019	22:18	LANO	F	J	N	0	41.3	11
1	7/29/2019	0:35	LACI	M	J	N	0	50.5	20
1	7/29/2019	0:40	LANO	F	A	N	0	41.2	13.25
1	7/30/2019	23:25	LANO	M	J	N	0	41	10.3
1	7/30/2019	23:25	LANO	M	J	N	0	42.3	12.3
1	7/30/2019	0:15	LANO	M	J	N	0	41.9	11.8
1	7/30/2019	0:40	LANO	F	J	N	0	41	12.5
1	7/30/2019	1:00	LANO	F	J	N	0	41.7	12.8
1	7/30/2019	1:00	LANO	M	J	N	0	42.8	12.3
1	7/30/2019	1:30	LANO	F	J	N	0	42.3	11.5
1	7/30/2019	1:30	LANO	M	J	N	0	40.9	11.5
1	7/30/2019	2:45	LACI	M	J	N	0	52.3	20
1	7/30/2019	3:00	LANO	F	J	N	0	41.9	12.5
1	7/30/2019	3:00	LACI	F	J	N	0	23	19.8

[1]LANO = silver-haired bat (*Lasionycteris noctivagans*); LACI = hoary bat (*Lasiurus cinereus*)
[2]F = female; M = male.
[3]J = juvenile; A = adult.
[4]N = non-reproductive.

Appendix I2. Details of bats captured at Site RB2 (July 31 – August 1) at the Red Butte Wind Project.

Site	Survey Night	Time	Species[1]	Sex[2]	Age[3]	Reproductive Status[4]	Reichard Score	Forearm Length (mm)	Weight (g)
2	7/31/2019	0:30	LANO	F	J	N	0	43.3	11.5
2	8/1/2019	0:54	LANO	M	J	N	0	40.1	12.2
2	8/1/2019	1:00	LABO	U	U	U	U	U	U

[1]LANO = silver-haired bat (*Lasionycteris noctivagans*); LABO = red bat (*Lasiurus borealis*).
[2]F = female; M = male; U = unknown (bat escaped net).
[3]J = juvenile; U = unknown (bat escaped net).
[4]N = non-reproductive; U = unknown (bat escaped net).

Appendix I3. Details of bats captured at Site RB3 (August 2 – 3) at the Red Butte Wind Project.

Site	Survey Night	Time	Species[1]	Sex[2]	Age[3]	Reproductive Status[4]	Reichard Score	Forearm Length (mm)	Weight (g)
3	8/2/2019	23:40	LABO	F	J	N	0	39.3	10.8
3	8/2/2019	2:00	LABO	F	J	N	0	41.3	12.1

[1]LABO = red bat (*Lasiurus borealis*).
[2]F = female.
[3]J = juvenile.
[4]N = non-reproductive.

Appendix I4. Details of bats captured at follow-up mist-net Site 4b (August 14 – 15) at the Red Butte Wind Project.

Site	Survey Night	Time	Species[1]	Sex[2]	Age[3]	Reproductive Status[4]	Reichard Score	Forearm Length (mm)	Weight (g)
4b	8/14/2019	21:44	MYSE	M	A	N	0	35.5	6
4b	8/15/2019	0:21	LANO	M	J	N	0	39.4	10
4b	8/15/2019	1:20	MYSE	M	J	N	0	34.8	6.25
4b	8/15/2019	1:56	LABO	F	J	N	0	38.8	14

[1]MYSE = northern long-eared bat (*Myotis septentrionalis*); LANO = silver-haired bat (*Lasionycteris noctivagans*); LABO (*Lasiurus borealis*) = red bat.
[2]M = male; F= female.
[3]A = adult; J = juvenile.
[4]N = non-reproductive.

Appendix I5. Details of bats captured at follow-up mist-net Site 5b (August 13 – 14) at the Red Butte Wind Project

Site	Survey Night	Time	Species[1]	Sex[2]	Age[3]	Reproductive Status[4]	Reichard Score	Forearm Length (mm)	Weight (g)
5b	8/13/2019	22:30	MYSE	M	J	N	0	36.2	6.5
5b	8/13/2019	22:30	MYSE	M	A	N	0	37	6.75
5b	8/13/2019	23:20	MYLU	F	A	PL	0	39.2	11.5
5b	8/14/2019	2:27	MYLU	M	A	N	0	39.2	11.25

[1]MYSE = northern long-eared bat (*Myotis septentrionalis*); MYLU = little brown bat (*Myotis lucifugus*).
[2]M = male; F= female.
[3]A = adult; J = juvenile.
[4]N = non-reproductive; PL = post-lactating.

Appendix J. Representative Photographs of Bat Species Captured during Mist-Net Surveys

Appendix J1. Representative photos of bat species captured at the Red Butte Wind Project. From top: LANO, LABO, LACI, MYLU, and MYSE.

Appendix K. Mist-Net Site Description Datasheets

Site Description and Weather Data Form

Location Information

Site ID:	Project:	State:
RB1	Red Butte	North Dakota
	Datum: NAD 83	County: Oliver

Net Locations – Take pictures of each net set and distinguishing characteristics

Net ID (A,B,...)	Net Size (e.g. 3x9)	UTM Zone	Easting	Northing	Net Nights Used (1,2,...)	Canopy Cover (%)
A	3 x 18	14	320949	5232216	1, 2	0
B	2 x 12	14	320923	5232229	1, 2	90
C	3 x 4	14	320917	5232290	2	25
D	2 x 9	14	320940	5232295	1, 2	10
E	3 x 6	14	320962	5232311	1, 2	0

Site Sketch

Should be drawn in a top-down view using map to assist with accuracy. Include all streams, roads, trails, and structures. Note all net locations using Net ID.

Net Night	Date (yyyy-mm-dd)	Biologists Present	Total Nets Open (#)	Sunset Time (24 Hour)	Moonrise Time	Moonset Time	[1] Moon Phase	Start Time	Start Temp (°F)	Start Wind Speed (mph)	Start Sky Code	Stop Time	Stop Temp	Stop Wind Speed	Stop Sky Code	Precip. During Survey (Yes/No)	Precip. Duration (min)	Night Complete (Yes/No)
1	2019-07-28	Brenna Hyzy, Pallavi Sirajuddin	5	2127	0309	0502	C	2125	70	16	0	2200	70	16	0	No	0	No
2	2019-07-29	Brenna Hyzy, Pallavi Sirajuddin	4	2128	0401	0604	N	2130	61	3	0	0230	53	3	0	No	0	Yes
3	2019-07-30	Brenna Hyzy, Pallavi Sirajuddin	5	2124	0459	0705	N	2120	78	15	2	0220	63	7	2	No	0	Yes
4																		
5																		

Habitat Information

[2] Primary Habitat Surveyed:	Dominant Canopy Species:	Estimated Canopy Tree Age (DBH):	Additional Comments:
Upland Forest	Acer negundo	Late-successional (25-38 cm)	Winded out 7/28
Forest Type: Deciduous	**Preferred Roost Trees Present:**		

[1] *New (N), Crescent (C), Half (H), Gibbous (G), Full (F)* [2] *Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Briefly Describe)*

Site Description and Weather Data Form

Location Information

Site ID:	Project:	State:
RB2	Red Butte	North Dakota
	Datum: NAD 83	County: Oliver

Net Locations – Take pictures of each net set and distinguishing characteristics

Net ID (A,B,...)	Net Size (e.g. 3x9)	UTM Zone	Easting	Northing	Net Nights Used (1,2,...)	Canopy Cover (%)
A	3 x 6	14	323129	5227701	1, 2	15
B	3 x 12	14	323134	5227736	1, 2	0
C	3 x 4	14	323098	5227765	1, 2	20
D	3 x 9	14	323035	5227776	1, 2	15
E	3 x 18	14	323163	5227674	2	0

Site Sketch Should be drawn in a top-down view using map to assist with accuracy. Include all streams, roads, trails, and structures. Note all net locations using Net ID.

Net Night	Date (yyyy-mm-dd)	Biologists Present	Total Nets Open (#)	Sunset Time (24 Hour)	Moonrise Time	Moonset Time	[1] Moon Phase	Start Time	Start Temp (°F)	Start Wind Speed (mph)	Start Sky Code	Stop Time	Stop Temp	Stop Wind Speed	Stop Sky Code	Precip. During Survey (Yes/No)	Precip. Duration (min)	Night Complete (Yes/No)
1	2019-07-31	Brenna Hyzy, Pallavi Sirajuddin	4	2119	0603	0802	C	2119	79	0	1	0220	68	0	0	No	0	Yes
2	2019-08-01	Brenna Hyzy, Pallavi Sirajuddin	5	2119	0648	2001	C	2119	70	6	1	0220	63	4	0	No	0	Yes
3																		
4																		
5																		

Habitat Information

[2] Primary Habitat Surveyed:	Dominant Canopy Species:	Estimated Canopy Tree Age (DBH):	Additional Comments:
Upland Forest	Unknown	Mid-successional (13-24 cm)	
Forest Type: Deciduous	**Preferred Roost Trees Present:**		

[1] *New (N), Crescent (C), Half (H), Gibbous (G), Full (F)* [2] *Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Briefly Describe)*

Site Description and Weather Data Form

Location Information

Site ID:	Project:	State:
RB3	Red Butte	North Dakota
	Datum: NAD 83	County: Oliver

Net Locations – Take pictures of each net set and distinguishing characteristics

Net ID (A,B,...)	Net Size (e.g. 3x9)	UTM Zone	Easting	Northing	Net Nights Used (1,2,...)	Canopy Cover (%)
A	3 x 18	14	0301833	5225070	1, 2	0
B	3 x 4	14	0301876	5225025	1, 2	20
C	2 x 9	14	0301793	5225012	1, 2	0
D	2 x 12	14	0301775	5225043	1, 2	0
E	2 x 2.6	14	0301809	5225097	2	20

Site Sketch Should be drawn in a top-down view using map to assist with accuracy. Include all streams, roads, trails, and structures. Note all net locations using Net ID.

Net Night	Date (yyyy-mm-dd)	Biologists Present	Total Nets Open (#)	Sunset Time (24 Hour)	Moonrise Time	Moonset Time	[1] Moon Phase	Start Time	Start Temp (°F)	Start Wind Speed (mph)	Start Sky Code	Stop Time	Stop Temp	Stop Wind Speed	Stop Sky Code	Precip. During Survey (Yes/No)	Precip. Duration (min)	Night Complete (Yes/No)
1	2019-08-02	Brenna Hyzy, Pallavi Sirajuddin	4	2115	808	2237	C	2115	80	2	0	0215	75	0	0	No	0	Yes
2	2019-08-03	Brenna Hyzy, Pallavi Sirajuddin	5	2115	929	2307	C	2115	77	14	1	0215	69	8	0	No	0	Yes
3																		
4																		
5																		

Habitat Information

[2] Primary Habitat Surveyed:	Dominant Canopy Species:	Estimated Canopy Tree Age (DBH):	Additional Comments:
Bottomland Forest	Unknown	Mid-successional (13-24 cm)	
Forest Type: Deciduous	**Preferred Roost Trees Present:**		

[1] *New (N), Crescent (C), Half (H), Gibbous (G), Full (F)* [2] *Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Briefly Describe)*

Site Description and Weather Data Form

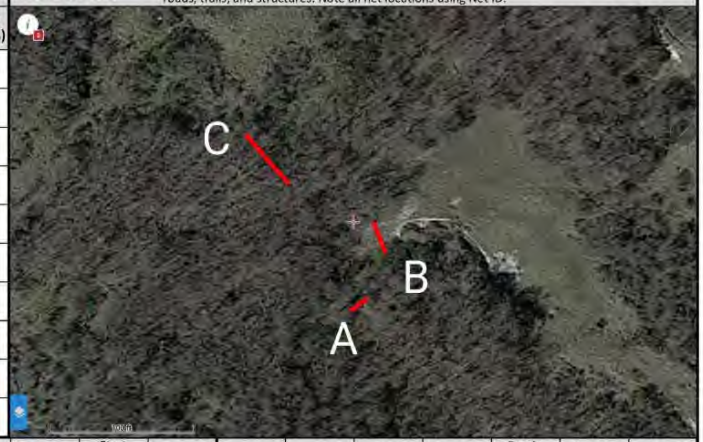
Location Information

Site ID:	Project:	State:
RB-4b	Red Butte	North Dakota
	Datum: NAD 83	County: Oliver

Net Locations – Take pictures of each net set and distinguishing characteristics

Net ID (A,B,...)	Net Size (e.g. 3x9)	UTM Zone	Easting	Northing	Net Nights Used (1,2,...)	Canopy Cover (%)
A	2 x 4	14	320093	5232912	1, 2	90
B	3 x 6	14	320095	5232925	1, 2	80
C	2 x 12	14	320071	5232943	1, 2	95

Site Sketch Should be drawn in a top-down view using map to assist with accuracy. Include all streams, roads, trails, and structures. Note all net locations using Net ID.



Net Night	Date (yyyy-mm-dd)	Biologists Present	Total Nets Open (#)	Sunset Time (24 Hour)	Moonrise Time	Moonset Time	[1] Moon Phase	Start Time	Start Temp (°F)	Start Wind Speed (mph)	Start Sky Code	Stop Time	Stop Temp	Stop Wind Speed	Stop Sky Code	Precip. During Survey (Yes/No)	Precip. Duration (min)	Night Complete (Yes/No)
1	2019-08-14	Julia Wilson, Kelly Lutsch	3	2057	2057	0553	F	2057	63.4	0.0	2	0230	59.2	0.9	1	Yes	55	Yes
2	2019-08-15	Julia Wilson, Kelly Lutsch	3	2056	2127	0633	F	2056	67.8	0.0	0	0156	54.0	0.0	0	No		Yes
3																		
4																		
5																		

Habitat Information

[2] Primary Habitat Surveyed:	Dominant Canopy Species:	Estimated Canopy Tree Age (DBH):	Additional Comments:
Upland Forest	Fraxinus pennsylvanica Ulmus americana	Mid-successional (13-24 cm)	Habitat around acoustic site sampled. Nets placed in forest corridors opening to field and shrub area.
Forest Type: Mixed	**Preferred Roost Trees Present:** Fraxinus pennsylvanica (snag) Unknown snag(s) with exfol. bark		

[1] *New (N), Crescent (C), Half (H), Gibbous (G), Full (F)* [2] *Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Briefly Describe)*

Site Description and Weather Data Form

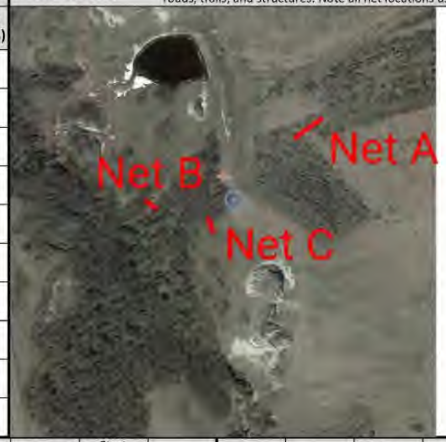
Location Information

Site ID:	Project:	State:
RB-5b	Red Butte	North Dakota
	Datum: NAD 83	County: Oliver

Net Locations – Take pictures of each net set and distinguishing characteristics

Net ID (A,B,...)	Net Size (e.g. 3x9)	UTM Zone	Easting	Northing	Net Nights Used (1,2,...)	Canopy Cover (%)
A	3 x 12	14	0322775	5229511	1	33
B	3 x 6	14	0322609	5229472	1	50
C	2 x 6	14	0322670	5229409	1	75

Site Sketch Should be drawn in a top-down view using map to assist with accuracy. Include all streams, roads, trails, and structures. Note all net locations using Net ID.



Net Night	Date (yyyy-mm-dd)	Biologists Present	Total Nets Open (#)	Sunset Time (24 Hour)	Moonrise Time	Moonset Time	[1] Moon Phase	Start Time	Start Temp (°F)	Start Wind Speed (mph)	Start Sky Code	Stop Time	Stop Temp	Stop Wind Speed	Stop Sky Code	Precip. During Survey (Yes/No)	Precip. Duration (min)	Night Complete (Yes/No)
1	2019-08-13	Kristina Hammond, Kelly Lutsch	3	2059	2023	0434	G	2105	61	0	1	0205	55	1	0	No	0	Yes
2	2019-08-14	Kristina Hammond	3	2058	2053	0544	F	2055	65	2	2	0225	59	7	1	Yes	80	No
3																		
4																		
5																		

Habitat Information

[2] Primary Habitat Surveyed:	Dominant Canopy Species:	Estimated Canopy Tree Age (DBH):	Additional Comments:
Field Edge	Populus deltoides Fraxinus pennsylvanica	Mid-successional (13-24 cm)	Nets placed around acoustic detector site covering forested corridor habitat, and field/forest edge habitat. 8/14 closed nets from 2255 to 0015 due to weather
Forest Type: Mixed	**Preferred Roost Trees Present:**		

[1] *New (N), Crescent (C), Half (H), Gibbous (G), Full (F)* [2] *Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Briefly Describe)*

Appendix L. Daily Weather Log for Acoustic Detector Nights

STATION:	KNDNEWSA2	Sunset Time:	21:26	Survey Start:	21:26	Determination:	*Valid*
SITES:	5, 8, 10	Sunrise Time:	6:18	End Time:	2:26	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/26/2019	9:23 PM	69.4F	53.6F	0.57	NNW	2.0mph	3.0mph	29.9in	0.0in	0.0in
7/26/2019	9:29 PM	69.1F	53.6F	0.58	NNW	2.9mph	3.0mph	29.9in	0.0in	0.0in
7/26/2019	9:34 PM	68.5F	53.2F	0.58	NW	5.0mph	5.0mph	29.9in	0.0in	0.0in
7/26/2019	9:39 PM	68.2F	53.2F	0.59	NNW	4.9mph	6.0mph	29.9in	0.0in	0.0in
7/26/2019	9:44 PM	68.2F	53.2F	0.59	NNW	4.9mph	6.0mph	29.9in	0.0in	0.0in
7/26/2019	9:49 PM	68.0F	52.7F	0.58	NNW	4.0mph	6.0mph	29.9in	0.0in	0.0in
7/26/2019	9:55 PM	68.2F	52.9F	0.58	NW	4.0mph	7.0mph	29.9in	0.0in	0.0in
7/26/2019	10:00 PM	68.5F	52.7F	0.57	NNW	4.0mph	5.0mph	29.9in	0.0in	0.0in
7/26/2019	10:05 PM	68.5F	52.7F	0.57	NW	4.0mph	4.0mph	29.9in	0.0in	0.0in
7/26/2019	10:10 PM	68.2F	52.9F	0.58	NNW	0.9mph	2.0mph	29.9in	0.0in	0.0in
7/26/2019	10:15 PM	67.1F	52.7F	0.6	NNW	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/26/2019	10:20 PM	65.7F	52.7F	0.63	NNW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	10:26 PM	63.9F	53.1F	0.68	NNW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	10:31 PM	62.1F	52.9F	0.72	NNW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	10:36 PM	60.3F	52.3F	0.75	NNW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	10:41 PM	59.2F	51.6F	0.76	NW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	10:46 PM	59.2F	51.6F	0.76	NW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	10:51 PM	58.3F	51.4F	0.78	NW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	10:57 PM	57.6F	51.1F	0.79	NNW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:02 PM	57.4F	51.3F	0.8	NW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:07 PM	57.4F	51.3F	0.8	NNW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:12 PM	57.4F	51.3F	0.8	NW	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/26/2019	11:17 PM	57.4F	51.3F	0.8	NW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:22 PM	57.0F	50.9F	0.8	NW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:28 PM	56.7F	50.5F	0.8	NNW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:33 PM	56.5F	50.7F	0.81	NW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:38 PM	56.5F	51.1F	0.82	NW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:43 PM	57.0F	51.3F	0.81	SE	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:48 PM	57.9F	51.8F	0.8	SE	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:53 PM	58.5F	51.6F	0.78	SE	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/26/2019	11:59 PM	57.4F	50.9F	0.79	SE	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/27/2019	12:04 AM	55.9F	49.8F	0.8	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	12:09 AM	55.0F	50.0F	0.83	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	12:14 AM	55.6F	50.9F	0.84	SE	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/27/2019	12:20 AM	55.8F	50.4F	0.82	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	12:25 AM	55.4F	50.0F	0.82	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	12:30 AM	55.2F	50.2F	0.83	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	12:35 AM	54.9F	50.2F	0.84	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	12:40 AM	54.9F	50.2F	0.84	SE	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/27/2019	12:45 AM	54.7F	50.0F	0.84	SE	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/27/2019	12:51 AM	54.3F	49.8F	0.85	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	12:56 AM	54.7F	50.2F	0.85	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	1:01 AM	55.0F	50.4F	0.84	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	1:06 AM	55.6F	50.2F	0.82	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	1:11 AM	54.9F	50.2F	0.84	SE	0.9mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	1:17 AM	54.3F	49.6F	0.84	SE	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/27/2019	1:22 AM	53.2F	49.1F	0.86	SE	0.0mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	1:27 AM	53.2F	49.1F	0.86	SSW	0.9mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	1:32 AM	53.4F	49.3F	0.86	SSW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/27/2019	1:37 AM	54.0F	49.8F	0.86	SSW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	1:43 AM	54.7F	50.5F	0.86	SSW	0.0mph	0.0mph	29.9in	0.0in	0.0in
7/27/2019	1:48 AM	55.6F	50.5F	0.83	SW	0.9mph	1.0mph	29.9in	0.0in	0.0in
7/27/2019	1:53 AM	55.8F	50.7F	0.83	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	1:58 AM	55.9F	50.9F	0.83	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	2:03 AM	55.2F	50.2F	0.83	SW	0.0mph	3.0mph	30.0in	0.0in	0.0in
7/27/2019	2:08 AM	54.3F	49.8F	0.85	NNW	2.9mph	3.0mph	30.0in	0.0in	0.0in
7/27/2019	2:13 AM	54.9F	50.7F	0.86	West	0.9mph	1.0mph	30.0in	0.0in	0.0in

7/27/2019	2:19 AM	55.9F	51.4F	0.85	SW	0.9mph	2.0mph	30.0in	0.0in	0.0in
7/27/2019	2:24 AM	55.9F	51.4F	0.85	West	0.9mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	2:29 AM	56.1F	51.4F	0.84	WSW	0.0mph	2.0mph	30.0in	0.0in	0.0in
7/27/2019	2:34 AM	55.8F	51.1F	0.84	SSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	2:39 AM	55.6F	50.9F	0.84	SW	0.9mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	2:44 AM	55.2F	50.5F	0.84	SW	0.0mph	2.0mph	30.0in	0.0in	0.0in
7/27/2019	2:49 AM	55.6F	50.9F	0.84	SW	0.0mph	2.0mph	30.0in	0.0in	0.0in
7/27/2019	2:54 AM	55.9F	50.9F	0.83	WSW	0.9mph	2.0mph	30.0in	0.0in	0.0in
7/27/2019	3:00 AM	55.4F	50.0F	0.82	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	3:05 AM	54.7F	50.0F	0.84	SW	0.9mph	2.0mph	30.0in	0.0in	0.0in
7/27/2019	3:10 AM	54.7F	50.0F	0.84	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	3:15 AM	53.8F	49.1F	0.84	WSW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	3:20 AM	54.1F	49.5F	0.84	WSW	0.9mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	3:25 AM	54.0F	49.3F	0.84	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	3:30 AM	53.2F	48.9F	0.85	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	3:35 AM	52.9F	48.7F	0.86	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	3:41 AM	52.5F	48.7F	0.87	WSW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	3:46 AM	52.5F	49.1F	0.88	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	3:51 AM	52.5F	49.1F	0.88	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	3:56 AM	52.5F	49.1F	0.88	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	4:01 AM	52.7F	49.3F	0.88	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	4:06 AM	52.3F	48.6F	0.87	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	4:11 AM	52.0F	48.6F	0.88	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	4:17 AM	51.6F	48.6F	0.89	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	4:22 AM	52.0F	49.1F	0.9	West	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	4:27 AM	52.0F	48.9F	0.89	SW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	4:32 AM	51.6F	48.6F	0.89	SW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	4:37 AM	51.4F	48.6F	0.9	SW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	4:42 AM	51.4F	48.9F	0.91	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	4:47 AM	51.6F	49.1F	0.91	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	4:52 AM	51.6F	48.7F	0.9	SSW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	4:57 AM	51.8F	48.9F	0.9	SW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	5:02 AM	52.0F	49.1F	0.9	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:08 AM	52.0F	49.1F	0.9	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:13 AM	51.8F	48.9F	0.9	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:18 AM	51.8F	48.9F	0.9	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:23 AM	52.0F	48.9F	0.89	WSW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:28 AM	51.6F	48.7F	0.9	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	5:33 AM	51.3F	48.2F	0.89	WSW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	5:38 AM	50.7F	48.2F	0.91	WSW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:43 AM	51.1F	48.6F	0.91	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:48 AM	51.1F	48.6F	0.91	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:53 AM	51.1F	48.6F	0.91	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	5:58 AM	51.1F	48.6F	0.91	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	6:03 AM	51.1F	48.6F	0.91	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	6:08 AM	51.1F	48.6F	0.91	SW	0.0mph	0.0mph	30.0in	0.0in	0.0in
7/27/2019	6:14 AM	51.1F	48.9F	0.92	SW	0.0mph	1.0mph	30.0in	0.0in	0.0in
7/27/2019	6:19 AM	51.6F	49.1F	0.91	SW	0.0mph	0.0mph	30.0in	0.0in	0.0in

STATION:	KNDNEWSA2	Sunset Time:	21:24	Survey Start:	21:24	Determination:	*Not valid*
SITES:	4 - 10	Sunrise Time:	6:19	End Time:	2:24	Reason:	Sustained winds over 9 mph for 40 mins, then gusty for several more hours

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/27/19	9:26 PM	74.5F	61.9F	65.00%	SW	4.0mph	5.0mph	29.8in	0.0in	0.0in
7/27/19	9:31 PM	74.5F	61.9F	65.00%	South	4.9mph	7.0mph	29.8in	0.0in	0.0in
7/27/19	9:36 PM	74.5F	61.5F	64.00%	SSE	4.0mph	7.0mph	29.8in	0.0in	0.0in
7/27/19	9:41 PM	74.5F	61.5F	64.00%	South	4.9mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	9:46 PM	74.5F	61.5F	64.00%	South	4.9mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	9:51 PM	74.1F	62.1F	66.00%	SSE	2.9mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	9:57 PM	73.6F	62.4F	68.00%	South	2.9mph	4.0mph	29.8in	0.0in	0.0in
7/27/19	10:02 PM	73.0F	61.9F	68.00%	South	4.0mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	10:07 PM	73.0F	61.9F	68.00%	South	2.9mph	5.0mph	29.8in	0.0in	0.0in
7/27/19	10:12 PM	73.0F	62.2F	69.00%	SSE	2.9mph	5.0mph	29.8in	0.0in	0.0in
7/27/19	10:17 PM	72.5F	62.2F	70.00%	South	4.0mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	10:23 PM	72.1F	62.2F	71.00%	SSW	2.9mph	4.0mph	29.8in	0.0in	0.0in
7/27/19	10:28 PM	72.1F	61.9F	70.00%	SSW	2.0mph	5.0mph	29.8in	0.0in	0.0in
7/27/19	10:33 PM	72.5F	61.7F	69.00%	SSW	2.0mph	5.0mph	29.8in	0.0in	0.0in
7/27/19	10:38 PM	72.7F	61.5F	68.00%	SSW	2.9mph	5.0mph	29.8in	0.0in	0.0in
7/27/19	10:43 PM	72.3F	61.5F	69.00%	South	0.9mph	2.0mph	29.8in	0.0in	0.0in
7/27/19	10:48 PM	72.0F	61.7F	70.00%	SSE	0.9mph	2.0mph	29.8in	0.0in	0.0in
7/27/19	10:53 PM	71.6F	61.7F	71.00%	SSE	2.9mph	3.0mph	29.8in	0.0in	0.0in
7/27/19	10:59 PM	71.4F	61.2F	70.00%	SSW	2.9mph	4.0mph	29.8in	0.0in	0.0in
7/27/19	11:04 PM	72.0F	61.2F	69.00%	SW	4.0mph	9.0mph	29.8in	0.0in	0.0in
7/27/19	11:09 PM	72.1F	61.3F	69.00%	SW	4.0mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	11:14 PM	72.1F	61.3F	69.00%	SSE	2.0mph	7.0mph	29.8in	0.0in	0.0in
7/27/19	11:19 PM	72.3F	61.2F	68.00%	SSE	4.0mph	5.0mph	29.8in	0.0in	0.0in
7/27/19	11:24 PM	72.5F	61.3F	68.00%	South	2.9mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	11:30 PM	72.5F	61.3F	68.00%	SW	6.0mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	11:35 PM	72.7F	61.5F	68.00%	SSW	2.9mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	11:40 PM	72.7F	61.5F	68.00%	SSE	2.9mph	7.0mph	29.8in	0.0in	0.0in
7/27/19	11:45 PM	72.5F	61.3F	68.00%	SSW	6.0mph	7.0mph	29.8in	0.0in	0.0in
7/27/19	11:50 PM	72.5F	61.3F	68.00%	SSW	4.9mph	6.0mph	29.8in	0.0in	0.0in
7/27/19	11:55 PM	72.5F	61.7F	69.00%	South	4.9mph	7.0mph	29.8in	0.0in	0.0in
7/28/19	12:01 AM	72.3F	61.5F	69.00%	SSW	6.9mph	7.0mph	29.8in	0.0in	0.0in
7/28/19	12:06 AM	72.3F	61.5F	69.00%	SSW	8.1mph	8.0mph	29.8in	0.0in	0.0in
7/28/19	12:11 AM	72.3F	61.5F	69.00%	SSW	2.9mph	6.0mph	29.8in	0.0in	0.0in
7/28/19	12:16 AM	72.1F	61.9F	70.00%	SW	4.0mph	9.0mph	29.8in	0.0in	0.0in
7/28/19	12:21 AM	72.1F	62.2F	71.00%	SSW	4.0mph	8.0mph	29.8in	0.0in	0.0in
7/28/19	12:26 AM	72.0F	62.1F	71.00%	SW	8.1mph	12.0mph	29.8in	0.0in	0.0in
7/28/19	12:32 AM	71.8F	62.2F	72.00%	SSW	8.1mph	10.0mph	29.8in	0.0in	0.0in
7/28/19	12:37 AM	71.8F	62.2F	72.00%	SSW	4.9mph	13.0mph	29.8in	0.0in	0.0in
7/28/19	12:42 AM	71.8F	62.6F	73.00%	SSW	6.9mph	10.0mph	29.8in	0.0in	0.0in
7/28/19	12:47 AM	72.0F	62.8F	73.00%	SSW	6.9mph	11.0mph	29.8in	0.0in	0.0in
7/28/19	12:52 AM	72.3F	62.8F	72.00%	SW	6.9mph	14.0mph	29.8in	0.0in	0.0in
7/28/19	12:57 AM	72.9F	63.3F	72.00%	SW	11.0mph	18.0mph	29.8in	0.0in	0.0in
7/28/19	1:03 AM	72.9F	63.3F	72.00%	SW	15.0mph	18.0mph	29.8in	0.0in	0.0in
7/28/19	1:08 AM	72.3F	63.1F	73.00%	SW	12.1mph	13.0mph	29.8in	0.0in	0.0in
7/28/19	1:13 AM	72.0F	63.7F	75.00%	SSW	17.9mph	26.0mph	29.8in	0.0in	0.0in
7/28/19	1:18 AM	72.0F	63.7F	75.00%	SSW	13.0mph	21.0mph	29.8in	0.0in	0.0in
7/28/19	1:23 AM	71.8F	63.9F	76.00%	SSW	14.1mph	18.0mph	29.8in	0.0in	0.0in
7/28/19	1:28 AM	71.2F	63.7F	77.00%	SSW	13.0mph	19.0mph	29.8in	0.0in	0.0in
7/28/19	1:34 AM	70.9F	63.7F	78.00%	SW	11.0mph	13.0mph	29.8in	0.0in	0.0in
7/28/19	1:39 AM	70.5F	63.7F	79.00%	SW	12.1mph	16.0mph	29.8in	0.0in	0.0in
7/28/19	1:44 AM	70.2F	63.7F	80.00%	SW	4.9mph	15.0mph	29.8in	0.0in	0.0in
7/28/19	1:49 AM	69.6F	63.5F	81.00%	SSW	4.9mph	11.0mph	29.8in	0.0in	0.0in
7/28/19	1:54 AM	69.1F	63.7F	83.00%	SW	8.1mph	15.0mph	29.8in	0.0in	0.0in
7/28/19	2:00 AM	68.5F	63.5F	84.00%	SW	12.1mph	14.0mph	29.7in	0.0in	0.0in
7/28/19	2:05 AM	68.5F	63.1F	83.00%	South	4.9mph	9.0mph	29.7in	0.0in	0.0in

7/28/19	2:10 AM	68.5F	62.4F	81.00%	SW	10.1mph	11.0mph	29.7in	0.0in	0.0in
7/28/19	2:15 AM	68.7F	62.6F	81.00%	South	6.9mph	12.0mph	29.7in	0.0in	0.0in
7/28/19	2:20 AM	68.7F	63.0F	82.00%	SSW	14.1mph	14.0mph	29.7in	0.0in	0.0in
7/28/19	2:25 AM	68.5F	63.5F	84.00%	South	6.9mph	14.0mph	29.7in	0.0in	0.0in
7/28/19	2:31 AM	68.2F	63.9F	86.00%	South	6.9mph	11.0mph	29.8in	0.0in	0.0in
7/28/19	2:36 AM	68.2F	64.2F	87.00%	SSE	8.1mph	12.0mph	29.8in	0.0in	0.0in
7/28/19	2:41 AM	68.0F	64.4F	88.00%	ESE	10.1mph	10.0mph	29.8in	0.0in	0.0in
7/28/19	2:46 AM	68.0F	64.0F	87.00%	South	6.0mph	13.0mph	29.8in	0.0in	0.0in
7/28/19	2:51 AM	68.2F	63.5F	85.00%	South	11.0mph	18.0mph	29.8in	0.0in	0.0in
7/28/19	2:56 AM	68.2F	63.5F	85.00%	South	4.0mph	12.0mph	29.8in	0.0in	0.0in
7/28/19	3:02 AM	67.8F	63.1F	85.00%	SSW	12.1mph	12.0mph	29.7in	0.0in	0.0in
7/28/19	3:07 AM	67.6F	63.0F	85.00%	SSW	6.9mph	11.0mph	29.7in	0.0in	0.0in
7/28/19	3:12 AM	68.2F	62.4F	82.00%	South	8.9mph	12.0mph	29.7in	0.0in	0.0in
7/28/19	3:17 AM	68.5F	62.4F	81.00%	South	12.1mph	12.0mph	29.7in	0.0in	0.0in
7/28/19	3:22 AM	68.4F	62.6F	82.00%	SW	8.1mph	9.0mph	29.7in	0.0in	0.0in
7/28/19	3:28 AM	68.4F	62.6F	82.00%	South	6.0mph	10.0mph	29.7in	0.0in	0.0in
7/28/19	3:33 AM	68.0F	62.6F	83.00%	SW	8.1mph	9.0mph	29.7in	0.0in	0.0in
7/28/19	3:38 AM	67.8F	62.1F	82.00%	South	6.0mph	9.0mph	29.7in	0.0in	0.0in
7/28/19	3:43 AM	67.8F	61.7F	81.00%	SSE	6.0mph	8.0mph	29.7in	0.0in	0.0in
7/28/19	3:48 AM	68.2F	61.3F	79.00%	South	4.0mph	8.0mph	29.7in	0.0in	0.0in
7/28/19	3:53 AM	68.7F	60.4F	75.00%	South	4.9mph	9.0mph	29.7in	0.0in	0.0in
7/28/19	3:59 AM	69.4F	60.4F	73.00%	South	6.0mph	7.0mph	29.7in	0.0in	0.0in
7/28/19	4:04 AM	69.6F	60.3F	72.00%	SSE	2.0mph	5.0mph	29.7in	0.0in	0.0in
7/28/19	4:09 AM	70.0F	60.1F	71.00%	SSE	0.9mph	2.0mph	29.7in	0.0in	0.0in
7/28/19	4:14 AM	69.8F	59.9F	71.00%	West	2.9mph	3.0mph	29.7in	0.0in	0.0in
7/28/19	4:19 AM	69.4F	60.4F	73.00%	SW	2.0mph	2.0mph	29.7in	0.0in	0.0in
7/28/19	4:24 AM	68.7F	60.8F	76.00%	South	2.0mph	3.0mph	29.7in	0.0in	0.0in
7/28/19	4:29 AM	69.1F	60.8F	75.00%	SSE	0.9mph	2.0mph	29.7in	0.0in	0.0in
7/28/19	4:35 AM	68.9F	60.6F	75.00%	SW	0.0mph	0.0mph	29.7in	0.0in	0.0in
7/28/19	4:40 AM	68.4F	61.5F	79.00%	West	10.1mph	11.0mph	29.7in	0.0in	0.0in
7/28/19	4:45 AM	67.6F	62.2F	83.00%	WSW	2.9mph	8.0mph	29.7in	0.0in	0.0in
7/28/19	4:50 AM	67.1F	62.8F	86.00%	WSW	6.0mph	9.0mph	29.7in	0.0in	0.0in
7/28/19	4:55 AM	66.7F	62.8F	87.00%	WSW	6.0mph	7.0mph	29.7in	0.0in	0.0in
7/28/19	5:00 AM	66.6F	62.6F	87.00%	West	4.9mph	5.0mph	29.7in	0.0in	0.0in
7/28/19	5:05 AM	66.4F	62.4F	87.00%	SW	0.0mph	2.0mph	29.7in	0.0in	0.0in
7/28/19	5:11 AM	66.2F	62.2F	87.00%	SSW	0.9mph	1.0mph	29.7in	0.0in	0.0in
7/28/19	5:16 AM	66.4F	62.4F	87.00%	SSE	0.9mph	2.0mph	29.7in	0.0in	0.0in
7/28/19	5:21 AM	66.7F	62.1F	85.00%	SSW	0.0mph	3.0mph	29.7in	0.0in	0.0in
7/28/19	5:26 AM	66.7F	62.1F	85.00%	SSW	0.0mph	0.0mph	29.7in	0.0in	0.0in
7/28/19	5:31 AM	66.4F	62.1F	86.00%	SSW	0.9mph	4.0mph	29.7in	0.0in	0.0in
7/28/19	5:36 AM	66.4F	62.1F	86.00%	SSE	2.9mph	4.0mph	29.7in	0.0in	0.0in
7/28/19	5:41 AM	66.4F	62.1F	86.00%	SSE	2.9mph	6.0mph	29.7in	0.0in	0.0in
7/28/19	5:46 AM	66.2F	62.2F	87.00%	South	2.0mph	5.0mph	29.7in	0.0in	0.0in
7/28/19	5:51 AM	65.8F	62.2F	88.00%	SW	2.0mph	4.0mph	29.7in	0.0in	0.0in
7/28/19	5:57 AM	65.7F	62.2F	89.00%	South	4.0mph	6.0mph	29.7in	0.0in	0.0in
7/28/19	6:02 AM	65.7F	62.2F	89.00%	South	2.9mph	6.0mph	29.7in	0.0in	0.0in
7/28/19	6:07 AM	65.7F	62.6F	90.00%	SSE	4.0mph	7.0mph	29.7in	0.0in	0.0in
7/28/19	6:12 AM	65.7F	62.2F	89.00%	South	2.9mph	5.0mph	29.7in	0.0in	0.0in
7/28/19	6:17 AM	65.7F	62.2F	89.00%	SSE	2.0mph	4.0mph	29.7in	0.0in	0.0in
7/28/19	6:22 AM	65.7F	62.2F	89.00%	SSE	2.9mph	4.0mph	29.7in	0.0in	0.0in

STATION:	KNDNEWSA2	Sunset Time:	21:23	Survey Start:	21:23	Determination:	*Valid*
SITES:	4 - 10	Sunrise Time:	6:20	End Time:	2:23	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/28/19	9:22 PM	70.2F	52.7F	54%	NW	8.9mph	20.0mph	29.83in	0.00in	0.00in
7/28/19	9:27 PM	69.8F	52.9F	55%	NNW	10.1mph	13.0mph	29.83in	0.00in	0.00in
7/28/19	9:33 PM	69.4F	53.1F	56%		10.1mph	18.0mph	29.84in	0.00in	0.00in
7/28/19	9:38 PM	69.3F	52.9F	56%	NNW	8.9mph	12.0mph	29.84in	0.00in	0.00in
7/28/19	9:43 PM	69.1F	53.2F	57%	NW	6.9mph	14.0mph	29.84in	0.00in	0.00in
7/28/19	9:48 PM	68.5F	53.2F	58%	NW	6.0mph	11.0mph	29.84in	0.00in	0.00in
7/28/19	9:53 PM	68.2F	52.9F	58%	NNW	8.9mph	15.0mph	29.84in	0.00in	0.00in
7/28/19	9:59 PM	68.2F	53.2F	59%	NW	8.1mph	12.0mph	29.85in	0.00in	0.00in
7/28/19	10:04 PM	68.0F	53.1F	59%	NNW	8.9mph	9.0mph	29.85in	0.00in	0.00in
7/28/19	10:09 PM	67.5F	53.1F	60%	NNW	4.9mph	8.0mph	29.85in	0.00in	0.00in
7/28/19	10:14 PM	67.3F	53.4F	61%	NNW	8.1mph	9.0mph	29.85in	0.00in	0.00in
7/28/19	10:19 PM	66.7F	53.2F	62%	NNW	6.0mph	9.0mph	29.85in	0.00in	0.00in
7/28/19	10:24 PM	66.4F	53.4F	63%	NNW	4.9mph	10.0mph	29.85in	0.00in	0.00in
7/28/19	10:30 PM	66.2F	53.2F	63%	NNW	6.0mph	8.0mph	29.86in	0.00in	0.00in
7/28/19	10:35 PM	65.8F	53.2F	64%	NNW	2.0mph	10.0mph	29.86in	0.00in	0.00in
7/28/19	10:40 PM	65.5F	53.4F	65%	NNW	2.0mph	5.0mph	29.86in	0.00in	0.00in
7/28/19	10:45 PM	65.1F	53.4F	66%	NNW	2.9mph	6.0mph	29.86in	0.00in	0.00in
7/28/19	10:50 PM	64.8F	53.6F	67%	NW	0.0mph	2.0mph	29.86in	0.00in	0.00in
7/28/19	10:55 PM	64.4F	53.2F	67%	WNW	0.9mph	2.0mph	29.86in	0.00in	0.00in
7/28/19	11:00 PM	64.0F	53.2F	68%	NW	0.0mph	2.0mph	29.86in	0.00in	0.00in
7/28/19	11:06 PM	63.7F	53.2F	69%	WNW	0.9mph	2.0mph	29.86in	0.00in	0.00in
7/28/19	11:11 PM	63.0F	53.1F	70%	WNW	0.9mph	2.0mph	29.87in	0.00in	0.00in
7/28/19	11:16 PM	62.2F	53.1F	72%	WNW	0.9mph	2.0mph	29.87in	0.00in	0.00in
7/28/19	11:21 PM	61.9F	53.1F	73%	WNW	2.0mph	2.0mph	29.87in	0.00in	0.00in
7/28/19	11:26 PM	61.5F	53.2F	74%	WNW	0.0mph	0.0mph	29.87in	0.00in	0.00in
7/28/19	11:31 PM	61.0F	53.1F	75%	WNW	0.0mph	1.0mph	29.87in	0.00in	0.00in
7/28/19	11:37 PM	60.4F	52.9F	76%	NW	0.0mph	1.0mph	29.87in	0.00in	0.00in
7/28/19	11:42 PM	60.1F	52.9F	77%	WNW	0.0mph	0.0mph	29.87in	0.00in	0.00in
7/28/19	11:47 PM	59.7F	52.9F	78%	WNW	0.0mph	0.0mph	29.87in	0.00in	0.00in
7/28/19	11:52 PM	59.4F	52.9F	79%	West	0.9mph	1.0mph	29.87in	0.00in	0.00in
7/28/19	11:57 PM	59.2F	52.7F	79%	West	0.0mph	1.0mph	29.88in	0.00in	0.00in
7/29/19	12:02 AM	59.2F	53.1F	80%	West	0.0mph	1.0mph	29.88in	0.00in	0.00in
7/29/19	12:08 AM	59.0F	52.5F	79%	WNW	0.0mph	2.0mph	29.88in	0.00in	0.00in
7/29/19	12:13 AM	59.0F	52.5F	79%	West	0.0mph	1.0mph	29.88in	0.00in	0.00in
7/29/19	12:18 AM	59.0F	52.2F	78%	WNW	0.0mph	1.0mph	29.88in	0.00in	0.00in
7/29/19	12:23 AM	59.2F	52.0F	77%	West	3.0mph	3.0mph	29.88in	0.00in	0.00in
7/29/19	12:28 AM	59.4F	52.2F	77%	NNW	0.9mph	2.0mph	29.88in	0.00in	0.00in
7/29/19	12:33 AM	59.4F	52.2F	77%	NNW	0.0mph	3.0mph	29.88in	0.00in	0.00in
7/29/19	12:39 AM	59.4F	52.2F	77%	NNW	2.9mph	4.0mph	29.89in	0.00in	0.00in
7/29/19	12:44 AM	59.5F	52.0F	76%	NNW	2.9mph	4.0mph	29.88in	0.00in	0.00in
7/29/19	12:49 AM	59.5F	52.3F	77%	NNW	2.0mph	5.0mph	29.89in	0.00in	0.00in
7/29/19	12:54 AM	59.5F	52.3F	77%		2.9mph	4.0mph	29.89in	0.00in	0.00in
7/29/19	12:59 AM	59.5F	52.3F	77%	NNW	6.0mph	6.0mph	29.89in	0.00in	0.00in
7/29/19	1:05 AM	59.9F	52.7F	77%	NNW	8.1mph	10.0mph	29.89in	0.00in	0.00in
7/29/19	1:10 AM	60.3F	53.1F	77%	NNW	10.1mph	10.0mph	29.90in	0.00in	0.00in
7/29/19	1:15 AM	60.4F	53.2F	77%	NW	6.0mph	10.0mph	29.90in	0.00in	0.00in
7/29/19	1:20 AM	60.1F	53.2F	78%	NNW	6.0mph	9.0mph	29.90in	0.00in	0.00in
7/29/19	1:25 AM	59.7F	53.2F	79%	NNW	8.1mph	9.0mph	29.90in	0.00in	0.00in
7/29/19	1:30 AM	59.7F	53.2F	79%	NNW	6.0mph	8.0mph	29.90in	0.00in	0.00in
7/29/19	1:36 AM	59.5F	53.1F	79%	NW	6.0mph	8.0mph	29.90in	0.00in	0.00in
7/29/19	1:41 AM	59.4F	53.2F	80%	NNW	8.1mph	9.0mph	29.90in	0.00in	0.00in
7/29/19	1:46 AM	59.4F	53.2F	80%	NW	6.0mph	9.0mph	29.90in	0.00in	0.00in
7/29/19	1:51 AM	59.4F	53.2F	80%	NW	6.0mph	10.0mph	29.90in	0.00in	0.00in
7/29/19	1:56 AM	59.4F	53.2F	80%	NNW	6.0mph	9.0mph	29.91in	0.00in	0.00in
7/29/19	2:01 AM	59.4F	53.2F	80%	NNW	6.0mph	8.0mph	29.91in	0.00in	0.00in
7/29/19	2:06 AM	59.4F	53.2F	80%	NNW	4.9mph	11.0mph	29.91in	0.00in	0.00in
7/29/19	2:11 AM	59.2F	53.4F	81%	NNW	6.0mph	8.0mph	29.91in	0.00in	0.00in

7/29/19	2:16 AM	58.6F	52.9F	81%	NNW	4.9mph	7.0mph	29.91in	0.00in	0.00in
7/29/19	2:21 AM	58.5F	53.1F	82%	NW	4.9mph	9.0mph	29.91in	0.00in	0.00in
7/29/19	2:26 AM	58.3F	52.9F	82%	NNW	4.0mph	6.0mph	29.92in	0.00in	0.00in
7/29/19	2:32 AM	58.3F	52.9F	82%	NNW	4.0mph	9.0mph	29.92in	0.00in	0.00in
7/29/19	2:37 AM	58.1F	52.7F	82%	NNW	8.1mph	9.0mph	29.92in	0.00in	0.00in
7/29/19	2:42 AM	58.3F	52.9F	82%	NNW	6.9mph	9.0mph	29.92in	0.00in	0.00in
7/29/19	2:47 AM	58.1F	52.7F	82%	NNW	6.9mph	10.0mph	29.93in	0.00in	0.00in
7/29/19	2:52 AM	57.6F	52.5F	83%	NNW	2.0mph	6.0mph	29.93in	0.00in	0.00in
7/29/19	2:58 AM	56.7F	51.8F	84%	NW	0.9mph	2.0mph	29.93in	0.00in	0.00in
7/29/19	3:03 AM	55.9F	51.4F	85%	NW	0.0mph	1.0mph	29.93in	0.00in	0.00in
7/29/19	3:08 AM	55.6F	51.8F	87%	NNW	2.9mph	4.0mph	29.93in	0.00in	0.00in
7/29/19	3:13 AM	55.6F	51.8F	87%	NW	2.9mph	6.0mph	29.93in	0.00in	0.00in
7/29/19	3:18 AM	55.8F	52.0F	87%	NNW	6.9mph	9.0mph	29.93in	0.00in	0.00in
7/29/19	3:23 AM	55.6F	51.8F	87%	NNW	2.9mph	5.0mph	29.93in	0.00in	0.00in
7/29/19	3:29 AM	55.2F	51.8F	88%	NNW	4.9mph	5.0mph	29.93in	0.00in	0.00in
7/29/19	3:34 AM	55.6F	52.2F	88%	NNW	6.0mph	9.0mph	29.93in	0.00in	0.00in
7/29/19	3:39 AM	55.8F	52.0F	87%	NNW	6.0mph	8.0mph	29.93in	0.00in	0.00in
7/29/19	3:44 AM	55.8F	52.0F	87%	NW	6.0mph	9.0mph	29.93in	0.00in	0.00in
7/29/19	3:49 AM	55.8F	52.0F	87%	NNW	4.0mph	6.0mph	29.93in	0.00in	0.00in
7/29/19	3:54 AM	55.2F	51.4F	87%		2.9mph	4.0mph	29.94in	0.00in	0.00in
7/29/19	4:00 AM	55.0F	51.3F	87%	NNW	6.0mph	8.0mph	29.94in	0.00in	0.00in
7/29/19	4:05 AM	55.0F	51.3F	87%	NNW	2.9mph	6.0mph	29.95in	0.00in	0.00in
7/29/19	4:10 AM	54.9F	51.1F	87%	NNW	2.9mph	6.0mph	29.95in	0.00in	0.00in
7/29/19	4:15 AM	54.3F	50.5F	87%	NNW	0.9mph	3.0mph	29.95in	0.00in	0.00in
7/29/19	4:20 AM	54.1F	50.9F	89%	NW	4.0mph	6.0mph	29.95in	0.00in	0.00in
7/29/19	4:25 AM	54.3F	51.1F	89%	NNW	6.9mph	8.0mph	29.96in	0.00in	0.00in
7/29/19	4:31 AM	54.5F	51.3F	89%	NNW	4.9mph	9.0mph	29.96in	0.00in	0.00in
7/29/19	4:36 AM	54.3F	51.1F	89%	NW	6.0mph	6.0mph	29.96in	0.00in	0.00in
7/29/19	4:41 AM	54.1F	50.9F	89%	NNW	4.0mph	6.0mph	29.96in	0.00in	0.00in
7/29/19	4:46 AM	54.0F	51.1F	90%	NNW	4.9mph	8.0mph	29.96in	0.00in	0.00in
7/29/19	4:51 AM	53.8F	50.9F	90%	NW	6.0mph	6.0mph	29.96in	0.00in	0.00in
7/29/19	4:56 AM	53.4F	50.5F	90%	NNW	2.9mph	5.0mph	29.97in	0.00in	0.00in
7/29/19	5:02 AM	53.2F	50.7F	91%	NW	2.9mph	5.0mph	29.97in	0.00in	0.00in
7/29/19	5:07 AM	53.2F	50.7F	91%	NNW	4.0mph	5.0mph	29.97in	0.00in	0.00in
7/29/19	5:12 AM	53.4F	50.5F	90%	NW	2.9mph	6.0mph	29.97in	0.00in	0.00in
7/29/19	5:17 AM	53.2F	50.4F	90%	NNW	2.9mph	5.0mph	29.97in	0.00in	0.00in
7/29/19	5:22 AM	53.1F	50.2F	90%	NNW	4.0mph	6.0mph	29.97in	0.00in	0.00in
7/29/19	5:27 AM	52.9F	50.4F	91%	NNW	4.9mph	7.0mph	29.97in	0.00in	0.00in
7/29/19	5:32 AM	52.9F	50.4F	91%	NNW	6.0mph	7.0mph	29.97in	0.00in	0.00in
7/29/19	5:37 AM	52.9F	50.4F	91%	NNW	4.0mph	6.0mph	29.97in	0.00in	0.00in
7/29/19	5:43 AM	52.9F	50.4F	91%	NW	2.9mph	4.0mph	29.98in	0.00in	0.00in
7/29/19	5:48 AM	52.5F	50.0F	91%	NNW	0.0mph	1.0mph	29.97in	0.00in	0.00in
7/29/19	5:53 AM	52.2F	49.6F	91%	NNW	2.0mph	4.0mph	29.98in	0.00in	0.00in
7/29/19	5:58 AM	52.0F	49.6F	92%	NNW	2.0mph	4.0mph	29.97in	0.00in	0.00in
7/29/19	6:03 AM	51.8F	49.3F	91%	NNW	0.0mph	2.0mph	29.98in	0.00in	0.00in
7/29/19	6:08 AM	51.4F	48.9F	91%	NNW	0.0mph	0.0mph	29.98in	0.00in	0.00in
7/29/19	6:13 AM	50.9F	48.7F	92%	WNW	0.0mph	0.0mph	29.98in	0.00in	0.00in
7/29/19	6:18 AM	50.5F	48.4F	92%	WNW	0.0mph	1.0mph	29.98in	0.00in	0.00in

STATION:	KNDNEWSA2	Sunset Time:	21:22	Survey Start:	21:23	Determination:	*Not valid*
SITES:	4 - 10	Sunrise Time:	6:21	End Time:	2:22	Reason:	Low temps over an hour during survey period

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/29/19	9:24 PM	62.4F	48.4F	60%	East	0.0mph	1.0mph	29.98in	0.00in	0.00in
7/29/19	9:29 PM	61.5F	48.0F	61%	East	0.9mph	1.0mph	29.98in	0.00in	0.00in
7/29/19	9:34 PM	61.3F	50.7F	68%	East	0.0mph	0.0mph	29.98in	0.00in	0.00in
7/29/19	9:39 PM	60.3F	50.4F	70%	East	0.0mph	0.0mph	29.98in	0.00in	0.00in
7/29/19	9:44 PM	59.4F	49.6F	70%	East	0.0mph	0.0mph	29.99in	0.00in	0.00in
7/29/19	9:50 PM	58.8F	47.5F	66%	East	0.0mph	1.0mph	29.99in	0.00in	0.00in
7/29/19	9:55 PM	58.6F	47.3F	66%	East	0.0mph	1.0mph	29.99in	0.00in	0.00in
7/29/19	10:00 PM	59.2F	47.5F	65%	East	0.0mph	1.0mph	30.00in	0.00in	0.00in
7/29/19	10:05 PM	59.4F	47.7F	65%	East	0.0mph	1.0mph	30.00in	0.00in	0.00in
7/29/19	10:10 PM	59.2F	47.8F	66%	East	0.0mph	1.0mph	30.00in	0.00in	0.00in
7/29/19	10:15 PM	58.8F	47.8F	67%	ESE	3.0mph	3.0mph	30.00in	0.00in	0.00in
7/29/19	10:21 PM	58.8F	47.8F	67%	ESE	2.0mph	2.0mph	30.00in	0.00in	0.00in
7/29/19	10:26 PM	58.8F	48.2F	68%	ESE	0.9mph	2.0mph	30.01in	0.00in	0.00in
7/29/19	10:31 PM	58.6F	48.6F	69%	ESE	0.9mph	3.0mph	30.01in	0.00in	0.00in
7/29/19	10:36 PM	58.1F	48.4F	70%	ESE	0.9mph	2.0mph	30.01in	0.00in	0.00in
7/29/19	10:41 PM	57.4F	48.4F	72%	ESE	2.0mph	3.0mph	30.01in	0.00in	0.00in
7/29/19	10:46 PM	57.2F	48.6F	73%	ESE	2.0mph	2.0mph	30.01in	0.00in	0.00in
7/29/19	10:52 PM	57.4F	48.4F	72%	East	0.9mph	2.0mph	30.01in	0.00in	0.00in
7/29/19	10:57 PM	57.4F	48.4F	72%	ESE	0.9mph	2.0mph	30.01in	0.00in	0.00in
7/29/19	11:02 PM	57.6F	48.6F	72%	East	2.0mph	4.0mph	30.01in	0.00in	0.00in
7/29/19	11:07 PM	57.7F	48.4F	71%	East	2.0mph	2.0mph	30.01in	0.00in	0.00in
7/29/19	11:13 PM	57.6F	48.6F	72%	ESE	2.0mph	4.0mph	30.01in	0.00in	0.00in
7/29/19	11:18 PM	57.4F	48.4F	72%	ESE	2.0mph	3.0mph	30.02in	0.00in	0.00in
7/29/19	11:23 PM	57.0F	48.4F	73%	ESE	2.0mph	2.0mph	30.01in	0.00in	0.00in
7/29/19	11:28 PM	56.7F	48.4F	74%	East	2.0mph	3.0mph	30.01in	0.00in	0.00in
7/29/19	11:33 PM	56.3F	48.2F	74%	ESE	2.0mph	2.0mph	30.02in	0.00in	0.00in
7/29/19	11:39 PM	56.1F	48.0F	74%	ESE	2.0mph	3.0mph	30.02in	0.00in	0.00in
7/29/19	11:44 PM	56.7F	48.0F	73%	SE	0.9mph	2.0mph	30.02in	0.00in	0.00in
7/29/19	11:49 PM	57.0F	48.4F	73%	SE	0.9mph	3.0mph	30.02in	0.00in	0.00in
7/29/19	11:54 PM	56.8F	48.6F	74%	SE	2.0mph	2.0mph	30.02in	0.00in	0.00in
7/29/19	11:59 PM	56.7F	48.4F	74%	ESE	0.9mph	2.0mph	30.02in	0.00in	0.00in
7/30/19	12:05 AM	56.3F	48.6F	75%	ESE	0.9mph	2.0mph	30.02in	0.00in	0.00in
7/30/19	12:10 AM	56.3F	48.9F	76%	ESE	0.9mph	4.0mph	30.02in	0.00in	0.00in
7/30/19	12:15 AM	56.1F	48.7F	76%	SE	0.9mph	2.0mph	30.02in	0.00in	0.00in
7/30/19	12:20 AM	55.8F	48.7F	77%	SE	0.0mph	1.0mph	30.02in	0.00in	0.00in
7/30/19	12:26 AM	55.8F	48.7F	77%	SE	0.9mph	1.0mph	30.02in	0.00in	0.00in
7/30/19	12:31 AM	55.4F	48.4F	77%	ESE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	12:36 AM	53.8F	47.1F	78%	ESE	0.0mph	1.0mph	30.02in	0.00in	0.00in
7/30/19	12:41 AM	52.3F	46.8F	81%	ESE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	12:46 AM	51.4F	46.4F	83%	ESE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	12:51 AM	50.5F	46.2F	85%	ESE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	12:56 AM	50.4F	46.6F	87%	ESE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	1:01 AM	49.8F	46.0F	87%	ESE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	1:06 AM	49.6F	46.2F	88%	East	0.0mph	1.0mph	30.02in	0.00in	0.00in
7/30/19	1:11 AM	50.0F	46.6F	88%	East	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	1:16 AM	49.6F	45.7F	86%	East	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	1:22 AM	49.1F	45.3F	87%	East	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	1:27 AM	48.6F	45.1F	88%	East	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	1:32 AM	48.0F	44.6F	88%	East	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	1:37 AM	48.0F	45.0F	89%	East	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	1:42 AM	47.8F	45.0F	90%	East	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	1:48 AM	48.0F	45.9F	92%	SSW	0.0mph	1.0mph	30.03in	0.00in	0.00in
7/30/19	1:53 AM	48.4F	45.5F	90%	SSE	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	1:58 AM	48.4F	45.5F	90%	SSE	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	2:03 AM	48.0F	45.1F	90%	SW	0.0mph	1.0mph	30.03in	0.00in	0.00in
7/30/19	2:08 AM	47.8F	45.0F	90%	SW	0.0mph	1.0mph	30.03in	0.00in	0.00in
7/30/19	2:13 AM	47.1F	44.1F	89%	SW	0.0mph	0.0mph	30.03in	0.00in	0.00in

7/30/19	2:19 AM	46.6F	43.9F	90%	SW	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	2:24 AM	46.0F	43.5F	91%	SW	0.0mph	0.0mph	30.03in	0.00in	0.00in
7/30/19	2:29 AM	46.6F	44.4F	92%	SW	0.0mph	1.0mph	30.03in	0.00in	0.00in
7/30/19	2:34 AM	46.9F	45.0F	93%	SW	0.0mph	1.0mph	30.03in	0.00in	0.00in
7/30/19	2:39 AM	47.1F	45.0F	92%	SW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	2:45 AM	46.9F	44.8F	92%	SW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	2:50 AM	46.2F	43.5F	90%	WSW	0.0mph	1.0mph	30.02in	0.00in	0.00in
7/30/19	2:55 AM	46.2F	44.1F	92%	WSW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:00 AM	46.8F	44.8F	93%	WSW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:05 AM	47.1F	45.1F	93%	WSW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:10 AM	47.3F	45.3F	93%	WSW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:16 AM	47.1F	45.1F	93%	WSW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:21 AM	46.9F	45.0F	93%	WSW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:26 AM	46.9F	45.3F	94%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:31 AM	47.1F	45.1F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:36 AM	47.1F	45.1F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:41 AM	47.1F	45.1F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:47 AM	47.5F	45.9F	94%	SE	0.0mph	1.0mph	30.02in	0.00in	0.00in
7/30/19	3:52 AM	47.3F	45.3F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	3:57 AM	46.9F	45.0F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:02 AM	46.9F	45.3F	94%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:07 AM	46.9F	45.0F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:12 AM	47.1F	45.5F	94%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:18 AM	47.1F	45.1F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:23 AM	47.3F	45.3F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:28 AM	46.9F	45.0F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:33 AM	46.8F	44.8F	93%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:38 AM	46.8F	45.1F	94%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:43 AM	46.9F	45.3F	94%	SE	0.0mph	1.0mph	30.03in	0.00in	0.00in
7/30/19	4:48 AM	47.1F	45.7F	95%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:54 AM	47.1F	45.5F	94%	SE	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	4:59 AM	47.7F	46.2F	95%	South	0.0mph	1.0mph	30.02in	0.00in	0.00in
7/30/19	5:04 AM	47.8F	46.4F	95%	South	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	5:09 AM	47.8F	46.2F	94%	South	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	5:14 AM	48.2F	46.8F	95%	SSE	0.0mph	2.0mph	30.02in	0.00in	0.00in
7/30/19	5:19 AM	48.4F	46.8F	94%	West	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	5:25 AM	48.4F	46.8F	94%	SSW	0.0mph	0.0mph	30.02in	0.00in	0.00in
7/30/19	5:30 AM	48.7F	47.3F	95%	SSE	0.9mph	4.0mph	30.02in	0.00in	0.00in
7/30/19	5:35 AM	49.6F	48.2F	95%	SSE	2.0mph	4.0mph	30.02in	0.00in	0.00in
7/30/19	5:40 AM	50.0F	48.0F	93%	SSE	4.9mph	5.0mph	30.01in	0.00in	0.00in
7/30/19	5:45 AM	50.5F	48.6F	93%	SSE	2.9mph	3.0mph	30.01in	0.00in	0.00in
7/30/19	5:50 AM	50.7F	48.6F	92%	South	2.9mph	3.0mph	30.01in	0.00in	0.00in
7/30/19	5:55 AM	50.7F	48.6F	92%	South	2.0mph	3.0mph	30.02in	0.00in	0.00in
7/30/19	6:01 AM	50.7F	48.2F	91%	South	2.0mph	5.0mph	30.02in	0.00in	0.00in
7/30/19	6:06 AM	51.1F	48.6F	91%	SSE	2.9mph	6.0mph	30.01in	0.00in	0.00in
7/30/19	6:11 AM	51.4F	48.9F	91%	ESE	2.9mph	5.0mph	30.01in	0.00in	0.00in
7/30/19	6:16 AM	51.6F	48.7F	90%	SSE	4.9mph	7.0mph	30.01in	0.00in	0.00in
7/30/19	6:21 AM	51.6F	48.7F	90%	SSE	4.9mph	6.0mph	30.01in	0.00in	0.00in

STATION:	KNDNEWSA2	Sunset Time:	21:21	Survey Start:	21:21	Determination:	*Valid*
SITES:	4 - 10	Sunrise Time:	6:23	End Time:	2:21	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/30/19	9:19 PM	68.2F	60.3F	76%	East	2.0mph	5.0mph	29.91in	0.00in	0.00in
7/30/19	9:24 PM	68.0F	60.4F	77%	ESE	2.9mph	4.0mph	29.91in	0.00in	0.00in
7/30/19	9:29 PM	67.8F	60.3F	77%	ESE	2.0mph	4.0mph	29.91in	0.00in	0.00in
7/30/19	9:35 PM	67.8F	60.3F	77%	SE	2.9mph	5.0mph	29.91in	0.00in	0.00in
7/30/19	9:40 PM	67.8F	60.3F	77%	SE	4.9mph	7.0mph	29.91in	0.00in	0.00in
7/30/19	9:45 PM	67.8F	60.3F	77%	SE	6.9mph	8.0mph	29.91in	0.00in	0.00in
7/30/19	9:50 PM	67.8F	60.3F	77%	SSE	2.9mph	6.0mph	29.91in	0.00in	0.00in
7/30/19	9:55 PM	67.6F	60.6F	78%	SE	4.9mph	8.0mph	29.91in	0.00in	0.00in
7/30/19	10:00 PM	67.6F	60.6F	78%	SSE	4.0mph	7.0mph	29.91in	0.00in	0.00in
7/30/19	10:06 PM	67.6F	60.6F	78%	ESE	4.0mph	7.0mph	29.91in	0.00in	0.00in
7/30/19	10:11 PM	67.5F	60.4F	78%	SE	4.9mph	6.0mph	29.91in	0.00in	0.00in
7/30/19	10:16 PM	67.5F	60.8F	79%	ESE	4.0mph	5.0mph	29.92in	0.00in	0.00in
7/30/19	10:21 PM	67.3F	60.6F	79%	SE	2.9mph	5.0mph	29.92in	0.00in	0.00in
7/30/19	10:26 PM	67.1F	60.8F	80%	SE	2.0mph	5.0mph	29.92in	0.00in	0.00in
7/30/19	10:31 PM	66.9F	60.6F	80%	SE	2.9mph	6.0mph	29.92in	0.00in	0.00in
7/30/19	10:37 PM	66.9F	60.6F	80%	SE	4.0mph	5.0mph	29.92in	0.00in	0.00in
7/30/19	10:42 PM	66.9F	60.6F	80%	SE	4.0mph	6.0mph	29.92in	0.00in	0.00in
7/30/19	10:47 PM	66.7F	60.8F	81%	SSE	2.9mph	4.0mph	29.92in	0.00in	0.00in
7/30/19	10:52 PM	66.7F	60.8F	81%	SE	2.9mph	4.0mph	29.92in	0.00in	0.00in
7/30/19	10:57 PM	66.6F	60.6F	81%	SE	2.9mph	5.0mph	29.92in	0.00in	0.00in
7/30/19	11:02 PM	66.4F	60.8F	82%	SE	2.9mph	5.0mph	29.93in	0.00in	0.00in
7/30/19	11:07 PM	66.4F	60.8F	82%	SE	2.9mph	8.0mph	29.93in	0.00in	0.00in
7/30/19	11:13 PM	66.2F	60.6F	82%	SE	2.9mph	4.0mph	29.93in	0.00in	0.00in
7/30/19	11:18 PM	66.0F	60.6F	83%	SE	0.9mph	5.0mph	29.93in	0.00in	0.00in
7/30/19	11:23 PM	66.0F	60.6F	83%	SSE	4.0mph	4.0mph	29.93in	0.00in	0.00in
7/30/19	11:28 PM	66.2F	60.8F	83%	SE	2.9mph	6.0mph	29.94in	0.00in	0.00in
7/30/19	11:33 PM	66.0F	60.6F	83%	SE	0.9mph	5.0mph	29.94in	0.00in	0.00in
7/30/19	11:38 PM	66.0F	61.0F	84%	SE	2.0mph	6.0mph	29.94in	0.00in	0.00in
7/30/19	11:44 PM	66.0F	61.0F	84%	SSE	2.9mph	5.0mph	29.94in	0.00in	0.00in
7/30/19	11:49 PM	65.8F	60.8F	84%	SSE	6.0mph	8.0mph	29.94in	0.00in	0.00in
7/30/19	11:54 PM	65.8F	60.8F	84%	SE	4.9mph	7.0mph	29.93in	0.00in	0.00in
7/30/19	11:59 PM	65.8F	60.8F	84%	SSE	4.9mph	7.0mph	29.94in	0.00in	0.00in
7/31/19	12:04 AM	65.8F	60.8F	84%	SE	4.0mph	7.0mph	29.94in	0.00in	0.00in
7/31/19	12:09 AM	65.7F	60.6F	84%	SSE	4.9mph	8.0mph	29.93in	0.00in	0.00in
7/31/19	12:14 AM	65.7F	61.0F	85%	ESE	2.9mph	6.0mph	29.93in	0.00in	0.00in
7/31/19	12:19 AM	65.7F	61.0F	85%	SSE	6.9mph	10.0mph	29.93in	0.00in	0.00in
7/31/19	12:24 AM	65.7F	61.0F	85%	SSE	6.0mph	9.0mph	29.93in	0.00in	0.00in
7/31/19	12:29 AM	65.7F	61.0F	85%	SSE	4.9mph	10.0mph	29.93in	0.00in	0.00in
7/31/19	12:34 AM	65.7F	61.0F	85%	SE	4.0mph	8.0mph	29.92in	0.00in	0.00in
7/31/19	12:40 AM	65.7F	61.3F	86%	SSE	6.0mph	10.0mph	29.92in	0.00in	0.00in
7/31/19	12:45 AM	65.7F	61.3F	86%	SE	8.9mph	9.0mph	29.92in	0.00in	0.00in
7/31/19	12:50 AM	65.7F	61.3F	86%	South	8.1mph	10.0mph	29.92in	0.00in	0.00in
7/31/19	12:55 AM	65.5F	61.2F	86%	SSW	4.9mph	9.0mph	29.92in	0.00in	0.00in
7/31/19	1:00 AM	65.5F	61.2F	86%	SSE	4.9mph	7.0mph	29.91in	0.00in	0.00in
7/31/19	1:05 AM	65.1F	61.2F	87%	SSE	4.0mph	7.0mph	29.91in	0.00in	0.00in
7/31/19	1:11 AM	64.9F	61.0F	87%	SE	2.9mph	7.0mph	29.91in	0.00in	0.00in
7/31/19	1:16 AM	64.8F	60.8F	87%	SE	2.9mph	4.0mph	29.91in	0.00in	0.00in
7/31/19	1:21 AM	64.4F	60.8F	88%	SE	4.0mph	6.0mph	29.91in	0.00in	0.00in
7/31/19	1:26 AM	64.0F	60.4F	88%	SE	6.0mph	9.0mph	29.91in	0.00in	0.00in
7/31/19	1:31 AM	63.7F	60.4F	89%	South	2.0mph	6.0mph	29.91in	0.00in	0.00in
7/31/19	1:36 AM	63.5F	60.3F	89%	SE	2.0mph	5.0mph	29.91in	0.00in	0.00in
7/31/19	1:42 AM	63.3F	60.3F	90%	SSE	2.9mph	6.0mph	29.91in	0.00in	0.00in
7/31/19	1:47 AM	63.1F	60.1F	90%	SSE	4.0mph	6.0mph	29.90in	0.00in	0.00in
7/31/19	1:52 AM	63.0F	60.3F	91%	SSE	4.9mph	8.0mph	29.91in	0.00in	0.00in
7/31/19	1:57 AM	63.0F	60.3F	91%	SSE	4.9mph	7.0mph	29.90in	0.00in	0.00in
7/31/19	2:02 AM	63.0F	60.3F	91%	SSE	4.9mph	7.0mph	29.89in	0.00in	0.00in
7/31/19	2:07 AM	62.8F	60.1F	91%	SE	8.1mph	9.0mph	29.89in	0.00in	0.00in

7/31/19	2:12 AM	62.8F	60.1F	91%	SSE	4.9mph	8.0mph	29.89in	0.00in	0.00in
7/31/19	2:18 AM	62.6F	60.3F	92%	SSE	8.9mph	10.0mph	29.89in	0.00in	0.00in
7/31/19	2:23 AM	62.6F	60.3F	92%	SE	6.9mph	11.0mph	29.88in	0.00in	0.00in
7/31/19	2:28 AM	62.4F	60.1F	92%	South	4.0mph	10.0mph	29.88in	0.00in	0.00in
7/31/19	2:33 AM	62.4F	60.1F	92%	SSE	4.0mph	10.0mph	29.88in	0.00in	0.00in
7/31/19	2:38 AM	62.2F	59.9F	92%	SE	6.0mph	10.0mph	29.88in	0.00in	0.00in
7/31/19	2:44 AM	62.1F	60.1F	93%	ESE	4.0mph	10.0mph	29.88in	0.00in	0.00in
7/31/19	2:49 AM	62.1F	60.1F	93%	SSE	6.0mph	8.0mph	29.88in	0.00in	0.00in
7/31/19	2:54 AM	61.9F	59.9F	93%	SSE	4.9mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	2:59 AM	61.9F	59.9F	93%	South	8.1mph	8.0mph	29.88in	0.00in	0.00in
7/31/19	3:04 AM	61.7F	59.9F	94%	SSE	2.9mph	10.0mph	29.88in	0.00in	0.00in
7/31/19	3:09 AM	61.5F	59.7F	94%	SSE	4.0mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	3:14 AM	61.5F	59.7F	94%	SE	8.9mph	10.0mph	29.88in	0.00in	0.00in
7/31/19	3:20 AM	61.3F	59.5F	94%	SE	2.9mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	3:25 AM	61.3F	59.5F	94%	SE	4.9mph	8.0mph	29.88in	0.00in	0.00in
7/31/19	3:30 AM	61.3F	59.5F	94%	SW	8.1mph	8.0mph	29.88in	0.00in	0.00in
7/31/19	3:35 AM	61.2F	59.4F	94%	SSE	8.9mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	3:41 AM	61.2F	59.7F	95%	South	8.1mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	3:46 AM	61.2F	59.7F	95%	SE	6.9mph	10.0mph	29.88in	0.00in	0.00in
7/31/19	3:51 AM	61.0F	59.5F	95%	SSE	6.0mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	3:56 AM	61.0F	59.5F	95%	SSW	6.0mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	4:01 AM	61.0F	59.5F	95%	South	4.9mph	7.0mph	29.88in	0.00in	0.00in
7/31/19	4:06 AM	60.8F	59.4F	95%	SSE	6.9mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	4:12 AM	60.8F	59.4F	95%	South	4.0mph	7.0mph	29.88in	0.00in	0.00in
7/31/19	4:17 AM	61.0F	59.5F	95%	SSE	6.0mph	9.0mph	29.88in	0.00in	0.00in
7/31/19	4:22 AM	61.0F	59.9F	96%	SSE	4.9mph	7.0mph	29.88in	0.00in	0.00in
7/31/19	4:27 AM	61.2F	60.1F	96%	South	4.9mph	8.0mph	29.88in	0.00in	0.00in
7/31/19	4:32 AM	61.2F	60.1F	96%	SE	6.0mph	8.0mph	29.88in	0.00in	0.00in
7/31/19	4:38 AM	61.2F	60.1F	96%	South	2.0mph	7.0mph	29.88in	0.00in	0.00in
7/31/19	4:43 AM	61.3F	60.3F	96%	SSW	4.0mph	6.0mph	29.88in	0.00in	0.00in
7/31/19	4:48 AM	61.3F	60.3F	96%	SW	0.0mph	3.0mph	29.88in	0.00in	0.00in
7/31/19	4:53 AM	61.3F	60.3F	96%	SSW	0.0mph	1.0mph	29.88in	0.00in	0.00in
7/31/19	4:58 AM	61.5F	60.4F	96%	SE	2.0mph	3.0mph	29.87in	0.00in	0.00in
7/31/19	5:03 AM	61.5F	60.4F	96%	SSE	2.0mph	3.0mph	29.87in	0.00in	0.00in
7/31/19	5:09 AM	61.5F	60.4F	96%	SSE	0.9mph	3.0mph	29.87in	0.00in	0.00in
7/31/19	5:14 AM	61.7F	60.6F	96%	SE	0.9mph	4.0mph	29.87in	0.00in	0.00in
7/31/19	5:19 AM	61.9F	60.8F	96%	SSE	2.9mph	3.0mph	29.87in	0.00in	0.00in
7/31/19	5:24 AM	61.9F	60.8F	96%	South	2.0mph	3.0mph	29.87in	0.00in	0.00in
7/31/19	5:29 AM	61.9F	60.8F	96%	SE	2.0mph	4.0mph	29.87in	0.00in	0.00in
7/31/19	5:34 AM	61.9F	60.8F	96%	SSE	4.0mph	4.0mph	29.87in	0.00in	0.00in
7/31/19	5:40 AM	62.1F	61.0F	96%	SSE	2.9mph	3.0mph	29.87in	0.00in	0.00in
7/31/19	5:45 AM	62.1F	61.0F	96%	SSE	4.9mph	5.0mph	29.87in	0.00in	0.00in
7/31/19	5:50 AM	62.1F	61.0F	96%	SE	2.9mph	6.0mph	29.87in	0.00in	0.00in
7/31/19	5:55 AM	62.1F	61.0F	96%	ESE	4.9mph	7.0mph	29.87in	0.00in	0.00in
7/31/19	6:00 AM	62.1F	61.0F	96%	SSE	4.0mph	8.0mph	29.87in	0.00in	0.00in
7/31/19	6:05 AM	62.2F	61.2F	96%	SE	4.0mph	8.0mph	29.87in	0.00in	0.00in
7/31/19	6:11 AM	62.2F	61.2F	96%	SSE	6.9mph	10.0mph	29.87in	0.00in	0.00in
7/31/19	6:16 AM	62.2F	61.2F	96%	SSE	6.9mph	9.0mph	29.87in	0.00in	0.00in
7/31/19	6:21 AM	62.2F	61.2F	96%	SSE	6.9mph	11.0mph	29.86in	0.00in	0.00in
7/31/19	6:26 AM	62.2F	61.2F	96%	SSW	10.1mph	12.0mph	29.87in	0.00in	0.00in

STATION:	KNDNEWSA2	Sunset Time:	21:18	Survey Start:	21:18	Determination:	*Valid*
SITES:	4, 6, 7, 9	Sunrise Time:	6:25	End Time:	2:18	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/31/19	9:19 PM	74.5F	68.5F	82%	ESE	2.0mph	2.0mph	29.87in	0.00in	0.00in
7/31/19	9:24 PM	74.1F	68.5F	83%	NE	4.0mph	5.0mph	29.86in	0.00in	0.00in
7/31/19	9:30 PM	73.9F	68.4F	83%	NE	0.0mph	3.0mph	29.87in	0.00in	0.00in
7/31/19	9:35 PM	73.8F	68.4F	83%	ESE	2.0mph	3.0mph	29.88in	0.00in	0.00in
7/31/19	9:40 PM	73.2F	68.2F	84%	SSE	0.9mph	2.0mph	29.89in	0.00in	0.00in
7/31/19	9:45 PM	73.0F	68.0F	84%	SSE	2.0mph	5.0mph	29.88in	0.00in	0.00in
7/31/19	9:50 PM	72.9F	68.0F	85%	SE	4.0mph	4.0mph	29.88in	0.00in	0.00in
7/31/19	9:55 PM	73.0F	68.0F	84%	NE	2.0mph	4.0mph	29.89in	0.00in	0.00in
7/31/19	10:00 PM	73.0F	68.0F	84%	ENE	8.9mph	11.0mph	29.89in	0.00in	0.00in
7/31/19	10:06 PM	73.0F	68.0F	84%	SSE	2.9mph	4.0mph	29.90in	0.00in	0.00in
7/31/19	10:11 PM	73.2F	68.2F	84%	South	4.0mph	6.0mph	29.89in	0.00in	0.00in
7/31/19	10:16 PM	72.9F	68.0F	85%	SE	0.9mph	2.0mph	29.89in	0.00in	0.00in
7/31/19	10:21 PM	72.5F	68.0F	86%	NE	0.0mph	4.0mph	29.90in	0.00in	0.00in
7/31/19	10:26 PM	72.3F	67.8F	86%	North	0.0mph	1.0mph	29.91in	0.00in	0.00in
7/31/19	10:31 PM	72.1F	67.6F	86%	SSE	2.9mph	4.0mph	29.91in	0.00in	0.00in
7/31/19	10:37 PM	72.1F	67.6F	86%	SW	4.9mph	6.0mph	29.91in	0.00in	0.00in
7/31/19	10:42 PM	72.1F	68.0F	87%	SSE	6.0mph	10.0mph	29.90in	0.00in	0.00in
7/31/19	10:47 PM	72.0F	67.8F	87%	SSE	2.0mph	7.0mph	29.91in	0.00in	0.00in
7/31/19	10:52 PM	72.0F	67.8F	87%	NE	2.9mph	4.0mph	29.92in	0.00in	0.00in
7/31/19	10:57 PM	72.0F	67.8F	87%	NE	0.9mph	5.0mph	29.92in	0.00in	0.00in
7/31/19	11:02 PM	72.0F	68.2F	88%	ESE	0.9mph	5.0mph	29.92in	0.00in	0.00in
7/31/19	11:08 PM	71.8F	67.6F	87%	SSE	2.9mph	4.0mph	29.92in	0.00in	0.00in
7/31/19	11:13 PM	71.2F	67.5F	88%	ESE	0.9mph	3.0mph	29.91in	0.00in	0.00in
7/31/19	11:18 PM	71.1F	67.3F	88%	NNW	0.9mph	2.0mph	29.92in	0.00in	0.00in
7/31/19	11:23 PM	70.7F	66.9F	88%	ESE	0.9mph	1.0mph	29.92in	0.00in	0.00in
7/31/19	11:28 PM	70.2F	66.7F	89%	ESE	0.0mph	1.0mph	29.92in	0.00in	0.00in
7/31/19	11:34 PM	69.6F	66.6F	90%	ESE	0.0mph	0.0mph	29.92in	0.00in	0.00in
7/31/19	11:39 PM	69.4F	66.4F	90%	ESE	0.9mph	1.0mph	29.92in	0.00in	0.00in
7/31/19	11:44 PM	68.7F	66.0F	91%	SW	0.9mph	2.0mph	29.92in	0.00in	0.00in
7/31/19	11:49 PM	68.5F	66.2F	92%	WSW	0.9mph	3.0mph	29.91in	0.00in	0.00in
7/31/19	11:54 PM	68.7F	66.6F	93%	SSE	4.9mph	6.0mph	29.91in	0.00in	0.00in
7/31/19	11:59 PM	68.9F	66.7F	93%	South	2.0mph	7.0mph	29.91in	0.00in	0.00in
8/1/19	12:04 AM	69.1F	66.7F	92%	SSW	2.0mph	5.0mph	29.91in	0.00in	0.00in
8/1/19	12:10 AM	69.1F	66.7F	92%	SSW	4.0mph	5.0mph	29.91in	0.00in	0.00in
8/1/19	12:15 AM	69.1F	66.7F	92%	South	0.9mph	5.0mph	29.91in	0.00in	0.00in
8/1/19	12:20 AM	68.7F	66.4F	92%	South	4.0mph	5.0mph	29.91in	0.00in	0.00in
8/1/19	12:25 AM	68.7F	66.4F	92%	South	2.9mph	5.0mph	29.91in	0.00in	0.00in
8/1/19	12:30 AM	68.5F	66.4F	93%	SSE	4.0mph	6.0mph	29.91in	0.00in	0.00in
8/1/19	12:35 AM	68.5F	66.4F	93%	SSE	4.9mph	6.0mph	29.91in	0.00in	0.00in
8/1/19	12:41 AM	68.7F	66.6F	93%	SSE	4.0mph	5.0mph	29.91in	0.00in	0.00in
8/1/19	12:46 AM	68.7F	66.6F	93%	SE	4.0mph	6.0mph	29.91in	0.00in	0.00in
8/1/19	12:51 AM	68.9F	66.7F	93%	SSE	4.9mph	6.0mph	29.91in	0.00in	0.00in
8/1/19	12:56 AM	68.7F	66.4F	92%	SE	0.9mph	4.0mph	29.92in	0.00in	0.00in
8/1/19	1:01 AM	68.5F	66.4F	93%	ESE	2.9mph	6.0mph	29.92in	0.00in	0.00in
8/1/19	1:06 AM	68.4F	66.2F	93%	ESE	2.0mph	5.0mph	29.92in	0.00in	0.00in
8/1/19	1:12 AM	68.4F	66.2F	93%	SE	4.0mph	7.0mph	29.92in	0.00in	0.00in
8/1/19	1:17 AM	68.4F	66.2F	93%	SE	4.9mph	9.0mph	29.92in	0.00in	0.00in
8/1/19	1:22 AM	68.4F	66.2F	93%	SE	6.0mph	9.0mph	29.91in	0.00in	0.00in
8/1/19	1:27 AM	68.4F	66.2F	93%	ESE	4.9mph	6.0mph	29.92in	0.00in	0.00in
8/1/19	1:32 AM	68.2F	66.0F	93%	SE	4.9mph	8.0mph	29.92in	0.00in	0.00in
8/1/19	1:37 AM	68.2F	66.4F	94%	SSW	4.9mph	9.0mph	29.91in	0.00in	0.00in
8/1/19	1:43 AM	68.2F	66.4F	94%	ESE	6.0mph	8.0mph	29.91in	0.00in	0.00in
8/1/19	1:48 AM	68.0F	66.2F	94%	ESE	4.0mph	7.0mph	29.91in	0.00in	0.00in
8/1/19	1:53 AM	67.8F	66.0F	94%	SSE	0.0mph	6.0mph	29.92in	0.00in	0.00in
8/1/19	1:58 AM	67.8F	66.0F	94%	ESE	4.0mph	5.0mph	29.92in	0.00in	0.00in
8/1/19	2:03 AM	67.6F	65.8F	94%	ESE	0.9mph	3.0mph	29.92in	0.00in	0.00in
8/1/19	2:08 AM	67.5F	65.7F	94%	East	0.0mph	4.0mph	29.93in	0.00in	0.00in

8/1/19	2:14 AM	67.1F	65.3F	94%	SW	0.9mph	1.0mph	29.92in	0.00in	0.00in
8/1/19	2:19 AM	66.6F	64.8F	94%	WSW	0.0mph	3.0mph	29.92in	0.00in	0.00in
8/1/19	2:24 AM	66.4F	64.9F	95%	WSW	0.9mph	1.0mph	29.92in	0.00in	0.00in
8/1/19	2:29 AM	66.4F	64.9F	95%	SSW	3.0mph	3.0mph	29.92in	0.00in	0.00in
8/1/19	2:34 AM	66.4F	64.9F	95%	SSW	2.9mph	3.0mph	29.92in	0.00in	0.00in
8/1/19	2:40 AM	66.4F	65.1F	96%	SSE	0.9mph	3.0mph	29.92in	0.00in	0.00in
8/1/19	2:45 AM	66.2F	64.9F	96%	SSE	0.0mph	2.0mph	29.92in	0.00in	0.00in
8/1/19	2:50 AM	66.6F	65.3F	96%	SSW	2.0mph	4.0mph	29.92in	0.00in	0.00in
8/1/19	2:55 AM	66.7F	65.5F	96%	SW	0.0mph	2.0mph	29.92in	0.00in	0.00in
8/1/19	3:00 AM	66.7F	65.5F	96%	ESE	0.0mph	4.0mph	29.92in	0.00in	0.00in
8/1/19	3:05 AM	66.7F	65.5F	96%	South	0.0mph	1.0mph	29.92in	0.00in	0.00in
8/1/19	3:11 AM	66.9F	65.7F	96%	South	2.9mph	4.0mph	29.91in	0.00in	0.00in
8/1/19	3:16 AM	66.7F	65.5F	96%	SE	2.9mph	3.0mph	29.91in	0.00in	0.00in
8/1/19	3:21 AM	66.7F	65.5F	96%	SE	0.0mph	1.0mph	29.91in	0.00in	0.00in
8/1/19	3:26 AM	66.7F	65.5F	96%	South	2.0mph	3.0mph	29.91in	0.00in	0.00in
8/1/19	3:31 AM	66.9F	66.0F	97%	SSW	0.9mph	2.0mph	29.91in	0.00in	0.00in
8/1/19	3:36 AM	66.9F	66.0F	97%	SSE	0.0mph	0.0mph	29.91in	0.00in	0.00in
8/1/19	3:41 AM	66.7F	65.5F	96%	SSE	0.0mph	0.0mph	29.91in	0.00in	0.00in
8/1/19	3:46 AM	66.0F	64.8F	96%	WSW	0.0mph	1.0mph	29.91in	0.00in	0.00in
8/1/19	3:51 AM	65.8F	64.6F	96%	SW	0.0mph	1.0mph	29.91in	0.00in	0.00in
8/1/19	3:56 AM	65.8F	64.6F	96%	SW	0.0mph	0.0mph	29.91in	0.00in	0.00in
8/1/19	4:02 AM	65.3F	64.0F	96%	SW	2.0mph	3.0mph	29.91in	0.00in	0.00in
8/1/19	4:07 AM	65.5F	64.6F	97%	SW	2.9mph	4.0mph	29.91in	0.00in	0.00in
8/1/19	4:12 AM	65.7F	64.8F	97%	SSE	2.0mph	4.0mph	29.91in	0.00in	0.00in
8/1/19	4:17 AM	65.8F	64.9F	97%	South	2.0mph	3.0mph	29.91in	0.00in	0.00in
8/1/19	4:22 AM	66.0F	65.1F	97%	SW	2.0mph	4.0mph	29.91in	0.00in	0.00in
8/1/19	4:27 AM	66.2F	65.3F	97%	South	4.0mph	6.0mph	29.91in	0.00in	0.00in
8/1/19	4:33 AM	66.4F	65.5F	97%	SSE	2.0mph	4.0mph	29.91in	0.00in	0.00in
8/1/19	4:38 AM	66.6F	65.7F	97%	SW	0.9mph	1.0mph	29.91in	0.00in	0.00in
8/1/19	4:43 AM	66.4F	65.5F	97%	South	0.9mph	2.0mph	29.91in	0.00in	0.00in
8/1/19	4:48 AM	66.0F	65.1F	97%	South	0.0mph	1.0mph	29.91in	0.00in	0.00in
8/1/19	4:53 AM	66.0F	65.1F	97%	SSE	2.0mph	5.0mph	29.91in	0.00in	0.00in
8/1/19	4:59 AM	66.4F	65.5F	97%	SW	2.0mph	4.0mph	29.91in	0.00in	0.00in
8/1/19	5:04 AM	66.2F	65.3F	97%	South	2.0mph	3.0mph	29.91in	0.00in	0.00in
8/1/19	5:09 AM	66.2F	65.3F	97%	SSE	2.9mph	4.0mph	29.91in	0.00in	0.00in
8/1/19	5:14 AM	66.0F	65.1F	97%	SE	0.0mph	1.0mph	29.92in	0.00in	0.00in
8/1/19	5:19 AM	66.0F	65.1F	97%	ESE	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	5:24 AM	66.0F	65.1F	97%	SE	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	5:30 AM	65.8F	64.9F	97%	SE	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	5:35 AM	65.8F	64.9F	97%	SE	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	5:40 AM	65.8F	64.9F	97%	SSW	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	5:45 AM	65.7F	64.8F	97%	SSW	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	5:50 AM	65.7F	64.8F	97%	SSW	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	5:56 AM	65.7F	64.8F	97%	SSW	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	6:01 AM	65.5F	64.6F	97%	SSW	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	6:06 AM	65.5F	64.6F	97%	SSW	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	6:11 AM	65.5F	64.6F	97%	SSW	0.0mph	0.0mph	29.92in	0.00in	0.00in
8/1/19	6:16 AM	65.3F	64.4F	97%	SSW	0.0mph	0.0mph	29.91in	0.00in	0.00in
8/1/19	6:21 AM	65.3F	64.4F	97%	SSW	0.0mph	0.0mph	29.91in	0.00in	0.00in

STATION:	KNDNEWSA2	Sunset Time:	21:17	Survey Start:	21:17	Determination:	*Valid*
SITES:	6b, 7b; 9a and 9b	Sunrise Time:	6:25	End Time:	2:17	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
8/1/19	9:15 PM	66.0F	63.7F	92%	SE	4.9mph	6.0mph	29.93in	0.00in	0.63in
8/1/19	9:20 PM	66.0F	63.7F	92%	ESE	0.9mph	2.0mph	29.93in	0.00in	0.63in
8/1/19	9:25 PM	65.8F	63.7F	93%	SSE	2.0mph	2.0mph	29.94in	0.00in	0.63in
8/1/19	9:31 PM	65.7F	63.5F	93%	SE	0.9mph	2.0mph	29.94in	0.00in	0.63in
8/1/19	9:36 PM	65.7F	63.3F	92%	ESE	2.0mph	3.0mph	29.94in	0.00in	0.63in
8/1/19	9:41 PM	65.5F	63.1F	92%	South	2.0mph	2.0mph	29.94in	0.00in	0.63in
8/1/19	9:46 PM	65.1F	63.0F	93%	SSE	0.9mph	3.0mph	29.95in	0.00in	0.63in
8/1/19	9:51 PM	65.1F	63.0F	93%	SSW	2.9mph	3.0mph	29.94in	0.00in	0.63in
8/1/19	9:57 PM	65.1F	63.0F	93%	South	2.0mph	4.0mph	29.94in	0.00in	0.63in
8/1/19	10:02 PM	65.1F	63.3F	94%	SE	4.0mph	5.0mph	29.95in	0.00in	0.63in
8/1/19	10:07 PM	65.1F	63.3F	94%	SSW	2.0mph	4.0mph	29.95in	0.00in	0.63in
8/1/19	10:12 PM	65.1F	63.3F	94%	South	2.9mph	3.0mph	29.95in	0.00in	0.63in
8/1/19	10:17 PM	65.1F	63.0F	93%	SSW	2.0mph	5.0mph	29.95in	0.00in	0.63in
8/1/19	10:23 PM	65.1F	63.0F	93%	South	4.0mph	4.0mph	29.95in	0.00in	0.63in
8/1/19	10:28 PM	65.3F	63.0F	92%	SSW	2.9mph	5.0mph	29.95in	0.00in	0.63in
8/1/19	10:33 PM	65.3F	63.0F	92%	SSE	4.9mph	5.0mph	29.95in	0.00in	0.63in
8/1/19	10:38 PM	65.1F	62.8F	92%	South	6.0mph	6.0mph	29.96in	0.00in	0.63in
8/1/19	10:43 PM	64.9F	62.6F	92%	SSE	2.9mph	6.0mph	29.96in	0.00in	0.63in
8/1/19	10:48 PM	64.9F	62.6F	92%	SSE	6.0mph	8.0mph	29.96in	0.00in	0.63in
8/1/19	10:54 PM	64.8F	62.4F	92%	SSE	4.9mph	10.0mph	29.95in	0.00in	0.63in
8/1/19	10:59 PM	64.6F	62.2F	92%	SE	6.0mph	9.0mph	29.95in	0.00in	0.63in
8/1/19	11:04 PM	64.6F	62.2F	92%	SE	8.9mph	9.0mph	29.95in	0.00in	0.63in
8/1/19	11:09 PM	64.4F	62.1F	92%	SSE	4.9mph	6.0mph	29.96in	0.00in	0.63in
8/1/19	11:14 PM	64.2F	62.2F	93%	SE	4.9mph	6.0mph	29.96in	0.00in	0.63in
8/1/19	11:19 PM	64.2F	62.2F	93%	SSE	0.9mph	4.0mph	29.96in	0.00in	0.63in
8/1/19	11:25 PM	64.0F	62.1F	93%	ESE	0.0mph	1.0mph	29.96in	0.00in	0.63in
8/1/19	11:30 PM	64.0F	62.1F	93%	SE	2.0mph	4.0mph	29.97in	0.00in	0.63in
8/1/19	11:35 PM	63.9F	62.1F	94%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.63in
8/1/19	11:40 PM	63.7F	61.9F	94%	ESE	0.0mph	4.0mph	29.97in	0.00in	0.63in
8/1/19	11:45 PM	63.7F	61.9F	94%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.63in
8/1/19	11:50 PM	63.3F	61.5F	94%	ESE	0.0mph	1.0mph	29.97in	0.00in	0.63in
8/1/19	11:56 PM	63.1F	61.3F	94%	ESE	0.0mph	1.0mph	29.97in	0.00in	0.63in
8/2/19	12:01 AM	62.4F	60.6F	94%	ESE	0.0mph	1.0mph	29.97in	0.00in	0.00in
8/2/19	12:06 AM	62.1F	60.3F	94%	ESE	0.0mph	1.0mph	29.97in	0.00in	0.00in
8/2/19	12:11 AM	61.9F	60.4F	95%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	12:16 AM	61.9F	60.8F	96%	ESE	0.0mph	1.0mph	29.98in	0.00in	0.00in
8/2/19	12:22 AM	62.1F	61.0F	96%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	12:27 AM	62.2F	61.2F	96%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	12:32 AM	62.2F	61.2F	96%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	12:37 AM	62.2F	61.2F	96%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	12:42 AM	62.4F	61.3F	96%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	12:47 AM	62.2F	61.2F	96%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	12:53 AM	61.9F	60.8F	96%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	12:58 AM	61.9F	60.8F	96%	ESE	0.0mph	0.0mph	29.98in	0.00in	0.00in
8/2/19	1:03 AM	61.5F	60.4F	96%	ESE	0.0mph	1.0mph	29.97in	0.00in	0.00in
8/2/19	1:08 AM	61.5F	60.4F	96%	ESE	0.0mph	0.0mph	29.98in	0.00in	0.00in
8/2/19	1:13 AM	61.5F	60.4F	96%	ESE	0.0mph	0.0mph	29.98in	0.00in	0.00in
8/2/19	1:18 AM	61.3F	60.3F	96%	ESE	0.0mph	0.0mph	29.98in	0.00in	0.00in
8/2/19	1:23 AM	61.3F	60.3F	96%	ESE	0.0mph	0.0mph	29.98in	0.00in	0.00in
8/2/19	1:28 AM	61.2F	60.1F	96%	SSE	0.0mph	1.0mph	29.98in	0.00in	0.00in
8/2/19	1:34 AM	61.3F	60.4F	97%	South	0.9mph	2.0mph	29.97in	0.00in	0.00in
8/2/19	1:39 AM	61.2F	60.1F	96%	SSE	0.9mph	2.0mph	29.97in	0.00in	0.00in
8/2/19	1:44 AM	61.2F	60.1F	96%	SSE	0.9mph	2.0mph	29.97in	0.00in	0.00in
8/2/19	1:49 AM	61.5F	60.6F	97%	SSW	2.9mph	5.0mph	29.97in	0.00in	0.00in
8/2/19	1:54 AM	61.9F	61.0F	97%	SE	2.0mph	3.0mph	29.96in	0.00in	0.00in
8/2/19	1:59 AM	61.9F	60.8F	96%	SSE	2.9mph	4.0mph	29.97in	0.00in	0.00in

8/2/19	2:04 AM	62.1F	61.0F	96%	SSE	0.9mph	2.0mph	29.97in	0.00in	0.00in
8/2/19	2:10 AM	62.1F	61.0F	96%	SSE	0.9mph	3.0mph	29.96in	0.00in	0.00in
8/2/19	2:15 AM	62.1F	61.0F	96%	SSW	2.0mph	3.0mph	29.96in	0.00in	0.00in
8/2/19	2:20 AM	62.2F	61.2F	96%	South	2.0mph	5.0mph	29.96in	0.00in	0.00in
8/2/19	2:25 AM	62.1F	60.6F	95%	SSE	0.9mph	3.0mph	29.97in	0.00in	0.00in
8/2/19	2:30 AM	61.5F	60.1F	95%	SE	0.0mph	2.0mph	29.97in	0.00in	0.00in
8/2/19	2:35 AM	61.5F	60.4F	96%	SE	0.0mph	3.0mph	29.97in	0.00in	0.00in
8/2/19	2:41 AM	62.1F	61.0F	96%	ESE	4.0mph	4.0mph	29.96in	0.00in	0.00in
8/2/19	2:46 AM	62.8F	61.7F	96%	ESE	6.0mph	6.0mph	29.96in	0.00in	0.00in
8/2/19	2:51 AM	63.1F	61.7F	95%	SE	4.0mph	9.0mph	29.97in	0.00in	0.00in
8/2/19	2:56 AM	63.3F	61.5F	94%	SE	2.0mph	4.0mph	29.97in	0.00in	0.00in
8/2/19	3:01 AM	63.3F	61.5F	94%	SE	2.9mph	4.0mph	29.97in	0.00in	0.00in
8/2/19	3:06 AM	63.3F	61.5F	94%	SSE	4.9mph	5.0mph	29.97in	0.00in	0.00in
8/2/19	3:11 AM	63.3F	61.3F	93%	SSE	2.9mph	4.0mph	29.96in	0.00in	0.00in
8/2/19	3:16 AM	63.1F	61.2F	93%	SSE	2.0mph	2.0mph	29.96in	0.00in	0.00in
8/2/19	3:21 AM	62.8F	60.8F	93%	SSW	0.0mph	1.0mph	29.96in	0.00in	0.00in
8/2/19	3:26 AM	62.2F	60.3F	93%	South	0.0mph	1.0mph	29.97in	0.00in	0.00in
8/2/19	3:31 AM	62.1F	60.3F	94%	SW	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	3:36 AM	61.5F	59.7F	94%	SW	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	3:42 AM	61.3F	59.5F	94%	SW	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	3:47 AM	61.2F	59.7F	95%	ESE	0.0mph	1.0mph	29.97in	0.00in	0.00in
8/2/19	3:52 AM	61.2F	59.7F	95%	ESE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	3:57 AM	61.0F	59.5F	95%	ESE	0.0mph	1.0mph	29.96in	0.00in	0.00in
8/2/19	4:02 AM	61.3F	60.3F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:07 AM	61.0F	59.5F	95%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:13 AM	60.3F	58.8F	95%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:18 AM	60.3F	58.8F	95%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:23 AM	59.9F	58.5F	95%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:28 AM	59.2F	57.4F	94%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:33 AM	58.5F	57.0F	95%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:39 AM	58.6F	57.6F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:44 AM	58.8F	57.7F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:49 AM	58.8F	57.7F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:54 AM	58.6F	57.6F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	4:59 AM	59.0F	58.1F	97%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:04 AM	58.6F	57.6F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:09 AM	57.9F	56.8F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:15 AM	57.9F	57.0F	97%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:20 AM	58.3F	57.4F	97%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:25 AM	57.7F	56.7F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:30 AM	56.8F	55.4F	95%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:35 AM	56.7F	55.6F	96%	ESE	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:40 AM	56.8F	55.9F	97%	South	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:46 AM	56.8F	55.9F	97%	SSW	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:51 AM	57.0F	56.1F	97%	SSW	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	5:56 AM	57.6F	56.7F	97%	SSW	0.0mph	0.0mph	29.96in	0.00in	0.00in
8/2/19	6:01 AM	57.9F	57.4F	98%	SSW	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	6:06 AM	58.6F	58.1F	98%	NE	0.0mph	0.0mph	29.97in	0.00in	0.00in
8/2/19	6:11 AM	58.6F	58.1F	98%	ENE	2.0mph	2.0mph	29.97in	0.00in	0.00in
8/2/19	6:16 AM	58.8F	58.3F	98%	ENE	0.9mph	3.0mph	29.98in	0.00in	0.00in
8/2/19	6:22 AM	59.4F	58.8F	98%	NE	0.0mph	0.0mph	29.98in	0.00in	0.00in
8/2/19	6:27 AM	59.5F	59.0F	98%	NE	0.0mph	2.0mph	29.98in	0.00in	0.00in

STATION:	KNDNEWSA2	Sunset Time:	20:59	Survey Start:	20:59	Determination:	*Valid*
SITES:	6b and 7b (redeployment)	Sunrise Time:	6:42	End Time:	1:59	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
8/13/19	8:57 PM	59.2 F	54.0 F	83 %	NNW	0.9 mph	1.0 mph	30.10 in	0.00 in	0.00 in
8/13/19	9:03 PM	59.2 F	54.0 F	83 %	NNW	2.0 mph	2.0 mph	30.10 in	0.00 in	0.00 in
8/13/19	9:08 PM	59.2 F	54.0 F	83 %	NW	0.9 mph	3.0 mph	30.10 in	0.00 in	0.00 in
8/13/19	9:13 PM	59.4 F	53.8 F	82 %	NW	0.9 mph	3.0 mph	30.10 in	0.00 in	0.00 in
8/13/19	9:18 PM	59.4 F	54.1 F	83 %	NNW	0.0 mph	1.0 mph	30.10 in	0.00 in	0.00 in
8/13/19	9:23 PM	58.8 F	54.0 F	84 %	NNW	0.0 mph	0.0 mph	30.10 in	0.00 in	0.00 in
8/13/19	9:28 PM	58.5 F	54.0 F	85 %	NNW	0.0 mph	0.0 mph	30.11 in	0.00 in	0.00 in
8/13/19	9:33 PM	58.5 F	53.6 F	84 %	NNW	0.0 mph	1.0 mph	30.11 in	0.00 in	0.00 in
8/13/19	9:38 PM	58.5 F	53.6 F	84 %	North	0.0 mph	0.0 mph	30.11 in	0.00 in	0.00 in
8/13/19	9:44 PM	58.5 F	53.2 F	83 %	NNW	0.0 mph	1.0 mph	30.11 in	0.00 in	0.00 in
8/13/19	9:49 PM	58.1 F	52.9 F	83 %	NNW	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	9:54 PM	57.7 F	52.9 F	84 %	NE	0.0 mph	1.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	9:59 PM	57.7 F	52.9 F	84 %	ENE	0.0 mph	1.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:04 PM	57.6 F	53.1 F	85 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:09 PM	57.4 F	53.2 F	86 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:14 PM	57.0 F	52.9 F	86 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:19 PM	56.7 F	53.1 F	88 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:25 PM	55.9 F	52.7 F	89 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:30 PM	55.2 F	52.3 F	90 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:35 PM	54.9 F	52.0 F	90 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:40 PM	54.3 F	51.4 F	90 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:45 PM	53.6 F	51.1 F	91 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	10:50 PM	52.9 F	50.4 F	91 %	ENE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	10:55 PM	52.2 F	49.8 F	92 %	ENE	0.0 mph	0.0 mph	30.12 in	0.00 in	0.00 in
8/13/19	11:00 PM	51.6 F	49.5 F	92 %	ENE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:05 PM	51.3 F	49.3 F	93 %	ENE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:11 PM	50.7 F	48.7 F	93 %	ENE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:16 PM	50.4 F	48.4 F	93 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:21 PM	50.0 F	48.0 F	93 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:26 PM	49.8 F	48.2 F	94 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:31 PM	49.5 F	47.5 F	93 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:36 PM	48.6 F	46.9 F	94 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:41 PM	48.6 F	46.9 F	94 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:46 PM	48.4 F	46.9 F	95 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:51 PM	48.7 F	47.7 F	96 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/13/19	11:56 PM	48.7 F	47.7 F	96 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/14/19	12:01 AM	48.9 F	47.8 F	96 %	SSE	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:06 AM	48.6 F	47.1 F	95 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/14/19	12:11 AM	48.4 F	46.9 F	95 %	SSE	0.0 mph	0.0 mph	30.13 in	0.00 in	0.00 in
8/14/19	12:17 AM	48.4 F	47.3 F	96 %	SSE	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:22 AM	48.4 F	47.3 F	96 %	SSE	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:27 AM	48.4 F	47.3 F	96 %	SSE	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:32 AM	48.6 F	47.5 F	96 %	SSE	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:37 AM	48.6 F	47.5 F	96 %	SSE	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:42 AM	48.4 F	47.3 F	96 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:47 AM	48.6 F	47.5 F	96 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:52 AM	48.7 F	47.7 F	96 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	12:57 AM	48.6 F	47.5 F	96 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	1:02 AM	48.7 F	47.7 F	96 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	1:07 AM	48.0 F	46.6 F	95 %	SW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	1:12 AM	47.7 F	46.6 F	96 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	1:18 AM	47.8 F	46.8 F	96 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	1:23 AM	47.8 F	46.8 F	96 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	1:28 AM	47.8 F	46.8 F	96 %	South	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	1:33 AM	47.3 F	45.9 F	95 %	South	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	1:38 AM	46.6 F	45.1 F	95 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in

8/14/19	1:43 AM	46.0 F	44.6 F	95 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	1:48 AM	45.7 F	44.4 F	95 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	1:53 AM	45.9 F	44.8 F	96 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	1:58 AM	46.6 F	45.9 F	97 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	2:03 AM	46.9 F	46.2 F	97 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	2:08 AM	46.9 F	46.2 F	97 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	2:14 AM	46.9 F	46.2 F	97 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	2:19 AM	46.9 F	46.2 F	97 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	2:24 AM	46.8 F	46.0 F	97 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	2:29 AM	47.5 F	46.8 F	97 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	2:34 AM	47.7 F	46.9 F	97 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	2:39 AM	47.8 F	46.9 F	97 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	2:44 AM	48.4 F	47.5 F	97 %	SSW	0.0 mph	0.0 mph	30.15 in	0.00 in	0.00 in
8/14/19	2:49 AM	48.7 F	48.2 F	98 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	2:54 AM	48.9 F	48.4 F	98 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	2:59 AM	48.7 F	48.2 F	98 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:04 AM	48.9 F	48.0 F	97 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:10 AM	48.9 F	48.0 F	97 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:15 AM	49.3 F	48.4 F	97 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:20 AM	49.3 F	48.4 F	97 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:25 AM	49.3 F	48.4 F	97 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:30 AM	49.1 F	48.0 F	96 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:35 AM	48.9 F	47.8 F	96 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:40 AM	48.6 F	47.1 F	95 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:45 AM	48.2 F	46.8 F	95 %	WSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:50 AM	47.7 F	46.2 F	95 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	3:55 AM	47.5 F	46.4 F	96 %	SW	0.0 mph	2.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:00 AM	47.5 F	46.4 F	96 %	WSW	0.0 mph	2.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:05 AM	47.7 F	46.6 F	96 %	WSW	2.0 mph	3.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:10 AM	47.7 F	46.6 F	96 %	WSW	2.9 mph	3.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:16 AM	47.8 F	46.9 F	97 %	SW	2.0 mph	3.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:21 AM	47.8 F	46.9 F	97 %	SW	2.0 mph	3.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:26 AM	47.5 F	46.4 F	96 %	SW	0.9 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:31 AM	47.1 F	46.0 F	96 %	SW	0.0 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:36 AM	47.7 F	46.9 F	97 %	WSW	0.0 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:41 AM	47.8 F	46.9 F	97 %	WSW	0.0 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:46 AM	47.7 F	46.9 F	97 %	SW	0.0 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:51 AM	47.7 F	46.9 F	97 %	SW	0.0 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	4:56 AM	47.7 F	46.9 F	97 %	SW	0.9 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:01 AM	47.7 F	46.9 F	97 %	WSW	0.0 mph	2.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:06 AM	47.7 F	46.9 F	97 %	WSW	0.9 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:11 AM	47.5 F	46.8 F	97 %	SW	0.0 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:17 AM	47.5 F	46.8 F	97 %	SW	0.9 mph	2.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:22 AM	47.5 F	46.8 F	97 %	WSW	0.0 mph	2.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:27 AM	47.5 F	46.8 F	97 %	WSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:32 AM	47.5 F	46.8 F	97 %	West	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:37 AM	47.1 F	46.4 F	97 %	West	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:42 AM	47.1 F	46.4 F	97 %	West	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:47 AM	47.5 F	46.8 F	97 %	West	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:52 AM	47.7 F	46.9 F	97 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	5:57 AM	47.7 F	46.9 F	97 %	SSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:03 AM	47.5 F	46.8 F	97 %	SSW	0.0 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:08 AM	47.5 F	46.8 F	97 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:13 AM	47.7 F	46.9 F	97 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:18 AM	47.5 F	46.8 F	97 %	SW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:23 AM	47.1 F	46.4 F	97 %	WSW	0.0 mph	0.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:28 AM	46.8 F	46.0 F	97 %	SW	0.0 mph	1.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:33 AM	46.6 F	45.9 F	97 %	West	0.9 mph	2.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:38 AM	46.8 F	46.0 F	97 %	WSW	0.9 mph	2.0 mph	30.14 in	0.00 in	0.00 in
8/14/19	6:44 AM	46.8 F	46.0 F	97 %	West	0.9 mph	1.0 mph	30.14 in	0.00 in	0.00 in

STATION:	KNDNEWSA2	Sunset Time:	20:57	Survey Start:	20:57	Determination:	*Invalid*
SITES:	6b and 7b (redeployment)	Sunrise Time:	6:43	End Time:	1:57	Reason:	Rain persisting more than 30 mins

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
8/14/19	8:53 PM	63.0 F	57.4 F	82 %	SSW	0.0 mph	1.0 mph	29.95 in	0.00 in	0.01 in
8/14/19	8:58 PM	62.8 F	56.8 F	81 %	SW	0.0 mph	1.0 mph	29.95 in	0.00 in	0.01 in
8/14/19	9:03 PM	62.4 F	56.8 F	82 %	SW	0.0 mph	0.0 mph	29.95 in	0.00 in	0.01 in
8/14/19	9:08 PM	62.1 F	56.8 F	83 %	SW	0.0 mph	1.0 mph	29.95 in	0.00 in	0.01 in
8/14/19	9:13 PM	61.5 F	56.3 F	83 %	SW	0.0 mph	1.0 mph	29.95 in	0.00 in	0.01 in
8/14/19	9:18 PM	61.3 F	56.1 F	83 %	SSW	0.0 mph	3.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	9:24 PM	61.3 F	56.1 F	83 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	9:29 PM	61.2 F	55.9 F	83 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	9:34 PM	60.6 F	55.8 F	84 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	9:39 PM	60.4 F	55.6 F	84 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	9:44 PM	60.4 F	55.6 F	84 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	9:49 PM	60.3 F	55.4 F	84 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	9:55 PM	60.3 F	55.4 F	84 %	South	0.0 mph	1.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	10:00 PM	60.1 F	55.6 F	85 %	SSE	0.0 mph	0.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	10:05 PM	60.3 F	55.8 F	85 %	SSE	0.0 mph	0.0 mph	29.97 in	0.00 in	0.01 in
8/14/19	10:10 PM	60.4 F	55.9 F	85 %	South	0.0 mph	1.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	10:15 PM	60.4 F	55.9 F	85 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	10:20 PM	60.4 F	55.9 F	85 %	South	0.0 mph	1.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	10:25 PM	60.4 F	55.9 F	85 %	SE	2.0 mph	3.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	10:30 PM	60.4 F	55.9 F	85 %	SSE	2.0 mph	5.0 mph	29.96 in	0.00 in	0.01 in
8/14/19	10:35 PM	60.8 F	56.3 F	85 %	SE	4.0 mph	4.0 mph	29.97 in	0.00 in	0.01 in
8/14/19	10:40 PM	61.0 F	56.1 F	84 %	SSE	0.9 mph	3.0 mph	29.97 in	0.00 in	0.01 in
8/14/19	10:45 PM	61.2 F	56.3 F	84 %	South	0.9 mph	3.0 mph	29.97 in	0.00 in	0.01 in
8/14/19	10:51 PM	61.3 F	56.1 F	83 %	South	2.9 mph	3.0 mph	29.97 in	0.00 in	0.01 in
8/14/19	10:56 PM	61.5 F	56.3 F	83 %	WSW	2.0 mph	2.0 mph	29.98 in	0.00 in	0.01 in
8/14/19	11:01 PM	61.7 F	56.8 F	84 %	NNW	2.9 mph	13.0 mph	30.01 in	0.00 in	0.01 in
8/14/19	11:06 PM	62.4 F	57.2 F	83 %	NW	11.0 mph	11.0 mph	30.02 in	0.00 in	0.01 in
8/14/19	11:11 PM	61.3 F	57.2 F	86 %	NNW	10.1 mph	19.0 mph	30.02 in	0.01 in	0.02 in
8/14/19	11:16 PM	60.4 F	57.2 F	89 %	NNW	11.0 mph	13.0 mph	30.01 in	0.02 in	0.03 in
8/14/19	11:21 PM	60.1 F	57.4 F	91 %	NNW	6.9 mph	13.0 mph	30.01 in	0.04 in	0.05 in
8/14/19	11:27 PM	59.7 F	57.4 F	92 %		6.0 mph	8.0 mph	29.99 in	0.07 in	0.08 in
8/14/19	11:32 PM	59.5 F	57.6 F	93 %	NNE	4.0 mph	8.0 mph	29.98 in	0.09 in	0.10 in
8/14/19	11:37 PM	59.5 F	57.7 F	94 %	ESE	0.9 mph	3.0 mph	29.97 in	0.11 in	0.12 in
8/14/19	11:42 PM	59.4 F	57.6 F	94 %	ESE	2.9 mph	6.0 mph	29.95 in	0.12 in	0.13 in
8/14/19	11:47 PM	59.2 F	57.4 F	94 %	ESE	2.0 mph	3.0 mph	29.96 in	0.12 in	0.13 in
8/14/19	11:52 PM	58.8 F	57.0 F	94 %	South	0.0 mph	0.0 mph	29.95 in	0.12 in	0.13 in
8/14/19	11:57 PM	58.6 F	56.8 F	94 %	South	0.0 mph	1.0 mph	29.95 in	0.12 in	0.13 in
8/15/19	12:02 AM	58.5 F	56.7 F	94 %	SW	0.9 mph	2.0 mph	29.95 in	0.12 in	0.00 in
8/15/19	12:07 AM	58.3 F	56.5 F	94 %	WSW	0.9 mph	2.0 mph	29.95 in	0.12 in	0.00 in
8/15/19	12:13 AM	58.3 F	56.5 F	94 %	South	0.9 mph	2.0 mph	29.95 in	0.11 in	0.00 in
8/15/19	12:18 AM	58.1 F	56.3 F	94 %	South	2.9 mph	3.0 mph	29.95 in	0.10 in	0.00 in
8/15/19	12:23 AM	57.9 F	56.1 F	94 %	SSE	2.0 mph	3.0 mph	29.94 in	0.07 in	0.00 in
8/15/19	12:28 AM	57.7 F	56.3 F	95 %	SSE	0.9 mph	3.0 mph	29.94 in	0.04 in	0.00 in
8/15/19	12:33 AM	57.6 F	56.1 F	95 %	South	0.9 mph	4.0 mph	29.94 in	0.03 in	0.00 in
8/15/19	12:38 AM	57.6 F	56.1 F	95 %	South	0.9 mph	2.0 mph	29.94 in	0.01 in	0.00 in
8/15/19	12:43 AM	57.4 F	55.9 F	95 %	SSW	0.0 mph	2.0 mph	29.94 in	0.00 in	0.00 in
8/15/19	12:48 AM	57.0 F	55.6 F	95 %	SSW	0.9 mph	2.0 mph	29.93 in	0.00 in	0.00 in
8/15/19	12:53 AM	56.8 F	55.4 F	95 %	SSW	0.9 mph	1.0 mph	29.93 in	0.00 in	0.00 in
8/15/19	12:58 AM	56.8 F	55.4 F	95 %	SSW	0.0 mph	1.0 mph	29.93 in	0.00 in	0.00 in
8/15/19	1:04 AM	56.8 F	55.4 F	95 %	SSW	0.9 mph	1.0 mph	29.93 in	0.00 in	0.00 in
8/15/19	1:09 AM	57.0 F	55.6 F	95 %	South	2.0 mph	2.0 mph	29.93 in	0.00 in	0.00 in
8/15/19	1:14 AM	57.2 F	55.8 F	95 %	South	2.0 mph	4.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	1:19 AM	57.4 F	55.9 F	95 %	South	2.0 mph	3.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	1:24 AM	57.7 F	56.3 F	95 %	South	2.0 mph	5.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	1:29 AM	57.7 F	56.3 F	95 %	SSE	2.0 mph	4.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	1:35 AM	57.7 F	55.9 F	94 %	South	2.0 mph	5.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	1:40 AM	57.6 F	55.8 F	94 %	South	2.0 mph	7.0 mph	29.92 in	0.00 in	0.00 in

8/15/19	1:45 AM	57.7 F	55.9 F	94 %	SSW	2.0 mph	5.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	1:50 AM	57.7 F	55.9 F	94 %	South	2.0 mph	5.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	1:55 AM	57.6 F	55.8 F	94 %	SSW	2.0 mph	3.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	2:00 AM	57.7 F	55.9 F	94 %	South	2.9 mph	3.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	2:05 AM	57.7 F	55.9 F	94 %	SSE	2.9 mph	4.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	2:10 AM	57.6 F	55.6 F	93 %	South	0.9 mph	2.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	2:15 AM	57.6 F	55.6 F	93 %	SSW	2.0 mph	3.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	2:21 AM	57.7 F	55.8 F	93 %	SSW	2.0 mph	3.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	2:26 AM	57.9 F	55.9 F	93 %	SSW	2.0 mph	3.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	2:31 AM	57.9 F	55.6 F	92 %	South	2.0 mph	5.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	2:36 AM	58.3 F	55.9 F	92 %	South	4.0 mph	5.0 mph	29.90 in	0.00 in	0.00 in
8/15/19	2:41 AM	58.3 F	55.9 F	92 %	SSW	4.0 mph	4.0 mph	29.90 in	0.00 in	0.00 in
8/15/19	2:46 AM	58.3 F	55.9 F	92 %	SSW	2.0 mph	2.0 mph	29.90 in	0.00 in	0.00 in
8/15/19	2:51 AM	58.3 F	55.9 F	92 %	SSW	0.9 mph	5.0 mph	29.90 in	0.00 in	0.00 in
8/15/19	2:56 AM	58.5 F	56.1 F	92 %	SSW	2.0 mph	4.0 mph	29.90 in	0.00 in	0.00 in
8/15/19	3:01 AM	58.6 F	55.9 F	91 %	SW	0.9 mph	3.0 mph	29.89 in	0.00 in	0.00 in
8/15/19	3:07 AM	58.8 F	56.1 F	91 %	SW	0.9 mph	3.0 mph	29.89 in	0.00 in	0.00 in
8/15/19	3:12 AM	59.4 F	56.7 F	91 %	SW	2.0 mph	5.0 mph	29.89 in	0.00 in	0.00 in
8/15/19	3:17 AM	59.5 F	56.7 F	90 %	SSW	2.9 mph	6.0 mph	29.89 in	0.00 in	0.00 in
8/15/19	3:22 AM	59.7 F	56.8 F	90 %	SSW	2.9 mph	4.0 mph	29.89 in	0.00 in	0.00 in
8/15/19	3:27 AM	59.7 F	56.8 F	90 %	SW	2.0 mph	5.0 mph	29.89 in	0.00 in	0.00 in
8/15/19	3:32 AM	59.7 F	56.8 F	90 %	SW	2.0 mph	3.0 mph	29.89 in	0.00 in	0.00 in
8/15/19	3:37 AM	59.5 F	56.7 F	90 %	SW	0.9 mph	2.0 mph	29.89 in	0.00 in	0.00 in
8/15/19	3:42 AM	59.5 F	56.8 F	91 %	NNW	8.1 mph	13.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	3:47 AM	60.3 F	57.6 F	91 %	NW	2.0 mph	3.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	3:52 AM	60.6 F	57.7 F	90 %	West	0.0 mph	7.0 mph	29.92 in	0.00 in	0.00 in
8/15/19	3:57 AM	60.6 F	57.4 F	89 %	WSW	0.9 mph	1.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	4:02 AM	60.8 F	57.6 F	89 %	NW	4.9 mph	7.0 mph	29.91 in	0.00 in	0.00 in
8/15/19	4:08 AM	61.0 F	57.7 F	89 %	NNW	2.0 mph	3.0 mph	29.91 in	0.01 in	0.01 in
8/15/19	4:13 AM	60.6 F	57.7 F	90 %	NNW	2.0 mph	2.0 mph	29.91 in	0.01 in	0.01 in
8/15/19	4:18 AM	60.4 F	57.6 F	90 %	NNE	0.0 mph	1.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	4:23 AM	60.3 F	57.6 F	91 %	NNE	0.0 mph	0.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	4:28 AM	59.9 F	57.2 F	91 %	NNW	0.0 mph	0.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	4:33 AM	59.5 F	56.8 F	91 %	NNW	0.0 mph	0.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	4:38 AM	59.2 F	56.8 F	92 %	North	0.0 mph	2.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	4:43 AM	59.0 F	56.7 F	92 %	North	0.0 mph	0.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	4:48 AM	58.6 F	56.7 F	93 %	ENE	0.0 mph	0.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	4:54 AM	58.6 F	56.7 F	93 %	NE	0.0 mph	0.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	4:59 AM	58.5 F	56.7 F	94 %	NE	0.0 mph	1.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	5:04 AM	58.5 F	56.7 F	94 %	NE	0.0 mph	2.0 mph	29.90 in	0.01 in	0.01 in
8/15/19	5:09 AM	58.3 F	56.5 F	94 %	ENE	0.0 mph	1.0 mph	29.89 in	0.00 in	0.01 in
8/15/19	5:14 AM	58.1 F	56.3 F	94 %	NE	0.0 mph	1.0 mph	29.89 in	0.00 in	0.01 in
8/15/19	5:19 AM	57.9 F	56.1 F	94 %	NE	0.0 mph	0.0 mph	29.89 in	0.00 in	0.01 in
8/15/19	5:24 AM	57.6 F	55.8 F	94 %	ENE	0.0 mph	0.0 mph	29.89 in	0.00 in	0.01 in
8/15/19	5:30 AM	57.4 F	55.6 F	94 %	ENE	0.0 mph	0.0 mph	29.89 in	0.00 in	0.01 in
8/15/19	5:35 AM	57.0 F	55.2 F	94 %	NE	0.0 mph	0.0 mph	29.89 in	0.00 in	0.01 in
8/15/19	5:40 AM	56.8 F	55.2 F	94 %	ENE	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	5:45 AM	56.7 F	55.2 F	95 %	ENE	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	5:50 AM	56.7 F	55.2 F	95 %	ENE	0.0 mph	1.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	5:55 AM	56.8 F	55.4 F	95 %	NE	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	6:00 AM	56.8 F	55.4 F	95 %	NW	0.0 mph	1.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	6:06 AM	56.7 F	55.2 F	95 %	NW	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	6:11 AM	56.5 F	55.0 F	95 %	NW	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	6:16 AM	56.5 F	55.0 F	95 %	NW	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	6:21 AM	56.5 F	55.4 F	96 %	NW	0.0 mph	0.0 mph	29.87 in	0.00 in	0.01 in
8/15/19	6:26 AM	56.5 F	55.0 F	95 %	NW	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	6:31 AM	56.3 F	55.2 F	96 %	NW	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	6:36 AM	56.3 F	55.2 F	96 %	NW	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in
8/15/19	6:41 AM	56.5 F	55.4 F	96 %	NW	0.0 mph	0.0 mph	29.88 in	0.00 in	0.01 in

STATION:	KNDNEWSA2	Sunset Time:	20:56	Survey Start:	20:56	Determination:	*Valid*
SITES:	6b and 7b (redeployment)	Sunrise Time:	6:44	End Time:	1:56	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
8/15/19	8:54 PM	63.9 F	59.0 F	84 %	ESE	0.0 mph	1.0 mph	29.79 in	0.00 in	0.54 in
8/15/19	8:59 PM	63.3 F	58.5 F	84 %	SW	0.0 mph	0.0 mph	29.79 in	0.00 in	0.54 in
8/15/19	9:04 PM	62.4 F	57.9 F	85 %	SW	0.0 mph	0.0 mph	29.79 in	0.00 in	0.54 in
8/15/19	9:09 PM	61.3 F	57.2 F	86 %	SW	0.0 mph	1.0 mph	29.79 in	0.00 in	0.54 in
8/15/19	9:14 PM	60.4 F	56.5 F	87 %	SW	0.0 mph	0.0 mph	29.80 in	0.00 in	0.54 in
8/15/19	9:20 PM	59.7 F	56.1 F	88 %	SW	0.0 mph	0.0 mph	29.80 in	0.00 in	0.54 in
8/15/19	9:25 PM	59.4 F	55.8 F	88 %	SW	0.0 mph	0.0 mph	29.80 in	0.00 in	0.54 in
8/15/19	9:30 PM	59.0 F	55.8 F	89 %	SW	0.0 mph	0.0 mph	29.80 in	0.00 in	0.54 in
8/15/19	9:35 PM	58.6 F	55.4 F	89 %	SW	0.0 mph	0.0 mph	29.80 in	0.00 in	0.54 in
8/15/19	9:40 PM	58.3 F	55.0 F	89 %	SW	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	9:45 PM	57.9 F	54.7 F	89 %	SE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.54 in
8/15/19	9:51 PM	57.2 F	54.0 F	89 %	SE	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	9:56 PM	56.8 F	54.3 F	91 %	West	0.0 mph	1.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:01 PM	56.3 F	53.4 F	90 %	SSW	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:06 PM	56.5 F	54.5 F	93 %	SSW	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:11 PM	56.8 F	54.9 F	93 %	SSW	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:16 PM	56.7 F	54.3 F	92 %	SSW	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:22 PM	56.5 F	54.1 F	92 %	SSW	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:27 PM	56.5 F	54.1 F	92 %	South	0.0 mph	1.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:32 PM	55.6 F	53.1 F	91 %	South	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:37 PM	55.6 F	53.6 F	93 %	SSW	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:42 PM	55.8 F	53.8 F	93 %	SW	0.0 mph	1.0 mph	29.82 in	0.00 in	0.54 in
8/15/19	10:47 PM	56.1 F	54.1 F	93 %	South	0.0 mph	0.0 mph	29.82 in	0.00 in	0.54 in
8/15/19	10:52 PM	56.3 F	54.3 F	93 %	SSE	0.9 mph	2.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	10:58 PM	56.7 F	54.7 F	93 %	SSE	4.0 mph	4.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:03 PM	57.0 F	54.7 F	92 %	SSE	0.9 mph	2.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:08 PM	57.0 F	54.7 F	92 %	SSE	0.9 mph	2.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:13 PM	56.8 F	54.0 F	90 %	South	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:18 PM	56.1 F	53.6 F	91 %	SW	0.0 mph	1.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:23 PM	55.8 F	53.4 F	92 %	South	0.0 mph	1.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:28 PM	55.9 F	54.0 F	93 %	SSE	0.0 mph	1.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:34 PM	55.9 F	54.0 F	93 %	South	0.0 mph	1.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:39 PM	55.9 F	53.6 F	92 %	SW	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:44 PM	55.9 F	53.6 F	92 %	SSE	0.0 mph	1.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:49 PM	55.8 F	53.4 F	92 %	South	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:54 PM	55.6 F	53.2 F	92 %	South	0.0 mph	0.0 mph	29.81 in	0.00 in	0.54 in
8/15/19	11:59 PM	55.4 F	53.4 F	93 %	South	0.0 mph	0.0 mph	29.80 in	0.00 in	0.54 in
8/16/19	12:05 AM	55.6 F	54.0 F	94 %	South	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:10 AM	55.9 F	54.0 F	93 %	SSE	0.0 mph	1.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:15 AM	55.9 F	54.0 F	93 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:20 AM	55.8 F	53.8 F	93 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:25 AM	55.9 F	54.0 F	93 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:30 AM	55.4 F	53.4 F	93 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:35 AM	55.2 F	53.2 F	93 %	SSE	0.0 mph	1.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:40 AM	55.0 F	53.1 F	93 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:46 AM	55.0 F	53.4 F	94 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:51 AM	55.0 F	53.4 F	94 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	12:56 AM	54.9 F	53.2 F	94 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:01 AM	55.0 F	53.4 F	94 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:06 AM	54.5 F	52.5 F	93 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:11 AM	54.1 F	52.5 F	94 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:16 AM	54.1 F	52.5 F	94 %	SSE	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:21 AM	54.1 F	52.5 F	94 %	South	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:27 AM	54.1 F	52.5 F	94 %	West	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:32 AM	54.1 F	52.2 F	93 %	West	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	1:37 AM	54.1 F	52.2 F	93 %	West	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:42 AM	54.0 F	52.0 F	93 %	West	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in

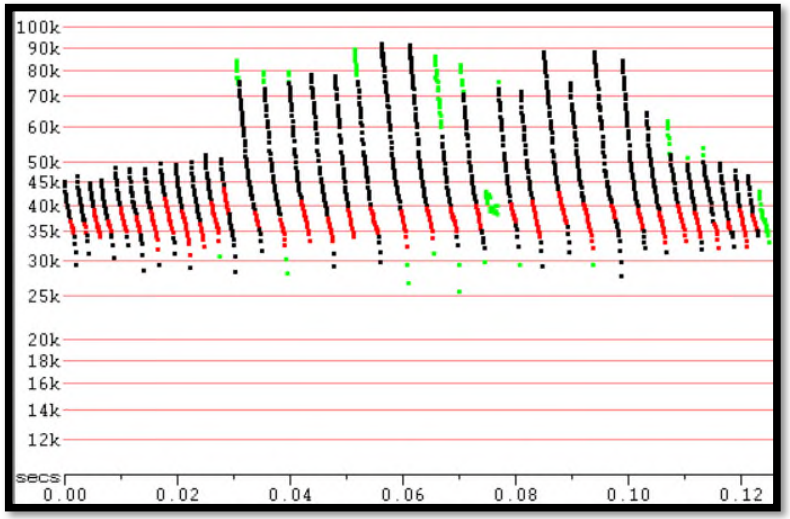
8/16/19	1:47 AM	54.1 F	52.2 F	93 %	West	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	1:52 AM	54.1 F	52.2 F	93 %	West	0.0 mph	0.0 mph	29.80 in	0.00 in	0.00 in
8/16/19	1:57 AM	54.0 F	52.0 F	93 %	SSW	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:02 AM	54.0 F	51.6 F	92 %	SSW	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:07 AM	54.0 F	52.0 F	93 %	SE	0.0 mph	1.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:13 AM	54.5 F	52.5 F	93 %	SE	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:18 AM	54.3 F	51.8 F	91 %	SE	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:23 AM	54.0 F	51.6 F	92 %	SSE	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:28 AM	54.0 F	52.0 F	93 %	SSE	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:33 AM	54.1 F	51.8 F	92 %	SSE	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:38 AM	53.8 F	51.4 F	92 %	SE	0.0 mph	0.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	2:43 AM	53.4 F	51.1 F	92 %	SE	0.0 mph	1.0 mph	29.79 in	0.00 in	0.00 in
8/16/19	2:48 AM	53.2 F	51.3 F	93 %	SW	0.9 mph	3.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	2:53 AM	53.4 F	51.4 F	93 %	SW	0.9 mph	2.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	2:58 AM	53.2 F	51.3 F	93 %	WSW	0.0 mph	0.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:03 AM	53.1 F	51.1 F	93 %	WSW	0.0 mph	0.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:08 AM	52.9 F	50.9 F	93 %	West	0.0 mph	0.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:13 AM	52.7 F	50.7 F	93 %	WSW	0.0 mph	1.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:19 AM	52.9 F	50.9 F	93 %	West	0.0 mph	1.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:24 AM	52.9 F	51.3 F	94 %	WSW	0.9 mph	2.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:29 AM	53.2 F	51.3 F	93 %	West	0.9 mph	2.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:34 AM	53.2 F	51.3 F	93 %	WSW	0.9 mph	1.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:39 AM	53.1 F	51.1 F	93 %	SW	0.0 mph	1.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:44 AM	53.1 F	51.1 F	93 %	West	0.9 mph	2.0 mph	29.78 in	0.00 in	0.00 in
8/16/19	3:49 AM	53.4 F	51.8 F	94 %	WSW	2.0 mph	4.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	3:54 AM	53.8 F	51.8 F	93 %	SW	2.0 mph	3.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	3:59 AM	53.8 F	51.8 F	93 %	West	2.0 mph	4.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:04 AM	54.0 F	52.0 F	93 %	WSW	2.9 mph	4.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:09 AM	54.0 F	52.0 F	93 %	WSW	2.0 mph	3.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:14 AM	54.1 F	52.2 F	93 %	WSW	2.0 mph	5.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:20 AM	54.5 F	52.2 F	92 %	WSW	2.0 mph	3.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:25 AM	54.7 F	52.2 F	91 %	WSW	2.9 mph	3.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:30 AM	54.3 F	51.8 F	91 %	WSW	2.0 mph	2.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:35 AM	54.0 F	51.4 F	91 %	WSW	0.9 mph	2.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:40 AM	53.8 F	51.4 F	92 %	West	0.0 mph	1.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:45 AM	53.4 F	51.1 F	92 %	West	0.9 mph	1.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:50 AM	53.1 F	51.1 F	93 %	West	0.9 mph	1.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	4:55 AM	52.5 F	50.5 F	93 %	West	0.0 mph	0.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	5:00 AM	52.5 F	50.5 F	93 %	West	0.9 mph	1.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	5:05 AM	52.3 F	50.4 F	93 %	West	0.9 mph	1.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	5:10 AM	52.2 F	50.2 F	93 %	West	0.9 mph	1.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	5:15 AM	52.2 F	50.5 F	94 %	West	0.9 mph	2.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	5:20 AM	52.2 F	50.2 F	93 %	West	0.9 mph	2.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	5:25 AM	52.0 F	50.0 F	93 %	West	0.9 mph	2.0 mph	29.77 in	0.00 in	0.00 in
8/16/19	5:30 AM	52.0 F	50.0 F	93 %	West	0.9 mph	1.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	5:35 AM	52.0 F	50.0 F	93 %	WSW	0.9 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	5:40 AM	51.4 F	49.5 F	93 %	WSW	0.9 mph	1.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	5:46 AM	51.3 F	49.3 F	93 %	WSW	0.9 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	5:51 AM	51.3 F	49.6 F	94 %	WSW	2.0 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	5:56 AM	51.1 F	49.1 F	93 %	WSW	0.9 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:01 AM	51.1 F	49.5 F	94 %	WNW	0.9 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:06 AM	51.4 F	49.8 F	94 %	WSW	2.0 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:11 AM	51.8 F	49.8 F	93 %	WSW	2.0 mph	3.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:16 AM	51.8 F	49.8 F	93 %	WSW	0.9 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:21 AM	51.8 F	49.8 F	93 %	SW	0.9 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:27 AM	51.6 F	49.5 F	92 %	West	0.9 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:32 AM	51.6 F	49.6 F	93 %	WNW	0.9 mph	2.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:37 AM	51.6 F	49.6 F	93 %	West	0.0 mph	1.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:42 AM	51.6 F	49.6 F	93 %	West	0.9 mph	1.0 mph	29.76 in	0.00 in	0.00 in
8/16/19	6:47 AM	51.4 F	49.5 F	93 %	WSW	0.0 mph	1.0 mph	29.76 in	0.00 in	0.00 in

STATION:	KNDNEWSA2	Sunset Time:	20:54	Survey Start:	20:54	Determination:	*Valid*
SITES:	6b and 7b (redeployment)	Sunrise Time:	6:46	End Time:	1:54	Reason:	No adverse weather

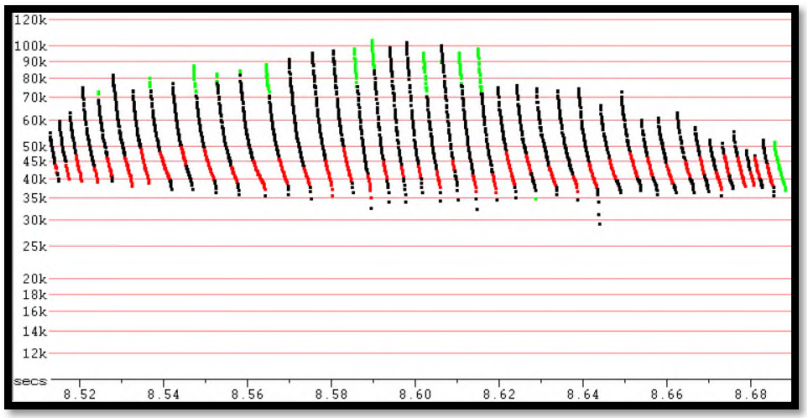
Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
8/16/19	8:54 PM	67.8 F	58.8 F	73 %	South	0.9 mph	2.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	8:59 PM	67.6 F	59.0 F	74 %	SW	0.9 mph	2.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:04 PM	67.3 F	58.6 F	74 %	South	0.9 mph	3.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:09 PM	66.7 F	58.6 F	75 %	SW	0.9 mph	1.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:15 PM	66.6 F	58.8 F	76 %	South	0.9 mph	2.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:20 PM	66.4 F	59.0 F	77 %	SE	2.0 mph	3.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:25 PM	66.0 F	58.6 F	77 %	SW	2.9 mph	3.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:30 PM	65.7 F	58.6 F	78 %	SSW	2.0 mph	3.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:35 PM	65.3 F	58.6 F	79 %	SSW	0.9 mph	4.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:41 PM	64.9 F	58.6 F	80 %	SSW	2.0 mph	2.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:46 PM	64.8 F	58.5 F	80 %	South	2.0 mph	4.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	9:51 PM	64.6 F	58.3 F	80 %	SSW	2.0 mph	3.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	9:56 PM	64.6 F	58.6 F	81 %	South	2.0 mph	3.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:01 PM	64.2 F	58.3 F	81 %	South	0.9 mph	4.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:06 PM	64.0 F	58.1 F	81 %	South	0.9 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:12 PM	64.0 F	57.7 F	80 %	South	2.9 mph	3.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:17 PM	64.2 F	57.6 F	79 %	SSE	4.0 mph	4.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:22 PM	64.6 F	57.9 F	79 %	South	2.0 mph	5.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:27 PM	65.1 F	58.1 F	78 %	South	6.0 mph	6.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:32 PM	65.5 F	58.5 F	78 %	South	2.9 mph	4.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:38 PM	66.0 F	58.6 F	77 %	South	2.0 mph	7.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:43 PM	66.7 F	59.0 F	76 %	SSW	2.0 mph	5.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:48 PM	66.9 F	59.2 F	76 %	SSW	2.9 mph	6.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	10:53 PM	66.9 F	59.2 F	76 %	South	6.0 mph	6.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	10:58 PM	66.9 F	59.2 F	76 %	South	2.9 mph	5.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	11:03 PM	67.1 F	58.8 F	75 %	SW	4.9 mph	6.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	11:08 PM	67.3 F	59.0 F	75 %	SE	2.9 mph	7.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	11:13 PM	67.3 F	59.0 F	75 %	SSW	2.0 mph	7.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	11:18 PM	67.3 F	58.6 F	74 %	SSW	4.0 mph	6.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	11:23 PM	67.3 F	58.6 F	74 %	SW	6.9 mph	8.0 mph	29.61 in	0.00 in	0.00 in
8/16/19	11:29 PM	67.3 F	58.6 F	74 %	West	8.1 mph	16.0 mph	29.62 in	0.00 in	0.00 in
8/16/19	11:34 PM	67.8 F	58.8 F	73 %	WSW	8.1 mph	9.0 mph	29.63 in	0.00 in	0.00 in
8/16/19	11:39 PM	67.8 F	58.8 F	73 %	SW	6.0 mph	10.0 mph	29.63 in	0.00 in	0.00 in
8/16/19	11:44 PM	68.4 F	58.6 F	71 %	West	8.9 mph	9.0 mph	29.63 in	0.00 in	0.00 in
8/16/19	11:49 PM	68.5 F	59.5 F	73 %	WSW	4.0 mph	7.0 mph	29.64 in	0.00 in	0.00 in
8/16/19	11:54 PM	68.0 F	59.4 F	74 %	West	2.0 mph	3.0 mph	29.63 in	0.00 in	0.00 in
8/16/19	11:59 PM	67.6 F	59.0 F	74 %	West	0.0 mph	2.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	12:05 AM	67.3 F	59.0 F	75 %	West	0.0 mph	1.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	12:10 AM	66.7 F	59.0 F	76 %	West	0.0 mph	1.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	12:15 AM	66.4 F	59.0 F	77 %	West	0.9 mph	2.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	12:20 AM	66.0 F	59.4 F	79 %	West	0.0 mph	0.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	12:25 AM	65.5 F	58.8 F	79 %	West	0.0 mph	0.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	12:31 AM	65.1 F	58.8 F	80 %	SSE	2.0 mph	3.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	12:36 AM	65.1 F	58.1 F	78 %	SSE	0.9 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	12:41 AM	65.5 F	58.1 F	77 %	South	2.0 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	12:46 AM	65.7 F	58.3 F	77 %	SSE	2.0 mph	3.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	12:51 AM	65.7 F	58.3 F	77 %	SSW	2.0 mph	4.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	12:56 AM	66.2 F	58.1 F	75 %	South	4.9 mph	6.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	1:01 AM	66.4 F	57.9 F	74 %	South	2.9 mph	6.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	1:07 AM	66.4 F	57.9 F	74 %	South	2.0 mph	5.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	1:12 AM	65.8 F	57.7 F	75 %	SSE	2.9 mph	5.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	1:17 AM	65.5 F	57.7 F	76 %	South	4.0 mph	4.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	1:22 AM	65.1 F	57.4 F	76 %	South	0.9 mph	4.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	1:27 AM	64.2 F	57.6 F	79 %	SW	0.9 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	1:32 AM	63.7 F	57.4 F	80 %	SW	0.9 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	1:37 AM	63.1 F	57.2 F	81 %	SW	0.9 mph	2.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	1:43 AM	62.6 F	57.0 F	82 %	WSW	0.0 mph	1.0 mph	29.61 in	0.00 in	0.00 in

8/17/19	1:48 AM	62.6 F	57.0 F	82 %	South	0.9 mph	1.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	1:53 AM	62.2 F	56.7 F	82 %	SSE	0.9 mph	2.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	1:58 AM	62.4 F	56.8 F	82 %	South	0.9 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:03 AM	62.4 F	56.8 F	82 %	West	2.0 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:08 AM	62.6 F	57.0 F	82 %	West	2.0 mph	3.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:14 AM	62.6 F	57.0 F	82 %	West	2.0 mph	3.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:19 AM	62.6 F	57.0 F	82 %	SW	0.9 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:24 AM	62.4 F	56.8 F	82 %	WSW	2.0 mph	2.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:29 AM	62.1 F	56.8 F	83 %	WSW	0.0 mph	1.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:34 AM	61.5 F	56.7 F	84 %	West	0.0 mph	1.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:39 AM	61.5 F	57.0 F	85 %	WSW	2.0 mph	3.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	2:44 AM	62.2 F	57.4 F	84 %	WSW	0.0 mph	1.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	2:49 AM	62.6 F	57.0 F	82 %	NW	4.9 mph	6.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	2:55 AM	63.1 F	57.2 F	81 %	NW	4.9 mph	10.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:00 AM	63.0 F	57.0 F	81 %	NW	12.1 mph	12.0 mph	29.61 in	0.00 in	0.00 in
8/17/19	3:05 AM	62.8 F	57.2 F	82 %	NNW	11.0 mph	12.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:10 AM	62.2 F	57.4 F	84 %	NW	8.1 mph	12.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:15 AM	61.9 F	57.4 F	85 %	NNW	12.1 mph	13.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:20 AM	61.7 F	57.4 F	86 %	North	10.1 mph	10.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:25 AM	61.5 F	57.6 F	87 %	NNW	6.9 mph	10.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:30 AM	61.2 F	57.2 F	87 %	NNE	8.1 mph	10.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:35 AM	61.2 F	57.6 F	88 %	NNW	6.9 mph	9.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:41 AM	61.0 F	57.4 F	88 %	NNW	4.9 mph	9.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:46 AM	60.4 F	56.8 F	88 %		4.9 mph	6.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:51 AM	60.3 F	57.0 F	89 %		4.0 mph	6.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	3:56 AM	60.1 F	56.8 F	89 %	NNW	4.0 mph	7.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	4:01 AM	59.9 F	56.7 F	89 %	North	6.0 mph	9.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	4:06 AM	59.5 F	56.3 F	89 %	NNE	6.0 mph	7.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	4:11 AM	59.4 F	56.5 F	90 %		4.9 mph	7.0 mph	29.62 in	0.00 in	0.00 in
8/17/19	4:16 AM	59.2 F	56.3 F	90 %	NNW	4.9 mph	9.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	4:21 AM	59.2 F	56.3 F	90 %	NNW	6.9 mph	9.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	4:26 AM	59.2 F	56.3 F	90 %	North	6.0 mph	9.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	4:32 AM	59.2 F	56.3 F	90 %	NW	4.9 mph	7.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	4:37 AM	59.2 F	55.9 F	89 %	NNW	4.9 mph	8.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	4:42 AM	58.8 F	55.9 F	90 %	NNW	6.0 mph	9.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	4:47 AM	58.6 F	55.8 F	90 %	NW	8.1 mph	10.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	4:52 AM	58.6 F	55.8 F	90 %	NNW	6.0 mph	12.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	4:57 AM	58.6 F	55.8 F	90 %	NNW	8.1 mph	9.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	5:02 AM	58.5 F	55.6 F	90 %	NW	6.9 mph	9.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	5:07 AM	58.3 F	55.4 F	90 %	NNW	4.9 mph	8.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	5:12 AM	58.1 F	55.2 F	90 %	NNW	6.0 mph	9.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	5:17 AM	57.9 F	55.0 F	90 %	NNW	8.1 mph	9.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	5:22 AM	57.9 F	55.0 F	90 %		6.9 mph	9.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	5:27 AM	57.9 F	55.0 F	90 %	NNW	6.0 mph	7.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	5:33 AM	57.7 F	54.9 F	90 %	NNW	4.0 mph	7.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	5:38 AM	57.6 F	54.7 F	90 %	NNW	4.0 mph	8.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	5:43 AM	57.6 F	54.7 F	90 %	NW	4.0 mph	7.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	5:48 AM	57.4 F	54.9 F	91 %	NNW	6.0 mph	8.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	5:53 AM	57.2 F	54.7 F	91 %	NNW	4.0 mph	6.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	5:58 AM	57.0 F	54.5 F	91 %	North	4.0 mph	7.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	6:03 AM	57.2 F	54.7 F	91 %	NNW	2.9 mph	7.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	6:08 AM	57.6 F	55.0 F	91 %	NNW	2.0 mph	6.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	6:13 AM	57.6 F	55.0 F	91 %	NE	0.0 mph	3.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	6:18 AM	57.7 F	55.2 F	91 %	NNE	0.0 mph	6.0 mph	29.63 in	0.00 in	0.00 in
8/17/19	6:23 AM	57.6 F	55.0 F	91 %	NNE	2.0 mph	2.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	6:29 AM	57.6 F	55.0 F	91 %	NNW	0.9 mph	3.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	6:34 AM	57.6 F	55.0 F	91 %	North	2.9 mph	5.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	6:39 AM	57.6 F	55.0 F	91 %	NNW	2.0 mph	5.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	6:44 AM	57.6 F	55.0 F	91 %	NNW	2.0 mph	7.0 mph	29.64 in	0.00 in	0.00 in
8/17/19	6:49 AM	57.6 F	55.0 F	91 %	North	0.9 mph	5.0 mph	29.64 in	0.00 in	0.00 in

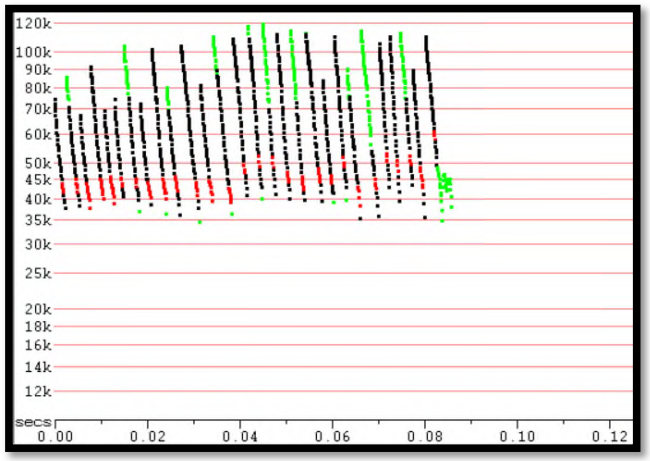
Appendix M. Representative Bat Species Calls



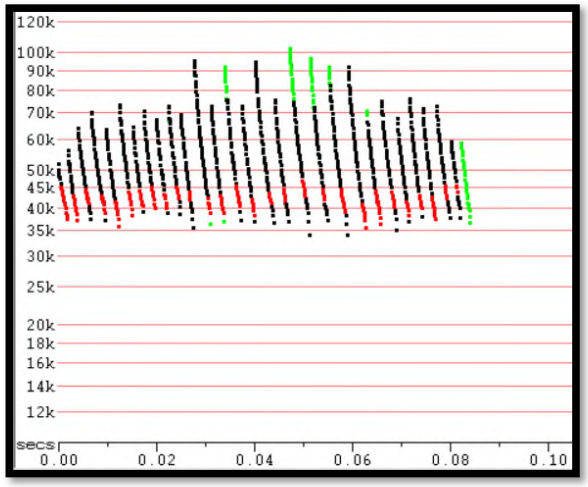
Appendix M1. Call screen of potential northern long-eared bat call from site 6a reclassified as a big brown bat by qualitative analysis.



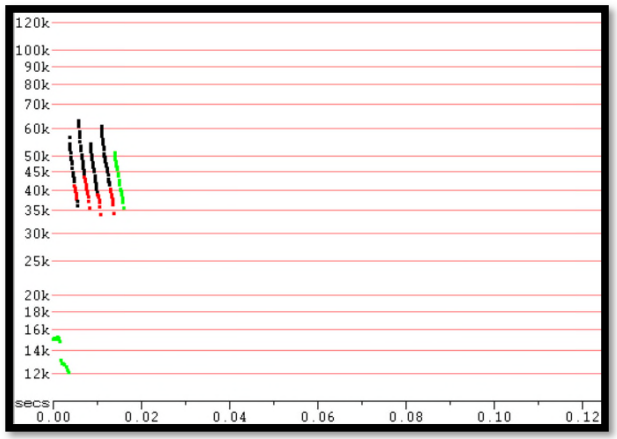
Appendix M2. Call screen of potential northern long-eared bat call from site 5b reclassified as a little brown bat by qualitative analysis.



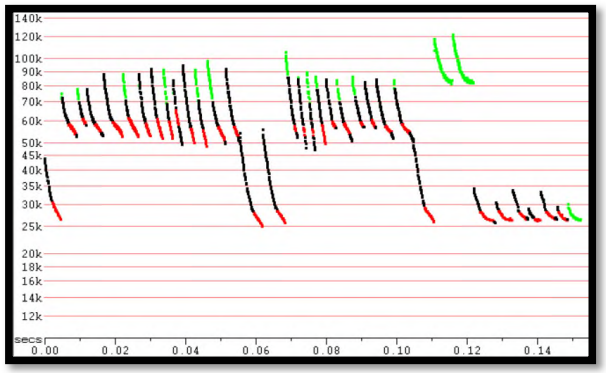
Appendix M3. Call screen of potential northern long-eared bat call from site 4b confirmed as a northern long-eared bat by qualitative analysis.



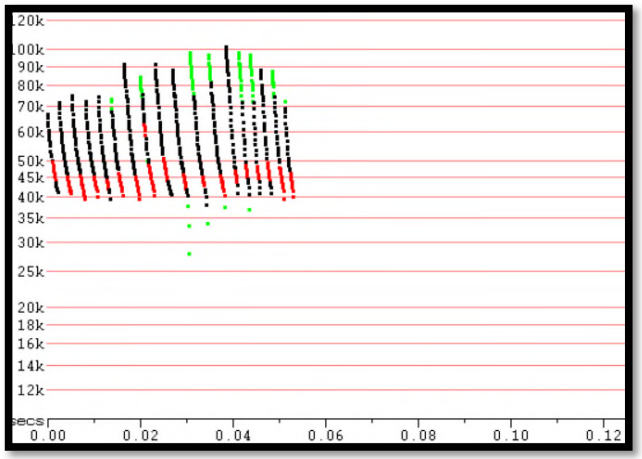
Appendix M4. Call screen of potential northern long-eared bat call from site 5b confirmed as a northern long-eared bat by qualitative analysis.



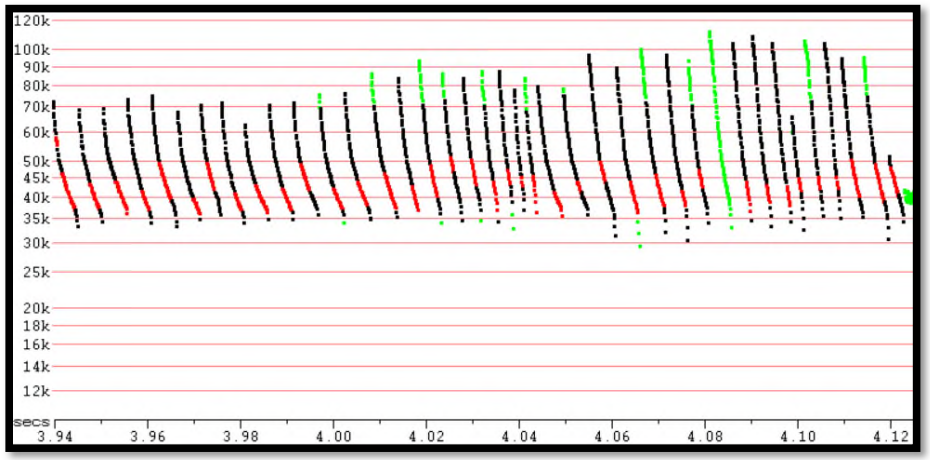
Appendix M5. Call screen of potential northern long-eared bat call from site 4b reclassified as a high frequency unknown by qualitative analysis.



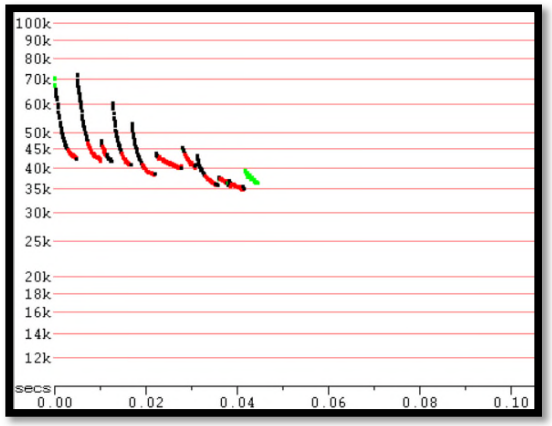
Appendix M6. Call screen of potential northern long-eared bat call from site 4b reclassified as a low frequency unknown by qualitative analysis. The detector is recording the second and third harmonics of the fundamental frequency and Kaleidoscope is identifying those harmonic calls as northern long-eared bats because of the high frequency components. The gaps in the sequence of lower frequency calls are instances when the second and third harmonics are more inten se and the detector is recording those calls instead of the fundamental frequency.



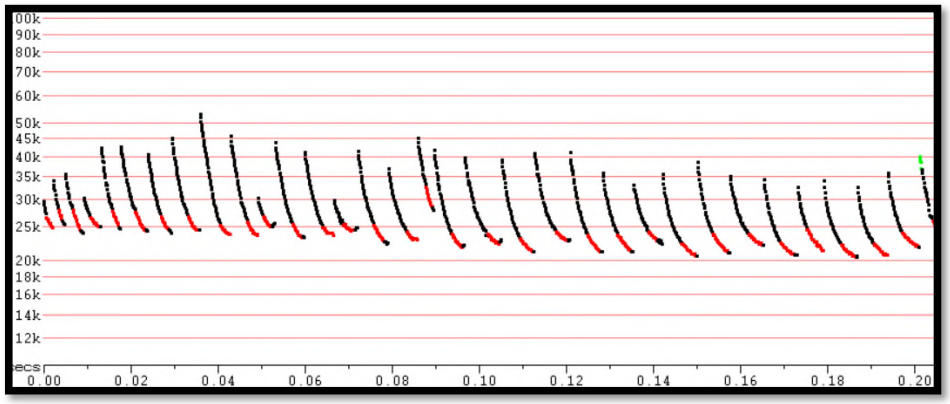
Appendix M7. Call screen of potential northern long-eared bat call from site 6a reclassified as an unknown *Myotis* species call by qualitative analysis.



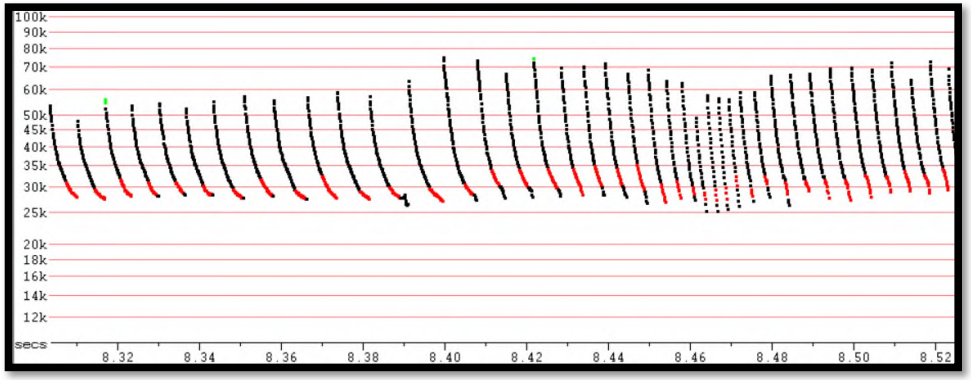
Appendix M8. Call screen of little brown bat call from site 6a identified by qualitative analysis.



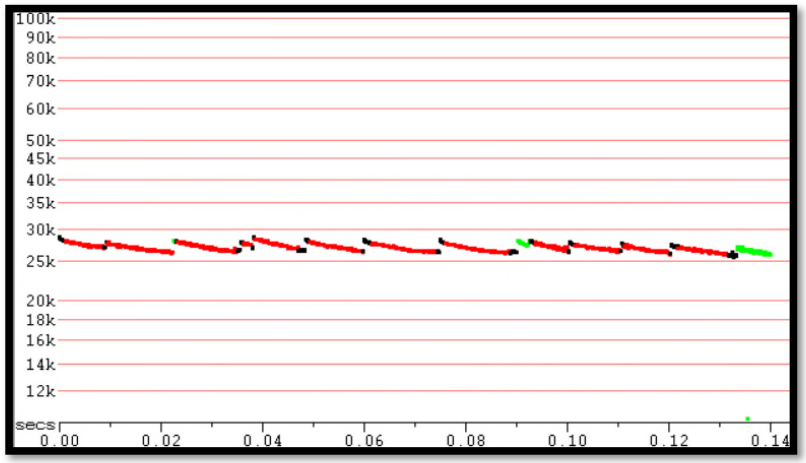
Appendix M9. Call screen of an eastern red bat call from site 5b identified by qualitative analysis.



Appendix M10. Call screen of a hoary bat call from site 6a identified by qualitative analysis.



Appendix M11. Call screen of a big brown bat call from site 5b identified by qualitative analysis.



Appendix M12. Call screen of a silver-haired bat call from site 5b identified by qualitative analysis.

Appendix B15. Northern Long-Eared Bat Presence/Absence Acoustic Surveys (2020)

Northern Long-Eared Bat Presence/Absence Surveys

Oliver Wind IV Project

Oliver and Mercer Counties, North Dakota

Surveys Conducted July 22 – July 28, 2020

Prepared for:

Oliver Wind IV, LLC

Prepared by:

Julia Wilson, Kristina Hammond, Kevin Murray, and Clayton Derby

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4007 State Street, Suite 109
Bismarck, North Dakota

Report Revised: August 29, 2023

WEST

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EXECUTIVE SUMMARY

Oliver Wind IV, LLC (Company), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC, is developing the Oliver Wind IV Project (Project) located in Oliver County with the associated transmission line extending into Mercer County. The Company contracted Western EcoSystems Technology, Inc. (WEST) to conduct summer presence/absence acoustic surveys for the federally threatened northern long-eared bat (*Myotis septentrionalis*; NLEB) at the Project. WEST employed acoustic surveys to determine whether NLEB is present or absent within the Study Area during the summer maternity season (May 15 – August 15).

The US Fish and Wildlife Service (USFWS) 2020 *Range-Wide Indiana Bat Survey Guidelines* (Guidelines), which also apply to the NLEB, recommends a minimum of one acoustic survey site (site) consisting of two acoustic detector locations (detector locations) for every 49.8 hectares (ha; 123.0 acres [ac]) of suitable summer habitat for non-linear projects, with each detector location deployed for four nights to total eight detector nights per site. For linear projects, the Guidelines recommend a minimum of two detector nights for each 1.0-kilometer (km; 0.6-miles [mi]) segment of suitable summer habitat. For the purposes of this NLEB presence/absence survey, the transmission portion of the Project was treated as a linear "project" and the power generating portion of the project was treated as a "non-linear" project (Study Area, Figure 1).

Sites and detector locations within the Study Area were selected by creating 1.0-km buffers around the turbine layout and the portion of the T-Line encompassed therein. The linear portion of the Project where surveys were conducted (i.e., T-Line route) is defined as the 20.0-km (12.4-mi) long T-Line and a 30.5-meters (m; 100.0-feet [ft]) buffer on each side (60.9 m [200.0 ft] total) of the centerline. A total of 342.0 ha (845.1 ac) of potentially suitable NLEB summer habitat were identified through desktop analysis within the Study Area, resulting in 14 detector locations (corresponding to seven sites) proposed within the Study Area as per the 2020 Guidelines. Five 1.0-km segments with potential NLEB summer habitat were identified along the T-Line route, resulting in five detector locations (corresponding to five survey sites) proposed along the T-Line route as per the Guidelines.

A federally permitted bat biologist conducted acoustic surveys July 22 – July 28, 2020, for a total of 59 detector-nights within the Study Area and 14 detector-nights along the T-Line route, following methods described in the current Guidelines. Kaleidoscope identified 27 call files as potential NLEB calls. Upon qualitative review, four call files at one detector location 7B were confirmed as NLEB calls. However, little brown bats (*Myotis lucifugus*) and western long-eared bats (*Myotis evotis*), which have similar calls to NLEB, were also present at detector location 7B and it is possible that the calls identified as NLEB were false positives. No follow-up mist-net or telemetry surveys were conducted but acquiring capture data (using mist-net surveys) are recommended in order to reduce the uncertainty associated with the 2020 acoustic data.

STUDY PARTICIPANTS

Clayton Derby	Project Manager; Senior Reviewer
Kevin Murray	Qualitative Acoustic Analyst; Senior Bat Biologist Review
Julia Wilson	Permitted Bat Biologist; Report Writer
Kristina Hammond-Rendon	Permitted Bat Biologist
Alex Brazeal	Acoustic Technician
Terri Thorn	GIS Specialist
Jolie Blevins	Bat Project Coordinator; Data Manager
Carissa Goodman	Technical Editor
Sofía Agudelo	Senior Technical Editor; Reviewer

REPORT REFERENCE

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[1] The Appendices include documents referring to the Red Butte Wind Farm. The Project name was changed to Oliver Wind IV Project in 2022, making the information in the Appendices applicable to the Oliver Wind IV Project despite references to the Red Butt Wind Farm.

BACKGROUND AND PROJECT OVERVIEW

Oliver Wind IV, LLC (Oliver Wind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC (NextEra), is developing the Oliver Wind IV Energy Center (WEC) and Transmission Line (T-Line), collectively known as the Oliver Wind IV Project (Project), in Oliver and Mercer Counties, North Dakota (Figure 1). Oliver Wind IV contracted Western EcoSystems Technology, Inc. (WEST) to conduct presence/absence surveys for the federally threatened northern long-eared bat (*Myotis septentrionalis*; NLEB; US Fish and Wildlife Service [USFWS] 2015) during the summer maternity season (May 15 – August 15) within the Study Area.

Based on North Dakota Game and Fish Department (NDGFD) records for North Dakota, NLEB is considered rare in the state (Dyke et al. 2015, NDGFD 2019). Recent research by North Dakota State University found that presence is unlikely throughout North Dakota except potentially in Badlands areas in the extreme western part of the state (Nelson et al. 2015; Dr. E. Gillam, North Dakota State University, pers. com. May 16, 2019). The Project is approximately 85 miles east the Badlands area. However, four NLEB were captured in August 2019 within the Study Area for the Project Study Area (Wilson et al. 2023). The objective of the 2020 surveys was to determine if NLEB are present within the new 2020 Study Area (Figure 1) located to the north and west of the sites where the four NLEB's were captured in 2019.

METHODS

All surveys followed methods described within the USFWS *Range-Wide Indiana Bat Summer Survey Guidelines* (Guidelines), which also apply to the NLEB (USFWS 2020). The Guidelines for surveys recommend: 1) desktop habitat assessment, 2) presence/probable absence acoustic or mist-net surveys, and 3) telemetry surveys (if needed). A study plan for the Project was provided to the USFWS on June 12, 2020, and no response was received.

Habitat Assessment and Survey Effort

For non-linear projects, the Guidelines specify a minimum survey effort of one acoustic survey site (site) consisting of two acoustic detector locations (detector locations) for every 49.8 hectares (ha; 123.0 acres [ac]) of suitable summer habitat. Each detector location should be deployed for four nights to total eight detector nights per site (USFWS 2020). For linear projects, the Guidelines recommend a minimum of two detector nights for each 1.0-kilometer (km; 0.6-mile [mi]) segment that contains suitable summer NLEB habitat. The Guidelines define suitable NLEB habitat as any forest (i.e., deciduous, coniferous, mixed) or forested landscape feature (e.g., woody wetlands, forested riparian areas, shelterbelts). For the purposes of this NLEB presence/absence survey, the transmission portion of the Project was treated as a linear "project" and the power generating portion of the project was treated as a "non-linear" project (Study Area; Figure 1).

Sites and detector locations within the Study Area were selected by creating 1.0-km buffers around the current turbine layout and the portion of the T-Line encompassed therein. A federally

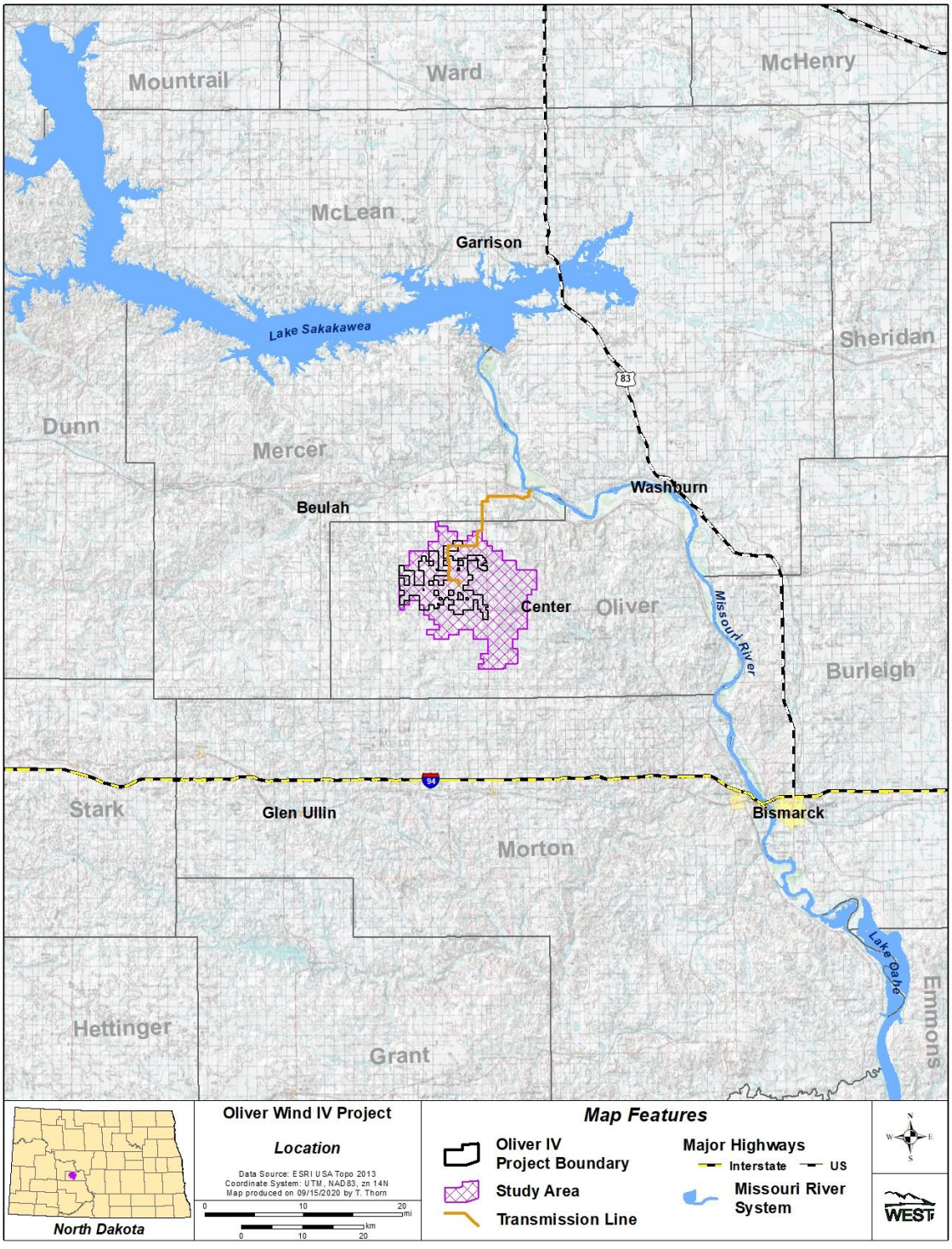


Figure 1. Location of the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota.

permitted bat biologist (K. Hammond-Rendon) conducted a desktop analysis using a combination of manually digitized forest areas and land cover data (National Land Cover Database 2016). A total of 342.0 ha (845.1 ac) of potentially suitable NLEB summer habitat were identified within the Study Area, resulting in 14 detector locations (corresponding to seven sites) proposed for acoustic surveys within the Study Area as per the Guidelines. Two alternative detector locations were identified if the aforementioned sites were deemed undesirable due to site-specific conditions within the Study Area. Another federally permitted bat biologist (J. Wilson) micro-sited these detector locations in the field based on available habitat and landscape features, and deployed acoustic detectors within the Study Area from July 22 – July 27, 2020. All detectors within the Study Area functioned for at least four nights.

The T-Line runs 20.0 km (12.4 mi) to the Stanton Station near the Missouri River; the linear portion of the Project where surveys were conducted (i.e., T-Line route) is defined as the T-Line and a 30.5-meters (m; 100.0-feet [ft]) buffer on each side (60.9 m [200.0 ft] total) of the centerline. A federally permitted bat biologist (K. Hammond-Rendon) identified five 1.0-km segments along the T-Line route that contained suitable forested habitat, resulting in five detector locations (corresponding to five sites) proposed along the T-Line route as per the Guidelines. Another federally permitted bat biologist (J. Wilson) deployed five acoustic detectors within the T-Line route, based on available habitat and landscape features, from July 24 – July 28, 2020. All detectors within the T-Line route functioned for at least two nights.

Detectors were deployed in an efficient order, with the detectors in the Study Area (minimum of four detector nights) deployed first, followed by deployment of the T-Line route detectors (minimum of two detector nights). This meant the minimum required survey nights were completed simultaneously at some locations, such that it was not possible to pick up every detector immediately following the last valid detector-night. As a result, three detectors were deployed for five nights and 11 detectors were deployed for four nights in the Study Area, totaling 59 detector-nights. This level of effort exceeded the minimum required survey effort recommended for non-linear projects (USFWS 2020). Upon completion of the minimum required two detector nights for the T-Line route, it was not possible to pick up all detectors within the following day. As a result, four detectors were deployed for three nights, and one detector was deployed for the minimum of two nights, resulting in a total of 14 detector-nights for the T-Line route. This level of effort exceeded the minimum survey effort recommended for linear projects (USFWS 2020).

Acoustic Surveys

Acoustic surveys were conducted for the Project from July 22 – July 28, 2020, using Song Meter full-spectrum ultrasonic detectors (SM4; Wildlife Acoustics, Inc., Maynard, Massachusetts). Acoustic monitoring began before sunset and continued for the entire night (1800 – 0800 hours). If weather conditions such as persistent rain (for 30 or more minutes [min]), strong sustained winds (greater than 14.5 km [9.0 mi] per hour for 30 or more min), or cold temperatures (below 10 degrees Celsius [50 degrees Fahrenheit] for 30 or more min) occurred, then the location subjected to those conditions was surveyed for an additional night. Weather conditions were

checked with KNDHAZEN8 weather station, and weather data are available on Weather Underground's Wundermap (Weather Underground 2020).

Omnidirectional SMM-U2 detector microphones were positioned at least 3.0 m (9.8 ft) off the ground, oriented perpendicularly to the ground. Detectors were set up at least 6.0 m (19.7 ft) away from tall vegetation. No weatherproofing was used. For each acoustic detector, the following data were recorded: date, start and end time; weather; detector orientation; site and detector location description, coordinates, tree species composition, stand age, and vegetation community type. Representative photographs of each detector location were catalogued, and coordinates were recorded with a Global Position System unit with an accuracy of less than 6.0 m (19.7 ft).

Standard settings used for each SM4 detector are shown in Figure 2. The biologist verified that detectors were functioning properly by using internal SM4 microphone (mic) calibration and checking the status diagnostic screens. These tools allowed the field crew to verify that the mic was connected and functioning, that data cards were installed, that battery voltage was sufficient, and that the unit was programmed properly. In addition, the detector summary and diagnostic files were saved and used to verify proper functioning of detectors.

Full-spectrum bat call files from all nights were converted to zero-crossing files and identified using a USFWS-approved automated bat call identification program (Kaleidoscope Pro® [Kaleidoscope], version 5.1.0; Wildlife Acoustics, Inc. 2020). The Bats of North America classifier 5.1.0 was used to generate a list of species identified and a list of nightly maximum likelihood estimator (MLE) p-values for each species with the potential to occur at the Project. The following species were included in the Kaleidoscope model: big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), western small-footed bat (*Myotis ciliolabrum*), western long-eared bat, little brown bat, NLEB, and long-legged bat (*Myotis volans*). The minimum number of pulses was set to "2", and the bat classifier setting was set to "0 Balanced (Neutral)". Defaults were used for all other software settings and no filters were applied to the data set.

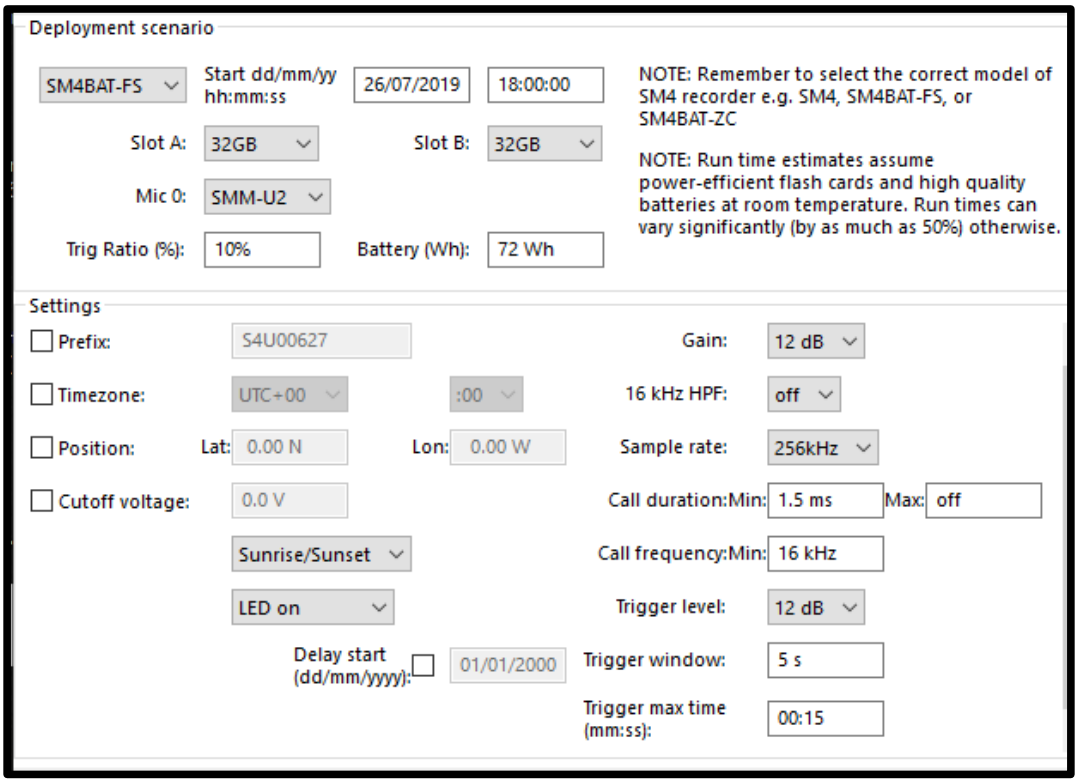


Figure 2. Standard settings for Song Meter 4 full-spectrum ultrasonic detectors used on the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota.

Per the Guidelines, all calls from each night that Kaleidoscope considered as likely to be NLEB (MLE p-value less than 0.05) were qualitatively reviewed by a qualified biologist (Dr. K. Murray) with extensive acoustic identification experience (Appendix A). All calls Kaleidoscope identified as NLEB, regardless of the MLE p-value, were also examined and verified by the qualified biologist. Bat calls were identified by comparing the call characteristics to calls from a known library and published echolocation call parameters for bat species in the eastern US (Murray et al. 2001 [p. 732], Britzke et al. 2011 [Table S1]). All call sequences not characteristic of NLEB, or sequences produced by species other bat species, or of insufficient quality, were reclassified.

RESULTS

Fourteen detector locations (seven sites) within the Study Area and five detector locations (five sites) along the T-Line route were surveyed during NLEB presence/absence acoustic surveys conducted at the Project in the summer of 2020. Due to limited available habitat observed at detector location 3B during micro-siting, one of the alternate detector locations (alt2) was used as a replacement. Detector locations and site descriptions are in Figure 3 and Table 1. Maps, photographs, datasheets, and weather verification tables are included in Appendices B, C, D, and E, respectively. The weather during all nights was considered valid (Appendix E) and the acoustic detectors functioned properly for the entire survey period, totaling 73 valid detector-nights across

the Project. Kaleidoscope outputs are in Appendix F; summaries of the qualitative analyses are in Appendix G; and spectrograms of representative bat calls are in Appendix H.

Kaleidoscope recognized a total of 9,464 bat calls and identified 6,881 of all calls to species (72.7%; Table 1) during acoustic surveys conducted at the Project. Hoary bats were the most commonly identified species (1,820 calls [19.2%]), followed by silver-haired bats (1,395 calls [14.7%]), little brown bats (1,159 calls [12.2%]), eastern red bats (1,137 calls [12.0%]), big brown bats (1,021 calls [10.8%]), western small-footed bat (187 calls [2.0%]), long-legged bat (79 calls [0.8%]), western long-eared bat (56 calls [0.6%]), and NLEB (27 calls [0.3%]; Table 2). The remaining 2,583 calls (27.3%) were not identifiable to species by Kaleidoscope. Bat echolocation calls have a high level of variation, causing overlap in call traits among species. Therefore, call identification is imperfect, and each identification has an associated error rate (USFWS 2013). In addition, the error rates associated with Kaleidoscope identifications of unknown bat calls have not been characterized. For these reasons, the results of the Kaleidoscope analysis can be misleading and should be viewed with caution.

Kaleidoscope identified 26 call files as potential NLEB at three detector locations within the Study Area (2B, 4A, and 7B) and one call file at one detector location (T5) along the T-Line route (Table 2; Appendix F). The MLE p-values for NLEB presence met Guideline criteria ($p < 0.05$) on one night at detector location 7B (Appendix F). A total of four calls at detector location 7B were confirmed as NLEB by the qualitative review of the calls, of which three occurred on July 22 and one on July 23, 2020 (Appendix G). Other potential NLEB calls identified by Kaleidoscope within the Study Area were reclassified as little brown bats, western long-eared bats, hoary bats, and big brown bats by qualitative call analyses. The potential NLEB call identified by Kaleidoscope at detector location T5 along the T-Line route was reclassified as an unknown *Myotis* sp. Thus, no NLEB calls were confirmed in the T-Line route, which is located 5.8 km (3.6 mi) north of where NLEB were captured in mist-nets in 2019 (Wilson et al. 2019).

Although four NLEB calls were confirmed at detector location 7B, there was a higher than normal potential for NLEB false positives at this location due to a barn in the vicinity that was likely being used as a roost by little brown bats and western long-eared bats. Both species can emit calls that resemble NLEB and may do so more often when near a roost or when flying in the presence of conspecifics, making call attributes (slope and duration) difficult to differentially distinguish to species level. These situations are best addressed with mist-net surveys or telemetry studies to resolve the uncertainty, but mist-net or telemetry surveys were not conducted as part of the 2020 surveys.

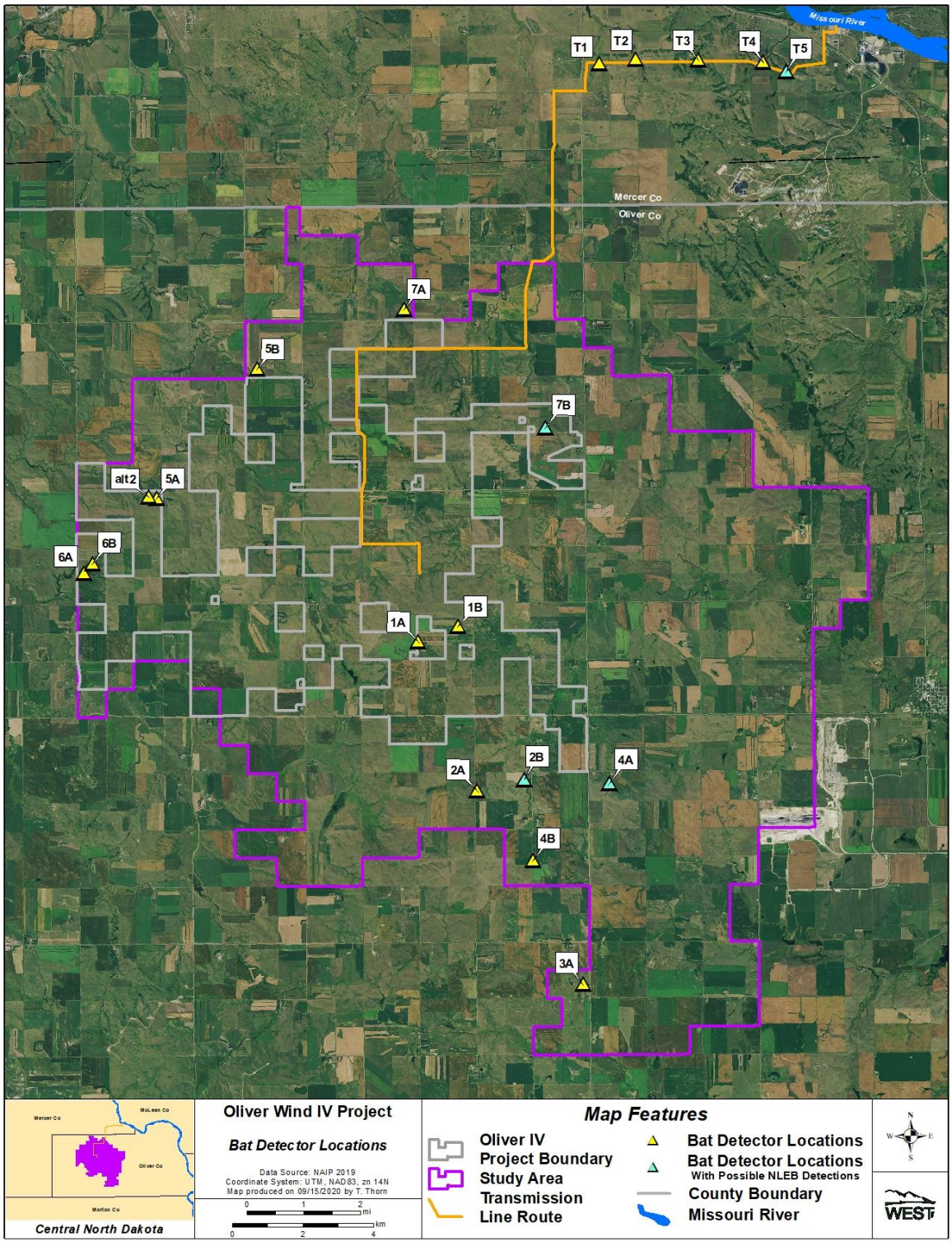


Figure 3. Detector locations for the northern long-eared (NLEB) bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

Table 1. Detector location coordinates, descriptions, and results of Kaleidoscope[1] identification software from valid and invalid survey nights at the Oliver Wind IV Project and Study Area Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

Detector Location ID	Latitude[2]	Longitude[2]	Description	Bat Calls Identified	Total Bat Calls	Valid Detector Nights	Invalid Detector Nights	Bat Calls per Detector Night
1A	47.1304	-101.4892	Forest edge	62	85	4	0	21.3
1B	47.1342	-101.4743	Forest edge	122	167	4	0	41.8
2A	47.0922	-101.4676	Forest edge	1,180	1,461	4	0	365.3
2B	47.0949	-101.4500	Forest edge	86	145	5	0	29.0
3A	47.0426	-101.4286	Forest edge	185	296	5	0	59.2
alt2	47.1677	-101.5897	Creek/riparian	272	385	4	0	96.3
4A	47.0938	-101.4181	Bottomland forest	294	506	5	0	101.2
4B	47.0741	-101.4468	Forest edge	19	32	4	0	8.0
5A	47.1674	-101.5867	Pond and Forest	608	816	4	0	204.0
5B	47.2002	-101.5488	Pond and Forest	306	403	4	0	100.8
6A	47.1482	-101.6140	Creek/riparian	551	688	4	0	172.0
6B	47.1507	-101.6109	Creek/riparian	60	104	4	0	26.0
7A	47.2153	-101.4936	Forest edge	198	280	4	0	70.0
7B	47.1847	-101.4411	Upland forest	957	1,697	4	0	424.3
T1	47.2777	-101.4200	Creek/riparian	221	287	3	0	95.7
T2	47.2786	-101.4062	Pond and Forest	993	1,184	3	0	394.7
T3	47.2783	-101.3829	Bottomland forest	304	373	2	0	186.5
T4	47.2776	-101.3586	Bottomland forest	226	274	3	0	91.3
T5	47.2752	-101.3499	Forest edge	237	281	3	0	93.7
Totals				**6,881**	**9,464**	**73**	**0**	**129.6**

[1.] Number of calls that were identified to species by Kaleidoscope Pro® software.

[2.] Coordinate system and datum: Universal Transverse Mercator North American Datum 1983, Zone 14.

Table 2. Bat calls identified by Kaleidoscope[1] at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020. Numbers in parentheses indicate number of northern long-eared bat calls confirmed by qualitative analysis.

Detector Location ID	EPFU	LABO	LACI	LANO	MYCI	MYEV	MYLU	MYSE	MYVO	NOID
1A	17	19	2	3	7	0	10	0	4	23
1B	20	23	55	15	2	1	6	0	0	45
2A	40	150	901	29	16	0	40	0	4	281
2B	19	12	8	14	4	0	22	1 (0)	6	59
3A	22	55	11	11	11	0	56	0	19	111
alt2	102	69	32	20	4	1	40	0	4	113
4A	27	45	100	37	26	0	54	1 (0)	4	212
4B	7	3	0	2	1	0	6	0	0	13
5A	113	149	123	31	24	0	161	0	7	208
5B	31	33	10	19	11	1	200	0	1	97
6A	12	432	29	20	29	2	26	0	1	137
6B	10	14	24	4	2	0	5	0	1	44
7A	23	24	104	14	5	0	12	0	16	82
7B	82	14	296	59	30	44	398	24 (4)	10	740
T1	60	26	22	94	3	0	14	0	2	66
T2	220	31	60	599	4	2	77	0	0	191
T3	78	11	19	179	5	2	10	0	0	69
T4	61	16	13	127	1	3	5	0	0	48
T5	77	11	11	118	2	0	17	1 (0)	0	44
Totals	**1,021**	**1,137**	**1,820**	**1,395**	**187**	**56**	**1,159**	**27**	**79**	**2,583**
	10.8%	**12.0%**	**19.2%**	**14.7%**	**2.0%**	**0.6%**	**12.2%**	**0.3%**	**0.8%**	**27.3%**

[1.] Kaleidoskope Pro® Version 5.1.0

EPFU = big brown bat (*Eptesicus fuscus*); LABO = eastern red bat (*Lasiurus borealis*); LACI = hoary bat (*Lasiurus cinereus*); LANO = silver-haired bat (*Lasionycteris noctivagans*); MYCI = western small-footed bat (*Myotis ciliolabrum*); MYEV = western long-eared bat (*Myotis evotis*); MYLU = little brown bat (*Myotis lucifugus*); MYSE = NLEB, northern long-eared bat (*Myotis septentrionalis*); MYVO = long-legged bat (*Myotis volans*); NOID = unknown or no identification.

REFERENCES

Britzke, E. R., J. E. Duchamp, K. L. Murray, R. K. Swihart, and L. W. Robbins. 2011. Acoustic Identification of Bats in the Eastern United States: A Comparison of Parametric and Nonparametric Methods. Journal of Wildlife Management 75(3): 660-667.

Dyke, S. R., S. K. Johnson, and P. T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department, Bismarck, ND.

ESRI. 2013. World Topographic Map. ArcGIS Resource Center. ESRI, producers of ArcGIS software. ESRI, Redlands, California. Last modified January 10, 2019. Available online: http://www.arcgis.com/home/item.html?id=30e5fe3149c34df1ba922e6f5bbf808f

H. Hayes and M. Piorkowski. 2022. Summer Bat Presence/Absence Surveys, Oliver Wind IV Energy Center, Oliver and Mercer Counties, North Dakota: Surveys Conducted August 11 – August 24, 2022. Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 29, 2023.

Murray, K.L., J. Wilson and C. Derby. 2019. Northern Long-Eared Bat Summer Presence/Absence Surveys, Oliver Wind IV IV Project, Oliver County, North Dakota: Surveys Conducted July 26 – August 15, 2019. Prepared for Oliver IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Report Revised August 29, 2023

Murray, K. L., E. R. Britzke, and L. W. Robbins. 2001. Variation in Search-Phase Calls of Bats. Journal of Mammalogy 82: 728-737.

National Land Cover Database (NLCD). 2016. *As cited* includes:

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. doi: 10.1016/j.isprsjprs.2018.09.006.

and

Multi-Resolution Land Characteristics (MRLC). 2019. National Land Cover Database (NLCD) 2016. Multi-Resolution Land Characteristics (MRLC) Consortium. US Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, MRLC Project, Sioux Falls, South Dakota. May 10, 2019. Information online: https://www.mrlc.gov/data.

Nelson, J., P. R. Barnhart, and E. H. Gillam. 2015. Distribution and Occurrence of Bat Species in North Dakota. The Prairie Naturalist 47: 84-93.

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

North Dakota Game and Fish Department (NDGFD). 2019. Northern Long-eared Bat. NDGFD, Bismarck, ND 58501. Available online: https://gf.nd.gov/wildlife/id/bats/northern-long-eared

US Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). 2019. Arcgis NAIP Imagery Digital Orthophoto Quarter Quads (DOQQS): North Dakota. Updated February 1, 2017. Available online: https://nrcs.app.box.com/v/naip/folder/18145523608; Information online: http://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/

US Fish and Wildlife Service (USFWS). 2013. Acoustic Bat Identification Software Testing Criteria – Draft January 2013. Available online: https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/AcousticPrgrmDrftTestCriteria3Jan13.pdf

US Fish and Wildlife Service (USFWS). 2015. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat with 4(D) Rule; Final Rule and Interim Rule. Department of the Interior, Fish and Wildlife Service, 50 CFR Part 17. 80 Federal Register (FR) 63: 17974-18033. April 2, 2015.

US Fish and Wildlife Service (USFWS). 2020. Range-Wide Indiana Bat Survey Guidelines. USFWS Midwest Region Endangered Species. March 2020. 65 pp. Available online: https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/FINAL%20Range-wide%20IBat%20Survey%20Guidelines%203.23.20.pdf

Weather Underground. 2020. Wundermap KNDSTANT5. Price Farms Station, Stanton, North Dakota. Information online https://www.wunderground.com/dashboard/pws/KNDSTANT5

Wildlife Acoustics, Inc. 2020. Kaleidoscope Pro® Version 5.1.0. (Acoustic analysis computer software). Wildlife Acoustics, Maynard, Massachusetts. Information online: www.wildlifeacoustics.com

Wilson, J., K. Murray, and C. Derby. 2019. Bat Summer Presence/Absence Surveys, Oliver Wind IV Project, Oliver County, North Dakota: Surveys Conducted July 26 – August 19, 2019. Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. Report Revised August 29, 2023. 18pp.

Appendix A. Resume of Acoustic Analyst for the Northern Long-Eared Bat Presence/Absence Acoustic Surveys at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020

Kevin Murray, Ph.D., *Consulting Ecologist*

PROFESSIONAL EXPERIENCE

2010-Present	*Consulting Ecologist and Project Manager,* WEST, Inc., Bloomington, Indiana
2009	*Lead Biological Science Technician,* National Park Service, Ozark Scenic Riverways
2006-2008	*Research Assistant*, University of Miami, Coral Gables, FL
2002-2006	*Doctoral Fellow,* University of Miami, Coral Gables, FL
2001-2002	*Lead Biological Science Technician,* Missouri State University, Springfield, Missouri
2000	*Biological Science Technician,* Oregon State University, Corvallis, Oregon
1998-2000	*Biological Science Technician,* Missouri State University, Springfield, Missouri

EDUCATION

Ph.D.
University of Miami
Coral Gables, Florida
2008
Biology

M.S.
Missouri State University
Springfield, Missouri
2001
Biology

B.S.
Missouri State University
Springfield, Missouri
1998
Biology

SCIENTIFIC ORGANIZATION MEMBERSHIPS

American Society of Mammalogists

North American Society for Bat Research

Midwest Bat Working Group

SPECIALTY AREAS

Dr. Murray has extensive research experience in bat ecology. He has experience in capture and identification of over fifteen species of bats in North America, including work with endangered species (*Myotis sodalis*, *Myotis grisescens*, *Myotis septentrionalis* [proposed]). He has managed projects and conducted bat surveys all over the eastern U.S. including numerous Missouri projects.

Dr. Murray has 18 years of experience in acoustic identification of bat echolocation calls in North America, Central America, and the Caribbean, including extensive experience with *M. septentrionalis*, *M. sodalis* and *M. grisescens*.

Dr. Murray has conducted 5 acoustic ID workshops (1998 to present) training individuals from federal and state agencies, universities, and consulting companies.

Dr. Murray has 19 publications, including 17 on bat research and 10 on bat echolocation, and numerous presentations on bat research at scientific conferences.

SELECTED PROFESSIONAL PUBLICATIONS

Clement, M.J., **K.L. Murray**, D.I. Solick, and J.C. Gruver. 2014. The effect of call libraries and acoustic filters on the identification of bat echolocation. Ecology and Evolution 4:3482-3493.

Britzke, E.R., E.H. Gillam and **K.L. Murray**. 2013. Current state of understanding of ultrasonic detectors for the study of bat ecology. Acta Theriologica 58:109-117.

Britzke, E.R., J.E. Duchamp, **K.L. Murray**, R.K. Swihart, and L.W. Robbins. 2011. Acoustic identification of bats in the eastern United States: a comparison of parametric and nonparametric methods. Journal of Wildlife Management 75:660-667.

Murray, K.L., E. Fraser, C. Davy, T.H. Fleming, and M.B. Fenton. 2009. Characterization of the echolocation calls of bats from Exuma, Bahamas. Acta Chiropterologica 11:415-424.

Robbins, L.W., **K.L. Murray**, and P. McKenzie. 2008. Evaluating the effectiveness of the standard mist netting protocol for the endangered Indiana bat (*Myotis sodalis*). Northeastern Naturalist.

Britzke, E.R., K.L. Murray, J.S. Heywood and L. W. Robbins. 2002. Acoustic identification. Pg. 221-225 *in* The Indiana Bat: Biology and Management of an Endangered Species (A. Kurta and J. Kennedy eds.). Bat Conservation International. Austin, TX.

Murray, K.L., E.R. Britzke, and L.W. Robbins. 2001. Variation in search-phase calls of bats. Journal of Mammalogy 82:728-737.

Murray, K.L., E.R. Britzke, B.M. Hadley, and L.W. Robbins. 1999. Surveying bat communities: a comparison between mist nets and the Anabat II bat detector system. Acta Chiropterologica 1:105-112.

HONORS AND AWARDS

National Science Foundation Education Fellowship, University of Miami, 2008

National Geographic Society Committee for Research and Exploration Grant (Biology), 2006

University Doctoral Fellowship, University of Miami, 2002-2005

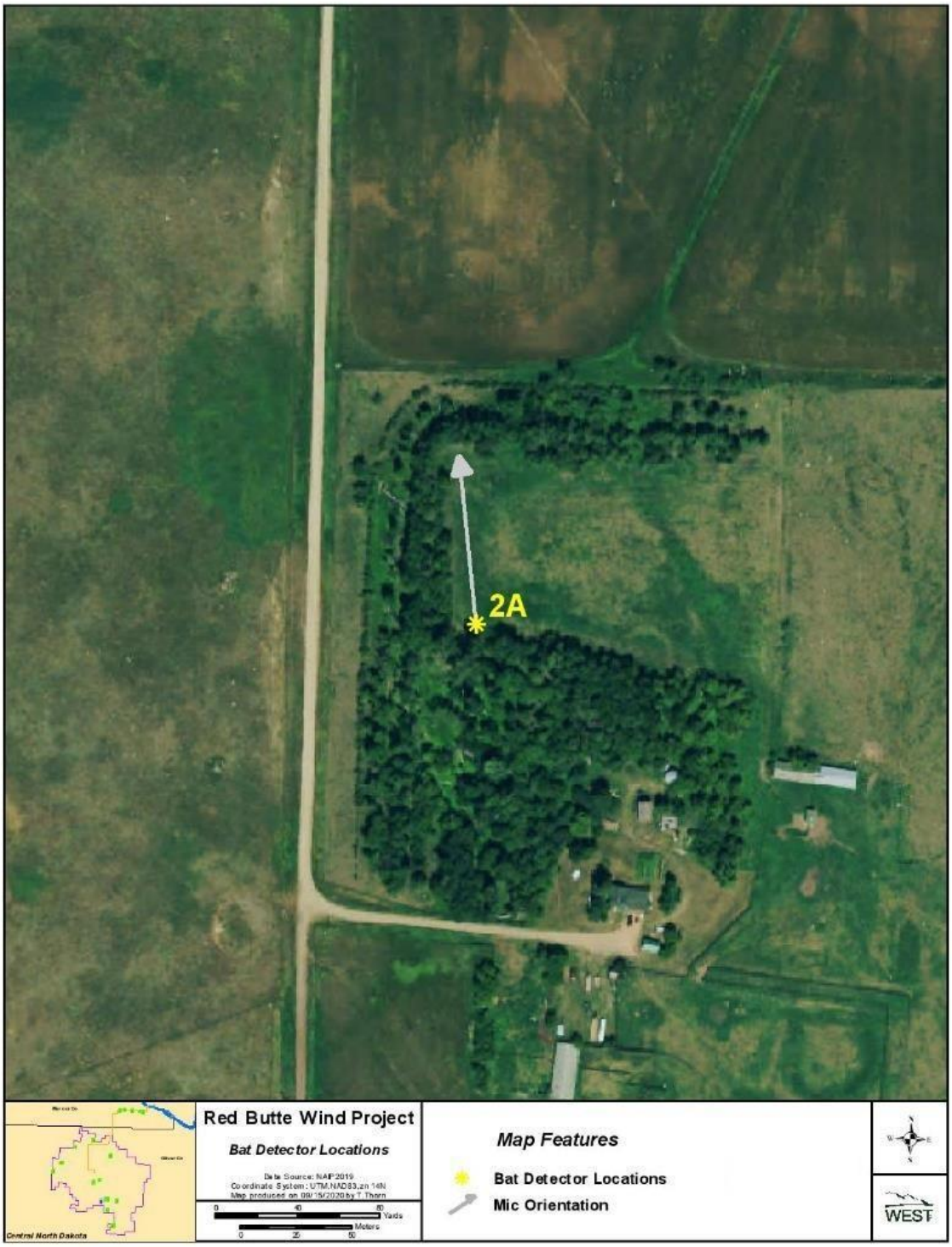
Distinguished Thesis Award, Midwestern Association of Graduate Schools, 2002

Basil and Joann Boritzki Award for Outstanding Graduate Work, Missouri State University, 2000.

Appendix B. Maps of Detector Locations for the Northern Long-Eared Bat Presence/Absence Acoustic Surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020

Appendix B1. Map of acoustic detector location 1A at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

Appendix B2. Map of acoustic detector location 1B at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.



Appendix B3. Map of acoustic detector location 2A at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

Appendix B4. Map of acoustic detector location 2B at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

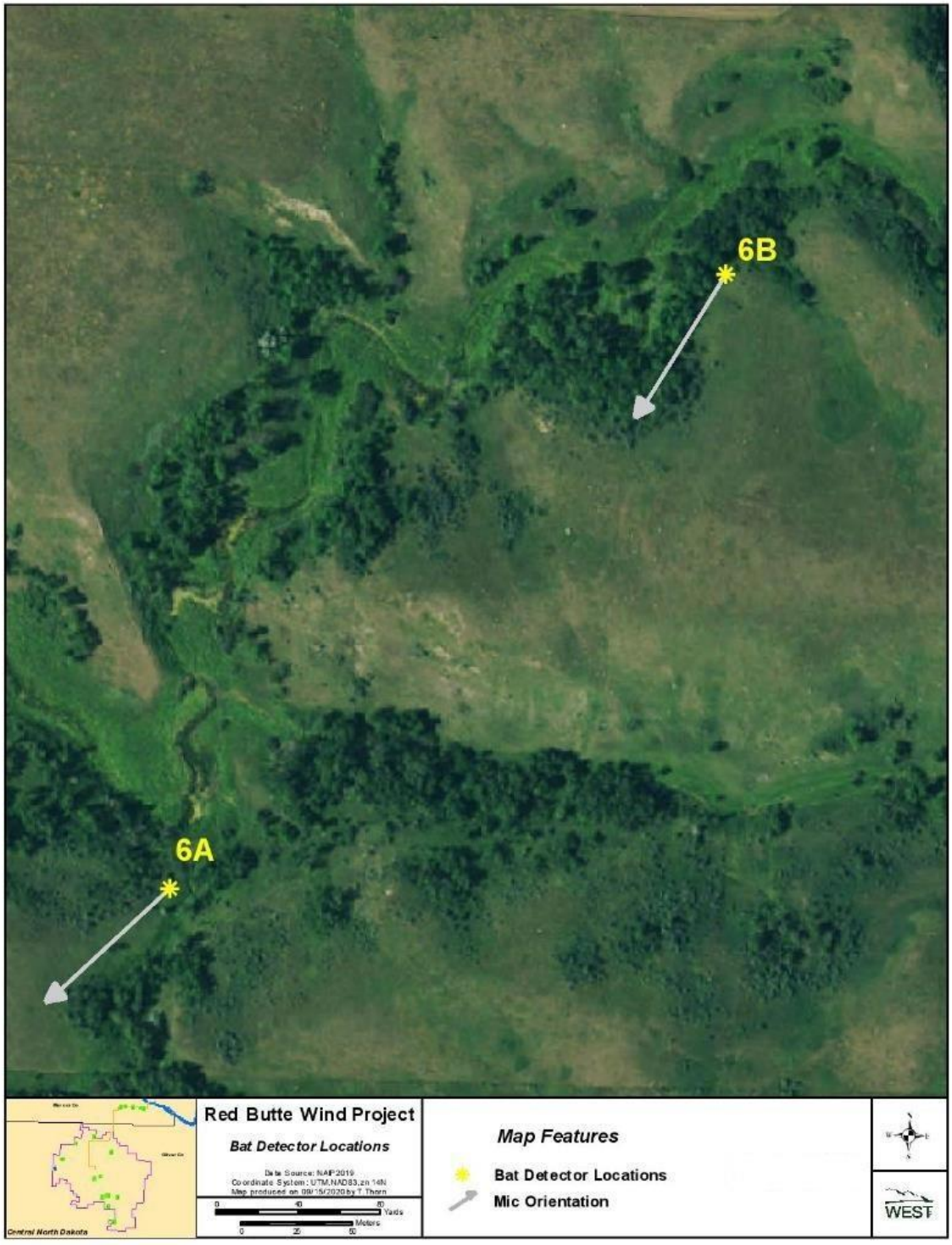
Appendix B5. Map of acoustic detector location 3A at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

Appendix B6. Map of acoustic detector location 4A at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

Appendix B7. Map of acoustic detector location 4B at the Oliver Wind IV Project in Oliver and Counties, North Dakota.

Appendix B8. Map of acoustic detector locations alt2 and 5A at the Oliver Wind IV Project in Oliver and Counties, North Dakota.

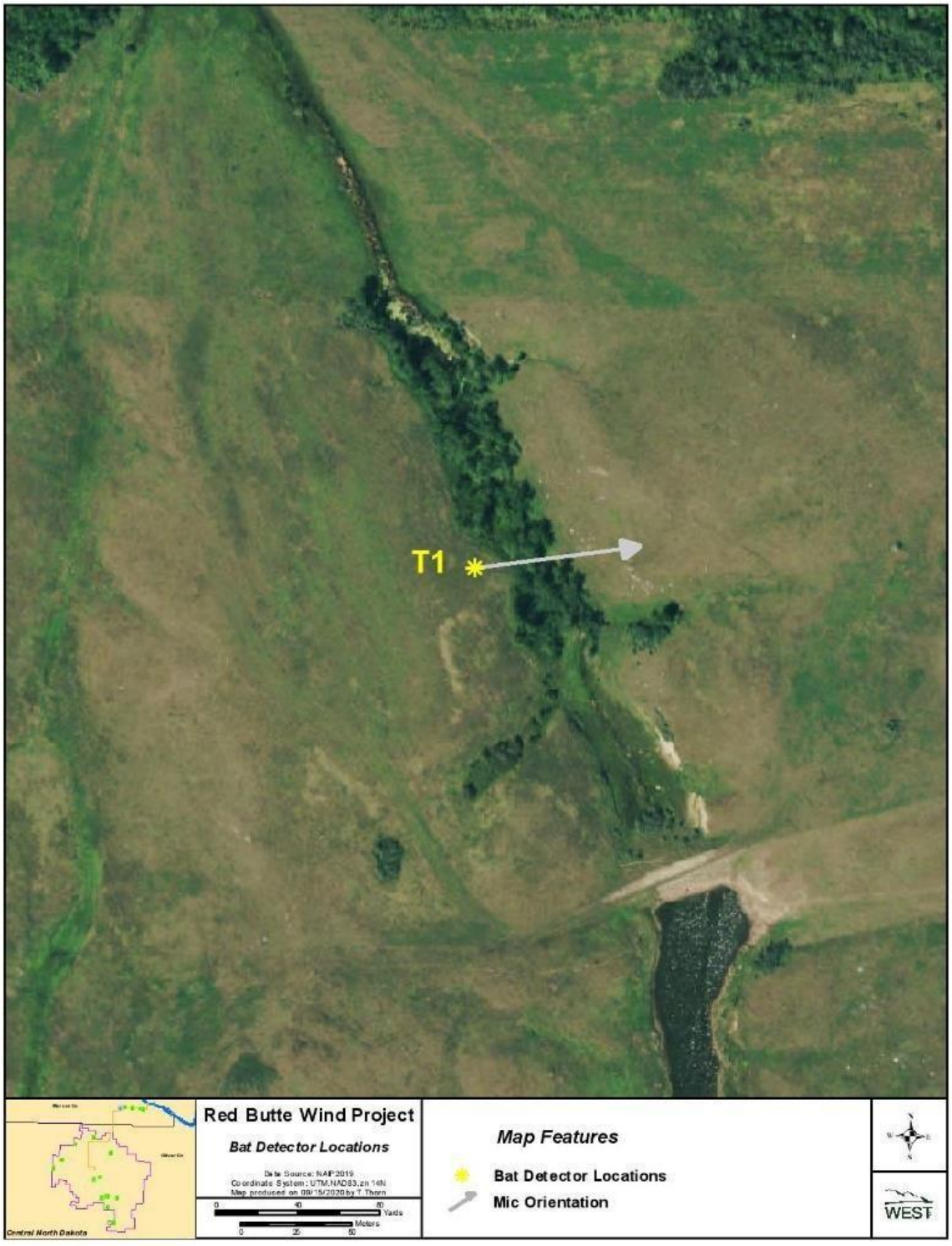
Appendix B9. Map of acoustic detector location 5B at the Oliver Wind IV Project in Oliver and Counties, North Dakota.



Appendix B10. Map of acoustic detector locations 6A and 6B at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

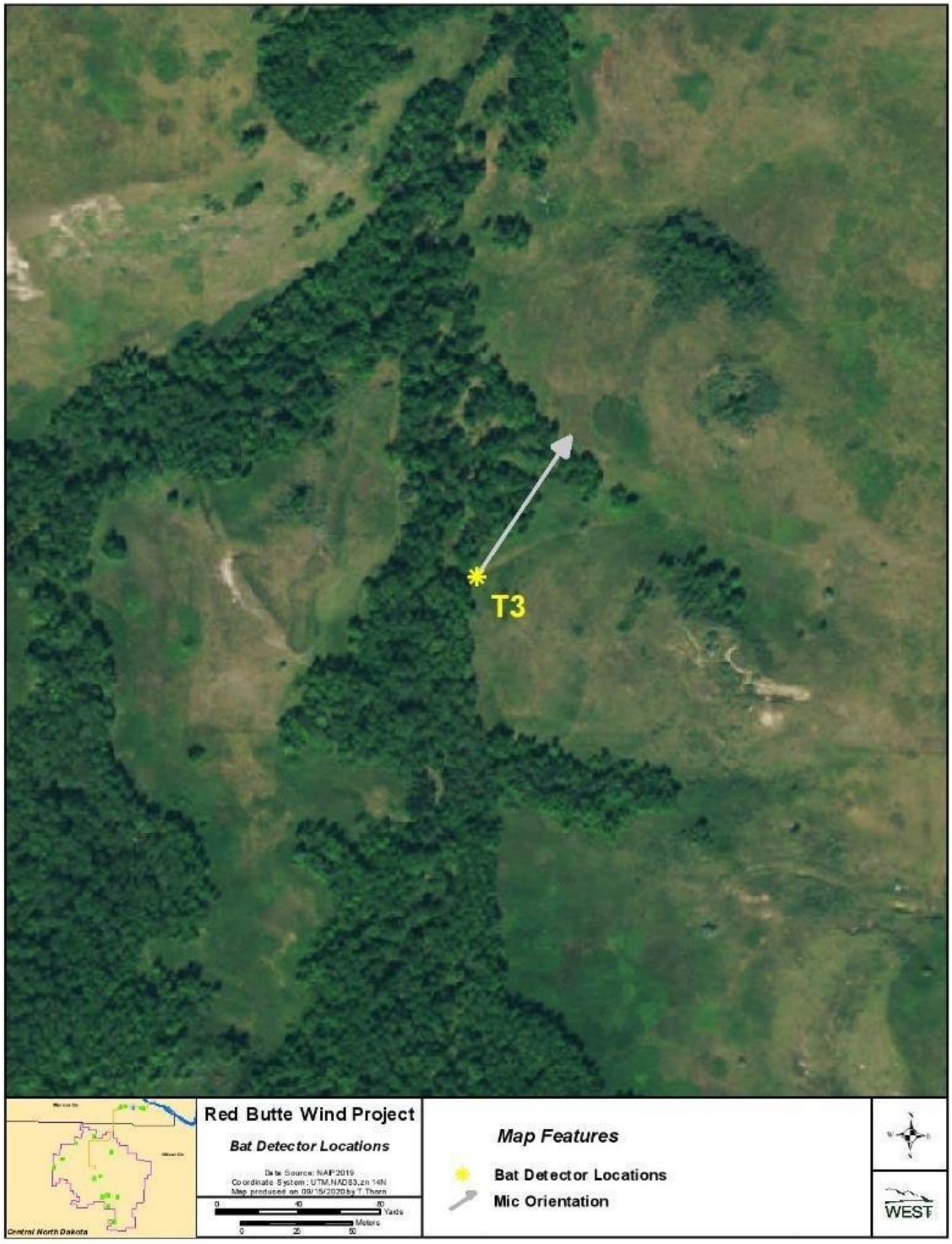
Appendix B11. Map of acoustic detector location 7A at the Oliver Wind IV Project in Oliver and Counties, North Dakota.

Appendix B12. Map of acoustic detector location 7B at the Oliver Wind IV Project in Oliver and Counties, North Dakota.



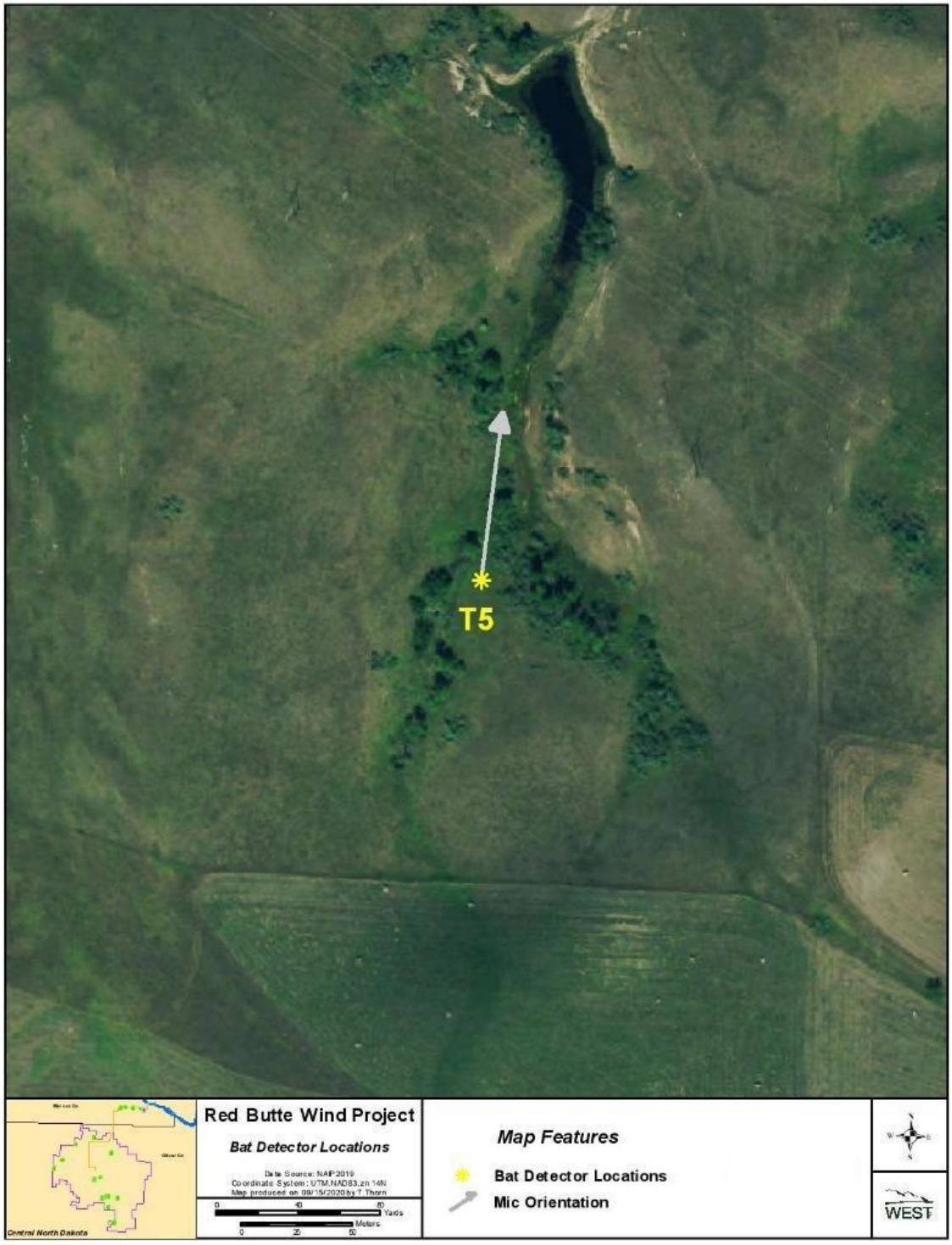
Appendix B13. Map of acoustic detector location T1 at the Oliver Wind IV Project in Oliver and Counties, North Dakota.

Appendix B14. Map of acoustic detector location T2 at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.



Appendix B15. Map of acoustic detector location T3 at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

Appendix B16. Map of acoustic detector location T4 at the Oliver Wind IV Project in Oliver and Counties, North Dakota.



Appendix B17. Map of acoustic detector location T5 at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

Appendix C. Photographs of Detector Locations for the Northern Long-Eared Bat Presence/Absence Acoustic Surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020

Appendix C1. Acoustic detector location 1A.

Appendix C2. Acoustic detector location 1B.

Appendix C3. Acoustic detector location 2A.

Appendix C4. Acoustic detector location 2B.

Note: Photos are representative only; original deployment photos were lost. Orientation and location are consistent with deployment; microphone type differed.

Appendix C5. Acoustic detector location 3A.

Appendix C6. Acoustic detector location alt2.

Appendix C7. Acoustic detector location 4A.

Note: Photos are representative only; original deployment photos were lost. Orientation and location are consistent with deployment; microphone type differed.

Appendix C8. Acoustic detector location 4B.

Appendix C9. Acoustic detector location 5A.

Appendix C10. Acoustic detector location 5B.

Appendix C11. Acoustic detector location 6A.

Appendix C12. Acoustic detector location 6B.

Note: Photos are representative only; original deployment photos were lost. Orientation and location are consistent with deployment; microphone type differed.

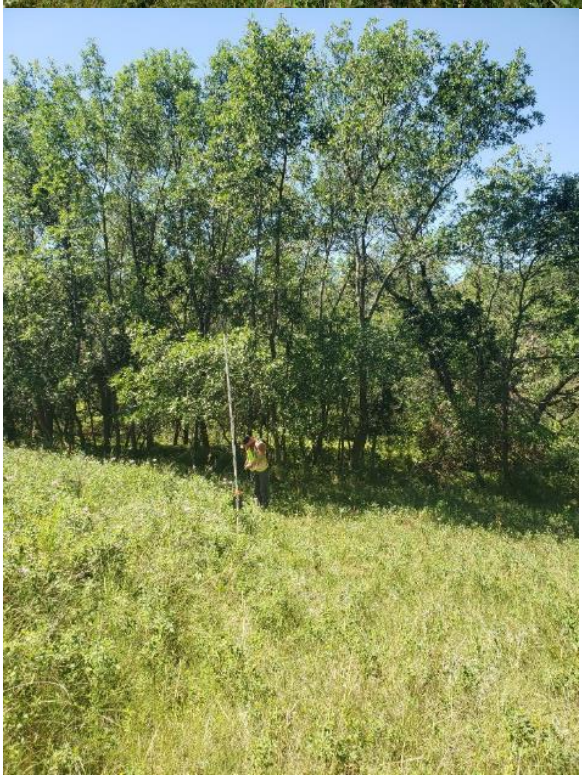
Appendix C13. Acoustic detector location 7A.

Appendix C14. Acoustic detector location 7B.

Appendix C15. Acoustic detector location T1.

Note: Photos are representative only; original deployment photos were lost. Orientation and location are consistent with deployment; microphone type differed.

Appendix C16. Acoustic detector location T2.



Appendix C17. Acoustic detector location T3.

Appendix C18. Acoustic detector location T4.

Appendix C19. Acoustic detector location T5.

Note: Photos are representative only; original deployment photos were lost. Orientation and location are consistent with deployment; microphone type differed.

Appendix D. Acoustic Datasheets for the Northern Long-Eared Bat Presence/Absence Acoustic Surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MNSA): 1 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-23	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1523	**End Time:** 1707	**Easting:** 311219	**Northing:** 5222658

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02778			
Detector Housing: None	**Mic Serial:** 205029	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 80		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and "static heard")	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-23	1523	6.3	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2020-07-27	1707	5.7	✓	✓			pickup, 1 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 35
Forest Type: Deciduous	**% Open/Ag:** 65
Dominant Tree Species: Fraxinus pennsylvanica	**% Water:** 0
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present:	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Moved to north of forested area along field edge due to land ownership (spoke with neighboring unsigned LO)

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 1 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-23	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1427	**End Time:** 1728	**Easting:** 312366	**Northing:** 5223046

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 00602			
Detector Housing: None	**Mic Serial:** 202636	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 165		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-23	1427	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-27	1728	5.6	✓	✓			pick up, 1 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 60
Forest Type: Deciduous	**% Open/Ag:** 40
Dominant Tree Species: Acer negundo	**% Water:** 0
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present:	
Topography: Flat	

[3]Habitat Description within 100m (i.e. the sketched area)

Between forest and immature tree rows

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 2 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-23	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1018	**End Time:** 1805	**Easting:** 312726	**Northing:** 5218369

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02867			
Detector Housing: None	**Mic Serial:** 204909	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 352		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-23	1018	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-27	1805	5.7	✓	✓			pickup, 10gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 65
Forest Type: Deciduous	**% Open/Ag:** 35
Dominant Tree Species: Platanus occidentalis, Acer negundo	**% Water:** 0
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Field edge, barn nearby, close to pasture

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 2 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-23	**End Date:** 2020-07-28	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1045	**End Time:** 1300	**Easting:** 314070	**Northing:** 5218625
*Use 24 hour time format	*Use yyyy-mm-dd date format	*Easting should be 6 digits	*Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 05114			
Detector Housing: None	**Mic Serial:** 204857	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 182		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-23	1045	6.3	✓	✓	✓	✓	setup				Record Status Data / Standby Error
2020-07-28	1300	5.7	✓	✓			pickup, 1 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 15
Forest Type: Mixed	**% Open/Ag:** 85
Dominant Tree Species: Pinus sylvestris, Fraxinus pennsylvanica	**% Water:** 0
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Fraxinus pennsylvanica (snag)	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Field edge with snags

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 3 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-23	**End Date:** 2020-07-28	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1155	**End Time:** 1355	**Easting:** 315515	**Northing:** 5212755
*Use 24 hour time format	*Use yyyy-mm-dd date format	*Easting should be 6 digits	*Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 05063			
Detector Housing: None	**Mic Serial:** 204904	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 85		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-23	1155	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-28	1355	5.4	✓	✓			pickup,4 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 25
Forest Type: Deciduous	**% Open/Ag:** 75
Dominant Tree Species: Fraxinus pennsylvanica, Acer negundo	**% Water:** 0
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Flat	

[3] **Habitat Description** within 100m (i.e. the sketched area)

Edge of shelterbelt with dead trees and expansive pasture

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): alt 2	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-23	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1621	**End Time:** 1620	**Easting:** 303735	**Northing:** 5227057

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 04801			
Detector Housing: None	**Mic Serial:** 204837	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 132		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-23	1621	6.3	✓	✓	✓	✓	set up				Record Status Data Standby Error
2020-07-27	1620	5.7	✓	✓			pick up, 3 gb				Record Status Data Standby Error
											Record Status Data Standby Error
											Record Status Data Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 40
Forest Type: Deciduous	**% Open/Ag:** 57
Dominant Tree Species: Acer negundo, Fraxinus pennsylvanica	**% Water:** 3
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Slope	

[3] Habitat Description within 100m (i.e. the sketched area)

Near forested riparian area, adjacent to emergent wetland and creek bed (dry at present)

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat) | Detector Orientation: ✓ (Detector + Bat Feature Sampled) | Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 4 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-23	**End Date:** 2020-07-28	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1305	**End Time:** 1338	**Easting:** 316490	**Northing:** 5218429

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02834			
Detector Housing: None	**Mic Serial:** 204858	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 342		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-23	1305	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-28	1338	5.7	✓	✓			pickup, 3gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Bottomland Forest	**% Forest:** 20
Forest Type: Deciduous	**% Open/Ag:** 70
Dominant Tree Species: Salix sandbar, Platanus occidentalis	**% Water:** 10
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Platanus occidentalis (snag)	
Topography: Low Point	

[3]Habitat Description within 100m (i.e. the sketched area)

Emergent wetland, forested wetland

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 4 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-23	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1109	**End Time:** 1812	**Easting:** 314239	**Northing:** 5216309
*Use 24 hour time format	*Use yyyy-mm-dd date format	*Easting should be 6 digits	*Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02775			
Detector Housing: None	**Mic Serial:** 204968	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 100		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-23	1109	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-27	1812	5.7	✓	✓			pickup, 1 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 20
Forest Type: Deciduous	**% Open/Ag:** 80
Dominant Tree Species: Ulmus parvifolia, Fraxinus pennsylvanica	**% Water:** 0
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Field and shelterbelt edge

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 5 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-22	**End Date:** 2020-07-26	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1438	**End Time:** 1335	**Easting:** 303968	**Northing:** 5227012

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02782			
Detector Housing: None	**Mic Serial:** 204905	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 20		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-22	1438	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-26	1335	5.7	✓	✓			pickup, 6 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Pond	**% Forest:** 20
Forest Type: Deciduous	**% Open/Ag:** 65
Dominant Tree Species: Fraxinus pennsylvanica	**% Water:** 15
Stand Age (DBH): Early-successional (0 - 12 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: High Point	

[3] Habitat Description within 100m (i.e. the sketched area)

Heavily cow trampled pond edge; tried to pick a spot where cows couldn't trample detector.

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 5 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson		**County:** Oliver
Start Date: 2020-07-22	**End Date:** 2020-07-26	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1538	**End Time:** 1436	**Easting:** 306957	**Northing:** 5230561

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 05113			
Detector Housing: None	**Mic Serial:** 204886	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 292		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Anabat Only: Test Indicators ("Data" lit and static heard)	Anabat Only: Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-22	1538	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-26	1436	5.6	✓	✓			pick up, 2 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)	
[1] **Primary Habitat:** Pond	**% Forest:** 25
Forest Type: Deciduous	**% Open/Ag:** 65
Dominant Tree Species: Fraxinus pennsylvanica, Acer negundo	**% Water:** 10
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Base of ridge adjacent to forest patch and creek with cattle pond

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat) | Detector Orientation: ✓ (Detector + Bat Feature Sampled) | Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 6 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-22	**End Date:** 2020-07-26	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1045	**End Time:** 1205	**Easting:** 301824	**Northing:** 5224947

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02896			
Detector Housing: None	**Mic Serial:** 204844	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 225		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-22	1045	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-26	1205	5.7	✓	✓			pickup, 4 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 30
Forest Type: Deciduous	**% Open/Ag:** 60
Dominant Tree Species: Fraxinus pennsylvanica, Acer negundo	**% Water:** 10
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present:	
Topography: Slope	

[3] Habitat Description within 100m (i.e. the sketched area)

Field slope near creek and pond

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 6 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazael		**County:** Oliver
Start Date: 2020-07-22	**End Date:** 2020-07-26	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1012	**End Time:** 1205	**Easting:** 302071	**Northing:** 5225219
*Use 24 hour time format	*Use yyyy-mm-dd date format	*Easting should be 6 digits	*Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02888			
Detector Housing: None	**Mic Serial:** 204906	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 210		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-22	1012	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-26	1232	5.8	✓	✓			pick up, 3 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 25
Forest Type: Deciduous	**% Open/Ag:** 70
Dominant Tree Species: Fraxinus pennsylvanica, Acer negundo	**% Water:** 5
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Slope	

[3] Habitat Description within 100m (i.e. the sketched area)

Field slope adjacent to small creek, pond nearby

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 7 A	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-22	**End Date:** 2020-07-26	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1228	**End Time:** 1510	**Easting:** 311191	**Northing:** 5232102

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02836			
Detector Housing: None	**Mic Serial:** 204946	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 38		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-22	1230	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-26	1510	5.6	✓	✓			pick up, 2 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 10
Forest Type: Deciduous	**% Open/Ag:** 75
Dominant Tree Species: Fraxinus pennsylvanica	**% Water:** 15
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present: Fraxinus pennsylvanica (snag)	
Topography: Slope	

[3]Habitat Description within 100m (i.e. the sketched area)

Flat grazing field, near snags and small pond. Moved away from original spot due to sewage hazard.

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector , including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): 7 B	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-22	**End Date:** 2020-07-26	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1305	**End Time:** 1548	**Easting:** 315057	**Northing:** 5228585
*Use 24 hour time format	*Use yyyy-mm-dd date format	*Easting should be 6 digits	*Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02599			
Detector Housing: None	**Mic Serial:** 204810	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 295		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-22	1305	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-26	1548	5.6	✓	✓			pickup, 12gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Upland Forest	**% Forest:** 25
Forest Type: Deciduous	**% Open/Ag:** 75
Dominant Tree Species: Fraxinus pennsylvanica, Acer negundo	**% Water:** 0
Stand Age (DBH): Mid-successional (13 - 24 cm)	
Preferred Roost Tree Species Present:	
Topography: Flat	

[3] **Habitat Description** within 100m (i.e. the sketched area)

Forest in junkyard, field adjacent. Old barn with openings also adjacent

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): T 1	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Mercer
Start Date: 2020-07-24	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1129	**End Time:** 1010	**Easting:** 316980	**Northing:** 5238861

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 00530			
Detector Housing: None	**Mic Serial:** 204838	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 80		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-24	1129	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-27	1010	5.7	✓	✓			pick up, 2 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Creek/Riparian	**% Forest:** 20
Forest Type: Deciduous	**% Open/Ag:** 75
Dominant Tree Species: Acer negundo	**% Water:** 5
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Slope	

[3]Habitat Description within 100m (i.e. the sketched area)

Slippe adjacent to forested riparian area, creek nearby

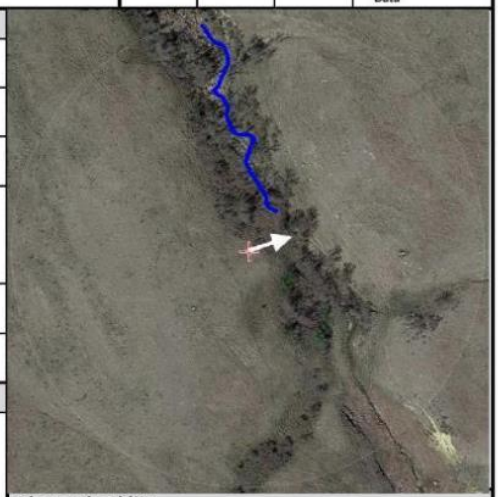


Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): T 2	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Mercer
Start Date: 2020-07-24	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1152	**End Time:** 1027	**Easting:** 318021	**Northing:** 5238937

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02886			
Detector Housing: None	**Mic Serial:** 205021	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 15		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-24	1152	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-27	1027	5.7	✓	✓			pickup 8 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Pond	**% Forest:** 23
Forest Type: Deciduous	**% Open/Ag:** 60
Dominant Tree Species: Populus tremuloides, Acer negundo	**% Water:** 7
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Unknown snag(s) with exfol. bark	
Topography: Flat	

[3] Habitat Description within 100m (i.e. the sketched area)

Little valley with open area for foraging, some mature trees, Salix spp. and large snags adjacent to pond.

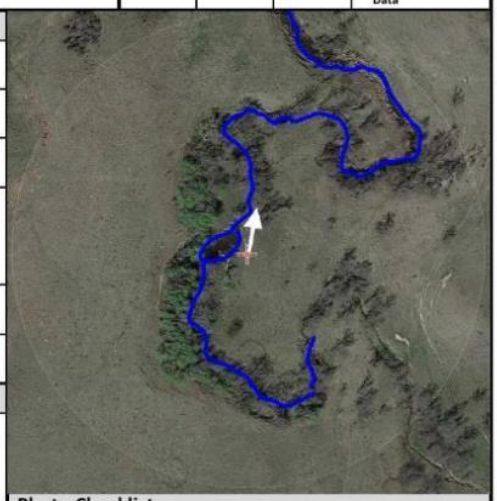


Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): T 3	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-27	**End Date:** 2020-07-29	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1250	**End Time:** 1300	**Easting:** 319788	**Northing:** 5238848
*Use 24 hour time format	*Use yyyy-mm-dd date format	*Easting should be 6 digits	*Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 05060			
Detector Housing: None	**Mic Serial:** 204870	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 32		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-27	1250	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-29	1300	5.8	✓	✓			pickup, 5 gb				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Bottomland Forest	**% Forest:** 50
Forest Type: Deciduous	**% Open/Ag:** 50
Dominant Tree Species: Acer negundo, Fraxinus pennsylvanica	**% Water:** 0
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Fraxinus pennsylvanica (snag), Unknown snag(s) with exfol. bark	
Topography: Slope	

[3] Habitat Description within 100m (i.e. the sketched area)

Adjacent to lowland forested corridor, and perpendicular flyway; riparian but dry at present (see green line)

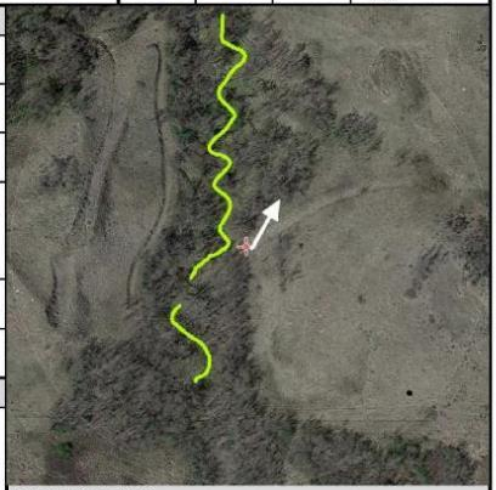


Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): T 4	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Oliver
Start Date: 2020-07-24	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1515	**End Time:** 1405	**Easting:** 321624	**Northing:** 5238711

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 02786			
Detector Housing: None	**Mic Serial:** 207484	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 275		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-24	1515	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-27	1405	5.8	✓	✓			pick up, 2 GB				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Bottomland Forest	**% Forest:** 30
Forest Type: Deciduous	**% Open/Ag:** 68
Dominant Tree Species: Fraxinus pennsylvanica, Acer negundo	**% Water:** 2
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present:	
Topography: Low Point	

[3] Habitat Description within 100m (i.e. the sketched area)

Forested wetland in low valley, little standing water at present

Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat)	Detector Orientation: ✓ (Detector + Bat Feature Sampled)	Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Acoustic Presence/Probable Absence Data Form

Site Information			
Site ID (SiteID + DetectorID, e.g MN5A): T 5	**Project:** Red Butte		**State:** North Dakota
	Surveyors: Julia Wilson, Alex Brazeal		**County:** Mercer
Start Date: 2020-07-24	**End Date:** 2020-07-27	**Datum:** NAD83	**UTM Zone:** 14
Start Time: 1436	**End Time:** 1352	**Easting:** 322269	**Northing:** 5238429

*Use 24 hour time format | *Use yyyy-mm-dd date format | *Easting should be 6 digits | *Northing should be 7 digits

Detector Information	Microphone Information		Anabat Only
Detector Model: SM4	**Sound Reception:** None		**Audio Div** (Should be 16)
Detector Serial: 04733			
Detector Housing: None	**Mic Serial:** 205023	**Mic Height (m):** 3	**Data Div** (Should be 16)
	Mic Horizontal Orientation (0-360°): 5		
Battery Source: Internal	**Mic Vertical Orientation (°):** 0		

All Detector Checklist

Date (yyyy-mm-dd)	Time (24 Hour)	Battery Voltage (V)	Perform Mic Check	Inspect Cables; Mic Holder; Housing	Replace Data Card(s)	Change Battery	Comments (Detector set up, picked up, moved, knocked over, vandalized, etc.)	Anabat Only: Sensitivity Setting (Normally 6)	Test Indicators ("Data" lit and static heard)	Set Volume (Lowest Setting)	LED Indicator Lights (Should be Standby, unless between 18:00 and 8:00)
2020-07-24	1436	6.3	✓	✓	✓	✓	set up				Record Status Data / Standby Error
2020-07-27	1352	5.7	✓	✓			pick up 2 GB				Record Status Data / Standby Error
											Record Status Data / Standby Error
											Record Status Data / Standby Error

Habitat Composition within 100m (i.e. the sketched area)

[1] **Primary Habitat:** Field Edge	**% Forest:** 25
Forest Type: Deciduous	**% Open/Ag:** 75
Dominant Tree Species: Fraxinus pennsylvanica	**% Water:** 0
Stand Age (DBH): Late-successional (25 - 38 cm)	
Preferred Roost Tree Species Present: Fraxinus pennsylvanica (snag)	
Topography: Slope	

[3] Habitat Description within 100m (i.e. the sketched area)

Drainage with trees and snags, leading to pond to north

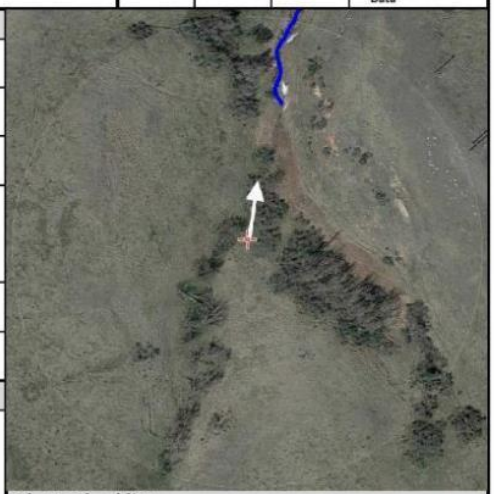


Photo Checklist

Detector Location: ✓ (Detector + All Surrounding Habitat) | Detector Orientation: ✓ (Detector + Bat Feature Sampled) | Detection Cone: ✓ (Air Space Sampled)

[1] Choices: Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Give Brief Description)
[2] Map out habitat features within a 100 m radius of the detector (x). Indicate direction of microphone using an arrow. Include any features of interest (water, buildings, rocky outcrops, etc.).
[3] Provide a written description of the surrounding habitat within a 100m radius of the detector, including details on width of the road/trail/cutline, size of pond/lake, distance to nearest water, etc.).

Appendix E. Daily Weather Log for Acoustic Detector Nights for the Northern Long-Eared Bat Presence/Absence Acoustic Surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020

STATION:	KNDHAZEN5	Sunset Time:	21:29	Survey Start:	21:29	Determination:	*Valid*
SITES:	5A, 5B, 6A, 6B, 7A, 7B	Sunrise Time:	6:14	End Time:	2:29	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/22/2020	9:24 PM	79.3 F	66.6 F	65 %	SSE	4.7 mph	6.5 mph	29.92 in	0.00 in	0.00 in
7/22/2020	9:29 PM	79.1 F	66.6 F	66 %	SE	5.9 mph	8.1 mph	29.92 in	0.00 in	0.00 in
7/22/2020	9:34 PM	78.9 F	66.7 F	66 %	SE	4.6 mph	6.4 mph	29.92 in	0.00 in	0.00 in
7/22/2020	9:39 PM	78.6 F	66.6 F	67 %	SE	6.0 mph	8.7 mph	29.92 in	0.00 in	0.00 in
7/22/2020	9:44 PM	78.6 F	66.4 F	66 %	SE	6.8 mph	9.1 mph	29.92 in	0.00 in	0.00 in
7/22/2020	9:49 PM	78.1 F	66.5 F	68 %	SE	5.1 mph	6.8 mph	29.91 in	0.00 in	0.00 in
7/22/2020	9:54 PM	77.7 F	66.3 F	68 %	SE	7.4 mph	9.9 mph	29.92 in	0.00 in	0.00 in
7/22/2020	9:59 PM	77.6 F	66.2 F	68 %	ESE	7.3 mph	9.9 mph	29.91 in	0.00 in	0.00 in
7/22/2020	10:04 PM	77.2 F	66.2 F	69 %	SE	5.9 mph	8.3 mph	29.91 in	0.00 in	0.00 in
7/22/2020	10:09 PM	76.7 F	65.7 F	69 %	SE	7.3 mph	9.4 mph	29.91 in	0.00 in	0.00 in
7/22/2020	10:14 PM	76.7 F	66.0 F	70 %	SE	6.2 mph	8.2 mph	29.91 in	0.00 in	0.00 in
7/22/2020	10:19 PM	76.5 F	65.8 F	70 %	SE	6.7 mph	8.9 mph	29.91 in	0.00 in	0.00 in
7/22/2020	10:24 PM	76.1 F	65.9 F	71 %	SE	5.7 mph	7.1 mph	29.91 in	0.00 in	0.00 in
7/22/2020	10:29 PM	75.7 F	65.8 F	71 %	ESE	6.0 mph	7.3 mph	29.92 in	0.00 in	0.00 in
7/22/2020	10:34 PM	75.4 F	65.9 F	72 %	ESE	4.5 mph	5.7 mph	29.92 in	0.00 in	0.00 in
7/22/2020	10:39 PM	74.7 F	65.7 F	74 %	ESE	4.5 mph	5.4 mph	29.92 in	0.00 in	0.00 in
7/22/2020	10:44 PM	74.5 F	65.5 F	74 %	ESE	4.3 mph	5.4 mph	29.92 in	0.00 in	0.00 in
7/22/2020	10:49 PM	74.5 F	65.6 F	74 %	ESE	3.8 mph	4.7 mph	29.92 in	0.00 in	0.00 in
7/22/2020	10:54 PM	73.9 F	65.5 F	75 %	East	3.8 mph	4.4 mph	29.92 in	0.00 in	0.00 in
7/22/2020	10:59 PM	73.9 F	65.3 F	75 %	East	4.0 mph	4.8 mph	29.92 in	0.00 in	0.00 in
7/22/2020	11:04 PM	73.6 F	65.3 F	75 %	ESE	5.3 mph	6.7 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:09 PM	73.8 F	65.4 F	75 %	East	4.8 mph	5.8 mph	29.92 in	0.00 in	0.00 in
7/22/2020	11:14 PM	73.4 F	65.2 F	76 %	ESE	4.4 mph	5.1 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:19 PM	73.4 F	65.1 F	75 %	ESE	4.5 mph	5.7 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:24 PM	73.4 F	65.1 F	75 %	East	4.6 mph	5.6 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:29 PM	73.2 F	64.9 F	75 %	ESE	4.8 mph	6.0 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:34 PM	73.5 F	65.0 F	75 %	ESE	4.2 mph	5.0 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:39 PM	73.0 F	64.9 F	75 %	East	5.2 mph	6.5 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:44 PM	72.4 F	64.8 F	77 %	ESE	4.2 mph	5.4 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:49 PM	72.1 F	64.6 F	77 %	ESE	4.8 mph	6.0 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:54 PM	72.3 F	64.3 F	76 %	ESE	7.0 mph	8.9 mph	29.93 in	0.00 in	0.00 in
7/22/2020	11:59 PM	72.8 F	64.6 F	75 %	ESE	6.6 mph	8.7 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:04 AM	72.3 F	64.2 F	76 %	East	7.0 mph	8.8 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:09 AM	72.3 F	64.2 F	76 %	East	6.2 mph	7.6 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:14 AM	72.1 F	64.0 F	76 %	East	5.9 mph	7.4 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:19 AM	72.0 F	64.0 F	76 %	East	5.2 mph	6.9 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:24 AM	72.2 F	63.8 F	75 %	East	6.5 mph	8.3 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:29 AM	72.2 F	63.8 F	75 %	East	5.4 mph	6.9 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:34 AM	72.1 F	63.6 F	74 %	East	5.3 mph	6.7 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:39 AM	72.1 F	63.5 F	74 %	East	5.0 mph	6.2 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:44 AM	72.0 F	63.6 F	75 %	East	3.8 mph	4.8 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:49 AM	71.8 F	63.6 F	75 %	East	4.4 mph	5.8 mph	29.93 in	0.00 in	0.00 in
7/23/2020	12:54 AM	71.7 F	63.5 F	75 %	ENE	3.7 mph	4.8 mph	29.94 in	0.00 in	0.00 in
7/23/2020	12:59 AM	71.6 F	63.6 F	76 %	East	3.5 mph	4.8 mph	29.94 in	0.00 in	0.00 in
7/23/2020	1:04 AM	71.4 F	63.3 F	75 %	East	3.4 mph	4.4 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:09 AM	71.4 F	63.4 F	76 %	East	5.1 mph	6.4 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:14 AM	71.0 F	63.3 F	77 %	ESE	2.9 mph	3.6 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:19 AM	70.8 F	63.1 F	77 %	East	3.6 mph	4.3 mph	29.94 in	0.00 in	0.00 in
7/23/2020	1:24 AM	71.0 F	63.1 F	76 %	East	3.5 mph	4.1 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:29 AM	71.0 F	63.1 F	76 %	ENE	1.8 mph	2.9 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:34 AM	70.6 F	63.1 F	77 %	East	2.3 mph	3.5 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:39 AM	70.5 F	63.0 F	77 %	East	2.5 mph	3.7 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:44 AM	70.6 F	62.9 F	77 %	ENE	3.7 mph	4.6 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:49 AM	70.7 F	63.1 F	77 %	East	3.0 mph	4.1 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:54 AM	70.3 F	63.0 F	78 %	ESE	2.3 mph	3.0 mph	29.93 in	0.00 in	0.00 in
7/23/2020	1:59 AM	70.1 F	62.7 F	78 %	ESE	2.1 mph	2.9 mph	29.93 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:29	Survey Start:	21:29	Determination:	*Valid*
SITES:	5A, 5B, 6A, 6B, 7A, 7B	Sunrise Time:	6:14	End Time:	2:29	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/23/2020	2:04 AM	70.3 F	62.8 F	77 %	East	3.4 mph	4.3 mph	29.93 in	0.00 in	0.00 in
7/23/2020	2:09 AM	70.3 F	62.7 F	77 %	ESE	5.2 mph	6.9 mph	29.93 in	0.00 in	0.00 in
7/23/2020	2:14 AM	70.2 F	62.8 F	77 %	East	4.1 mph	5.4 mph	29.92 in	0.00 in	0.00 in
7/23/2020	2:19 AM	70.1 F	62.7 F	78 %	East	3.9 mph	4.9 mph	29.92 in	0.00 in	0.00 in
7/23/2020	2:24 AM	70.0 F	62.6 F	78 %	East	3.1 mph	4.6 mph	29.92 in	0.00 in	0.00 in
7/23/2020	2:29 AM	69.9 F	62.6 F	78 %	ESE	3.1 mph	4.2 mph	29.92 in	0.00 in	0.00 in
7/23/2020	2:34 AM	69.7 F	62.5 F	78 %	ESE	3.2 mph	4.8 mph	29.92 in	0.00 in	0.00 in
7/23/2020	2:39 AM	69.7 F	62.5 F	78 %	ESE	1.3 mph	2.1 mph	29.92 in	0.00 in	0.00 in
7/23/2020	2:44 AM	69.6 F	62.4 F	78 %	ESE	3.9 mph	5.2 mph	29.92 in	0.00 in	0.00 in
7/23/2020	2:49 AM	69.6 F	62.4 F	78 %	ESE	4.1 mph	5.5 mph	29.91 in	0.00 in	0.00 in
7/23/2020	2:54 AM	69.8 F	62.5 F	78 %	East	3.3 mph	4.4 mph	29.92 in	0.00 in	0.00 in
7/23/2020	2:59 AM	69.4 F	62.5 F	78 %	ESE	3.5 mph	4.5 mph	29.92 in	0.00 in	0.00 in
7/23/2020	3:04 AM	69.4 F	62.6 F	79 %	East	3.2 mph	4.3 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:09 AM	69.3 F	62.3 F	78 %	East	2.8 mph	3.8 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:14 AM	69.4 F	62.5 F	79 %	East	2.7 mph	3.8 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:19 AM	69.3 F	62.6 F	79 %	ESE	3.9 mph	5.7 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:24 AM	69.3 F	62.6 F	79 %	ESE	3.0 mph	4.4 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:29 AM	69.1 F	62.5 F	79 %	ENE	1.6 mph	2.5 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:34 AM	68.9 F	62.4 F	80 %	East	1.6 mph	2.1 mph	29.90 in	0.00 in	0.00 in
7/23/2020	3:39 AM	68.8 F	62.3 F	80 %	East	1.9 mph	2.8 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:44 AM	68.9 F	62.4 F	80 %	ESE	2.1 mph	2.8 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:49 AM	68.9 F	62.5 F	80 %	East	2.7 mph	3.7 mph	29.90 in	0.00 in	0.00 in
7/23/2020	3:54 AM	68.6 F	62.5 F	81 %	East	1.3 mph	1.8 mph	29.91 in	0.00 in	0.00 in
7/23/2020	3:59 AM	68.6 F	62.5 F	81 %	ENE	1.5 mph	2.0 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:04 AM	68.5 F	62.6 F	82 %	East	1.6 mph	2.1 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:09 AM	68.4 F	62.6 F	82 %	East	2.0 mph	2.8 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:14 AM	68.5 F	62.6 F	82 %	East	2.6 mph	3.4 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:19 AM	68.4 F	62.6 F	82 %	East	2.2 mph	2.8 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:24 AM	68.4 F	62.7 F	82 %	ESE	1.4 mph	1.9 mph	29.91 in	0.00 in	0.00 in
7/23/2020	4:29 AM	68.6 F	62.9 F	82 %	ESE	2.6 mph	3.8 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:34 AM	68.4 F	63.0 F	83 %	ESE	2.3 mph	3.0 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:39 AM	68.2 F	62.9 F	83 %	SE	2.8 mph	3.8 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:44 AM	68.4 F	63.0 F	83 %	SE	1.9 mph	2.7 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:49 AM	68.6 F	63.1 F	83 %	ESE	2.4 mph	2.7 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:54 AM	68.5 F	63.1 F	83 %	East	2.6 mph	3.5 mph	29.90 in	0.00 in	0.00 in
7/23/2020	4:59 AM	68.5 F	63.3 F	84 %	SE	2.2 mph	2.7 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:04 AM	68.4 F	63.3 F	84 %	East	2.3 mph	2.9 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:09 AM	68.5 F	63.5 F	84 %	ESE	3.6 mph	4.8 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:14 AM	68.5 F	63.4 F	84 %	ESE	2.9 mph	3.9 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:19 AM	68.4 F	63.4 F	84 %	ESE	3.5 mph	4.7 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:24 AM	68.1 F	63.5 F	85 %	SE	2.8 mph	3.9 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:29 AM	68.3 F	63.6 F	85 %	SE	2.2 mph	2.7 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:34 AM	68.4 F	63.8 F	85 %	SE	3.0 mph	3.9 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:39 AM	68.4 F	63.8 F	85 %	ESE	3.9 mph	4.9 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:44 AM	68.2 F	63.9 F	86 %	ESE	3.7 mph	4.5 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:49 AM	68.2 F	63.9 F	86 %	ESE	2.7 mph	3.5 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:54 AM	68.4 F	64.0 F	86 %	ESE	2.0 mph	3.3 mph	29.89 in	0.00 in	0.00 in
7/23/2020	5:59 AM	68.5 F	64.2 F	86 %	ESE	3.8 mph	5.1 mph	29.89 in	0.00 in	0.00 in
7/23/2020	6:04 AM	68.5 F	64.3 F	86 %	ESE	4.8 mph	6.6 mph	29.89 in	0.00 in	0.00 in
7/23/2020	6:09 AM	68.4 F	64.3 F	87 %	East	4.2 mph	5.3 mph	29.89 in	0.00 in	0.00 in
7/23/2020	6:14 AM	68.0 F	64.1 F	87 %	East	3.1 mph	4.2 mph	29.89 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:28	Survey Start:	21:28	Determination:	*Valid*
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B	Sunrise Time:	6:15	End Time:	2:28	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/23/2020	9:24 PM	80.3 F	72.8 F	78 %	ESE	8.1 mph	10.2 mph	29.77 in	0.00 in	0.00 in
7/23/2020	9:29 PM	80.2 F	72.9 F	78 %	ESE	8.3 mph	10.6 mph	29.77 in	0.00 in	0.00 in
7/23/2020	9:34 PM	80.2 F	72.9 F	78 %	ESE	7.0 mph	9.1 mph	29.77 in	0.00 in	0.00 in
7/23/2020	9:39 PM	80.2 F	72.9 F	78 %	SE	5.3 mph	7.0 mph	29.78 in	0.00 in	0.00 in
7/23/2020	9:44 PM	80.1 F	72.9 F	79 %	SE	4.2 mph	5.8 mph	29.78 in	0.00 in	0.00 in
7/23/2020	9:49 PM	80.1 F	73.0 F	79 %	ESE	6.5 mph	8.3 mph	29.78 in	0.00 in	0.00 in
7/23/2020	9:54 PM	79.9 F	73.1 F	80 %	ESE	7.1 mph	8.6 mph	29.77 in	0.00 in	0.00 in
7/23/2020	9:59 PM	79.5 F	72.9 F	80 %	ESE	6.4 mph	8.1 mph	29.77 in	0.00 in	0.00 in
7/23/2020	10:04 PM	79.7 F	73.1 F	80 %	ESE	8.5 mph	10.5 mph	29.77 in	0.00 in	0.00 in
7/23/2020	10:09 PM	79.6 F	73.2 F	81 %	ESE	8.1 mph	10.8 mph	29.76 in	0.00 in	0.00 in
7/23/2020	10:14 PM	79.3 F	73.1 F	81 %	ESE	8.3 mph	10.0 mph	29.76 in	0.00 in	0.00 in
7/23/2020	10:19 PM	79.3 F	73.0 F	81 %	ESE	7.2 mph	8.7 mph	29.76 in	0.00 in	0.00 in
7/23/2020	10:24 PM	79.4 F	73.2 F	81 %	ESE	6.0 mph	7.4 mph	29.77 in	0.00 in	0.00 in
7/23/2020	10:29 PM	79.3 F	73.2 F	81 %	East	5.1 mph	6.3 mph	29.77 in	0.00 in	0.00 in
7/23/2020	10:34 PM	79.0 F	73.2 F	82 %	East	5.5 mph	6.7 mph	29.78 in	0.00 in	0.00 in
7/23/2020	10:39 PM	78.7 F	73.1 F	83 %	East	4.5 mph	5.5 mph	29.78 in	0.00 in	0.00 in
7/23/2020	10:44 PM	78.9 F	73.0 F	82 %	East	4.8 mph	6.0 mph	29.78 in	0.00 in	0.00 in
7/23/2020	10:49 PM	79.0 F	73.0 F	82 %	ESE	5.2 mph	6.6 mph	29.78 in	0.00 in	0.00 in
7/23/2020	10:59 PM	78.6 F	73.0 F	83 %	East	5.6 mph	7.0 mph	29.78 in	0.00 in	0.00 in
7/23/2020	11:04 PM	78.7 F	73.2 F	83 %	ESE	6.6 mph	8.1 mph	29.78 in	0.00 in	0.00 in
7/23/2020	11:09 PM	78.4 F	73.2 F	84 %	ESE	6.3 mph	8.3 mph	29.78 in	0.00 in	0.00 in
7/23/2020	11:14 PM	78.4 F	73.1 F	84 %	ESE	5.9 mph	7.2 mph	29.77 in	0.00 in	0.00 in
7/23/2020	11:19 PM	78.3 F	73.2 F	84 %	ESE	6.5 mph	8.0 mph	29.77 in	0.00 in	0.00 in
7/23/2020	11:24 PM	78.2 F	73.3 F	85 %	ESE	5.6 mph	7.1 mph	29.77 in	0.00 in	0.00 in
7/23/2020	11:29 PM	78.1 F	73.2 F	85 %	East	4.1 mph	5.5 mph	29.78 in	0.00 in	0.00 in
7/23/2020	11:34 PM	77.7 F	73.2 F	86 %	East	4.1 mph	4.8 mph	29.77 in	0.00 in	0.00 in
7/23/2020	11:39 PM	77.8 F	73.1 F	85 %	East	4.9 mph	6.5 mph	29.77 in	0.00 in	0.00 in
7/23/2020	11:44 PM	77.9 F	73.1 F	85 %	East	5.2 mph	6.7 mph	29.76 in	0.00 in	0.00 in
7/23/2020	11:49 PM	78.0 F	73.1 F	85 %	East	5.7 mph	7.2 mph	29.76 in	0.00 in	0.00 in
7/23/2020	11:54 PM	78.0 F	73.1 F	85 %	East	6.1 mph	7.4 mph	29.76 in	0.00 in	0.00 in
7/23/2020	11:59 PM	78.0 F	73.1 F	85 %	East	6.9 mph	8.2 mph	29.76 in	0.00 in	0.00 in
7/24/2020	12:04 AM	78.1 F	73.2 F	85 %	East	7.0 mph	8.4 mph	29.75 in	0.00 in	0.00 in
7/24/2020	12:09 AM	78.1 F	73.2 F	85 %	East	7.9 mph	9.7 mph	29.76 in	0.00 in	0.00 in
7/24/2020	12:14 AM	78.1 F	73.4 F	86 %	East	5.8 mph	7.1 mph	29.75 in	0.00 in	0.00 in
7/24/2020	12:19 AM	77.9 F	73.4 F	86 %	ENE	4.9 mph	6.3 mph	29.76 in	0.00 in	0.00 in
7/24/2020	12:24 AM	77.9 F	73.4 F	86 %	East	4.8 mph	6.2 mph	29.76 in	0.00 in	0.00 in
7/24/2020	12:29 AM	77.9 F	73.4 F	86 %	East	4.0 mph	5.5 mph	29.76 in	0.00 in	0.00 in
7/24/2020	12:34 AM	77.9 F	73.4 F	86 %	ENE	4.1 mph	5.7 mph	29.75 in	0.00 in	0.00 in
7/24/2020	12:39 AM	77.8 F	73.4 F	86 %	ENE	2.7 mph	4.1 mph	29.75 in	0.00 in	0.00 in
7/24/2020	12:44 AM	77.4 F	73.2 F	87 %	ENE	4.5 mph	6.1 mph	29.74 in	0.00 in	0.00 in
7/24/2020	12:49 AM	77.5 F	73.3 F	87 %	East	4.9 mph	6.7 mph	29.74 in	0.00 in	0.00 in
7/24/2020	12:54 AM	77.7 F	73.6 F	87 %	East	5.3 mph	6.3 mph	29.74 in	0.00 in	0.00 in
7/24/2020	12:59 AM	77.9 F	73.6 F	87 %	East	7.0 mph	8.8 mph	29.74 in	0.00 in	0.00 in
7/24/2020	1:04 AM	78.1 F	73.8 F	87 %	East	5.9 mph	7.3 mph	29.74 in	0.00 in	0.00 in
7/24/2020	1:09 AM	77.7 F	73.7 F	87 %	East	4.8 mph	6.1 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:14 AM	77.8 F	73.7 F	87 %	East	6.3 mph	7.7 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:19 AM	78.1 F	73.8 F	87 %	East	5.2 mph	6.7 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:24 AM	78.0 F	73.9 F	87 %	ESE	4.5 mph	5.6 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:29 AM	78.0 F	73.8 F	87 %	East	3.7 mph	4.6 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:34 AM	78.1 F	73.9 F	87 %	ESE	3.4 mph	4.8 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:39 AM	78.3 F	74.1 F	87 %	ESE	2.0 mph	2.8 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:44 AM	78.4 F	74.1 F	87 %	SE	2.1 mph	2.7 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:49 AM	78.4 F	74.0 F	86 %	East	1.9 mph	2.6 mph	29.73 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:28	Survey Start:	21:28	Determination:	*Valid*
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B	Sunrise Time:	6:15	End Time:	2:28	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/24/2020	1:54 AM	78.4 F	74.1 F	87 %	East	1.5 mph	2.0 mph	29.73 in	0.00 in	0.00 in
7/24/2020	1:59 AM	78.3 F	74.1 F	87 %	SSE	0.4 mph	0.9 mph	29.73 in	0.00 in	0.00 in
7/24/2020	2:04 AM	78.1 F	74.0 F	87 %	South	1.0 mph	1.2 mph	29.74 in	0.00 in	0.00 in
7/24/2020	2:09 AM	77.7 F	73.9 F	88 %	SW	2.7 mph	3.0 mph	29.74 in	0.00 in	0.00 in
7/24/2020	2:14 AM	77.4 F	73.8 F	89 %	SW	4.2 mph	5.0 mph	29.74 in	0.00 in	0.00 in
7/24/2020	2:19 AM	77.2 F	73.6 F	89 %	SW	2.5 mph	3.6 mph	29.74 in	0.00 in	0.00 in
7/24/2020	2:24 AM	76.9 F	73.7 F	90 %	SSW	1.3 mph	2.0 mph	29.74 in	0.00 in	0.00 in
7/24/2020	2:29 AM	76.8 F	73.7 F	90 %	SW	3.5 mph	4.3 mph	29.73 in	0.00 in	0.00 in
7/24/2020	2:34 AM	76.7 F	73.8 F	91 %	SW	3.8 mph	4.7 mph	29.73 in	0.00 in	0.00 in
7/24/2020	2:39 AM	76.6 F	73.8 F	91 %	SW	3.4 mph	3.8 mph	29.73 in	0.00 in	0.00 in
7/24/2020	2:44 AM	76.5 F	73.8 F	91 %	SW	3.9 mph	4.5 mph	29.73 in	0.00 in	0.00 in
7/24/2020	2:49 AM	76.4 F	73.7 F	91 %	SSW	2.6 mph	3.0 mph	29.73 in	0.00 in	0.00 in
7/24/2020	2:54 AM	75.9 F	73.3 F	91 %	South	1.2 mph	1.4 mph	29.72 in	0.00 in	0.00 in
7/24/2020	2:59 AM	75.7 F	73.3 F	92 %	South	1.3 mph	1.5 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:04 AM	75.6 F	73.4 F	92 %	South	1.0 mph	1.3 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:09 AM	75.6 F	73.4 F	93 %	SSW	1.3 mph	1.5 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:14 AM	75.4 F	73.2 F	93 %	SSW	0.0 mph	0.0 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:19 AM	75.3 F	73.1 F	93 %	SSW	0.0 mph	0.0 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:24 AM	75.2 F	73.0 F	93 %	SSW	0.0 mph	0.0 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:29 AM	75.1 F	73.0 F	94 %	SSW	0.0 mph	0.0 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:34 AM	74.8 F	72.8 F	94 %	SSW	0.1 mph	0.1 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:39 AM	74.7 F	72.7 F	94 %	SSW	1.5 mph	1.8 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:44 AM	74.4 F	72.7 F	95 %	SSW	2.0 mph	2.3 mph	29.72 in	0.00 in	0.00 in
7/24/2020	3:49 AM	73.9 F	72.3 F	95 %	SSW	0.5 mph	0.6 mph	29.73 in	0.00 in	0.00 in
7/24/2020	3:54 AM	73.8 F	72.6 F	96 %	East	0.8 mph	0.9 mph	29.73 in	0.00 in	0.00 in
7/24/2020	3:59 AM	73.6 F	72.4 F	96 %	ENE	1.5 mph	1.9 mph	29.73 in	0.00 in	0.00 in
7/24/2020	4:04 AM	73.4 F	72.3 F	96 %	ENE	1.0 mph	1.3 mph	29.73 in	0.00 in	0.00 in
7/24/2020	4:09 AM	73.6 F	72.5 F	96 %	SSE	0.0 mph	0.0 mph	29.74 in	0.00 in	0.00 in
7/24/2020	4:14 AM	73.8 F	72.7 F	96 %	South	0.1 mph	0.2 mph	29.74 in	0.00 in	0.00 in
7/24/2020	4:19 AM	73.6 F	72.4 F	96 %	SSW	1.1 mph	1.3 mph	29.74 in	0.00 in	0.00 in
7/24/2020	4:24 AM	73.2 F	72.1 F	96 %	SSW	1.2 mph	1.6 mph	29.75 in	0.00 in	0.00 in
7/24/2020	4:29 AM	72.8 F	71.7 F	96 %	SSW	0.1 mph	0.2 mph	29.75 in	0.00 in	0.00 in
7/24/2020	4:34 AM	73.2 F	72.1 F	96 %	SSW	2.4 mph	2.8 mph	29.75 in	0.00 in	0.00 in
7/24/2020	4:39 AM	73.3 F	72.2 F	96 %	SW	3.7 mph	4.2 mph	29.76 in	0.00 in	0.00 in
7/24/2020	4:44 AM	73.3 F	72.2 F	96 %	SW	3.5 mph	3.7 mph	29.76 in	0.00 in	0.00 in
7/24/2020	4:49 AM	72.7 F	71.6 F	96 %	SW	3.8 mph	4.3 mph	29.76 in	0.00 in	0.00 in
7/24/2020	4:54 AM	72.2 F	71.1 F	96 %	SSW	3.6 mph	4.1 mph	29.76 in	0.00 in	0.00 in
7/24/2020	4:59 AM	72.0 F	71.2 F	97 %	SW	3.4 mph	3.7 mph	29.76 in	0.00 in	0.00 in
7/24/2020	5:04 AM	71.7 F	71.0 F	97 %	SW	4.5 mph	4.8 mph	29.77 in	0.00 in	0.00 in
7/24/2020	5:09 AM	71.2 F	70.4 F	97 %	SSW	4.5 mph	4.9 mph	29.77 in	0.00 in	0.00 in
7/24/2020	5:14 AM	71.9 F	71.1 F	97 %	SW	3.4 mph	3.9 mph	29.77 in	0.00 in	0.00 in
7/24/2020	5:19 AM	71.9 F	71.2 F	97 %	SSW	3.4 mph	4.0 mph	29.78 in	0.00 in	0.00 in
7/24/2020	5:24 AM	71.6 F	70.9 F	97 %	South	1.5 mph	1.9 mph	29.78 in	0.00 in	0.00 in
7/24/2020	5:29 AM	71.6 F	70.9 F	97 %	SE	0.2 mph	0.3 mph	29.78 in	0.00 in	0.00 in
7/24/2020	5:34 AM	71.4 F	70.7 F	97 %	SE	0.0 mph	0.1 mph	29.78 in	0.00 in	0.00 in
7/24/2020	5:39 AM	71.5 F	70.8 F	97 %	South	1.3 mph	1.9 mph	29.78 in	0.00 in	0.00 in
7/24/2020	5:44 AM	72.1 F	71.4 F	97 %	South	0.7 mph	1.1 mph	29.78 in	0.00 in	0.00 in
7/24/2020	5:49 AM	72.0 F	71.2 F	97 %	ESE	1.0 mph	1.4 mph	29.78 in	0.00 in	0.00 in
7/24/2020	5:54 AM	72.0 F	71.2 F	97 %	East	1.3 mph	1.7 mph	29.78 in	0.00 in	0.00 in
7/24/2020	5:59 AM	72.1 F	71.3 F	97 %	East	0.2 mph	0.3 mph	29.78 in	0.00 in	0.00 in
7/24/2020	6:04 AM	71.9 F	71.1 F	97 %	SSE	0.0 mph	0.0 mph	29.79 in	0.00 in	0.00 in
7/24/2020	6:09 AM	71.6 F	70.9 F	97 %	SSE	0.6 mph	1.1 mph	29.78 in	0.00 in	0.00 in
7/24/2020	6:14 AM	71.4 F	70.7 F	97 %	SE	0.2 mph	0.4 mph	29.78 in	0.00 in	0.00 in
7/24/2020	6:19 AM	71.3 F	70.6 F	97 %	South	1.7 mph	2.5 mph	29.79 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:27	Survey Start:	21:27	Determination:	Valid
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, T1, T2, T4, T5	Sunrise Time:	6:16	End Time:	2:27	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/24/2020	9:29 PM	73.8 F	63.5 F	70 %	ESE	9.4 mph	11.2 mph	29.76 in	0.00 in	0.00 in
7/24/2020	9:34 PM	73.5 F	62.6 F	69 %	ESE	7.1 mph	8.6 mph	29.76 in	0.00 in	0.00 in
7/24/2020	9:39 PM	74.0 F	63.7 F	70 %	SW	7.1 mph	8.6 mph	29.78 in	0.00 in	0.00 in
7/24/2020	9:44 PM	73.9 F	62.6 F	68 %	WSW	5.2 mph	6.7 mph	29.78 in	0.00 in	0.00 in
7/24/2020	9:49 PM	74.8 F	63.4 F	68 %	South	4.1 mph	5.1 mph	29.78 in	0.00 in	0.00 in
7/24/2020	9:54 PM	73.9 F	63.2 F	70 %	South	5.9 mph	6.8 mph	29.78 in	0.00 in	0.00 in
7/24/2020	9:59 PM	73.5 F	63.9 F	72 %	SSW	3.7 mph	4.9 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:04 PM	72.2 F	63.3 F	74 %	South	3.7 mph	4.7 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:09 PM	73.4 F	63.2 F	70 %	South	5.7 mph	6.9 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:14 PM	72.7 F	63.7 F	73 %	SSW	4.7 mph	5.7 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:19 PM	71.1 F	63.1 F	76 %	South	3.6 mph	4.4 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:24 PM	71.0 F	62.9 F	75 %	SSW	3.0 mph	3.6 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:29 PM	70.0 F	62.7 F	78 %	SSW	1.4 mph	1.8 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:34 PM	69.6 F	62.4 F	78 %	SSE	0.2 mph	0.4 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:39 PM	69.5 F	62.1 F	77 %	SW	1.7 mph	2.1 mph	29.77 in	0.00 in	0.00 in
7/24/2020	10:44 PM	69.8 F	62.2 F	77 %	SW	1.8 mph	2.1 mph	29.77 in	0.00 in	0.00 in
7/24/2020	10:49 PM	70.0 F	62.2 F	76 %	SW	1.6 mph	1.8 mph	29.77 in	0.00 in	0.00 in
7/24/2020	10:54 PM	69.0 F	62.4 F	80 %	WSW	3.0 mph	3.4 mph	29.78 in	0.00 in	0.00 in
7/24/2020	10:59 PM	69.8 F	61.5 F	75 %	South	2.4 mph	2.7 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:04 PM	70.3 F	62.3 F	76 %	SE	2.0 mph	2.1 mph	29.77 in	0.00 in	0.00 in
7/24/2020	11:09 PM	68.9 F	62.2 F	79 %	SE	1.5 mph	1.9 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:14 PM	67.9 F	61.8 F	81 %	SSE	1.1 mph	1.1 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:24 PM	66.7 F	62.1 F	85 %	East	2.8 mph	3.0 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:29 PM	65.5 F	61.3 F	87 %	SE	1.9 mph	2.2 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:34 PM	65.8 F	61.4 F	86 %	SSE	3.1 mph	3.6 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:39 PM	66.8 F	61.8 F	84 %	South	4.3 mph	4.9 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:44 PM	67.3 F	62.2 F	84 %	South	2.9 mph	3.2 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:49 PM	68.9 F	62.9 F	81 %	SSW	2.2 mph	2.4 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:54 PM	69.0 F	63.3 F	82 %	SSW	2.1 mph	2.2 mph	29.78 in	0.00 in	0.00 in
7/24/2020	11:59 PM	69.1 F	63.3 F	82 %	SSW	1.4 mph	1.9 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:04 AM	69.7 F	63.8 F	82 %	SSW	2.7 mph	2.9 mph	29.77 in	0.00 in	0.00 in
7/25/2020	12:09 AM	69.9 F	63.2 F	79 %	SW	3.6 mph	4.2 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:14 AM	69.6 F	63.6 F	81 %	SSW	3.5 mph	4.1 mph	29.77 in	0.00 in	0.00 in
7/25/2020	12:19 AM	69.3 F	63.5 F	82 %	SW	2.8 mph	3.5 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:24 AM	69.0 F	63.2 F	82 %	WSW	5.5 mph	6.7 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:29 AM	69.7 F	63.8 F	82 %	SW	4.3 mph	4.9 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:34 AM	69.4 F	63.9 F	83 %	SW	2.3 mph	2.8 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:39 AM	67.9 F	63.1 F	84 %	SW	1.7 mph	2.1 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:44 AM	68.2 F	63.4 F	85 %	SSW	3.4 mph	4.2 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:49 AM	68.5 F	63.7 F	85 %	SSW	2.9 mph	3.5 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:54 AM	68.0 F	63.6 F	86 %	SSW	3.4 mph	3.6 mph	29.78 in	0.00 in	0.00 in
7/25/2020	12:59 AM	68.1 F	63.4 F	85 %	South	4.1 mph	4.7 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:04 AM	69.2 F	63.9 F	83 %	SSW	2.7 mph	3.4 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:09 AM	68.8 F	63.9 F	84 %	SE	2.4 mph	3.1 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:14 AM	66.7 F	62.8 F	88 %	ESE	0.7 mph	1.0 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:19 AM	65.4 F	62.1 F	89 %	ESE	0.9 mph	1.3 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:24 AM	65.3 F	62.0 F	90 %	SSW	1.7 mph	2.2 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:29 AM	66.7 F	62.9 F	88 %	SSW	3.2 mph	4.0 mph	29.79 in	0.00 in	0.00 in
7/25/2020	1:34 AM	67.0 F	63.1 F	87 %	South	4.4 mph	5.4 mph	29.79 in	0.00 in	0.00 in
7/25/2020	1:39 AM	67.4 F	63.4 F	87 %	SSE	4.1 mph	4.9 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:44 AM	68.2 F	63.4 F	85 %	South	4.3 mph	5.3 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:49 AM	69.0 F	64.0 F	84 %	South	6.3 mph	7.5 mph	29.78 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:27	Survey Start:	21:27	Determination:	Valid
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, T1, T2, T4, T5	Sunrise Time:	6:16	End Time:	2:27	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/25/2020	1:54 AM	69.1 F	64.0 F	84 %	SSW	6.8 mph	8.2 mph	29.78 in	0.00 in	0.00 in
7/25/2020	1:59 AM	68.9 F	64.0 F	84 %	South	5.5 mph	7.0 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:04 AM	69.3 F	63.9 F	83 %	South	5.6 mph	7.0 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:09 AM	69.9 F	64.1 F	82 %	South	6.0 mph	7.4 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:14 AM	70.1 F	63.9 F	81 %	South	6.6 mph	7.7 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:19 AM	70.2 F	64.2 F	81 %	South	5.9 mph	7.2 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:24 AM	69.7 F	64.1 F	82 %	South	6.8 mph	8.4 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:29 AM	69.3 F	64.4 F	85 %	South	6.3 mph	7.4 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:34 AM	67.9 F	64.0 F	87 %	SSE	6.9 mph	7.8 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:39 AM	67.4 F	63.6 F	88 %	South	6.8 mph	7.9 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:44 AM	67.8 F	63.9 F	88 %	South	7.7 mph	9.1 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:49 AM	68.4 F	64.4 F	87 %	South	7.6 mph	9.0 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:54 AM	67.8 F	64.1 F	88 %	South	7.3 mph	8.4 mph	29.78 in	0.00 in	0.00 in
7/25/2020	2:59 AM	67.6 F	64.1 F	89 %	SSE	7.0 mph	8.1 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:04 AM	67.4 F	64.0 F	89 %	South	6.6 mph	7.6 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:09 AM	67.3 F	64.0 F	89 %	South	6.4 mph	7.5 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:14 AM	67.8 F	64.4 F	89 %	South	6.4 mph	7.5 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:19 AM	67.9 F	64.2 F	88 %	South	6.3 mph	7.6 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:24 AM	68.5 F	64.4 F	87 %	South	4.2 mph	5.3 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:29 AM	67.3 F	63.9 F	89 %	SSW	3.7 mph	4.5 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:34 AM	66.9 F	63.4 F	89 %	South	4.3 mph	5.3 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:39 AM	68.1 F	63.7 F	86 %	South	4.9 mph	6.2 mph	29.78 in	0.00 in	0.00 in
7/25/2020	3:44 AM	69.0 F	64.0 F	84 %	South	5.3 mph	6.5 mph	29.77 in	0.00 in	0.00 in
7/25/2020	3:49 AM	69.3 F	63.9 F	83 %	South	5.5 mph	6.8 mph	29.77 in	0.00 in	0.00 in
7/25/2020	3:54 AM	69.2 F	63.8 F	83 %	South	5.1 mph	6.2 mph	29.77 in	0.00 in	0.00 in
7/25/2020	3:59 AM	69.3 F	64.0 F	83 %	South	6.0 mph	7.0 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:04 AM	68.2 F	63.9 F	86 %	South	6.0 mph	6.9 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:09 AM	67.5 F	63.4 F	87 %	South	4.7 mph	5.6 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:14 AM	67.5 F	63.0 F	85 %	South	4.4 mph	5.1 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:19 AM	68.2 F	63.2 F	84 %	South	5.2 mph	6.3 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:24 AM	68.5 F	63.7 F	85 %	South	5.7 mph	6.8 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:29 AM	67.6 F	63.5 F	87 %	SSW	4.8 mph	5.9 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:34 AM	67.0 F	63.0 F	87 %	South	5.0 mph	6.6 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:39 AM	67.3 F	63.0 F	86 %	South	3.9 mph	5.2 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:44 AM	66.4 F	62.5 F	88 %	South	2.3 mph	3.1 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:49 AM	66.4 F	62.6 F	88 %	South	3.3 mph	4.3 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:54 AM	66.7 F	62.9 F	88 %	South	2.7 mph	3.4 mph	29.77 in	0.00 in	0.00 in
7/25/2020	4:59 AM	67.2 F	63.1 F	87 %	South	4.8 mph	5.8 mph	29.77 in	0.00 in	0.00 in
7/25/2020	5:04 AM	67.6 F	63.5 F	87 %	South	4.0 mph	4.8 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:09 AM	67.2 F	63.2 F	87 %	South	4.2 mph	5.5 mph	29.77 in	0.00 in	0.00 in
7/25/2020	5:14 AM	67.2 F	63.4 F	88 %	SSE	3.4 mph	4.3 mph	29.77 in	0.00 in	0.00 in
7/25/2020	5:19 AM	66.0 F	62.7 F	89 %	South	3.9 mph	4.6 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:24 AM	67.1 F	63.2 F	88 %	South	4.7 mph	5.6 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:29 AM	67.1 F	63.3 F	88 %	South	5.7 mph	6.8 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:34 AM	67.4 F	63.3 F	87 %	South	7.6 mph	9.4 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:39 AM	67.8 F	63.5 F	86 %	South	7.0 mph	8.6 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:44 AM	67.8 F	63.5 F	86 %	South	6.5 mph	8.2 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:49 AM	67.5 F	63.6 F	87 %	South	5.3 mph	6.7 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:54 AM	67.5 F	63.5 F	87 %	South	5.0 mph	6.2 mph	29.78 in	0.00 in	0.00 in
7/25/2020	5:59 AM	67.7 F	63.5 F	86 %	South	4.3 mph	5.5 mph	29.79 in	0.00 in	0.00 in
7/25/2020	6:04 AM	68.4 F	63.8 F	85 %	SSE	5.0 mph	6.0 mph	29.78 in	0.00 in	0.00 in
7/25/2020	6:09 AM	67.9 F	63.9 F	87 %	SSE	4.7 mph	5.5 mph	29.78 in	0.00 in	0.00 in
7/25/2020	6:14 AM	67.6 F	63.6 F	87 %	SSE	5.8 mph	6.9 mph	29.78 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:27	Survey Start:	21:27	Determination:	Valid
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, T1, T2, T4, T5	Sunrise Time:	6:16	End Time:	2:27	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/25/2020	6:19 AM	67.9 F	63.6 F	86 %	South	5.6 mph	6.7 mph	29.78 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:26	Survey Start:	21:26	Determination:	Valid
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, T1, T2, T4, T5	Sunrise Time:	6:18	End Time:	2:26	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/25/2020	9:24 PM	67.3 F	54.2 F	63 %	NW	4.7 mph	5.8 mph	29.94 in	0.00 in	0.00 in
7/25/2020	9:29 PM	67.1 F	54.3 F	64 %	NW	4.8 mph	5.7 mph	29.94 in	0.00 in	0.00 in
7/25/2020	9:34 PM	66.4 F	54.6 F	66 %	WNW	4.4 mph	5.4 mph	29.94 in	0.00 in	0.00 in
7/25/2020	9:39 PM	65.9 F	54.7 F	67 %	NW	4.1 mph	4.8 mph	29.94 in	0.00 in	0.00 in
7/25/2020	9:44 PM	64.9 F	55.0 F	70 %	WNW	4.4 mph	5.2 mph	29.95 in	0.00 in	0.00 in
7/25/2020	9:49 PM	64.5 F	54.3 F	70 %	WNW	5.3 mph	6.2 mph	29.95 in	0.00 in	0.00 in
7/25/2020	9:54 PM	64.2 F	53.8 F	69 %	WNW	4.8 mph	5.9 mph	29.95 in	0.00 in	0.00 in
7/25/2020	9:59 PM	64.1 F	53.8 F	69 %	WNW	4.4 mph	5.4 mph	29.96 in	0.00 in	0.00 in
7/25/2020	10:04 PM	64.0 F	53.7 F	69 %	NW	4.5 mph	5.5 mph	29.96 in	0.00 in	0.00 in
7/25/2020	10:09 PM	63.8 F	53.6 F	69 %	WNW	4.2 mph	5.1 mph	29.96 in	0.00 in	0.00 in
7/25/2020	10:14 PM	63.4 F	53.5 F	70 %	NW	3.4 mph	4.0 mph	29.96 in	0.00 in	0.00 in
7/25/2020	10:19 PM	62.9 F	53.6 F	72 %	NW	2.7 mph	3.3 mph	29.96 in	0.00 in	0.00 in
7/25/2020	10:24 PM	62.3 F	53.5 F	73 %	WNW	2.2 mph	2.5 mph	29.97 in	0.00 in	0.00 in
7/25/2020	10:29 PM	62.2 F	53.2 F	72 %	WNW	2.5 mph	3.0 mph	29.97 in	0.00 in	0.00 in
7/25/2020	10:34 PM	62.3 F	53.5 F	73 %	WNW	2.4 mph	2.8 mph	29.97 in	0.00 in	0.00 in
7/25/2020	10:39 PM	62.2 F	53.4 F	73 %	West	2.4 mph	2.8 mph	29.97 in	0.00 in	0.00 in
7/25/2020	10:44 PM	62.1 F	53.5 F	73 %	WNW	2.6 mph	3.0 mph	29.97 in	0.00 in	0.00 in
7/25/2020	10:49 PM	62.7 F	53.7 F	73 %	WNW	2.9 mph	3.5 mph	29.98 in	0.00 in	0.00 in
7/25/2020	10:54 PM	62.6 F	53.6 F	72 %	WNW	3.4 mph	3.6 mph	29.98 in	0.00 in	0.00 in
7/25/2020	10:59 PM	62.9 F	53.7 F	72 %	West	3.7 mph	4.1 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:04 PM	63.2 F	53.8 F	71 %	WNW	4.4 mph	5.1 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:09 PM	63.6 F	54.0 F	71 %	WNW	3.8 mph	4.2 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:14 PM	63.2 F	54.2 F	73 %	West	3.1 mph	3.4 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:19 PM	62.6 F	54.1 F	74 %	West	2.7 mph	3.2 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:24 PM	62.6 F	53.9 F	73 %	WNW	3.3 mph	3.7 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:29 PM	62.9 F	54.2 F	73 %	West	3.0 mph	3.4 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:34 PM	62.8 F	54.4 F	74 %	West	3.1 mph	3.4 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:39 PM	62.6 F	54.3 F	74 %	West	3.4 mph	3.5 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:44 PM	62.6 F	54.3 F	74 %	West	2.6 mph	2.9 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:49 PM	62.6 F	54.6 F	75 %	West	2.2 mph	2.6 mph	29.98 in	0.00 in	0.00 in
7/25/2020	11:54 PM	62.3 F	54.6 F	76 %	West	2.2 mph	2.6 mph	29.99 in	0.00 in	0.00 in
7/25/2020	11:59 PM	61.7 F	54.5 F	77 %	West	2.3 mph	2.7 mph	29.99 in	0.00 in	0.00 in
7/26/2020	12:04 AM	61.5 F	54.7 F	78 %	West	2.7 mph	3.4 mph	29.99 in	0.00 in	0.00 in
7/26/2020	12:09 AM	61.5 F	55.1 F	79 %	West	3.0 mph	3.4 mph	29.99 in	0.00 in	0.00 in
7/26/2020	12:14 AM	61.3 F	54.7 F	79 %	West	3.0 mph	3.6 mph	29.99 in	0.00 in	0.00 in
7/26/2020	12:19 AM	61.3 F	54.8 F	79 %	WSW	2.6 mph	3.2 mph	29.99 in	0.00 in	0.00 in
7/26/2020	12:24 AM	61.2 F	54.8 F	79 %	West	3.6 mph	4.3 mph	30.00 in	0.00 in	0.00 in
7/26/2020	12:29 AM	61.5 F	55.0 F	79 %	West	4.1 mph	4.7 mph	30.00 in	0.00 in	0.00 in
7/26/2020	12:34 AM	61.6 F	55.2 F	79 %	West	4.2 mph	4.8 mph	30.00 in	0.00 in	0.00 in
7/26/2020	12:39 AM	61.2 F	55.0 F	80 %	West	4.6 mph	5.1 mph	30.00 in	0.00 in	0.00 in
7/26/2020	12:44 AM	61.3 F	55.0 F	80 %	West	4.6 mph	5.3 mph	30.00 in	0.00 in	0.00 in
7/26/2020	12:49 AM	61.6 F	55.3 F	80 %	West	4.8 mph	5.5 mph	30.00 in	0.00 in	0.00 in
7/26/2020	12:54 AM	61.1 F	55.1 F	81 %	West	3.6 mph	4.3 mph	30.00 in	0.00 in	0.00 in
7/26/2020	12:59 AM	60.8 F	55.1 F	82 %	West	1.4 mph	1.9 mph	30.00 in	0.00 in	0.00 in
7/26/2020	1:04 AM	60.0 F	54.6 F	83 %	SE	0.3 mph	0.5 mph	30.00 in	0.00 in	0.00 in
7/26/2020	1:09 AM	58.7 F	54.0 F	85 %	West	1.4 mph	1.8 mph	30.01 in	0.00 in	0.00 in
7/26/2020	1:14 AM	59.8 F	54.7 F	83 %	WNW	2.7 mph	3.2 mph	30.01 in	0.00 in	0.00 in
7/26/2020	1:19 AM	60.2 F	54.9 F	83 %	West	2.2 mph	2.6 mph	30.01 in	0.00 in	0.00 in
7/26/2020	1:24 AM	59.6 F	54.7 F	84 %	West	1.6 mph	2.1 mph	30.01 in	0.00 in	0.00 in
7/26/2020	1:29 AM	59.5 F	54.6 F	84 %	West	1.9 mph	2.2 mph	30.01 in	0.00 in	0.00 in
7/26/2020	1:34 AM	59.3 F	54.6 F	84 %	West	2.1 mph	2.2 mph	30.01 in	0.00 in	0.00 in
7/26/2020	1:39 AM	59.4 F	54.7 F	85 %	West	2.5 mph	2.8 mph	30.01 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:26	Survey Start:	21:26	Determination:	Valid
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, T1, T2, T4, T5	Sunrise Time:	6:18	End Time:	2:26	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/26/2020	1:44 AM	59.3 F	54.8 F	85 %	WNW	2.3 mph	2.5 mph	30.02 in	0.00 in	0.00 in
7/26/2020	1:49 AM	59.2 F	54.7 F	85 %	WNW	2.5 mph	2.9 mph	30.02 in	0.00 in	0.00 in
7/26/2020	1:54 AM	59.4 F	54.9 F	85 %	WNW	2.4 mph	2.9 mph	30.02 in	0.00 in	0.00 in
7/26/2020	1:59 AM	59.3 F	55.1 F	86 %	WNW	2.2 mph	2.4 mph	30.02 in	0.00 in	0.00 in
7/26/2020	2:04 AM	59.0 F	54.9 F	86 %	West	2.7 mph	3.0 mph	30.02 in	0.00 in	0.00 in
7/26/2020	2:09 AM	59.2 F	54.7 F	85 %	West	3.1 mph	3.3 mph	30.02 in	0.00 in	0.00 in
7/26/2020	2:14 AM	59.2 F	54.7 F	85 %	West	2.3 mph	2.5 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:19 AM	59.1 F	54.5 F	85 %	West	2.4 mph	2.8 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:24 AM	59.2 F	54.7 F	85 %	WSW	1.3 mph	1.7 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:29 AM	58.6 F	54.3 F	86 %	SSE	0.1 mph	0.2 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:34 AM	57.4 F	53.8 F	88 %	SSE	1.0 mph	1.3 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:39 AM	58.0 F	54.2 F	87 %	SSE	1.0 mph	1.1 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:44 AM	58.9 F	54.6 F	86 %	SSE	0.8 mph	0.8 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:49 AM	59.1 F	54.8 F	86 %	SSE	0.0 mph	0.0 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:54 AM	58.6 F	54.6 F	87 %	SSE	0.0 mph	0.0 mph	30.03 in	0.00 in	0.00 in
7/26/2020	2:59 AM	58.2 F	54.4 F	87 %	SSE	0.0 mph	0.0 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:04 AM	58.4 F	54.5 F	87 %	SSE	0.0 mph	0.0 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:09 AM	59.1 F	54.5 F	85 %	SW	0.1 mph	0.1 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:14 AM	59.9 F	54.5 F	82 %	WSW	1.2 mph	1.4 mph	30.02 in	0.00 in	0.00 in
7/26/2020	3:19 AM	60.2 F	54.3 F	81 %	WNW	2.0 mph	2.3 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:24 AM	60.2 F	54.2 F	81 %	West	1.8 mph	2.2 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:29 AM	60.2 F	54.1 F	81 %	West	1.8 mph	2.1 mph	30.02 in	0.00 in	0.00 in
7/26/2020	3:34 AM	60.5 F	54.4 F	80 %	SW	1.0 mph	1.3 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:39 AM	60.4 F	54.3 F	80 %	South	0.1 mph	0.1 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:44 AM	59.2 F	54.1 F	83 %	South	1.5 mph	1.8 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:49 AM	58.5 F	53.6 F	84 %	South	0.6 mph	0.7 mph	30.03 in	0.00 in	0.00 in
7/26/2020	3:54 AM	57.9 F	53.7 F	86 %	SSE	0.0 mph	0.0 mph	30.02 in	0.00 in	0.00 in
7/26/2020	3:59 AM	57.2 F	53.4 F	87 %	SSE	0.0 mph	0.0 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:04 AM	56.5 F	52.9 F	88 %	SSE	0.0 mph	0.0 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:09 AM	56.3 F	52.7 F	88 %	SSE	0.2 mph	0.3 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:14 AM	56.6 F	52.8 F	87 %	South	1.8 mph	2.2 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:19 AM	56.1 F	52.7 F	88 %	South	2.3 mph	2.4 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:24 AM	56.1 F	52.6 F	88 %	SSW	2.4 mph	2.8 mph	30.03 in	0.00 in	0.00 in
7/26/2020	4:29 AM	57.3 F	53.1 F	86 %	SSW	2.4 mph	3.0 mph	30.03 in	0.00 in	0.00 in
7/26/2020	4:34 AM	58.3 F	53.2 F	83 %	South	0.8 mph	1.2 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:39 AM	58.7 F	53.5 F	83 %	South	0.0 mph	0.0 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:44 AM	58.6 F	53.4 F	83 %	South	1.2 mph	1.3 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:49 AM	58.3 F	53.0 F	83 %	SSW	2.2 mph	2.2 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:54 AM	58.6 F	53.2 F	82 %	SSW	2.6 mph	3.1 mph	30.02 in	0.00 in	0.00 in
7/26/2020	4:59 AM	59.0 F	52.9 F	80 %	South	1.1 mph	1.3 mph	30.02 in	0.00 in	0.00 in
7/26/2020	5:04 AM	59.6 F	52.7 F	78 %	South	0.2 mph	1.0 mph	30.02 in	0.00 in	0.00 in
7/26/2020	5:09 AM	60.0 F	52.6 F	77 %	South	0.0 mph	0.1 mph	30.02 in	0.00 in	0.00 in
7/26/2020	5:14 AM	59.7 F	52.4 F	77 %	South	0.0 mph	0.0 mph	30.02 in	0.00 in	0.00 in
7/26/2020	5:19 AM	59.4 F	52.2 F	77 %	South	0.3 mph	0.4 mph	30.02 in	0.00 in	0.00 in
7/26/2020	5:24 AM	59.8 F	52.6 F	77 %	South	1.7 mph	1.9 mph	30.02 in	0.00 in	0.00 in
7/26/2020	5:29 AM	60.0 F	52.6 F	76 %	SSW	2.2 mph	2.2 mph	30.02 in	0.00 in	0.00 in
7/26/2020	5:34 AM	60.1 F	52.5 F	76 %	SSW	2.8 mph	3.1 mph	30.02 in	0.00 in	0.00 in
7/26/2020	5:39 AM	59.3 F	52.2 F	78 %	SSW	3.3 mph	3.4 mph	30.03 in	0.00 in	0.00 in
7/26/2020	5:44 AM	59.8 F	51.7 F	74 %	SSW	2.4 mph	2.8 mph	30.03 in	0.00 in	0.00 in
7/26/2020	5:49 AM	61.0 F	51.5 F	71 %	SSW	1.6 mph	1.8 mph	30.04 in	0.00 in	0.00 in
7/26/2020	5:54 AM	60.9 F	51.6 F	72 %	SSW	0.1 mph	0.1 mph	30.03 in	0.00 in	0.00 in
7/26/2020	5:59 AM	60.5 F	51.3 F	72 %	SSW	0.3 mph	0.4 mph	30.03 in	0.00 in	0.00 in
7/26/2020	6:04 AM	59.3 F	51.6 F	76 %	SW	0.2 mph	0.3 mph	30.02 in	0.00 in	0.00 in
7/26/2020	6:09 AM	58.6 F	51.0 F	76 %	WSW	2.1 mph	2.2 mph	30.02 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	**Sunset Time:**	21:26	**Survey Start:**	21:26	**Determination:**	Valid	
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, T1, T2, T4, T5	**Sunrise Time:**	6:18	**End Time:**	2:26	**Reason:**	No adverse weather	

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/26/2020	6:14 AM	59.6 F	51.7 F	75 %	WSW	1.8 mph	2.2 mph	30.02 in	0.00 in	0.00 in
7/26/2020	6:19 AM	59.5 F	51.6 F	75 %	WSW	1.6 mph	2.1 mph	30.03 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:25	Survey Start:	21:25	Determination:	Valid
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, T1, T2, T4, T5	Sunrise Time:	6:19	End Time:	2:25	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/26/2020	9:24 PM	68.4 F	53.4 F	59 %	West	3.9 mph	4.5 mph	30.07 in	0.00 in	0.00 in
7/26/2020	9:29 PM	68.0 F	53.3 F	59 %	West	4.3 mph	4.8 mph	30.07 in	0.00 in	0.00 in
7/26/2020	9:34 PM	67.4 F	53.0 F	60 %	West	4.5 mph	4.8 mph	30.06 in	0.00 in	0.00 in
7/26/2020	9:39 PM	66.8 F	52.6 F	60 %	West	4.4 mph	5.0 mph	30.07 in	0.00 in	0.00 in
7/26/2020	9:44 PM	66.7 F	52.6 F	60 %	West	4.6 mph	5.2 mph	30.07 in	0.00 in	0.00 in
7/26/2020	9:49 PM	66.3 F	52.4 F	61 %	West	3.9 mph	4.6 mph	30.07 in	0.00 in	0.00 in
7/26/2020	9:54 PM	66.3 F	52.2 F	60 %	WSW	3.3 mph	4.0 mph	30.07 in	0.00 in	0.00 in
7/26/2020	9:59 PM	66.7 F	52.2 F	60 %	WSW	3.6 mph	4.2 mph	30.08 in	0.00 in	0.00 in
7/26/2020	10:04 PM	66.5 F	52.3 F	60 %	WSW	3.2 mph	3.6 mph	30.08 in	0.00 in	0.00 in
7/26/2020	10:09 PM	66.4 F	52.2 F	60 %	WSW	3.6 mph	4.2 mph	30.08 in	0.00 in	0.00 in
7/26/2020	10:14 PM	66.5 F	52.1 F	60 %	WSW	3.5 mph	4.3 mph	30.08 in	0.00 in	0.00 in
7/26/2020	10:19 PM	66.6 F	52.3 F	60 %	WSW	3.8 mph	4.5 mph	30.07 in	0.00 in	0.00 in
7/26/2020	10:24 PM	66.4 F	52.2 F	60 %	West	3.7 mph	4.5 mph	30.08 in	0.00 in	0.00 in
7/26/2020	10:29 PM	66.2 F	52.1 F	60 %	WSW	3.6 mph	4.3 mph	30.08 in	0.00 in	0.00 in
7/26/2020	10:34 PM	66.3 F	52.3 F	61 %	West	4.0 mph	4.5 mph	30.09 in	0.00 in	0.00 in
7/26/2020	10:39 PM	65.8 F	52.2 F	61 %	West	4.3 mph	4.9 mph	30.09 in	0.00 in	0.00 in
7/26/2020	10:44 PM	65.5 F	52.3 F	63 %	West	3.8 mph	4.3 mph	30.09 in	0.00 in	0.00 in
7/26/2020	10:49 PM	64.9 F	52.3 F	64 %	WSW	3.1 mph	3.8 mph	30.09 in	0.00 in	0.00 in
7/26/2020	10:54 PM	64.5 F	52.2 F	64 %	SW	2.9 mph	3.7 mph	30.09 in	0.00 in	0.00 in
7/26/2020	10:59 PM	64.4 F	52.1 F	64 %	WSW	3.0 mph	4.0 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:04 PM	64.7 F	52.2 F	64 %	WSW	2.5 mph	3.1 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:09 PM	64.7 F	52.2 F	64 %	WSW	2.5 mph	3.2 mph	30.08 in	0.00 in	0.00 in
7/26/2020	11:14 PM	64.7 F	52.4 F	65 %	WSW	2.4 mph	3.2 mph	30.08 in	0.00 in	0.00 in
7/26/2020	11:19 PM	64.7 F	52.3 F	64 %	WSW	2.4 mph	2.9 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:24 PM	64.8 F	52.4 F	64 %	WSW	2.1 mph	2.6 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:29 PM	64.5 F	52.4 F	65 %	WSW	1.9 mph	2.3 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:34 PM	64.6 F	52.5 F	65 %	SW	2.3 mph	3.3 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:39 PM	64.7 F	52.6 F	65 %	SW	2.0 mph	2.6 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:44 PM	64.7 F	52.4 F	65 %	SW	1.8 mph	2.2 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:49 PM	65.1 F	52.7 F	64 %	SW	2.0 mph	2.3 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:54 PM	65.1 F	52.9 F	65 %	SW	1.6 mph	2.0 mph	30.09 in	0.00 in	0.00 in
7/26/2020	11:59 PM	64.8 F	52.7 F	65 %	WSW	2.3 mph	2.6 mph	30.09 in	0.00 in	0.00 in
7/27/2020	12:04 AM	64.8 F	52.7 F	65 %	WSW	2.2 mph	2.5 mph	30.09 in	0.00 in	0.00 in
7/27/2020	12:09 AM	64.8 F	52.7 F	65 %	SW	1.7 mph	2.1 mph	30.09 in	0.00 in	0.00 in
7/27/2020	12:14 AM	64.8 F	52.7 F	65 %	SSW	1.2 mph	1.6 mph	30.08 in	0.00 in	0.00 in
7/27/2020	12:19 AM	64.6 F	52.8 F	66 %	SSW	1.3 mph	1.7 mph	30.08 in	0.00 in	0.00 in
7/27/2020	12:24 AM	64.7 F	52.6 F	65 %	SW	1.5 mph	1.9 mph	30.08 in	0.00 in	0.00 in
7/27/2020	12:29 AM	65.2 F	52.8 F	64 %	SW	1.6 mph	2.1 mph	30.09 in	0.00 in	0.00 in
7/27/2020	12:34 AM	65.3 F	52.9 F	64 %	SW	1.3 mph	1.8 mph	30.09 in	0.00 in	0.00 in
7/27/2020	12:39 AM	64.9 F	52.9 F	65 %	WSW	1.8 mph	2.0 mph	30.09 in	0.00 in	0.00 in
7/27/2020	12:44 AM	64.7 F	53.0 F	66 %	West	2.2 mph	2.3 mph	30.08 in	0.00 in	0.00 in
7/27/2020	12:49 AM	64.0 F	52.9 F	67 %	WSW	1.9 mph	2.0 mph	30.08 in	0.00 in	0.00 in
7/27/2020	12:54 AM	64.1 F	52.7 F	66 %	SW	1.9 mph	2.3 mph	30.08 in	0.00 in	0.00 in
7/27/2020	12:59 AM	64.7 F	52.8 F	65 %	SSW	3.1 mph	3.4 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:04 AM	65.2 F	52.9 F	64 %	SSW	1.7 mph	2.0 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:09 AM	65.0 F	53.0 F	65 %	SSW	1.1 mph	1.4 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:14 AM	64.9 F	52.9 F	65 %	WSW	1.7 mph	2.1 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:19 AM	64.7 F	52.9 F	66 %	West	1.8 mph	2.2 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:24 AM	64.8 F	52.8 F	65 %	West	2.2 mph	2.5 mph	30.09 in	0.00 in	0.00 in
7/27/2020	1:29 AM	64.5 F	53.0 F	66 %	WSW	1.5 mph	2.1 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:34 AM	64.1 F	52.9 F	67 %	SSW	1.1 mph	1.2 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:39 AM	63.9 F	52.7 F	67 %	SSW	0.6 mph	1.1 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:44 AM	64.0 F	52.9 F	67 %	South	0.1 mph	0.4 mph	30.08 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:25	Survey Start:	21:25	Determination:	Valid
SITES:	1A, 1B, 2A, 2B, 3A, alt2, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, T1, T2, T4, T5	Sunrise Time:	6:19	End Time:	2:25	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/27/2020	1:49 AM	64.0 F	52.9 F	67 %	South	0.0 mph	0.0 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:54 AM	63.7 F	52.9 F	68 %	South	1.4 mph	1.6 mph	30.08 in	0.00 in	0.00 in
7/27/2020	1:59 AM	62.8 F	52.7 F	70 %	South	2.2 mph	2.3 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:04 AM	61.7 F	52.7 F	72 %	SSW	4.3 mph	4.7 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:09 AM	59.4 F	51.5 F	75 %	SW	5.2 mph	5.8 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:14 AM	60.9 F	51.9 F	72 %	SW	2.8 mph	3.1 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:19 AM	61.8 F	52.0 F	70 %	SW	4.4 mph	4.8 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:24 AM	62.4 F	52.5 F	70 %	SW	4.1 mph	5.0 mph	30.07 in	0.00 in	0.00 in
7/27/2020	2:29 AM	59.9 F	52.7 F	77 %	SSW	3.6 mph	4.1 mph	30.07 in	0.00 in	0.00 in
7/27/2020	2:34 AM	59.0 F	52.2 F	78 %	SSW	4.7 mph	5.4 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:39 AM	59.0 F	52.3 F	79 %	SSW	2.9 mph	3.5 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:44 AM	59.0 F	51.9 F	77 %	SW	3.8 mph	4.8 mph	30.07 in	0.00 in	0.00 in
7/27/2020	2:49 AM	60.3 F	52.1 F	74 %	SW	5.2 mph	6.4 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:54 AM	60.9 F	52.4 F	73 %	SW	5.5 mph	6.6 mph	30.08 in	0.00 in	0.00 in
7/27/2020	2:59 AM	60.9 F	52.4 F	74 %	SW	5.2 mph	6.2 mph	30.08 in	0.00 in	0.00 in
7/27/2020	3:04 AM	60.6 F	52.3 F	74 %	SW	4.4 mph	5.3 mph	30.08 in	0.00 in	0.00 in
7/27/2020	3:09 AM	60.4 F	52.2 F	74 %	SW	3.8 mph	4.9 mph	30.07 in	0.00 in	0.00 in
7/27/2020	3:14 AM	60.6 F	51.8 F	73 %	SW	4.0 mph	5.1 mph	30.07 in	0.00 in	0.00 in
7/27/2020	3:19 AM	61.2 F	52.3 F	73 %	SW	3.9 mph	4.5 mph	30.08 in	0.00 in	0.00 in
7/27/2020	3:24 AM	61.0 F	52.2 F	73 %	SW	3.9 mph	4.7 mph	30.08 in	0.00 in	0.00 in
7/27/2020	3:29 AM	60.8 F	52.0 F	73 %	SW	3.8 mph	4.9 mph	30.07 in	0.00 in	0.00 in
7/27/2020	3:34 AM	61.1 F	51.5 F	71 %	SW	4.7 mph	5.9 mph	30.07 in	0.00 in	0.00 in
7/27/2020	3:39 AM	61.9 F	51.7 F	69 %	SW	4.4 mph	5.3 mph	30.07 in	0.00 in	0.00 in
7/27/2020	3:44 AM	61.8 F	52.1 F	70 %	SW	3.9 mph	4.7 mph	30.07 in	0.00 in	0.00 in
7/27/2020	3:49 AM	61.2 F	51.6 F	71 %	SW	3.5 mph	4.0 mph	30.07 in	0.00 in	0.00 in
7/27/2020	3:54 AM	61.5 F	51.7 F	70 %	SW	3.0 mph	3.5 mph	30.07 in	0.00 in	0.00 in
7/27/2020	3:59 AM	61.1 F	51.4 F	71 %	SSW	3.0 mph	3.5 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:04 AM	61.0 F	51.1 F	70 %	SW	3.5 mph	4.1 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:09 AM	61.4 F	51.7 F	71 %	SSW	1.9 mph	2.3 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:14 AM	60.8 F	51.3 F	71 %	SSW	1.6 mph	2.3 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:19 AM	61.0 F	51.4 F	71 %	SSW	2.1 mph	2.6 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:24 AM	60.7 F	51.2 F	71 %	SSW	1.8 mph	2.2 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:29 AM	61.6 F	50.5 F	67 %	SW	3.0 mph	3.5 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:34 AM	63.8 F	51.3 F	64 %	SSW	3.2 mph	3.5 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:39 AM	63.0 F	51.4 F	66 %	SSW	3.2 mph	3.6 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:44 AM	62.0 F	51.2 F	68 %	SSW	3.1 mph	3.5 mph	30.06 in	0.00 in	0.00 in
7/27/2020	4:49 AM	62.7 F	50.6 F	65 %	SW	3.6 mph	4.1 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:54 AM	63.7 F	50.9 F	63 %	SW	3.6 mph	4.2 mph	30.07 in	0.00 in	0.00 in
7/27/2020	4:59 AM	63.5 F	51.1 F	64 %	SSW	3.3 mph	3.7 mph	30.07 in	0.00 in	0.00 in
7/27/2020	5:04 AM	62.5 F	51.3 F	67 %	SW	3.5 mph	4.0 mph	30.07 in	0.00 in	0.00 in
7/27/2020	5:09 AM	60.8 F	50.9 F	70 %	SSW	3.3 mph	3.6 mph	30.06 in	0.00 in	0.00 in
7/27/2020	5:14 AM	60.0 F	51.0 F	72 %	SSW	2.6 mph	3.2 mph	30.07 in	0.00 in	0.00 in
7/27/2020	5:19 AM	58.9 F	50.8 F	74 %	SSW	2.6 mph	3.2 mph	30.06 in	0.00 in	0.00 in
7/27/2020	5:24 AM	58.6 F	50.9 F	75 %	South	2.4 mph	2.9 mph	30.06 in	0.00 in	0.00 in
7/27/2020	5:29 AM	59.0 F	50.9 F	74 %	SSW	3.3 mph	4.0 mph	30.06 in	0.00 in	0.00 in
7/27/2020	5:34 AM	59.0 F	51.1 F	75 %	SSW	3.2 mph	3.9 mph	30.06 in	0.00 in	0.00 in
7/27/2020	5:39 AM	59.0 F	51.1 F	75 %	SSW	2.7 mph	3.6 mph	30.06 in	0.00 in	0.00 in
7/27/2020	5:44 AM	59.2 F	51.3 F	75 %	SSW	2.6 mph	3.2 mph	30.06 in	0.00 in	0.00 in
7/27/2020	5:49 AM	59.1 F	51.2 F	75 %	South	2.4 mph	2.8 mph	30.06 in	0.00 in	0.00 in
7/27/2020	5:54 AM	58.9 F	51.3 F	76 %	South	1.8 mph	2.0 mph	30.07 in	0.00 in	0.00 in
7/27/2020	5:59 AM	58.6 F	51.0 F	76 %	South	1.7 mph	2.2 mph	30.06 in	0.00 in	0.00 in
7/27/2020	6:04 AM	58.7 F	51.2 F	76 %	South	1.6 mph	2.0 mph	30.06 in	0.00 in	0.00 in
7/27/2020	6:09 AM	58.3 F	51.0 F	77 %	South	1.1 mph	1.5 mph	30.06 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:24	Survey Start:	21:24	Determination :	*Valid*
SITES:	2A, 3A, 4A, T3	Sunrise Time:	6:20	End Time:	2:24	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/27/20	9:24 PM	68.4 F	57.2 F	67 %	NNE	1.3 mph	1.6 mph	29.96 in	0.00 in	0.00 in
7/27/20	9:29 PM	67.7 F	57.3 F	69 %	SE	0.0 mph	0.1 mph	29.96 in	0.00 in	0.00 in
7/27/20	9:34 PM	67.0 F	56.9 F	70 %	SSE	0.0 mph	0.0 mph	29.96 in	0.00 in	0.00 in
7/27/20	9:39 PM	66.8 F	56.4 F	69 %	ESE	0.0 mph	0.1 mph	29.96 in	0.00 in	0.00 in
7/27/20	9:44 PM	66.8 F	56.4 F	69 %	SE	0.1 mph	0.1 mph	29.96 in	0.00 in	0.00 in
7/27/20	9:49 PM	66.6 F	56.1 F	69 %	SE	0.0 mph	0.0 mph	29.96 in	0.00 in	0.00 in
7/27/20	9:54 PM	66.4 F	55.3 F	67 %	ESE	0.2 mph	0.4 mph	29.96 in	0.00 in	0.00 in
7/27/20	9:59 PM	67.6 F	55.1 F	64 %	East	1.0 mph	1.2 mph	29.96 in	0.00 in	0.00 in
7/27/20	10:04 PM	68.2 F	55.0 F	63 %	ESE	0.8 mph	1.0 mph	29.97 in	0.00 in	0.00 in
7/27/20	10:09 PM	67.9 F	55.1 F	64 %	SE	0.0 mph	0.0 mph	29.97 in	0.00 in	0.00 in
7/27/20	10:14 PM	66.9 F	54.9 F	65 %	SE	0.0 mph	0.0 mph	29.97 in	0.00 in	0.00 in
7/27/20	10:19 PM	66.6 F	54.6 F	65 %	SE	0.0 mph	0.0 mph	29.97 in	0.00 in	0.00 in
7/27/20	10:24 PM	65.8 F	54.0 F	66 %	SE	0.0 mph	0.0 mph	29.96 in	0.00 in	0.00 in
7/27/20	10:29 PM	65.6 F	53.3 F	64 %	SE	0.0 mph	0.0 mph	29.96 in	0.00 in	0.00 in
7/27/20	10:34 PM	66.3 F	53.1 F	63 %	ESE	0.0 mph	0.1 mph	29.96 in	0.00 in	0.00 in
7/27/20	10:39 PM	66.8 F	53.3 F	62 %	SE	0.0 mph	0.0 mph	29.97 in	0.00 in	0.00 in
7/27/20	10:44 PM	66.1 F	53.5 F	64 %	SE	0.0 mph	0.0 mph	29.97 in	0.00 in	0.00 in
7/27/20	10:49 PM	65.1 F	52.9 F	65 %	SE	0.0 mph	0.0 mph	29.97 in	0.00 in	0.00 in
7/27/20	10:54 PM	65.7 F	53.3 F	64 %	South	1.1 mph	1.5 mph	29.97 in	0.00 in	0.00 in
7/27/20	10:59 PM	65.8 F	53.2 F	64 %	South	1.6 mph	2.0 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:04 PM	66.1 F	53.1 F	63 %	South	1.1 mph	1.2 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:09 PM	66.2 F	53.2 F	63 %	South	1.0 mph	1.1 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:14 PM	66.1 F	53.1 F	63 %	SSE	0.5 mph	1.1 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:19 PM	65.8 F	52.8 F	63 %	SSE	0.1 mph	0.3 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:24 PM	65.8 F	53.2 F	64 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.00 in
7/27/20	11:29 PM	65.4 F	53.3 F	65 %	SSW	2.3 mph	2.5 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:34 PM	63.9 F	52.8 F	67 %	SSW	3.1 mph	3.5 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:39 PM	64.7 F	52.7 F	65 %	SSW	2.1 mph	2.4 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:44 PM	65.4 F	52.6 F	63 %	South	1.7 mph	1.9 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:49 PM	65.9 F	52.9 F	63 %	SSW	1.5 mph	2.0 mph	29.98 in	0.00 in	0.00 in
7/27/20	11:54 PM	65.9 F	52.7 F	62 %	South	2.0 mph	2.3 mph	29.97 in	0.00 in	0.00 in
7/27/20	11:59 PM	65.9 F	52.6 F	62 %	South	1.7 mph	2.2 mph	29.97 in	0.00 in	0.00 in
7/28/20	12:04 AM	66.0 F	52.8 F	62 %	SSW	2.4 mph	2.9 mph	29.97 in	0.00 in	0.00 in
7/28/20	12:09 AM	65.2 F	52.6 F	64 %	SSW	3.2 mph	3.3 mph	29.97 in	0.00 in	0.00 in
7/28/20	12:14 AM	64.7 F	52.3 F	64 %	SSW	2.7 mph	3.1 mph	29.98 in	0.00 in	0.00 in
7/28/20	12:19 AM	64.9 F	52.1 F	63 %	South	2.2 mph	2.2 mph	29.98 in	0.00 in	0.00 in
7/28/20	12:24 AM	65.3 F	52.3 F	63 %	South	1.6 mph	1.9 mph	29.97 in	0.00 in	0.00 in
7/28/20	12:29 AM	64.9 F	52.4 F	64 %	SSE	1.1 mph	1.1 mph	29.97 in	0.00 in	0.00 in
7/28/20	12:34 AM	64.0 F	52.3 F	66 %	SSE	1.1 mph	1.2 mph	29.98 in	0.00 in	0.00 in
7/28/20	12:39 AM	63.5 F	52.2 F	67 %	SSE	1.8 mph	2.2 mph	29.98 in	0.00 in	0.00 in
7/28/20	12:44 AM	63.2 F	52.1 F	67 %	SSE	1.7 mph	2.2 mph	29.97 in	0.00 in	0.00 in
7/28/20	12:49 AM	62.9 F	52.0 F	68 %	South	2.0 mph	2.2 mph	29.98 in	0.00 in	0.00 in
7/28/20	12:54 AM	63.0 F	51.9 F	67 %	SSE	1.2 mph	1.4 mph	29.97 in	0.00 in	0.00 in
7/28/20	12:59 AM	63.2 F	52.1 F	67 %	SSE	0.9 mph	1.1 mph	29.97 in	0.00 in	0.00 in
7/28/20	1:04 AM	63.4 F	52.0 F	66 %	South	1.3 mph	1.5 mph	29.97 in	0.00 in	0.00 in
7/28/20	1:09 AM	63.5 F	52.1 F	66 %	South	2.5 mph	3.0 mph	29.97 in	0.00 in	0.00 in
7/28/20	1:14 AM	62.9 F	51.8 F	67 %	South	2.6 mph	3.0 mph	29.97 in	0.00 in	0.00 in
7/28/20	1:19 AM	63.1 F	51.8 F	66 %	South	2.2 mph	2.2 mph	29.97 in	0.00 in	0.00 in
7/28/20	1:24 AM	63.4 F	51.9 F	66 %	South	2.4 mph	3.1 mph	29.98 in	0.00 in	0.00 in
7/28/20	1:29 AM	63.2 F	52.0 F	67 %	South	2.8 mph	3.2 mph	29.98 in	0.00 in	0.00 in
7/28/20	1:34 AM	61.9 F	51.8 F	70 %	South	3.5 mph	3.8 mph	29.98 in	0.00 in	0.00 in
7/28/20	1:39 AM	61.4 F	51.3 F	70 %	South	3.5 mph	3.9 mph	29.98 in	0.00 in	0.00 in
7/28/20	1:44 AM	62.0 F	51.4 F	68 %	South	3.5 mph	3.6 mph	29.98 in	0.00 in	0.00 in
7/28/20	1:49 AM	62.6 F	51.4 F	67 %	South	3.5 mph	3.7 mph	29.97 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:24	Survey Start:	21:24	Determination :	*Valid*
SITES:	2A, 3A, 4A, T3	Sunrise Time:	6:20	End Time:	2:24	Reason:	No adverse weather

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/28/20	1:54 AM	62.9 F	51.3 F	66 %	South	3.4 mph	3.7 mph	29.97 in	0.00 in	0.00 in
7/28/20	1:59 AM	63.0 F	51.3 F	66 %	South	3.4 mph	3.5 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:04 AM	63.1 F	51.5 F	66 %	South	2.9 mph	3.2 mph	29.98 in	0.00 in	0.00 in
7/28/20	2:09 AM	62.3 F	51.3 F	67 %	South	3.2 mph	3.4 mph	29.98 in	0.00 in	0.00 in
7/28/20	2:14 AM	62.8 F	51.3 F	66 %	South	2.6 mph	3.1 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:19 AM	63.0 F	51.7 F	67 %	South	2.2 mph	2.3 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:24 AM	62.0 F	51.6 F	69 %	South	3.1 mph	3.3 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:29 AM	61.7 F	51.2 F	69 %	South	3.5 mph	3.7 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:34 AM	62.3 F	51.1 F	67 %	South	3.1 mph	3.4 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:39 AM	63.1 F	51.3 F	65 %	South	3.2 mph	3.4 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:44 AM	63.6 F	51.6 F	65 %	South	3.0 mph	3.4 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:49 AM	63.4 F	51.6 F	65 %	South	2.4 mph	2.9 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:54 AM	62.7 F	51.5 F	67 %	South	2.6 mph	2.7 mph	29.97 in	0.00 in	0.00 in
7/28/20	2:59 AM	62.2 F	51.1 F	67 %	South	3.4 mph	3.4 mph	29.97 in	0.00 in	0.00 in
7/28/20	3:04 AM	62.6 F	51.3 F	66 %	South	3.5 mph	3.8 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:09 AM	62.8 F	51.3 F	66 %	South	3.6 mph	4.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:14 AM	62.7 F	51.1 F	66 %	South	2.9 mph	3.4 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:19 AM	63.2 F	51.4 F	65 %	South	2.9 mph	3.4 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:24 AM	63.1 F	51.5 F	66 %	South	2.8 mph	3.4 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:29 AM	62.5 F	51.3 F	67 %	South	2.4 mph	2.6 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:34 AM	62.8 F	51.0 F	65 %	SSW	2.7 mph	3.2 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:39 AM	63.4 F	51.4 F	65 %	SSW	3.3 mph	3.5 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:44 AM	63.1 F	51.3 F	65 %	SSW	3.7 mph	4.3 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:49 AM	63.1 F	51.3 F	65 %	SSW	3.4 mph	3.5 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:54 AM	62.9 F	51.4 F	66 %	SSW	3.5 mph	3.8 mph	29.96 in	0.00 in	0.00 in
7/28/20	3:59 AM	62.6 F	51.2 F	66 %	SSW	2.8 mph	3.4 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:04 AM	62.6 F	51.6 F	67 %	SSW	3.4 mph	3.5 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:09 AM	61.7 F	51.0 F	68 %	SSW	3.8 mph	4.4 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:14 AM	62.9 F	51.1 F	65 %	SSW	3.4 mph	3.5 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:19 AM	63.6 F	51.2 F	64 %	SSW	3.4 mph	3.4 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:24 AM	63.8 F	51.6 F	65 %	SSW	2.1 mph	2.3 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:29 AM	60.7 F	51.5 F	72 %	NW	1.5 mph	1.7 mph	29.97 in	0.00 in	0.00 in
7/28/20	4:34 AM	58.0 F	50.5 F	76 %	SW	1.3 mph	1.5 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:39 AM	57.7 F	50.3 F	77 %	SSW	1.0 mph	1.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:44 AM	57.0 F	50.4 F	79 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:49 AM	56.7 F	50.2 F	79 %	South	0.0 mph	0.0 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:54 AM	57.0 F	50.3 F	78 %	South	0.3 mph	0.6 mph	29.96 in	0.00 in	0.00 in
7/28/20	4:59 AM	58.0 F	49.9 F	75 %	South	1.8 mph	2.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:04 AM	59.9 F	50.9 F	72 %	South	2.2 mph	2.3 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:09 AM	58.8 F	50.9 F	75 %	South	0.7 mph	1.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:14 AM	58.5 F	50.3 F	74 %	SSW	0.8 mph	1.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:19 AM	58.5 F	50.7 F	75 %	West	1.8 mph	2.2 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:24 AM	57.3 F	50.3 F	78 %	WSW	1.3 mph	1.5 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:29 AM	56.8 F	50.3 F	79 %	SSW	1.0 mph	1.1 mph	29.97 in	0.00 in	0.00 in
7/28/20	5:34 AM	56.9 F	50.3 F	78 %	SSW	0.8 mph	1.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:39 AM	57.3 F	50.5 F	78 %	SSW	0.9 mph	1.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:44 AM	56.7 F	50.4 F	80 %	SSW	0.9 mph	1.1 mph	29.97 in	0.00 in	0.00 in
7/28/20	5:49 AM	56.4 F	50.2 F	80 %	South	0.5 mph	1.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:54 AM	56.9 F	50.4 F	78 %	SSW	1.0 mph	1.1 mph	29.96 in	0.00 in	0.00 in
7/28/20	5:59 AM	56.8 F	50.4 F	79 %	SSW	0.6 mph	0.9 mph	29.96 in	0.00 in	0.00 in
7/28/20	6:04 AM	56.6 F	50.4 F	80 %	SSW	0.0 mph	0.0 mph	29.96 in	0.00 in	0.00 in
7/28/20	6:09 AM	56.3 F	50.2 F	80 %	SSW	0.1 mph	0.5 mph	29.97 in	0.00 in	0.00 in
7/28/20	6:14 AM	56.5 F	50.1 F	79 %	SSW	1.1 mph	1.5 mph	29.97 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:23	Survey Start:	21:23	Determination:	*Valid*			
SITES:	T3	Sunrise Time:	6:21	End Time:	2:23	Reason:	No adverse weather			

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/28/20	9:19 PM	70.4 F	57.7 F	64 %	SSE	4.5 mph	5.0 mph	29.91 in	0.00 in	0.00 in
7/28/20	9:24 PM	69.6 F	58.0 F	67 %	SSE	4.9 mph	5.8 mph	29.91 in	0.00 in	0.00 in
7/28/20	9:29 PM	69.2 F	57.5 F	66 %	SE	5.2 mph	5.9 mph	29.91 in	0.00 in	0.00 in
7/28/20	9:34 PM	69.3 F	57.9 F	67 %	SE	5.5 mph	6.5 mph	29.91 in	0.00 in	0.00 in
7/28/20	9:39 PM	69.0 F	58.0 F	68 %	SE	5.3 mph	6.2 mph	29.91 in	0.00 in	0.00 in
7/28/20	9:44 PM	68.6 F	57.9 F	69 %	SE	5.4 mph	6.1 mph	29.91 in	0.00 in	0.00 in
7/28/20	9:49 PM	68.5 F	58.1 F	70 %	SE	5.1 mph	6.1 mph	29.91 in	0.00 in	0.00 in
7/28/20	9:54 PM	68.3 F	57.8 F	69 %	SE	6.1 mph	7.2 mph	29.92 in	0.00 in	0.00 in
7/28/20	9:59 PM	68.7 F	57.8 F	68 %	SE	6.6 mph	7.5 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:04 PM	69.5 F	57.8 F	66 %	SE	6.7 mph	7.8 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:09 PM	69.5 F	57.8 F	66 %	SE	6.2 mph	7.3 mph	29.91 in	0.00 in	0.00 in
7/28/20	10:14 PM	69.2 F	57.9 F	67 %	SE	5.6 mph	6.6 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:19 PM	68.7 F	57.8 F	68 %	SE	5.0 mph	5.7 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:24 PM	67.9 F	58.1 F	71 %	SSE	4.5 mph	5.1 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:29 PM	66.5 F	57.6 F	73 %	SSE	4.8 mph	5.4 mph	29.91 in	0.00 in	0.00 in
7/28/20	10:34 PM	65.8 F	57.6 F	75 %	SSE	4.8 mph	5.4 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:39 PM	65.3 F	57.4 F	76 %	SSE	4.8 mph	5.5 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:44 PM	64.8 F	57.1 F	76 %	SSE	4.5 mph	5.1 mph	29.91 in	0.00 in	0.00 in
7/28/20	10:49 PM	64.8 F	56.9 F	76 %	SE	4.6 mph	5.0 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:54 PM	65.8 F	56.7 F	73 %	SE	5.2 mph	6.1 mph	29.92 in	0.00 in	0.00 in
7/28/20	10:59 PM	66.3 F	56.9 F	72 %	SE	4.8 mph	5.5 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:04 PM	65.9 F	57.1 F	73 %	SSE	4.7 mph	5.2 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:09 PM	65.6 F	56.9 F	73 %	SSE	4.8 mph	5.6 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:14 PM	64.8 F	56.9 F	76 %	South	4.7 mph	5.4 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:19 PM	63.8 F	56.5 F	77 %	South	5.2 mph	5.8 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:24 PM	63.4 F	56.1 F	77 %	SSE	5.0 mph	5.7 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:29 PM	63.4 F	56.0 F	77 %	South	4.8 mph	5.3 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:34 PM	63.3 F	56.5 F	78 %	South	5.5 mph	6.1 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:39 PM	63.0 F	56.6 F	80 %	SSE	5.4 mph	5.9 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:44 PM	62.5 F	56.3 F	80 %	South	5.4 mph	6.0 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:49 PM	62.4 F	56.5 F	81 %	South	4.9 mph	5.7 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:54 PM	62.2 F	56.7 F	82 %	South	5.3 mph	5.9 mph	29.92 in	0.00 in	0.00 in
7/28/20	11:59 PM	61.8 F	56.7 F	84 %	SSE	5.0 mph	5.6 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:04 AM	62.0 F	56.8 F	83 %	SSE	5.0 mph	5.8 mph	29.93 in	0.00 in	0.00 in
7/29/20	12:09 AM	62.2 F	56.9 F	83 %	SSE	5.1 mph	5.9 mph	29.93 in	0.00 in	0.00 in
7/29/20	12:14 AM	62.4 F	56.7 F	82 %	SSE	5.2 mph	5.9 mph	29.93 in	0.00 in	0.00 in
7/29/20	12:19 AM	62.9 F	56.2 F	79 %	SSE	4.6 mph	5.2 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:24 AM	63.6 F	56.4 F	78 %	SSE	4.7 mph	5.6 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:29 AM	63.7 F	56.3 F	77 %	SSE	4.9 mph	5.6 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:34 AM	63.0 F	56.4 F	79 %	South	5.1 mph	5.6 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:39 AM	62.7 F	56.1 F	79 %	SSE	4.3 mph	4.8 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:44 AM	63.0 F	56.2 F	78 %	SE	4.3 mph	4.6 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:49 AM	63.2 F	56.4 F	78 %	SSE	4.4 mph	5.1 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:54 AM	63.2 F	56.4 F	78 %	SSE	4.8 mph	5.4 mph	29.92 in	0.00 in	0.00 in
7/29/20	12:59 AM	62.8 F	56.5 F	80 %	SSE	5.0 mph	5.8 mph	29.92 in	0.00 in	0.00 in
7/29/20	1:04 AM	62.4 F	56.2 F	80 %	SSE	5.5 mph	6.1 mph	29.92 in	0.00 in	0.00 in
7/29/20	1:09 AM	61.9 F	56.2 F	82 %	SSE	5.1 mph	5.8 mph	29.92 in	0.00 in	0.00 in
7/29/20	1:14 AM	61.6 F	56.0 F	82 %	SSE	5.3 mph	5.9 mph	29.92 in	0.00 in	0.00 in
7/29/20	1:19 AM	61.4 F	55.9 F	82 %	SSE	5.5 mph	6.1 mph	29.92 in	0.00 in	0.00 in
7/29/20	1:24 AM	61.4 F	55.8 F	82 %	SSE	5.3 mph	6.0 mph	29.92 in	0.00 in	0.00 in
7/29/20	1:29 AM	62.1 F	55.6 F	79 %	SSE	5.8 mph	6.7 mph	29.93 in	0.00 in	0.00 in
7/29/20	1:34 AM	63.1 F	55.7 F	77 %	SE	6.1 mph	7.1 mph	29.93 in	0.00 in	0.00 in
7/29/20	1:39 AM	63.3 F	56.1 F	77 %	SE	5.7 mph	6.8 mph	29.93 in	0.00 in	0.00 in
7/29/20	1:44 AM	62.7 F	55.8 F	78 %	SSE	5.5 mph	6.5 mph	29.93 in	0.00 in	0.00 in
7/29/20	1:49 AM	62.9 F	55.9 F	78 %	SSE	5.8 mph	6.8 mph	29.93 in	0.00 in	0.00 in

STATION:	KNDHAZEN5	Sunset Time:	21:23	Survey Start:	21:23	Determination:	*Valid*			
SITES:	T3	Sunrise Time:	6:21	End Time:	2:23	Reason:	No adverse weather			

Date	Time	Temperature	Dew Point	Humidity	Wind	Speed	Gust	Pressure	Precip. Rate.	Precip. Accum.
7/29/20	1:54 AM	61.4 F	55.6 F	82 %	SSE	4.9 mph	5.6 mph	29.93 in	0.00 in	0.00 in
7/29/20	1:59 AM	61.2 F	55.0 F	80 %	SSE	5.2 mph	6.0 mph	29.92 in	0.00 in	0.00 in
7/29/20	2:04 AM	62.3 F	55.5 F	78 %	SE	6.5 mph	7.7 mph	29.92 in	0.00 in	0.00 in
7/29/20	2:09 AM	63.0 F	55.6 F	77 %	SE	6.4 mph	7.8 mph	29.92 in	0.00 in	0.00 in
7/29/20	2:14 AM	63.3 F	55.5 F	76 %	SE	7.6 mph	8.8 mph	29.93 in	0.00 in	0.00 in
7/29/20	2:19 AM	63.4 F	55.7 F	76 %	SE	7.2 mph	8.3 mph	29.93 in	0.00 in	0.00 in
7/29/20	2:24 AM	63.1 F	55.5 F	76 %	SE	7.2 mph	8.6 mph	29.92 in	0.00 in	0.00 in
7/29/20	2:29 AM	62.9 F	55.6 F	77 %	SE	6.7 mph	7.9 mph	29.92 in	0.00 in	0.00 in
7/29/20	2:34 AM	62.3 F	55.5 F	78 %	SE	6.8 mph	7.9 mph	29.92 in	0.00 in	0.00 in
7/29/20	2:39 AM	62.1 F	55.7 F	79 %	SSE	5.8 mph	7.0 mph	29.91 in	0.00 in	0.00 in
7/29/20	2:44 AM	61.8 F	55.3 F	79 %	SE	6.4 mph	7.7 mph	29.91 in	0.00 in	0.00 in
7/29/20	2:49 AM	62.0 F	55.5 F	79 %	SE	6.1 mph	7.4 mph	29.91 in	0.00 in	0.00 in
7/29/20	2:54 AM	62.1 F	55.8 F	80 %	SE	6.6 mph	7.7 mph	29.91 in	0.00 in	0.00 in
7/29/20	2:59 AM	62.0 F	55.6 F	80 %	SE	5.8 mph	6.8 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:04 AM	62.4 F	56.0 F	79 %	SE	6.6 mph	7.9 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:09 AM	62.6 F	56.1 F	79 %	SE	7.0 mph	8.1 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:14 AM	62.9 F	56.2 F	79 %	SE	6.5 mph	7.5 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:19 AM	62.1 F	55.7 F	80 %	SE	6.7 mph	7.9 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:24 AM	62.6 F	55.4 F	77 %	SE	7.7 mph	9.5 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:29 AM	63.0 F	55.6 F	77 %	SE	6.6 mph	7.8 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:34 AM	63.1 F	55.7 F	77 %	SE	6.6 mph	7.8 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:39 AM	63.1 F	55.9 F	77 %	SE	6.2 mph	7.6 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:44 AM	63.4 F	55.9 F	77 %	SE	8.5 mph	10.1 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:49 AM	64.3 F	56.4 F	76 %	SE	9.4 mph	10.8 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:54 AM	63.4 F	56.5 F	78 %	SE	8.6 mph	9.8 mph	29.91 in	0.00 in	0.00 in
7/29/20	3:59 AM	62.7 F	56.1 F	79 %	SE	8.6 mph	9.9 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:04 AM	62.7 F	56.1 F	79 %	SE	8.7 mph	10.3 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:09 AM	62.6 F	56.1 F	79 %	SE	8.4 mph	9.8 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:14 AM	62.4 F	56.1 F	80 %	SE	8.8 mph	10.0 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:19 AM	62.1 F	56.0 F	81 %	SE	8.8 mph	10.2 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:24 AM	62.2 F	55.9 F	80 %	SE	9.5 mph	11.3 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:29 AM	62.4 F	55.9 F	79 %	SE	9.6 mph	11.6 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:34 AM	62.6 F	56.0 F	79 %	SE	8.4 mph	9.9 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:39 AM	62.6 F	56.1 F	79 %	SE	9.2 mph	10.6 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:44 AM	62.7 F	56.0 F	79 %	SE	9.8 mph	11.9 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:49 AM	63.0 F	56.1 F	78 %	SE	8.8 mph	10.7 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:54 AM	62.9 F	56.1 F	78 %	SE	8.5 mph	9.9 mph	29.91 in	0.00 in	0.00 in
7/29/20	4:59 AM	62.7 F	56.1 F	79 %	SE	8.4 mph	9.6 mph	29.91 in	0.00 in	0.00 in
7/29/20	5:04 AM	62.0 F	55.9 F	81 %	SE	8.4 mph	9.8 mph	29.91 in	0.00 in	0.00 in
7/29/20	5:09 AM	61.8 F	56.0 F	81 %	SE	8.2 mph	9.6 mph	29.92 in	0.00 in	0.00 in
7/29/20	5:14 AM	60.9 F	55.7 F	83 %	SSE	8.2 mph	9.6 mph	29.91 in	0.00 in	0.00 in
7/29/20	5:19 AM	59.8 F	55.2 F	85 %	SSE	8.1 mph	9.1 mph	29.92 in	0.00 in	0.00 in
7/29/20	5:24 AM	59.2 F	54.8 F	85 %	SSE	8.0 mph	9.1 mph	29.92 in	0.00 in	0.00 in
7/29/20	5:29 AM	58.6 F	54.6 F	86 %	SSE	8.3 mph	9.7 mph	29.92 in	0.00 in	0.00 in
7/29/20	5:34 AM	58.2 F	54.4 F	87 %	SSE	8.0 mph	9.3 mph	29.92 in	0.00 in	0.00 in
7/29/20	5:39 AM	57.9 F	54.2 F	87 %	SSE	7.3 mph	8.6 mph	29.92 in	0.00 in	0.00 in
7/29/20	5:44 AM	57.9 F	54.2 F	88 %	South	7.1 mph	8.4 mph	29.93 in	0.00 in	0.00 in
7/29/20	5:49 AM	58.7 F	54.4 F	86 %	SSE	7.8 mph	9.0 mph	29.93 in	0.00 in	0.00 in
7/29/20	5:54 AM	59.2 F	54.7 F	85 %	SSE	7.3 mph	8.4 mph	29.93 in	0.00 in	0.00 in
7/29/20	5:59 AM	59.5 F	55.0 F	85 %	SSE	6.9 mph	8.1 mph	29.93 in	0.00 in	0.00 in
7/29/20	6:04 AM	59.5 F	55.0 F	85 %	South	7.4 mph	8.5 mph	29.94 in	0.00 in	0.00 in
7/29/20	6:09 AM	59.5 F	55.0 F	85 %	South	7.6 mph	9.0 mph	29.94 in	0.00 in	0.00 in
7/29/20	6:14 AM	59.4 F	54.9 F	85 %	South	7.2 mph	8.4 mph	29.94 in	0.00 in	0.00 in
7/29/20	6:19 AM	59.0 F	54.8 F	86 %	South	6.7 mph	7.7 mph	29.93 in	0.00 in	0.00 in

Appendix F. Kaleidoscope Output for the Northern Long-Eared Bat Presence/Absence Acoustic Surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020

Appendix F1. Kaleidoscope[1] analysis output number of files for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

	Number of Files										
Detector Location ID	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYCI**	**MYEV**	**MYLU**	**NLEB**	**MYVO**	**NOID**
1A	20200723	5	5			2				3	8
1B	20200724	8	7	2	1	5		6			15
1A	20200725	4	3		2			1			0
1B	20200726		4					3		1	0
1A	**1A**	**17**	**19**	**2**	**3**	**7**		**10**		**4**	**23**
1B	20200723	8	8	36	4			3			21
1B	20200724	7	5	8	4	1		1			10
1B	20200725	4	7	7	5	1					11
1B	20200726	1	3	4	2		1	2			3
1B	**1B**	**20**	**23**	**55**	**15**	**2**	**1**	**6**			**45**
2A	20200723	8	65	165	13	6		5		2	98
2A	20200724	23	29	450	6	6		20		1	129
2A	20200725	9	3	102	6	1		3		1	21
2A	20200726		53	184	4	3		12			33
2A	**2A**	**40**	**150**	**901**	**30**	**16**		**40**		**4**	**281**
2B	20200723		3		2			6		1	15
2B	20200724	9	4	1	3					1	9
2B	20200725	7			4	1		7	1	3	17
2B	20200726	2	5	3		1		5			9
2B	20200727	1		4	5	2		4		1	9
2B	**2B**	**19**	**12**	**8**	**14**	**4**		**22**	**1**	**6**	**59**
3A	20200723	9	17		5	4		6		1	27
3A	20200724	1	14	2	4	6		24		16	51
3A	20200725	5	3	4				8			12
3A	20200726	5	11	2		1		6		1	15
3A	20200727	2	10	3	2			12		1	6

Appendix F1. Kaleidoscope[1] analysis output number of files for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

	Number of Files										
Detector Location ID	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYCI**	**MYEV**	**MYLU**	**NLEB**	**MYVO**	**NOID**
3A	**3A**	**22**	**55**	**11**	**11**	**11**		**56**		**19**	**111**
4A	20200723	11	8	12	2	3		8			44
4A	20200724	6	9	20	6	8		41	1	3	59
4A	20200725	5	10	26	21	11		4			44
4A	20200726	3	11	22	7	2				1	40
4A	20200727	2	7	20	1	2		1			25
4A	**4A**	**27**	**45**	**100**	**37**	**26**		**54**	**1**	**4**	**212**
4B	20200723		2					1			2
4B	20200724	4			1			2			4
4B	20200725	2	1		1	1		2			5
4B	20200726	1						1			2
4B	**4B**	**7**	**3**		**2**	**1**		**6**			**13**
5A	20200722	20	5	8				11		1	19
5A	20200723	3	36	54	3	2		32			38
5A	20200724	62	56	38	3	14		76		5	81
5A	20200725	28	52	23	25	8		42		1	70
5A	**5A**	**113**	**149**	**123**	**31**	**24**		**161**		**7**	**208**
5B	20200722	2	8		1	6	1	168		1	45
5B	20200723	4	15		5	2		9			18
5B	20200724	14	8	3	6	3		19			28
5B	20200725	11	2	7	7			4			6
5B	**5B**	**31**	**33**	**10**	**19**	**11**	**1**	**200**		**1**	**97**
6A	20200722	3	44	2	1	20	2	12		1	42
6A	20200723	7	102		5	6		8			41
6A	20200724	1	272	12	12	2		3			40
6A	20200725	1	14	15	2	1		3			14
6A	**6A**	**12**	**432**	**29**	**20**	**29**	**2**	**26**		**1**	**137**

Appendix F1. Kaleidoscope[1] analysis output number of files for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

	Number of Files										
Detector Location ID	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYCI**	**MYEV**	**MYLU**	**NLEB**	**MYVO**	**NOID**
6B	20200722		8	1				1			4
6B	20200723	3	4	2	2	1				1	10
6B	20200724	2	1	10	1			3			6
6B	20200725	5	1	11	1	1		1			24
6B	**6B**	**10**	**14**	**24**	**4**	**2**		**5**		**1**	**44**
7A	20200722		5	8				1		2	12
7A	20200723	2	3	25	2	4		3		12	21
7A	20200724	18	11	60	6	1		2		1	33
7A	20200725	3	5	11	6			6		1	16
7A	**7A**	**23**	**24**	**104**	**14**	**5**		**12**		**16**	**82**
7B	20200722	16	2	85	16	5	37	188	20	2	354
7B	20200723	26	2	104	27	3	5	115	4	6	283
7B	20200724	23	5	90	6	16		55		1	68
7B	20200725	17	5	17	10	6	2	40		1	35
7B	**7B**	**82**	**14**	**296**	**59**	**30**	**44**	**398**	**24**	**10**	**740**
alt2	20200723	14	10	4	11	2		17			36
alt2	20200724	56	30	4	3	1	1	19		1	36
alt2	20200725	18	15	16	4	1		4			23
alt2	20200726	14	14	8	2					3	18
alt2	**alt2**	**102**	**69**	**32**	**20**	**4**	**1**	**40**		**4**	**113**
T1	20200724	21	8	8	34	2		5		2	24
T1	20200725	23	9	5	38			2			23
T1	20200726	16	9	9	22	1		7			19
T1	**T1**	**60**	**26**	**22**	**94**	**3**		**14**		**2**	**66**

Appendix F1. Kaleidoscope[1] analysis output number of files for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

	Number of Files										
Detector Location ID	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYCI**	**MYEV**	**MYLU**	**NLEB**	**MYVO**	**NOID**
T2	20200724	137	15	19	193	1	1	52			104
T2	20200725	12	3	18	165			2			16
T2	20200726	71	13	23	241	3	1	23			71
T2	**T2**	**220**	**31**	**60**	**599**	**4**	**2**	**77**			**191**
T3	20200727	10	8	16	43	1	1	3			24
T3	20200728	68	3	3	136	4	1	7			45
T3	**T3**	**78**	**11**	**19**	**179**	**5**	**2**	**10**			**69**
T4	20200724	26	5	4	27		1	3			17
T4	20200725	17	6	3	56		1				19
T4	20200726	18	5	6	44	1	1	2			12
T4	**T4**	**61**	**16**	**13**	**127**	**1**	**3**	**5**			**48**
T5	20200724	41	7		27	2		1			24
T5	20200725	22	2	5	61			7	1		13
T5	20200726	14	2	6	30			9			7
T5	**T5**	**77**	**11**	**11**	**118**	**2**		**17**	**1**		**44**

[1.] Kaleidoscope Pro® Version 5.1.0

EPFU = big brown bat (*Eptesicus fuscus*); LABO = eastern red bat (*Lasiurus borealis*); LACI = hoary bat (*Lasiurus cinereus*); LANO = silver-haired bat (*Lasionycteris noctivagans*); MYCI = western small-footed bat (*Myotis ciliolabrum*); MYEV = western long-eared bat (*Myotis evotis*); MYLU = little brown bat (*Myotis lucifugus*); NLEB = northern long-eared bat (*Myotis septentrionalis*); MYVO = long-legged bat (*Myotis volans*); NOID = unknown or no identification.

Appendix F2. Kaleidoscope[1] analysis output p-values for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

	P-Values									
Detector Location ID	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYCI**	**MYEV**	**MYLU**	**NLEB**	**MYVO**
1A	20200723	0	0	1	1	0.23	1	1	1	0
1A	20200724	0	0	0.18	1	0	1	0.01	1	1
1A	20200725	0.01	0	1	0.35	1	1	0.78	1	1
1A	20200726	1	0	1	1	1	1	0.16	1	0.29
1A	**1A**	**0**	**0**	**0.51**	**0.93**	**0**	**1**	**0.02**	**1**	**0**
1B	20200723	0.05	0	0	1	1	1	0.39	1	1
1B	20200724	0	0	0	0.74	0.29	1	0.95	1	1
1B	20200725	0.11	0	0	0.27	0.32	1	1	1	1
1B	20200726	0.8	0	0	0.72	1	0.07	0.28	1	1
1B	**1B**	**0**	**0**	**0**	**0.98**	**0.34**	**0.08**	**0.41**	**1**	**1**
2A	20200723	1	0	0	1	0.02	1	1	1	0.04
2A	20200724	1	0	0	1	0.01	1	0	1	1
2A	20200725	0.89	0	0	1	0.54	1	0.11	1	0.29
2A	20200726	1	0	0	1	0.42	1	0.31	1	1
2A	**2A**	**1**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**0.12**
2B	20200723	1	0.01	1	0.04	1	1	0	1	0.51
2B	20200724	0	0	0.81	0.47	1	1	1	1	0.11
2B	20200725	0	1	1	0.09	0.85	1	0	0.45	0.03
2B	20200726	0.11	0	0	1	0.51	1	0.01	1	1
2B	20200727	0.98	1	0	0.05	0.1	1	0	1	0.37
2B	**2B**	**0**	**0**	**0**	**0**	**0.25**	**1**	**0**	**0.78**	**0**

Appendix F2. Kaleidoscope[1] analysis output p-values for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

	P-Values									
Detector Location ID	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYCI**	**MYEV**	**MYLU**	**NLEB**	**MYVO**
3A	20200723	0	0	1	0.05	0.02	1	0.2	1	0.45
3A	20200724	0.91	0	0.12	0.04	0.22	1	0	1	0
3A	20200725	0	0.02	0	1	1	1	0	1	1
3A	20200726	0	0	0.1	1	0.79	1	0.05	1	0.45
3A	20200727	0.26	0	0.01	0.65	1	1	0	1	0.77
3A	**3A**	**0**	**0**	**0**	**0.10**	**0.04**	**1**	**0**	**1**	**0**
4A	20200723	0	0	0	1	0.03	1	0	1	1
4A	20200724	0.07	0	0	0.92	0	1	0	0.83	0.56
4A	20200725	0.88	0	0	0	0	1	0.32	1	1
4A	20200726	0.82	0	0	0.76	0.15	1	1	1	0.13
4A	20200727	0.93	0	0	1	0.04	1	1	1	1
4A	**4A**	**0**	**0**	**0**	**0.08**	**0**	**1**	**0**	**0.92**	**0.43**
4B	20200723	1	0.01	1	1	1	1	0.63	1	1
4B	20200724	0	1	1	0.85	1	1	0.02	1	1
4B	20200725	0.07	0.2	1	0.59	0.22	1	0.09	1	1
4B	20200726	0.12	1	1	1	1	1	0.12	1	1
4B	**4B**	**0**	**0.01**	**1**	**0.64**	**0.51**	**1**	**0**	**1**	**1**
5A	20200722	0	0	0	1	1	1	0	1	0.75
5A	20200723	1	0	0	1	0.94	1	0	1	1
5A	20200724	0	0	0	1	0	1	0	1	0.44
5A	20200725	0	0	0	0	0.01	1	0	1	1
5A	**5A**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**0.82**
5B	20200722	0.1	0.67	1	0.59	0.94	0.64	0	1	1
5B	20200723	0.04	0	1	0.01	0.31	1	0.01	1	1
5B	20200724	0	0	0.2	0.17	0.14	1	0	1	1
5B	20200725	0	0.04	0	0.16	1	1	0.01	1	1
5B	**5B**	**0**	**0**	**0**	**0**	**0.31**	**0.78**	**0**	**1**	**1**

Appendix F2. Kaleidoscope[1] analysis output p-values for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

	P-Values									
Detector Location ID	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYCI**	**MYEV**	**MYLU**	**NLEB**	**MYVO**
6A	20200722	0.02	0	0.06	0.97	0	0.01	0.16	1	0.74
6A	20200723	0	0	1	0.03	0.08	1	1	1	1
6A	20200724	1	0	0	0	1	1	1	1	1
6A	20200725	1	0	0	1	0.64	1	0.79	1	1
6A	**6A**	**0.01**	**0**	**0**	**0**	**0**	**0.01**	**1**	**1**	**1**
6B	20200722	1	0	0.06	1	1	1	1	1	1
6B	20200723	0.05	0	0.09	0.58	0.44	1	1	1	0.1
6B	20200724	0.53	0.28	0	1	1	1	0.01	1	1
6B	20200725	0.02	0.12	0	1	0.16	1	0.45	1	1
6B	**6B**	**0**	**0**	**0**	**1**	**0.28**	**1**	**0.25**	**1**	**0.38**
7A	20200722	1	0	0	1	1	1	0.99	1	0.01
7A	20200723	1	0	0	1	0.24	1	0.82	1	0
7A	20200724	0	0	0	1	0.68	1	0.95	1	0.17
7A	20200725	0.49	0	0	0.31	1	1	0	1	0.5
7A	**7A**	**0**	**0**	**0**	**1**	**0.37**	**1**	**0.06**	**1**	**0**
7B	20200722	0.02	1	0	1	1	0	0	0	1
7B	20200723	0	1	0	0.95	1	0	0	0.15	0.72
7B	20200724	0	0.18	0	1	0	1	0	1	1
7B	20200725	0	0.07	0	0.32	0.01	0.01	0	1	1
7B	**7B**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
alt2	20200723	0	0	0.12	0	0.44	1	0	1	1
alt2	20200724	0	0	0.67	1	1	0.13	0	1	0.9
alt2	20200725	0	0	0	1	0.7	1	0.53	1	1
alt2	20200726	0	0	0	1	1	1	1	1	0
alt2	**alt2**	**0**	**0**	**0**	**0.94**	**0.75**	**0.26**	**0**	**1**	**0.15**

Appendix F2. Kaleidoscope[1] analysis output p-values for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

	P-Values									
Detector Location ID	**Night**	**EPFU**	**LABO**	**LACI**	**LANO**	**MYCI**	**MYEV**	**MYLU**	**NLEB**	**MYVO**
T1	20200724	0	0	0.03	0	0.3	1	0.09	1	0.06
T1	20200725	0	0	0.54	0	1	1	0.84	1	1
T1	20200726	0	0	0	0	0.69	1	0.01	1	1
T1	**T1**	**0**	**0**	**0**	**0**	**0.31**	**1**	**0**	**1**	**0.26**
T2	20200724	0	0	0.63	0	1	0.33	0	1	1
T2	20200725	1	0	0.06	0	1	1	0.28	1	1
T2	20200726	0	0	0.22	0	0.23	0.14	0	1	1
T2	**T2**	**0**	**0**	**0.02**	**0**	**0.84**	**0.05**	**0**	**1**	**1**
T3	20200727	0.4	0	0	0	0.5	0.07	0.39	1	1
T3	20200728	0	0.01	1	0	0	0.07	0	1	1
T3	**T3**	**0**	**0**	**0.24**	**0**	**0**	**0.01**	**0**	**1**	**1**
T4	20200724	0	0	0.64	0	1	0.08	0.18	1	1
T4	20200725	0.01	0	1	0	1	0.07	1	1	1
T4	20200726	0	0	0.34	0	0.35	0.07	0.51	1	1
T4	**T4**	**0**	**0**	**0.48**	**0**	**0.75**	**0**	**0.32**	**1**	**1**
T5	20200724	0	0	1	0	0.04	1	1	1	1
T5	20200725	0	0.1	0.91	0	1	1	0	0.2	1
T5	20200726	0	0.14	0.11	0	1	1	0	1	1
T5	**T5**	**0**	**0**	**0.83**	**0**	**0.46**	**1**	**0**	**0.42**	**1**

[1] Kaleidoscope Pro® Version 5.1.0

EPFU = big brown bat (*Eptesicus fuscus*); LABO = eastern red bat (*Lasiurus borealis*); LACI = hoary bat (*Lasiurus cinereus*); LANO = silver-haired bat (*Lasionycteris noctivagans*); MYCI = western small-footed bat (*Myotis ciliolabrum*); MYEV = western long-eared bat (*Myotis evotis*); MYLU = little brown bat (*Myotis lucifugus*); NLEB = northern long-eared bat (*Myotis septentrionalis*); MYVO = long-legged bat (*Myotis volans*).

Appendix G. Qualitative Analysis Summary for the Northern Long-Eared Bat Presence/Absence Acoustic Surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020

Appendix G. Summary of qualitative acoustic analysis of calls identified as northern long-eared bats by Kaleidoscope[1] for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

Detector Location ID	Night	File Name	Kaleidoscope ID[2]	Qualitative ID[2]	Justification[3]
2B	7/25/2020	U7260157.29#	NLEB	HF Unknown	low bandwidth and Fmax; not characteristic of NLEB
4A	7/24/2020	U7250319.34#	NLEB	MYLU	slope too low for NLEB
7B	7/22/2020	U7222213.27#	NLEB	HF Unknown	approach-phase calls; calls that resemble NLEB have TBC < 65 ms indicative of approach-phase
7B	7/22/2020	U7222300.55#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7222308.48#	NLEB	HF Unknown	fragmentary call; cannot ID to species; low bandwidth and Fmax; not characteristic of NLEB
7B	7/22/2020	U7222317.01#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7222319.32#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7222342.43#	NLEB	HF Unknown	fragmentary call; cannot ID to species; low bandwidth, Fmax, and slope; not characteristic of NLEB
7B	7/22/2020	U7230011.53#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7230024.09#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7230027.53#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7230035.05#	NLEB	NLEB	none
7B	7/22/2020	U7230035.59#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7230102.24#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7230103.03#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7230124.23#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/22/2020	U7230126.26#	NLEB	HF Unknown	approach-phase calls; calls that resemble NLEB have TBC < 65 ms indicative of approach-phase; low slope
7B	7/22/2020	U7230127.48#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB

Appendix G. Summary of qualitative acoustic analysis of calls identified as northern long-eared bats by Kaleidoscope[1] for the northern long-eared bat presence/absence acoustic surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020.

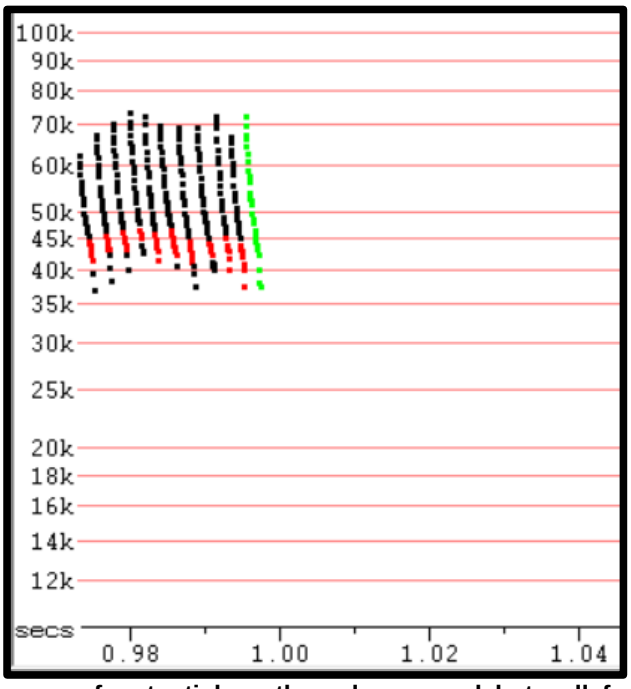
Detector Location ID	Night	File Name	Kaleidoscope ID[2]	Qualitative ID[2]	Justification[3]
7B	7/22/2020	U7230128.15#	NoID	NLEB	none
7B	7/22/2020	U7230130.32#	NLEB	HF Unknown	fragmentary calls; cannot ID to species
7B	7/22/2020	U7230201.59#	MYEV	NLEB	none
7B	7/22/2020	U7230213.51#	NLEB	HF Unknown	approach-phase calls; variable Fmin
7B	7/22/2020	U7230221.19#	NLEB	HF Unknown	approach-phase calls; calls that resemble NLEB have TBC < 65 ms indicative of approach-phase; low slope
7B	7/22/2020	U7230225.31#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/23/2020	U7232304.47#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/23/2020	U7240003.53#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
7B	7/23/2020	U7240116.23#	NLEB	NLEB	none
7B	7/23/2020	U7240116.40#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB
T5	7/25/2020	U7252248.41#	NLEB	HF Unknown	unknown Myotis; slope too low for NLEB

1. Kaleidoscope Pro® Version 5.1.0.

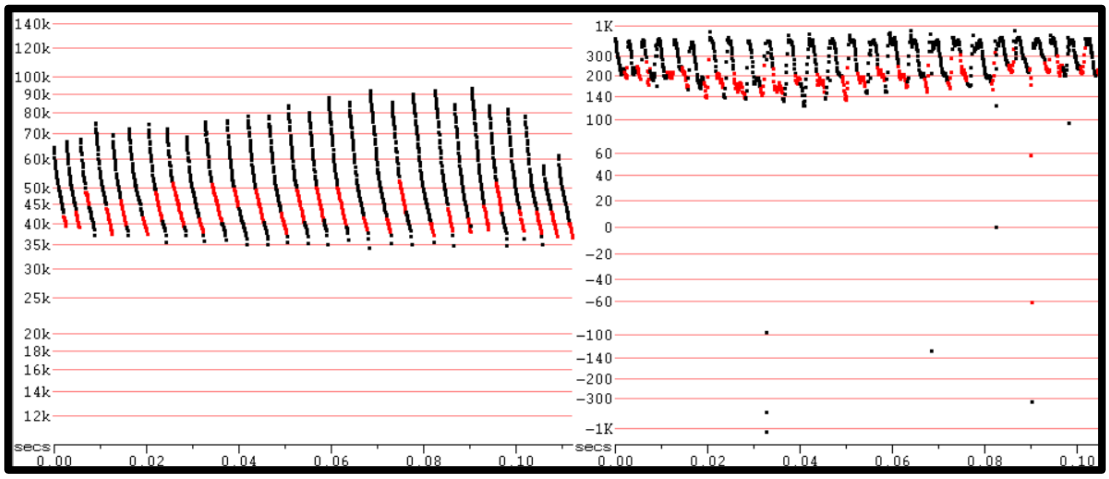
2. MYLU = little brown bat (*Myotis lucifugus*); NLEB = northern long-eared bat (*Myotis septentrionalis*); MYEV = long-eared myotis (*Myotis evotis*); HF Unknown = high frequency unknown; NoID = no identification; HF = high frequency.

3. Fmin = minimum call frequency; Fmax = maximum call frequency; TBC = time between calls; ms = milliseconds; slope = minimum call slope; bandwidth = call frequency range

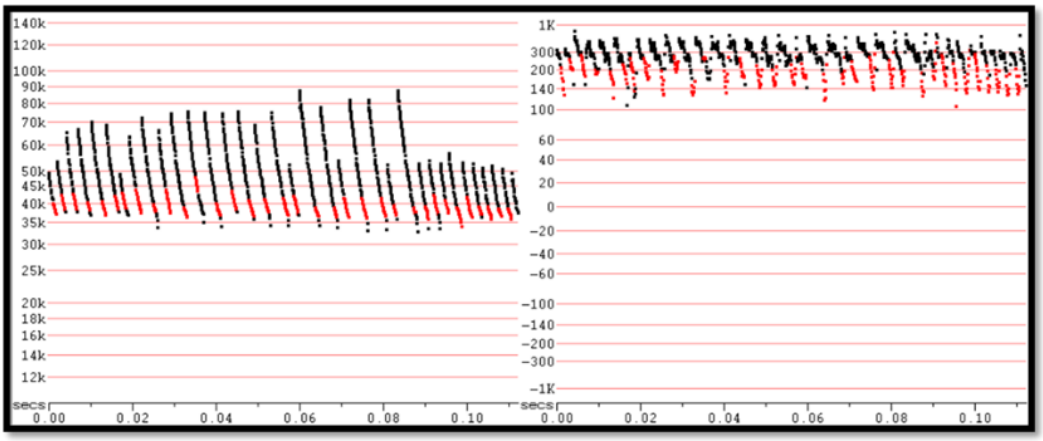
Appendix H. Representative Bat Species Calls for the Northern Long-Eared Bat Presence/Absence Acoustic Surveys at the Oliver Wind IV Project and Study Area in Oliver and Mercer Counties, North Dakota, from July 22 – July 28, 2020



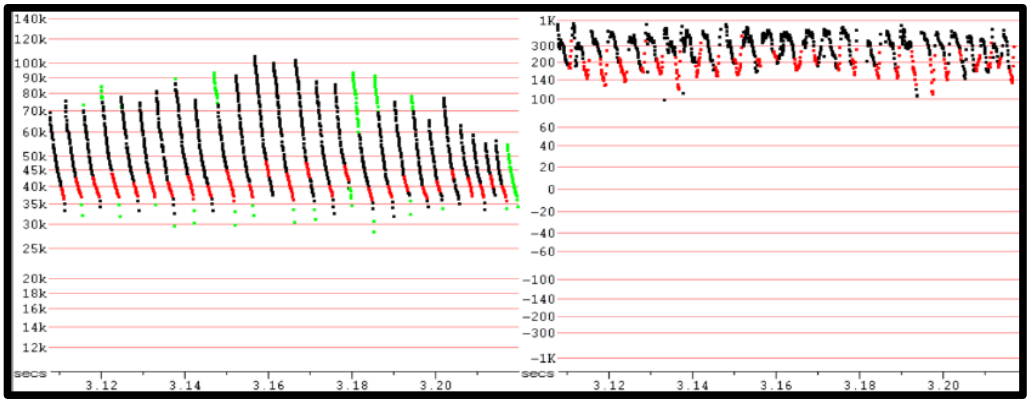
Appendix H1. Call screen of potential northern long-eared bat call from detector location 2B reclassified as high-frequency unknown by qualitative analysis.



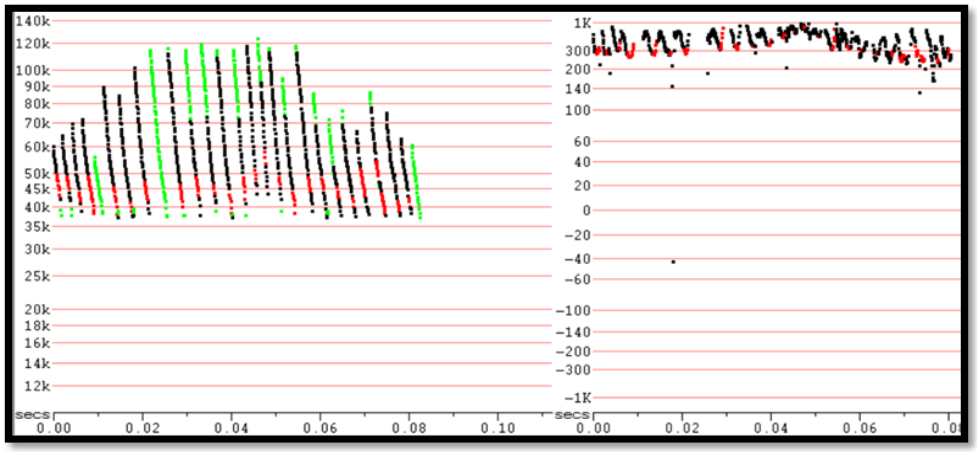
Appendix H2. Call screen (left) and slope plot (right) of potential northern long-eared bat call from detector location 4A reclassified as little brown bat by qualitative analysis.



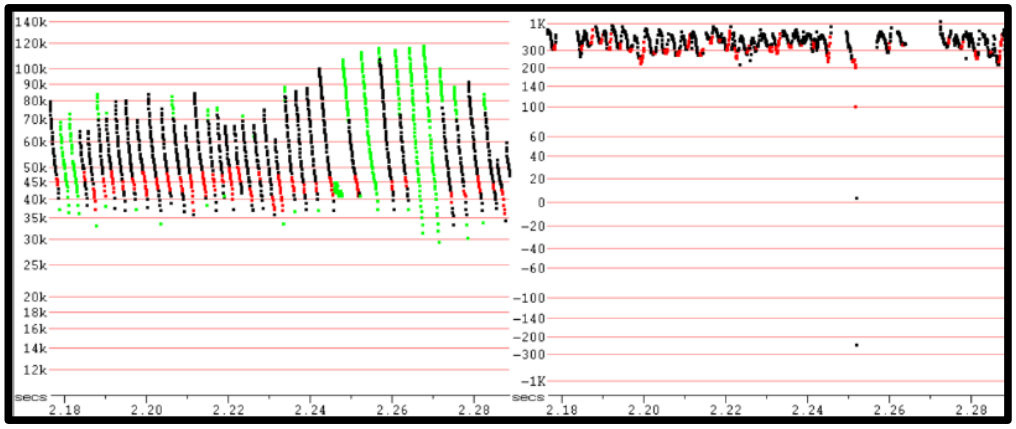
Appendix H3. Call screen (left) and slope plot (right) of potential northern long-eared bat call from detector location T5 reclassified as high-frequency unknown by qualitative analysis.



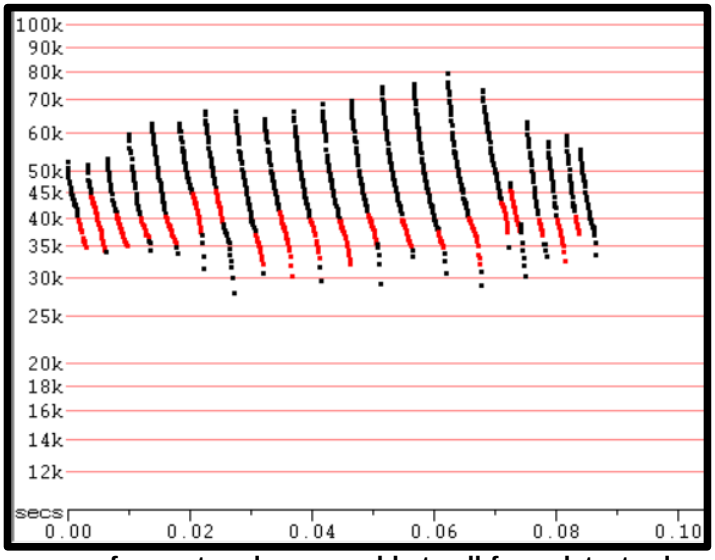
Appendix H4. Call screen (left) and slope plot (right) of potential northern long-eared bat call from detector location 7B reclassified as high-frequency unknown by qualitative analysis.



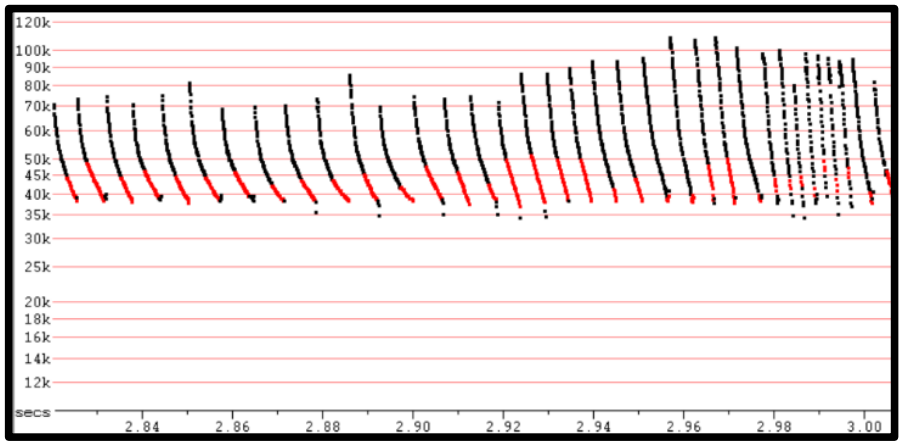
Appendix H5. Call screen (left) and slope plot (right) of a northern long-eared bat call from detector location 7B identified by Kaleidoscope Pro and qualitative analysis.



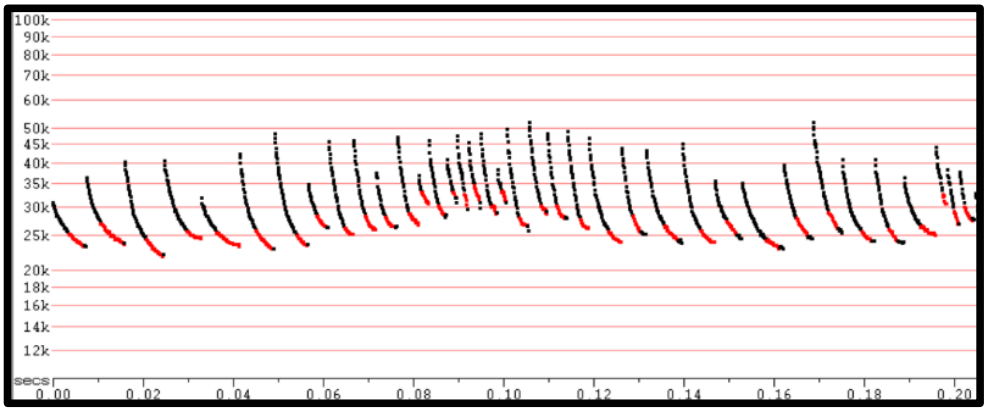
Appendix H6. Call screen (left) and slope plot (right) of a northern long-eared bat call from detector location 7B identified by Kaleidoscope Pro and qualitative analysis.



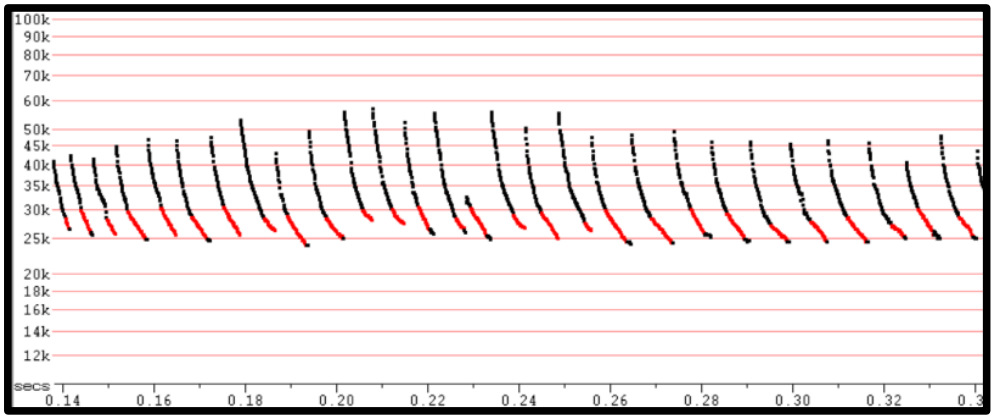
Appendix H7. Call screen of a western long-eared bat call from detector location 7B identified by Kaleidoscope Pro and qualitative analysis.



Appendix H8. Call screen of little brown bat call identified by Kaleidoscope Pro and qualitative analysis. The call screen includes approach-phase and feeding buzz calls (at the end).



Appendix H9. Call screen of a hoary bat call identified by qualitative analysis.



Appendix H10. Call screen of a big brown bat call identified by Kaleidoscope Pro and qualitative analysis.

Appendix B16. Summer Bat Presence/Absence Surveys (2022)

Northern Long-Eared Bat Presence/Absence Surveys

Oliver Wind IV Energy Center

Oliver and Mercer Counties, North Dakota

Surveys Conducted August 11 – August 24, 2022

Prepared for:

Oliver Wind IV, LLC

Prepared by:

Hannah Hayes and Martin Piorkowski

Western EcoSystems Technology, Inc.
4007 State Street Suite 109
Bismarck, North Dakota 58503

Report Date: August 29, 2023

WEST

Privileged and Confidential – Not for Distribution

EXECUTIVE SUMMARY

Oliver Wind IV, LLC (Oliver Wind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC (NextEra), is developing the Oliver Wind IV Energy Center (WEC) and Transmission Line (T-Line), collectively known as the Oliver Wind IV Project (Project), in Oliver and Mercer Counties, North Dakota. Western EcoSystems Technology, Inc. (WEST) was contracted to conduct follow-up mist-netting surveys at two sites that had either probable northern long-eared bat (*Myotis septentrionalis*; NLEB) acoustic detections or unknown *Myotis* ssp. detections in 2019 and 2020. The main objective of the 2022 summer bat survey was to attempt capture of NLEB during the summer maternity season (May 15 – August 15) at two sites where acoustic detections indicated the presence of the species.

Survey methods followed the U.S. Fish and Wildlife Service (USFWS) *Range-Wide Indiana Bat & Northern Long-Eared Bat Survey Guidelines* (USFWS 2022) and were approved by the USFWS North Dakota Ecological Services Field Office on August 4, 2022. The study plan was also provided to the North Dakota Game and Fish Department.

Mist-netting was conducted at two sites from August 11 to August 24, 2022, and. one bat was captured during the entire survey period: a silver-haired bat (*Lasionycteris noctivagans*). No NLEB were captured.

STUDY PARTICIPANTS

Martin Piorkowski	Project Manager
Kristina Hammond-Rendon	Senior Reviewer
Brenna Hyzy	Bat Biologist
Renea Wilson	Report Compiler
Hannah Hayes	Permitted Bat Biologist/ Report Compiler
Michelle Cavalieri	Bat Technician
Terri Thorn	GIS Specialist
Lucas Voorhees	Bat Project Coordinator
Carissa Goodman	Technical Editor

REPORT REFERENCE

H. Hayes and M. Piorkowski. 2022. Summer Bat Presence/Absence Surveys, Oliver Wind IV Energy Center, Oliver and Mercer Counties, North Dakota: Surveys Conducted August 11 – August 24, 2022. Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Report Revised August 29, 2023.

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Figure 2. Location of mist-net survey sites for the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota. 4

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Appendix B. Maps of Mist-Net Survey Sites
Appendix C. Photographs of Mist-Net Survey Sites
Appendix D. Photographs of Captured Bats
Appendix E. Summary of Mist-Net Captures
Appendix F. Mist-Net Survey Datasheets

[1]The Appendices include maps referring to the Red Butte Wind Farm. The Project name was changed to Oliver Wind IV Project in 2022, making the information in the Appendices applicable to the Oliver Wind IV Project despite references to the Red Butt Wind Farm.

INTRODUCTION

Oliver Wind IV, LLC (Oliver Wind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC (NextEra), is developing the Oliver Wind IV Energy Center (WEC) and Transmission Line (T-Line), collectively known as the Oliver Wind IV Project (Project), in Oliver and Mercer Counties, North Dakota (Figure 1). During the summers of 2019 and 2020, Western EcoSystems Technology, Inc. (WEST) conducted Presence/Probable Absence (P/A) surveys at the Project (Murray and Wilson 2020; Wilson et al. 2019) following U.S. Fish and Wildlife Service (USFWS) guidance as described in the *Range-Wide Indiana Bat Summer Survey Guidelines* (USFWS 2019, USFWS 2020).

Previous efforts included: desktop habitat mapping, acoustic P/A surveys, and P/A mist-netting surveys. From these previous efforts in 2020, two acoustic locations (T5 along the transmission line and 7B within the Project Area; Figure 2) had either probable northern long-eared bats or calls of an unknown *Myotis* spp. (Murray and Wilson 2020) but no follow-up mist-netting efforts were deployed in 2020. Therefore, the main objective of this 2022 summer bat survey was to attempt confirm the presence or probable absence of NLEB by conducting mist-net surveys during the summer maternity season (May 15 – August 15) at the sites where 2020 acoustic detections suggested probable presence of the species.

METHODS

All surveys followed methods described in the current *Range-Wide Indiana Bat & Northern Long-Eared Bat Survey Guidelines* (Guidelines; USFWS 2022). A Study Plan for the Project was provided to USFWS North Dakota Ecological Services Field Office on July 20, 2022 (Piorkowski 2022) with approval from USFWS on August 4, 2022 (Appendix A). All surveys were completed by a federally permitted bat biologist (H. Hayes; TE00101D-0, NDGF Scientific Collection License [Permit # 15568]).

Mist-Net Surveys

WEST conducted follow-up mist-netting surveys at two sites (T5 and 7B; Figure 2) that had either probable NLEB acoustic detections or unknown *Myotis* ssp. detections in 2019 and 2020. Mist-net surveys were conducted for six valid net-nights at each site for two calendar nights, for a total of 12 net nights. Three nights were invalid due to weather and additional nights were conducted and nets were moved. Standard 2-ply, 5-denier, nylon mist-nets with a mesh size of 38.0 millimeters (mm; 1.3 inches) were used at all mist-net sites. Mist-nets were placed in suitable bat habitat and positioned perpendicularly across flight corridors to fill the corridor from side-to-side and extended from ground level up to the overhanging canopy, when possible, or in forested habitat to specifically target NLEB. This required use of single-, double-, and triple-stacked mist-nets, depending on the canopy height at each mist-net location.

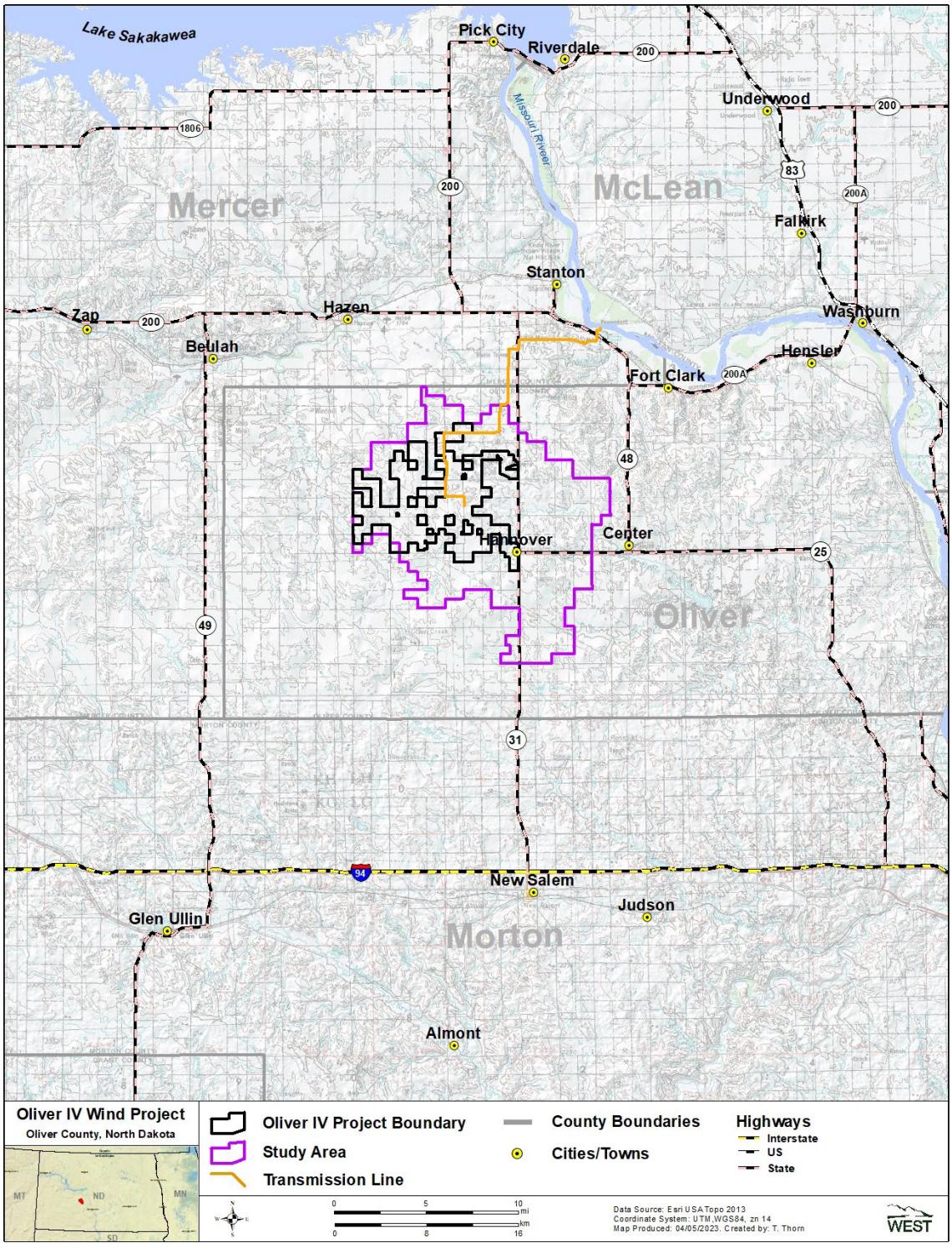

Figure 1. Location of the proposed Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

Mist-netting began at sunset and continued for at least five hours, and nets were checked every 10 minutes (min). Net locations were established at least 98 feet (30 meter) apart within each mist-net location. Disturbance in the form of noise and movement was minimized at all net locations. If weather conditions, such as persistent rain or heavy fog (more than 30 min in duration), strong winds (greater than nine miles [mi; 14 kilometers] per hour for more than 30 min), or cold temperatures (below 50 degrees [°] Fahrenheit [F; 10° Celsius] for 30 min or more) occurred, then those mist-net locations were resurveyed another night.

For each mist-net night, the date, start and end times, site description, site coordinates, mist-net specifics, and weather data (temperature, cloud cover, wind speed, precipitation, and moon phase) were recorded. All captured bats were identified to species. In addition, sex, age, reproductive condition, body mass (grams), forearm length (millimeters), and capture status (recapture/new capture) were recorded.

To assess exposure to white-nose syndrome (WNS), a Reichard Index score (0-3) was recorded for all captured bats (Reichard 2009). USFWS WNS decontamination protocols were followed (White-nose Syndrome Disease Management Group 2020, USFWS 2022) to prevent cross-contamination of captured bats with *Pseudogymnoascus destructans*, the fungus that causes WNS. Captured bats were measured and processed immediately and released within 15 min of capture. Voucher photographs of each bat species captured were taken. Photographs showing species' diagnostic characteristics were taken of every individual *Myotis* bat captured.

RESULTS

Appendices B, C, D, E and F contain maps of mist-net sites, photographs of mist-net sites, photographs of captured bats, a summary of mist-net captures, and mist-net survey datasheets, respectively.

Follow-up mist-net surveys were conducted at two sites (T5 and 7B, Figure 2) from August 11 to August 24, 2022 (Appendix B). Mist-netting was extended past the summer maternity season due to inclement weather (USFWS approval; pers. comm. H. Riddle, USFWS). Site 7B had seven net locations and site T5 had four net locations, for a total of 21 net-nights (Appendices B, C, and F). Mist-netting occurred within upland forest habitat, over prairie potholes, and edge habitat (Table 1). No NLEB were captured at either site; one juvenile male silver-haired bat (*Lasionycteris noctivagans*; SHBA) was captured at site 7B, and no bats were captured at site T5.

SUMMARY

Although no NLEB were captured at either site 7B or T5 during the 2022 summer maternity season, site 7B is still considered as a site where NLEB have probable presence due to the confirmed occurrence NLEB calls at 7B in 2020 (Wilson et al. 2020).

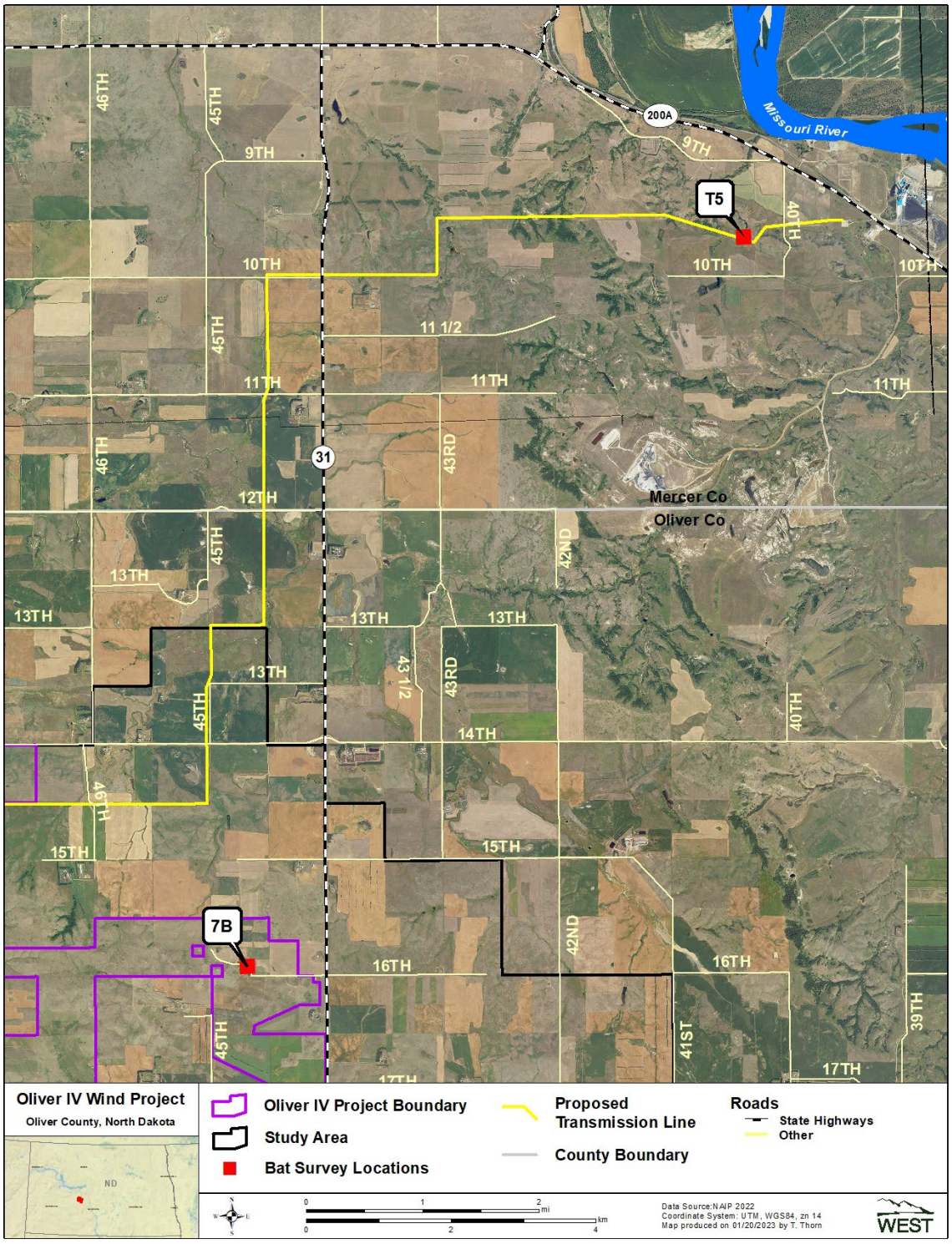

Figure 2. Location of mist-net survey sites for the proposed Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota.

Table 1. Locations and habitat descriptions of mist-net surveys at the Oliver Wind IV Project in Oliver and Mercer Counties, North Dakota on valid and invalid nights.

Mist-Net Site ID	Net	Easting*	Northing*	Site Description
7B	A	315034	5228579	Upland forest, interior
	B	315001	5228592	Upland forest, interior
	C	314946	5228635	Upland forest, across trail
	D	315034	5228598	Upland forest, across trail
	E	315079	5228605	Upland forest, edge
	F	315080	5228521	Upland forest, across trail
	G	314955	5228633	Upland forest, interior
T5	A	322288	5238471	Upland forest, edge
	B	322320	5238425	Upland forest, edge
	C	322323	5238400	Upland forest, draw
	D	322301	5238561	Across prairie pothole

* Coordinate system and datum: Universal Transverse Mercator, North American Datum 83.

ID = Identification.

REFERENCES

Murray, K.L., J. Wilson and C. Derby. 2019. Northern Long-Eared Bat Summer Presence/Absence Surveys, Oliver Wind IV Project, Oliver County, North Dakota: Surveys Conducted July 26 – August 15, 2019. Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Report Revised August 29, 2023. 18pp.

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

Piorkowski, M. 2022. Bat Study Plan: Northern long-eared bat follow-up mist-netting surveys, Red Butte Wind Project. Prepared for NextEra Energy Resources LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. July, 2022.

Reichard, J. E. 2009. Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-Nose Syndrome. Center for Ecology and Conservation, Boston University, Boston, Massachusetts. Available online: https://sbdn.org/wp-content/uploads/2018/08/Reichard_Scarring-index-bat-wings.pdf

USA Topo. 2013. USA Topo Maps. U.S. Geological Survey (USGS) topographical maps for the United States. ArcGIS. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California.

U.S. Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). 2022. NAIP Imagery. USDA, Farm Service Agency (FSA), Washington, D.C. January 2023.

U.S. Fish and Wildlife Service (USFWS). 2019 Range-Wide Indiana Bat Summer Survey Guidelines. USFWS Region 3, Bloomington, Indiana. April 209. 63 pp., including appendices. Available online: https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2019_Rangewide_IBat_Survey_Guidelines.pdf

U.S. Fish and Wildlife Service (USFWS). 2020. Range-Wide Indiana Bat Survey Guidelines. March 2020. 65 pp.

U.S. Fish and Wildlife Service (USFWS). 2022. Range-Wide Indiana Bat & Northern Long-Eared Bat Survey Guidelines. USFWS, Department of the Interior. March 2022. 67 pp. Available online: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines

White-Nose Syndrome Disease Management Group. 2020. National White-Nose Syndrome Decontamination Protocol. October 2020. Available online: https://www.whitenosesyndrome.org/mmedia-education/national-wns-decontamination-protocol-u-s

Wilson, J., K Hammond, K. Murray, and C. Derby. 2020. Northern Long-Eared Bat Presence/Absence Acoustic Surveys, Oliver Wind IV Project, Oliver and Mercer Counties, North Dakota: Surveys Conducted July 22 – July 28, 2020. Prepared for Oliver Wind IV, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Report Revised August 29, 2023. 15pp.

World Geodetic System (WGS) Sphere Mercator. 1984. WGS 84/Pseudo Mercator. Mercator variation projection data.

Appendix A. Site-Specific Authorization

Note: These Appendices include maps referring to the Red Butte Wind Farm. The Project name was changed to Oliver Wind IV Project in 2022, making the information in the Appendices applicable to the Oliver Wind IV Project despite references to the Red Butt Wind Farm.

Red Butte NLEB Study Plan and SSA request

Becker, Drew N <Drew_Becker@fws.gov> Thu, Aug 4, 2022 at 8:49 AM
To: Martin Piorkowski <mpiorkowski@west-inc.com>
Cc: "Riddle, Heidi L" <heidi_riddle@fws.gov>

Hi Martin,

Study design looks good from our perspective, we approve. Heidi will reach out soon.

Drew

Drew Becker
North Dakota Ecological Services Supervisor
U.S. Fish and Wildlife Service
3425 Miriam Avenue
Bismarck, North Dakota 58501
Office 701-355-8512
Cell 701-319-0127
drew_becker@fws.gov

Our Mission is to *work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people.*

NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.

From: Martin Piorkowski <mpiorkowski@west-inc.com>
Sent: Wednesday, August 3, 2022 2:59 PM
To: Becker, Drew N <Drew_Becker@fws.gov>
Subject: [EXTERNAL] Re: Red Butte NLEB Study Plan and SSA request

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hello Mr. Becker,

I was following up on this as the season is quickly closing. I was looking to see if you had any additional questions.

Thanks,
Marty

Martin Piorkowski
Wildlife Biologist/ Project Manager

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Environmental & Statistical Consultants
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(701) 250-3838 (Office)
(307) 634-1756 (HQ Office, Cheyenne)
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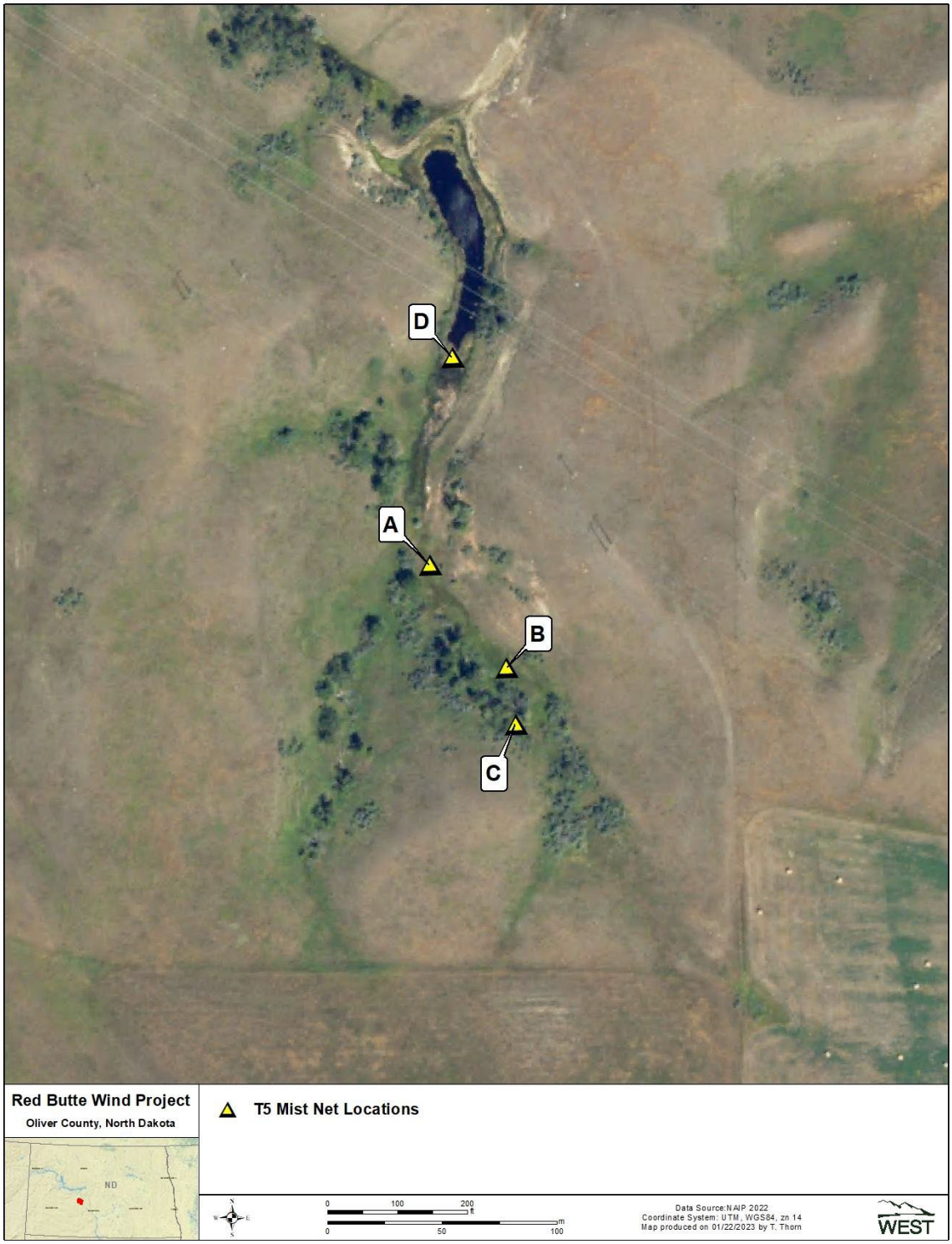
www.west-inc.com

Apendix A. U.S. Fish and Wildlife Service approval of northern long-eared bat mist-netting surveys for the Oliver Wind IV Project, Mercer and Oliver counties, North Dakota.

Appendix B. Maps of Mist-Net Survey Sites



Appendix B1. Location of mist-nets (A – D) at site T5 at the Oliver Wind IV Project in Mercer and Oliver counties, North Dakota.

Appendix B2. Location of mist-nets (A – G) at site 7B at the Oliver Wind IV Project in Mercer and Oliver counties, North Dakota.

Appendix C. Photographs of Mist-Net Survey Sites

Appendix C1a. Photographs of mist-nets (A – D; left to right, top to bottom) at site 7B at the Oliver Wind IV Project in Mercer and Oliver counties, North Dakota.

Appendix C1b. (cont.) Photographs of mist-nets (E – G; left to right, top to bottom) at site 7B at the Oliver Wind IV Project in Mercer and Oliver counties, North Dakota.

Appendix C2. Location of mist-nets (A – D; left to right, top to bottom) at site T5 at the Oliver Wind IV Project in Mercer and Oliver counties, North Dakota.

Appendix D. Photographs of Captured Bats

Appendix D. Juvenile male silver-haired bat captured at site 7B on August 24, 2022, at the Oliver Wind IV Project in Mercer and Oliver counties, North Dakota.

Appendix E. Summary of Mist-Net Captures

Appendix E. Summary of mist-net captures at the Oliver Wind IV Project in Mercer and Oliver counties, North Dakota.

Survey Site	Survey Night	Time	Species	Sex	Age	Reproductive Status	Reichard Score	Forearm Length (mm)	Weight (g)	Re-Captured (Yes/No)
7B	8/24/2022	02:02	LANO	M	J	N	0	40.6	11.25	No

LANO = *Lasionycteris noctivagans* (silver-haired bat; SHBA); M = male; J = juvenile; N = non-reproductive; mm = millimeter; g = grams.

Appendix F. Mist-Net Survey Datasheets

Site Description and Weather Data Form

Location Information

Site ID:	Project: Red Butte	State: North Dakota
7B	Datum: NAD 83	County: Oliver

Net Locations – Take pictures of each net set and distinguishing characteristics

Net ID (A,B,...)	Net Size (e.g. 3x9)	UTM Zone	Easting	Northing	Net Nights Used (1,2,...)	Canopy Cover (%)
A	3 x 6	14	315034	5228579	1, 2, 3	10
B	2 x 4	14	315001	5228592	1, 4	100
C	1 x 4	14	314946	5228635	1	40
D	1 x 4	14	315034	5228598	2, 3	100
E	2 x 6	14	315079	5228605	2, 3	5
F	2 x 9	14	315080	5228521	4	100
G	3 x 6	14	314955	5228633	4	90

Site Sketch

Should be drawn in a top-down view using map to assist with accuracy. Include all streams, roads, trails, and structures. Note all net locations using Net ID.

Net Night	Date (yyyy-mm-dd)	Biologists Present	Total Nets Open (#)	Sunset Time (24 Hour)	Moonrise Time	Moonset Time	Moon Phase[1]	Start Time	Start Temp (°F)	Start Wind Speed (mph)	Start Sky Code	Stop Time	Stop Temp	Stop Wind Speed	Stop Sky Code	Precip. During Survey (Yes/No)	Precip. Duration (min)	Night Complete (Yes/No)
1	2022-08-11	H. Hayes, M. Cavalieri	3	2104	2127	0533	F	2100	69	12	2	2130	61	13	2	No	0	No
2	2022-08-16	H. Hayes, M. Cavalieri	3	2058	2316	1216	G	2053	78	0	0	0203	60	1	0	No	0	Yes
3	2022-08-17	H. Hayes, M. Cavalieri	3	2056	2336	1328	G	2050	75	2	1	2127	72	2	2	No	0	No
4	2022-08-24	H. Hayes, M . Piorkowski	3	1841	0337	2003	C	2041	68	0	0	0141	56	0	2	No	0	Yes
5																		

Habitat Information

[2]Primary Habitat Surveyed:	Dominant Canopy Species:	Estimated Canopy Tree Age (DBH):	Additional Comments:
Upland Forest	Acer negundo Acer saccharum	Late-successional (25-38 cm)	Night 1 wind out/livestock interference. Net A 4x6 on night 2 only. Net D changed to 1x6 on night 3.
Forest Type: Mixed	**Preferred Roost Trees Present:** Unknown snag(s) with exfol. bark		

[1] *New (N), Crescent (C), Half (H), Gibbous (G), Full (F)* [2] *Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Briefly Describe)*

Bat Capture Data Form

Project: Red Butte
Site ID: 7B
Date: 2022-08-11
Biologist(s): H. Hayes, M. Cavalieri

State: North Dakota
County: Oliver
Net Night: 1
Night Complete: Yes (No)

Survey Comments:
Wind out/livestock interference at 2130

#	Species (4 Letter Code)	Time (24 Hour)	Sex (M, F, U)	Age (A, J, U)	[A] Repro. Status	Reichard Score (0 - 3)	Right Forearm (mm)	Weight (g)	Net ID (A, B,...)	Capture Height in Net (m)	Recapture (Yes / No)	[B] Band #	[C] Original Transmitter Frequency	Drifted Transmitter Frequency	[D] Bat ID (Site-Species #)	[E] Photos (None, Face, Calcar, Toes)	Comments
1	No bats																
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

[A] Male: (N) - non-reproductive, (TD) - testes-descended, (U) - unknown. Female: (N) - non-reproductive, (L) - lactating, (P) - pregnant, (PL) - post-lactating, (U) - unknown.
[B] Band RIGHT forearm on males, LEFT on females AND include letters.
[C] Original frequency: pre-assigned by manufacturer; Drifted frequency: final frequency prior to bat release.
[D] Bat ID: write Site ID – Species Code (with the sequential number of individuals of species captured; e.g. MN5-MYSO2). Only Myotis and target species are given a Bat ID.
[E] Take photos of 1) *ALL* MYSO/MYSE/MYLE/MYGR captured, 2) First several MYLU from each site, 3) One representative photo of each species captured.
[*] (U) – unknown is used exclusively when a bat escapes before the determination can be made.

Bat Capture Data Form

Project: Red Butte
Site ID: 7B
Date: 2022-08-16
Biologist(s): H. Hayes, M. Cavalieri

State: North Dakota
County: Oliver
Net Night: 2
Night Complete: (Yes) No

Survey Comments:

#	Species (4 Letter Code)	Time (24 Hour)	Sex (M, F, U)	Age (A, J, U)	[A] Repro. Status	Reichard Score (0 - 3)	Right Forearm (mm)	Weight (g)	Net ID (A, B,...)	Capture Height in Net (m)	Recapture (Yes / No)	[B] Band #	[C] Original Transmitter Frequency	Drifted Transmitter Frequency	[D] Bat ID (Site-Species #)	[E] Photos (None, Face, Calcar, Toes)	Comments
1	No bats																
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

[A] Male: (N) - non-reproductive, (TD) - testes-descended, (U) - unknown. Female: (N) - non-reproductive, (L) - lactating, (P) - pregnant, (PL) - post-lactating, (U) - unknown.
[B] Band RIGHT forearm on males, LEFT on females AND include letters.
[C] Original frequency: pre-assigned by manufacturer; Drifted frequency: final frequency prior to bat release.
[D] Bat ID: write Site ID – Species Code (with the sequential number of individuals of species captured; e.g. MN5-MYSO2). Only Myotis and target species are given a Bat ID.
[E] Take photos of 1) *ALL* MYSO/MYSE/MYLE/MYGR captured, 2) First several MYLU from each site, 3) One representative photo of each species captured.
[*] (U) – unknown is used exclusively when a bat escapes before the determination can be made.

Bat Capture Data Form

Project: Red Butte
Site ID: 7B
Date: 2022-08-17
Biologist(s): H. Hayes, M. Cavalieri

State: North Dakota
County: Oliver
Net Night: 3
Night Complete: Yes (No)

Survey Comments:
Lightning weather out @ 2127

WEST

#	Species (6 Letter Code)	Time (24 Hour)	Sex (M, F, U)	Age (A, J, U)	[A] Repro. Status	Reichard Score (0 - 3)	Right Forearm (mm)	Weight (g)	Net ID (A, B,...)	Capture Height in Net (m)	Recapture (Yes / No)	[B] Band #	[C] Original Transmitter Frequency	Drifted Transmitter Frequency	[D] Bat ID (Site-Species #)	[E] Photos (None, Face, Calcar, Toes)	Comments
1	No bats																
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

[A] Male: (N) - non-reproductive, (TD) - testes-descended, (U) - unknown. Female: (N) - non-reproductive, (L) - lactating, (P) - pregnant, (PL) - post-lactating, (U) - unknown.
[B] Band RIGHT forearm on males, LEFT on females AND include letters.
[C] Original frequency: pre-assigned by manufacturer; Drifted frequency: final frequency prior to bat release.
[D] Bat ID: write Site ID – Species Code (with the sequential number of individuals of species captured; e.g. MN5-MYSO2). Only Myotis and target species are given a Bat ID.
[E] Take photos of 1) *ALL* MYSO/MYSE/MYLE/MYGR captured, 2) First several MYLU from each site, 3) One representative photo of each species captured.
[*] (U) – unknown is used exclusively when a bat escapes before the determination can be made.

Bat Capture Data Form

Project: Red Butte
Site ID: 7B
Date: 2022-08-24
Biologist(s): H. Hayes, M. Piorowski
State: North Dakota
County: Oliver
Net Night: 4
Night Complete: (Yes) No
Survey Comments:

#	Species (4 Letter Code)	Time (24 Hour)	Sex (M, F, U)	Age (A, J, U)	[A] Repro. Status	Reichard Score (0 - 3)	Right Forearm (mm)	Weight (g)	Net ID (A, B,...)	Capture Height in Net (m)	Recapture (Yes / No)	[B] Band #	[C] Original Transmitter Frequency	Drifted Transmitter Frequency	[D] Bat ID (Site-Species #)	[E] Photos (None, Face, Calcar, Toes)	Comments
1	LANO	0202	M	J	N	0	40.6	11.25	F	1.5	No				7B - LANO1	Face / Calcar	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

[A] Male: (N) - non-reproductive, (TD) - testes-descended, (U) - unknown. Female: (N) - non-reproductive, (L) - lactating, (P) - pregnant, (PL) - post-lactating, (U) - unknown.
[B] Band RIGHT forearm on males, LEFT on females AND include letters.
[C] Original frequency: pre-assigned by manufacturer; Drifted frequency: final frequency prior to bat release.
[D] Bat ID: write Site ID – Species Code (with the sequential number of individuals of species captured; e.g. MN5-MYSO2). Only Myotis and target species are given a Bat ID.
[E] Take photos of 1) *ALL* MYSO/MYSE/MYLE/MYGR captured, 2) First several MYLU from each site, 3) One representative photo of each species captured.
[*] (U) – unknown is used exclusively when a bat escapes before the determination can be made.

Site Description and Weather Data Form

Location Information

Site ID:	Project:	State:
T5	Red Butte	North Dakota
	Datum: NAD 83	County: Mercer

Net Locations – Take pictures of each net set and distinguishing characteristics

Net ID (A,B,...)	Net Size (e.g. 3x9)	UTM Zone	Easting	Northing	Net Nights Used (1,2,...)	Canopy Cover (%)
A	3 x 12	14	322288	5238471	1, 2, 3	0
B	3 x 12	14	322320	5238425	1	0
C	2 x 6	14	322323	5238400	1, 2, 3	40
D	3 x 12	14	322301	5238561	2, 3	0

Site Sketch

Net Night	Date (yyyy-mm-dd)	Biologists Present	Total Nets Open (#)	Sunset Time (24 Hour)	Moonrise Time	Moonset Time	Moon Phase[1]	Start Time	Start Temp (°F)	Start Wind Speed (mph)	Start Sky Code	Stop Time	Stop Temp	Stop Wind Speed	Stop Sky Code	Precip. During Survey (Yes/No)	Precip. Duration (min)	Night Complete (Yes/No)
1	2022-08-12	H. Hayes, M. Cavalieri	3	2104	2155	0659	G	2100	74	7	1	0204	65	0	3	No	0	Yes
2	2022-08-13	H. Hayes, M. Cavalieri	3	2102	2217	0822	G	2057	76	2	0	2350	71	10	1	No	0	No
3	2022-08-14	H. Hayes, M. Cavalieri	3	2100	2239	0945	G	2058	81	1	0	0200	73	5	0	No	0	Yes
4																		
5																		

Habitat Information

[2]Primary Habitat Surveyed:	Dominant Canopy Species:	Estimated Canopy Tree Age (DBH):	Additional Comments:
Pond	Fraxinus pennsylvanica Salix spp.	Mid-successional (13-24 cm)	Night 1 fog rolled in at 10 to 2. Night 2 lightning out.
Forest Type:	**Preferred Roost Trees Present:**		
Deciduous	Unknown snag(s) with exfol. bark		

[1] *New (N), Crescent (C), Half (H), Gibbous (G), Full (F)* [2] *Bridge, Bottomland Forest, Cave Entrance, Creek/Riparian, Field Edge, Mine Portal, Open Field, Pond, Structure, Upland Forest, or Other (Briefly Describe)*

Bat Capture Data Form

Project: Red Butte
Site ID: T5
Date: 2022-08-12
Biologist(s): H. Hayes, M. Cavalieri

State: North Dakota
County: Mercer
Net Night: 1
Night Complete: (Yes) No

Survey Comments:
Fog rolled in 10 minutes before close

#	Species (4 Letter Code)	Time (24 Hour)	Sex (M, F, U)	Age (A, J, U)	[A] Repro. Status	Reichard Score (0 - 3)	Right Forearm (mm)	Weight (g)	Net ID (A, B,...)	Capture Height in Net (m)	Recapture (Yes / No)	[B] Band #	[C] Original Transmitter Frequency	Drifted Transmitter Frequency	[D] Bat ID (Site-Species #)	[E] Photos (None, Face, Calcar, Toes)	Comments
1	No bats																
2																	
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5																	
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13																	
14																	
15																	

[A] Male: (N) - non-reproductive, (TD) - testes-descended, (U) - unknown. Female: (N) - non-reproductive, (L) - lactating, (P) - pregnant, (PL) - post-lactating, (U) - unknown.
[B] Band RIGHT forearm on males, LEFT on females AND include letters.
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[E] Take photos of 1) *ALL* MYSO/MYSE/MYLE/MYGR captured, 2) First several MYLU from each site, 3) One representative photo of each species captured.
[*] (U) – unknown is used exclusively when a bat escapes before the determination can be made.

Bat Capture Data Form

Project: Red Butte
Site ID: T5
Date: 2022-08-13
Biologist(s): H. Hayes, M. Cavalieri

State: North Dakota
County: Mercer
Net Night: 2
Night Complete: Yes (No)

Survey Comments:
Lightning weather out @ 2350

#	Species (4 Letter Code)	Time (24 Hour)	Sex (M, F, U)	Age (A, J, U)	Repro. Status [A]	Reichard Score (0 - 3)	Right Forearm (mm)	Weight (g)	Net ID (A, B,...)	Capture Height in Net (m)	Recapture (Yes / No)	Band # [B]	Original Transmitter Frequency [C]	Drifted Transmitter Frequency [C]	Bat ID (Site-Species #) [D]	Photos (None, Face, Calcar, Toes) [E]	Comments
1	No bats																
2																	
3																	
4																	
5																	
6																	
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11																	
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13																	
14																	
15																	

[A] Male: (N) - non-reproductive, (TD) - testes-descended, (U) - unknown. Female: (N) - non-reproductive, (L) - lactating, (P) - pregnant, (PL) - post-lactating, (U) - unknown.
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[*] (U) – unknown is used exclusively when a bat escapes before the determination can be made.

Bat Capture Data Form

Project: Red Butte
Site ID: T5
Date: 2022-08-14
Biologist(s): H. Hayes, M. Cavalieri

State: North Dakota
County: Mercer
Net Night: 3
Night Complete: (Yes) No

Survey Comments:

#	Species (4 Letter Code)	Time (24 Hour)	Sex (M, F, U)	Age (A, J, U)	[A] Repro. Status	Reichard Score (0 - 3)	Right Forearm (mm)	Weight (g)	Net ID (A, B,...)	Capture Height in Net (m)	Recapture (Yes / No)	[B] Band #	[C] Original Transmitter Frequency	Drifted Transmitter Frequency	[D] Bat ID (Site-Species #)	[E] Photos (None, Face, Calcar, Toes)	Comments
1	No bats																
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11																	
12																	
13																	
14																	
15																	

[A] Male: (N) - non-reproductive, (TD) - testes-descended, (U) - unknown. Female: (N) - non-reproductive, (L) - lactating, (P) - pregnant, (PL) - post-lactating, (U) - unknown.
[B] Band RIGHT forearm on males, LEFT on females AND include letters.
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[D] Bat ID: write Site ID – Species Code (with the sequential number of individuals of species captured; e.g. MN5-MYSO2). Only Myotis and target species are given a Bat ID.
[E] Take photos of 1) *ALL* MYSO/MYSE/MYLE/MYGR captured, 2) First several MYLU from each site, 3) One representative photo of each species captured.
[*] (U) – unknown is used exclusively when a bat escapes before the determination can be made.

Appendix B17. Dakota Skipper Habitat Assessment

ENVIRONMENTAL & STATISTICAL CONSULTANTS

901 Lamberton Pl NE, South Suite
Albuquerque, NM 87107

TECHNICAL MEMORANDUM

Date: August 23, 2023

To: Dina Brown, Oliver Wind IV, LLC

From: Kevin Shelley, Western EcoSystems Technology, Inc.

Subject: Dakota Skipper (*Hesperia dakotae*) Habitat Assessment for the Oliver Wind IV Energy Project, Oliver and Mercer Counties, North Dakota.

INTRODUCTION

Oliver Wind IV, LLC (Company) is pursuing development of the Oliver Wind IV Energy Center (Project) and associated transmission line in Oliver and Morton counties, North Dakota (Figure 1). The Company contracted Western EcoSystems Technology, Inc. (WEST) to conduct a Dakota skipper (DASK; *Hesperia dakotae*) habitat assessment in support of the Project.

Over the past three decades, the species has been documented in three townships within Oliver County but not within Mercer County. (USFWS 2022). Thus, the overall purpose of this study was to assess native (unbroken) prairie grasslands where potential Project infrastructure could be sited within the Project Area and transmission line route to determine whether the existing vegetative conditions are suitable to support the reproductive needs of DASK during its larval stage. Identifying the location, size, and juxtaposition of DASK suitable habitat will aid the Company in project planning by identifying the location of 1) high quality native prairie grasslands and 2) DASK larval habitat within the Project Area and transmission line. Therefore, the survey objective was to locate, map, and estimate the total area (ac) of potential DASK larval habitat within the Project Area.

PROJECT LOCATION

The Project Area and transmission line route are generally located approximately 3.7 miles (mi; 6.0 kilometers [km]) west of the town of Center, within Oliver and Mercer counties in central North Dakota (Figure 1). The Project Area and transmission line route occur within the Northwestern Glaciated Plains Level III Ecoregion, in an area historically dominated by grasslands but extensively converted to agricultural use (e.g., row crops and livestock grazing; Bryce et al. 1996, US Environmental Protection Agency 2012; 2013). The terrain within the Project Area and

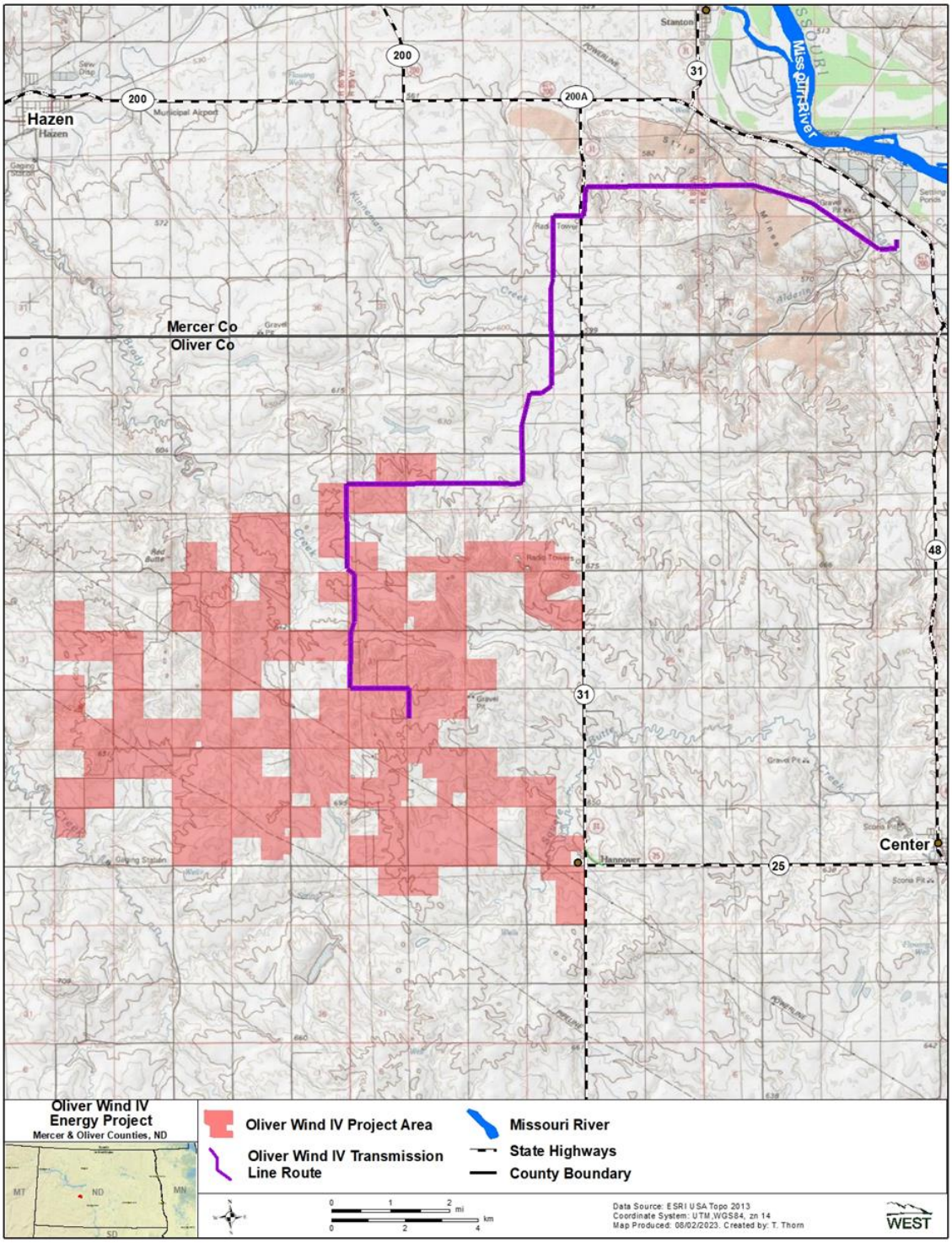


Figure 1. Location of the Oliver Wind IV Energy Project, Oliver and Mercer counties, North Dakota.

transmission line route is gently rolling with interspersed level areas, and elevations of 1,663–2,385 feet (ft; 507– 727 meters [m]) above sea level (US Geological Survey 2023).

Dakota Skipper

The DASK inhabits tallgrass prairie and mixed-grass prairie in the north-central US and north into Canada (southern Saskatchewan and Manitoba Provinces). The species has been documented to occur in numerous counties in North Dakota. The optimum habitat conditions for DASK larval life stage typically occurs in grassland patches nested within larger patches of native (unbroken) grasslands. The sites where the species tends to reside are among the most diverse native grassland plant (grass and forb) communities, have minimal soil disturbance, and minimal non-native plant species.

METHODS

The DASK habitat assessment was conducted during the summers of 2022 and 2023, and encompassed the Project footprint associated with proposed locations of anticipated infrastructure (collection lines [dated July 19, 2022], and updated transmission line [May 12, 2023]). WEST was provided spatial data by the Company in 2022 and 2023 that depicted the location and size of native prairie (unbroken) grasslands that needed additional surveys to determine whether DASK larval habitat was present.

Pedestrian field surveys were conducted by a WEST Senior Ecologist with over five years of experience assessing and classifying DASK larval habitat. Native unbroken grasslands within the Project Area that coincided with collection or transmission line corridors (150-ft survey corridors) were surveyed to determine the presence or absence of potential DASK larval habitat. Sites determined to be suitable DASK larval habitat (polygons) were delineated using a handheld GPS location device loaded with ArcGIS imagery (Esri 2023).

RESULTS

Pedestrian field surveys were completed by a DASK habitat expert on August 10, 17 – 19, and 22 – 23, 2022 and on June 15, June 26 – 27, July 6, and July 17, 2023. Twenty-eight sites (habitat patches) totaling 13.10 acres were found with the requisite plant species diversity and richness and classified as DASK larval habitat (Figure 2; Table 1). No additional sites were found with the requisite plant species diversity and richness necessary to be classified as DASK larval habitat.

Table 1. Identified Dakota Skipper larval habitat patches delineated during field surveys in 2022 and 2023 at the Oliver Wind IV Energy Project and associated transmission line, Oliver and Mercer counties, North Dakota.

Site ID	acres	Site ID	acres
1	1.41	15	0.38
2	0.52	16	0.11
3	0.32	17	0.28
4	1.20	18	0.13
5	0.13	19	0.28
6	0.21	20	0.10
7	0.62	21	0.18
8	0.04	22	0.15
9	0.23	23	0.13
10	0.04	24	0.89
11	0.21	25	0.05
12	1.86	26	1.22
13	0.97	27	0.06†
14	1.17	28	0.21†
		Total:	**13.10 acres**

†Sites (ID 27 and ID 28) classified in 2023. The remaining 26 sites were classified in 2022.

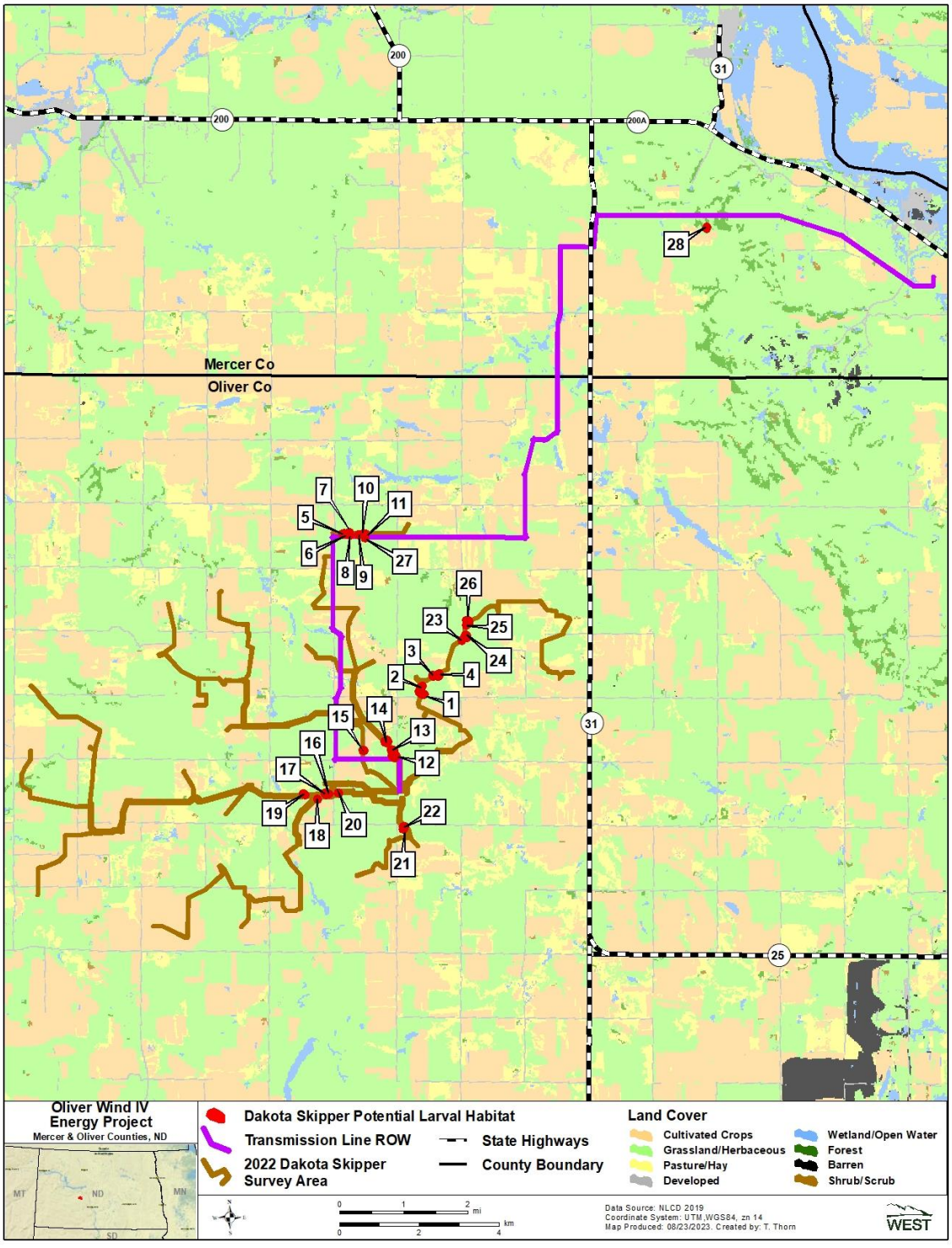


Figure 2. The location of 28 Dakota skipper larval habitat patches associated with the Oliver Wind IV Energy Center and transmission line, Oliver and Mercer counties, North Dakota (surveys conducted in 2022 and 2023).

REFERENCES

Bryce, S. A., J. M. Omernik, D. A. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S. H. Azevedo. 1996. Ecoregions of North Dakota and South Dakota. (Color poster with map, descriptive text, summary tables, and photographs.) US Geological Survey (USGS) map (map scale 1:1,500,000). USGS, Reston, Virginia. US Environmental Protection Agency (USEPA). Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-39

Esri. 2023. World Imagery and Aerial Photos (World Topo). ArcGIS Resource Center. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California. Accessed July 2023. Available online: https://www.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=10df2279f9684e4a9f6a7f08febac2a9

Google Earth. 2023. Google Earth Aerial Imagery. Google, Mountain View, California. Accessed July 2023. Available online: https://www.google.com/earth/

National Land Cover Database (NLCD). 2019. National Land Cover Database 2019 - Landcover & Imperviousness (NLCD2019). Available online: https://www.mrlc.gov/data. As cited includes:

Dewitz, J., and US Geological Survey (USGS). 2021. National Land Cover Database (NLCD) 2019 Products. Version 2.0. USGS data release. June 2021. doi: 10.5066/P9KZCM54.

Homer, C., J. Dewitz, S. Jin, G. Xian, C. Costello, P. Danielson, L. Gass, M. Funk, J. Wickham, S. Stehman, R. Auch, and K. Riitters. 2020. Conterminous United States Land Cover Change Patterns 2001–2016 from the 2016 National Land Cover Database. ISPRS Journal of Photogrammetry and Remote Sensing 162(5): 184-199. doi: 10.1016/j.isprsjprs.2020.02.019.

Jin, S., C. Homer, L. Yang, P. Danielson, J. Dewitz, C. Li, Z. Zhu, G. Xian, and D. Howard. 2019. Overall Methodology Design for the United States National Land Cover Database 2016 Products. Remote Sensing. 2971. doi: 10.3390/rs11242971.

Wickham, J., S. V. Stehman, D. G. Sorenson, L. Gass, and J. A. Dewitz. 2021, Thematic Accuracy Assessment of the NLCD 2016 Land Cover for the Conterminous United States: Remote Sensing of Environment 257: 112357. doi: 10.1016/j.rse.2021.112357.

and

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. doi: 10.1016/j.isprsjprs.2018.09.006.

US Environmental Protection Agency (USEPA). 2012. Level III and Level IV Ecoregions of New Mexico. USEPA Office of Research and Development - National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. Last updated May 8, 2012. Accessed July 2023. Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-6#pane-29

US Environmental Protection Agency (USEPA). 2013. Level III and Level IV Ecoregions of the Continental United States. Ecosystems Research, USEPA. April 16, 2013. Accessed July 2023. Available online: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

US Fish and Wildlife Service. 2022. 2022 Dakota Skipper (*Hesperia dacotae*) North Dakota Survey Protocol. Mountain-Prairie Region (Region 6). Denver, CO. 19pp.

US Geological Survey (USGS). 2023. The National Map. TNM Download V2.0. Topo Map data, 3DEP products, Lidar, IfSAR, NHD (Hydrography Dataset), NAIP Plus Imagery, National Structures Dataset. Accessed May 2023. Available online: https://apps.nationalmap.gov/downloader/#/

Appendix C

Agency Notification Letters and Correspondence

Appendix C1
Agency Notification Letter Templates

AECOM
1000 East Calgary Ave
Bismarck, ND 58503
aecom.com

(701) 221-4148 tel
(701) 221-4155 fax

Subject: Red Butte Wind Energy Center and 230 kV Transmission Line Project Oliver and Mercer Counties, ND

Red Butte Wind, LLC (Red Butte Wind), a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC, is proposing to develop the Red Butte Wind Energy Center (Wind Energy Center) and the approximately 15-mile, 230 kV transmission line (Transmission Line, and collectively with the Wind Energy Center, the "Project") in Oliver and Mercer Counties, ND. Red Butte Wind plans to complete North Dakota Public Service Commission permitting and construction in 2020. An agency information request letter was originally sent by PRC Wind in 2016 when the Project began development. Due to the three-year timespan, this letter serves as a new information request.

The Wind Energy Center will have a nameplate capacity of approximately 200 megawatts, consisting of wind turbines and associated infrastructure. The Wind Energy Center will be located entirely within Oliver County, ND. The Transmission Line will connect the Wind Energy Center to the electrical grid at the Basin Electric Leland Substation in southeast Mercer County. The Transmission Line will be located in Oliver and Mercer Counties, ND. Red Butte Wind requests the consideration of the Project shown on the attached map (Figure 1). The Wind Energy Center Project Area and 2-mile wide Transmission Line Corridor encompass the following legal locations:

County	Township	Range	Sections
Oliver	141 N	84 W	6, 7, 18
	141 N	85 W	1, 2, 10 - 15
	142 N	84 W	4 – 9, 17 - 20, 29 - 31
	142 N	85 W	1 - 31, 33 - 36
	142 N	86 W	1 - 5, 8 - 15, 17, 22 – 26, 34 - 36
	143 N	84 W	30 - 33
	143 N	85 W	7, 9, 10, 14 - 36
	143 N	86 W	1, 2, 12 – 14, 21 – 29, 32 - 36
Mercer	144 N	84 W	15 -17, 19 – 23, 27 - 33
	144 N	85 W	21 – 28, 33 - 36

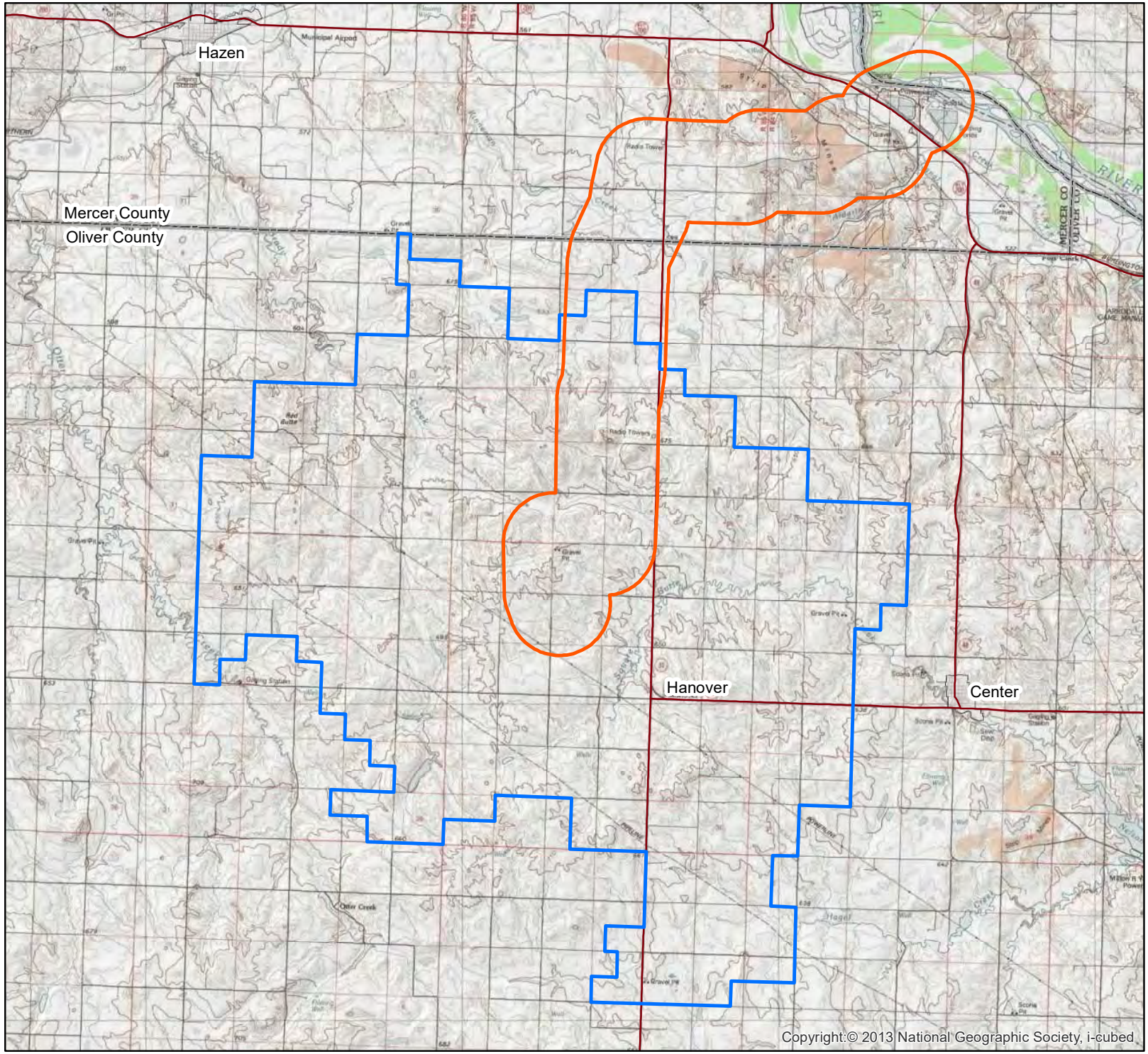
To ensure that all social, economic, and environmental effects are considered and per Section 69-06-01-05 of the North Dakota Administrative Code, we are soliciting your views and comments on the Project. We are particularly interested in any property which your agency may own or have an interest in and which would be adjacent to the Project. We would also appreciate being made aware of any proposed developments your agency may be contemplating in the areas under consideration for the Project. Any information that might help us in our siting studies and permit applications would be appreciated. We would appreciate a response within 30 days of receipt of this letter. If no reply is received by this date, it will be assumed that you have no comment on this Project.

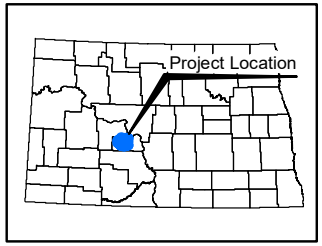
If further information is desired regarding the proposed Project, please contact Lindsey Churchill at (701) 221-4148 in Bismarck, ND, or at the email and address below.

Sincerely,

Lindsey Churchill, PhD, PWS
AECOM
Environmental Project Manager
1000 East Calgary Avenue Suite 1
Bismarck, ND 58503
lindsey.churchill@aecom.com

Enclosure:
Figure 1 - Project Location Map





Legend

- City Boundary
- County Boundary
- Red Butte Project Area
- Transmission Line Corridor

0 0.75 1.5 3 Miles

Figure 1
Project Location
Red Butte Wind Energy Center and 230 kV Transmission Line Mercer and Oliver Counties, North Dakota

N W E S

AECOM

Oliver IV Wind 000823

merjent

p 612.746.3660 ▪ f 612.746.3679 ▪ www.merjent.com

1 Main Street SE ▪ Suite 300 ▪ Minneapolis, Minnesota ▪ 55414

March 31, 2023

Subject: Notification of the Proposed Oliver Wind IV Energy Center in Oliver County, North Dakota and Associated 345-kV Transmission Line in Oliver and Mercer Counties, North Dakota

Oliver Wind IV, LLC (Oliver Wind IV), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC, is proposing to develop the Oliver Wind IV Energy Center (Wind Project; formerly known as the Red Butte Wind Energy Center [Red Butte]) in Oliver County, North Dakota and its associated 345-kilovolt (kV) transmission line (Transmission Line) in Oliver and Mercer counties, North Dakota. The purpose of this letter is to provide notification of the Project per North Dakota Administrative Code Section 69-06-01-05. A previous notification letter was sent to your agency or entity for the Red Butte project in 2019. Due to the four-year timespan and modifications to the Project including refined Study Areas, change in name, updated construction timeline, and updated interconnection, this letter serves as a new information request.

Oliver Wind IV plans to submit to the North Dakota Public Service Commission an application for a Certificate of Site Compatibility for the Wind Project and a consolidated application for a Certificate of Corridor Compatibility and Route Permit for the Transmission Line and complete construction in the fourth quarter of 2024. The Wind Project will have a nameplate capacity of approximately 200-megawatts and will consist of 71 wind turbines, access roads, underground electrical collection lines and communication systems, a collection substation, an aircraft detection lighting system, an operations and maintenance facility, and meteorological towers. The Wind Project's generated power will interconnect to the electrical grid at the new Basin Electric 345-kV Substation through an approximately 20-mile-long 345-kV transmission line.

We are solicitating input from your agency or entity regarding any sensitive resources, current or planned development, or property interests your agency or entity may have in or around the Study Areas that should be considered as it moves forward with development. In addition, we ask that you provide information regarding any applicable permits that may be required from your office. Oliver Wind IV respectfully requests your response within 30 days of receipt of this letter. Copies of all correspondence received in response to this letter will be included with the North Dakota Public Service Commission applications. Oliver Wind IV requests the consideration of the Study Areas shown within the legal descriptions provided in the tables below and on the attached map.

Wind Project Study Area			
County	**Township**	**Range**	**Section**
Oliver	142 N	85 W	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 28, 29, 30
	142 N	86 W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
	142 N	87 W	1, 12, 13
	143 N	85 W	7, 8, 9, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35
	143 N	86 W	10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
	143 N	87 W	25, 36

Transmission Line Study Area			
County	**Township**	**Range**	**Section**
Oliver	142 N	85 W	4, 5, 6, 7, 8
	142 N	86 W	1
	143 N	85 W	2, 3, 4, 7, 8, 9, 10, 11, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30, 31, 32, 33
	143 N	86 W	12, 13, 14, 23, 24, 25, 26, 36
Mercer	144 N	84 W	16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 32, 33, 34, 35
	144 N	85 W	13, 14, 15, 21, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35

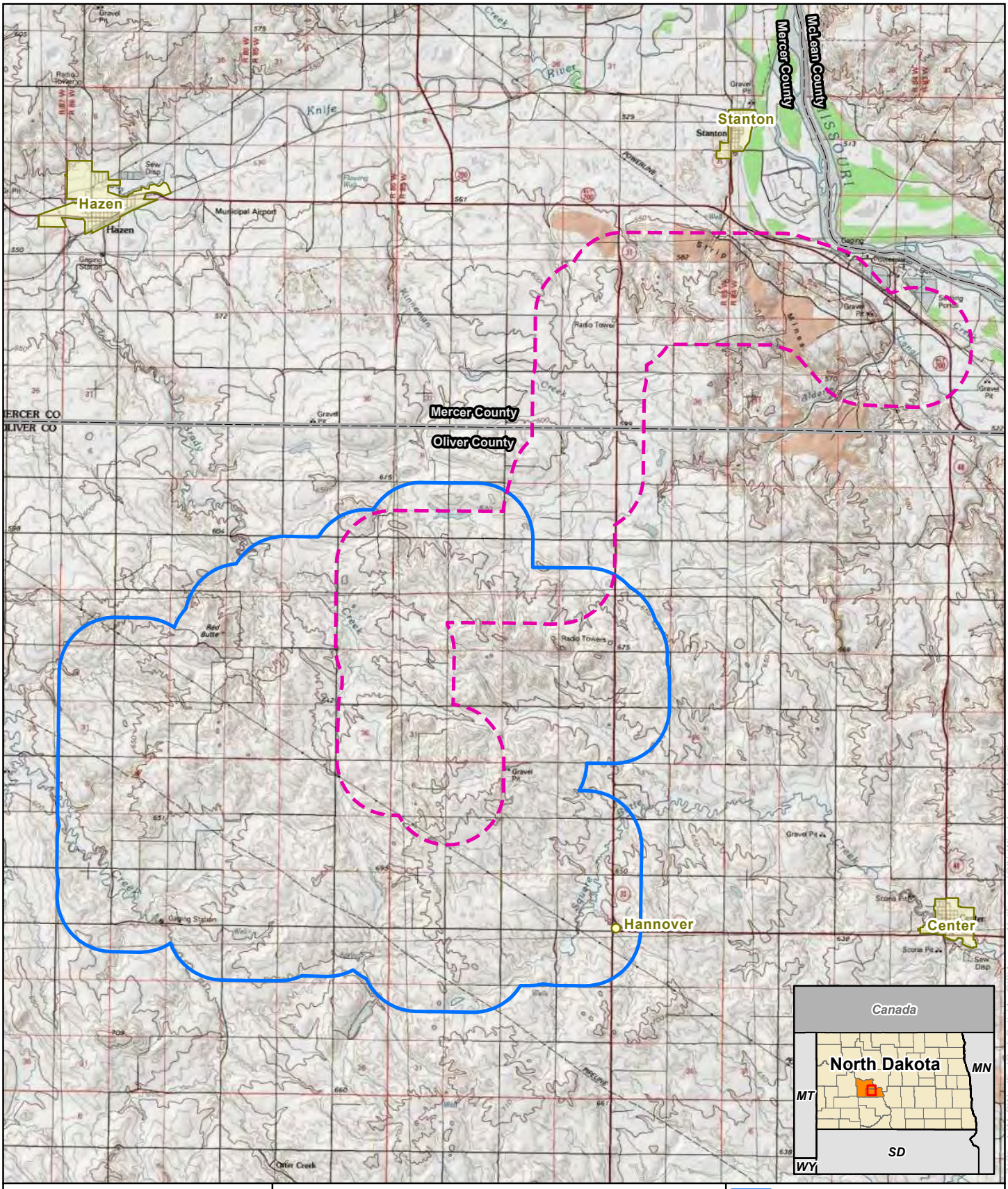
We sincerely appreciate your cooperation in this matter. Oliver Wind IV has contracted with Merjent on this Project. If further information is desired or if you have comments regarding the Project, please contact me at the address provided below, by e-mail at lindsey.churchill@merjent.com, or by phone at 701-526-4848.

Sincerely,

Lindsey Churchill, PhD, PWS
Senior Project Manager

Merjent, Inc.
1 Main Street SE, Suite 300
Minneapolis, Minnesota 55414

Enclosure: Study Area Map



Study Area Map

Oliver Wind IV Energy Centerr and Transmission Line

Mercer and Oliver Counties, North Dakota

Source: Z:\Clients\M_P\NextEra\Red_Butte\ArcGIS\Agency_Notification\OIV_Wind_AgencyNotification.aprx

Date: (3/22/2023)

Appendix C2
North Dakota Aeronautics Commission

Good morning Lindsey,

We received your letter on the Red Butte and Transmission Line project. It does not appear the location will have an impact on our nearest public airport, Mercer County Regional Airport (Hazen). However, I do not see a proposed height of transmission line or construction equipment on the letter you sent. If the height is above 200' AGL then you need to submit a case to the FAA for review. You can do so on this website https://oeaaa.faa.gov/oeaaa/external/portal.jsp

Below are the rules in determining whether a case needs to be filed or not. You can file a case on the above website and also find instructions on how to do so. Please let me know if you have any questions.

Who Needs to File

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference 14 CFR Part 77.9.

Please click here to use the FAA's Notice Criteria Tool to determine if you meet the requirements to file notice of your construction or alteration

OR

In accordance with 14 CFR Part 77.9, if you propose any of the following types of construction or alteration, you must file notice with the FAA at least 45 days prior to beginning construction:

- any construction or alteration that exceeds an imaginary surface extending outward and upward at any of the following slopes:
  - 100 to 1 for a horizontal distance of 20,000 ft. from the nearest point of the nearest runway of each airport described in 14 CFR 77.9(d) with its longest runway more than 3,200 ft. in actual length, excluding heliports
  - 50 to 1 for a horizontal distance of 10,000 ft. from the nearest point of the nearest runway of each airport described in 14 CFR 77.9(d) with its longest runway no more than 3,200 ft. in actual length, excluding heliports
  - 25 to 1 for a horizontal distance of 5,000 ft. from the nearest point of the nearest landing and takeoff area of each heliport described in 14 CFR 77.9(d);
- OR any highway, railroad, waterway or other traverse way for mobile objects, of a height which, if adjusted upward as defined in 14 CFR 77.9(c) would exceed a standard of 14 CFR 77.9 (a) or (b);
- OR your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy;
- OR your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception;
- OR any construction or alteration exceeding 200 feet above ground level, regardless of location;
- OR any construction or alteration located on an airport described in 14 CFR 77.9(d);
- OR filing has been requested by the FAA.

Thank you!

Nels Lund
Airport Planner
North Dakota Aeronautics Commission
PO Box 5020
Bismarck, ND 58502-5020
701-328-9655 (Office)
701-955-8280 (Cell)
https://aero.nd.gov

Appendix C3
North Dakota Industrial Commission

From: Holweger, Todd L.
To: Lindsey Churchill
Subject: EXTERNAL: Proposed Oliver Wind IV Energy Center
Date: Tuesday, April 25, 2023 3:13:22 PM
Attachments: image001.png
Proposed Oliver Wind IV Energy center letter.pdf

CAUTION: This email originated from outside of Merjent.

Lindsey,

After reviewing the "Wind Project Study Area" it appears that the only well that exists is:
File no. 38701, Summit Carbon Solutions, LLC, Slash Lazy H 5, Section 6-142N-86W.

There are no wells within the "Transmission Line Study Area".

Thank you,

Todd L. Holweger
Permit Manager/Geophysical Supervisor, Oil & Gas Division

701.328.8024 (o) • tholweger@nd.gov • https://www.dmr.nd.gov/oilgas/

Appendix C4
North Dakota Department of Transportation

NORTH Dakota | Transportation
Be Legendary.™

September 4, 2019

Lindsey Churchill, PHD, PWS
AECOM
Environmental Project Manager
1000 East Calgary Avenue, Suite1
Bismarck ND 58503

RED BUTTE WIND ENERGY CENTER AND 230 kV TRANSMISSION LINE PROJECT, OLIVER AND MERCER COUNTIES, NORTH DAKOTA

We have reviewed your July 31, 2019, letter.

This project should have no adverse effect on the North Dakota Department of Transportation highways.

However, if because of this project any work needs to be done on highway right of way, appropriate permits and risk management documents will need to be obtained from the Department of Transportation District Engineers, Rob Rayhorn at 701-227-6510.

CHAD M. ORN, P.E., DIRECTOR – OFFICE OF PROJECT DEVELOPMENT

57/cmo/js
c: Rob Rayhorn, Dickinson District Engineer

Appendix C5
State Historical Society of North Dakota

August 6, 2019

Ms. Lindsey Churchill, Ph.D.
Environmental Project Manager
AECOM
1000 East Calgary Avenue Suite 1
Bismarck, ND 58503

ND SHPO Ref: 19-0538 PSC Red Butte Wind Energy Center and 230 kV Transmission Line Project in Oliver and Mercer Counties, North Dakota

Dear Ms. Churchill,

We reviewed your preliminary information on ND SHPO Ref: 19-0538 PSC Red Butte Wind Energy Center and 230 kV Transmission Line Project in Oliver and Mercer Counties, North Dakota. We recommend survey for cultural resources as follows:

- A current Class I (file search) to determine any additional recorded cultural resources in the project area.

- A Class II (reconnaissance) and Class III (pedestrian) survey by a permitted architectural historian for standing buildings and structures (including cemeteries) over 50 years old in the visual Area of Potential Effect (APE). This is within a two-mile radius of individual turbine locations. The purpose is to evaluate any architectural or structural features that may be eligible for nomination to the National Register of Historic Places. At least three out of the seven aspects of integrity used to evaluate historic properties could be impacted by the proposed project: the setting, feeling, and association of historic sites. We also may have concerns regarding the visitor's experience and the line of site of a tall transmission line in the vicinity of Knife River Indian Villages National Historic Site (KNRI) and Fort Clark State Historic Site. You may want to consider consultation with the Site Superintendent of KNRI.

- A Class III archaeological survey of all areas of direct impact including crane paths, met towers, access roads, turbine locations and staging areas, unless the footprint has been recently surveyed for cultural resources.

Thank you for the opportunity to review this project to date. We look forward to review of the Class I/Class III surveys. Please include the ND SHPO reference number listed above in any further correspondence for this specific project. If you have any questions, please contact Andrew Clark at (701)-328-3574 or Susan Quinnell at (701) 328-3576 or squinnell@nd.gov.

Sincerely,

Claudia J. Berg
Director, State Historical Society of North Dakota

June 21, 2021

Melinda McCarthy
AECOM
1000 East Calgary Ave, Ste 1
Bismarck, ND 58503

ND SHPO Ref.: 19-0332 Red Butte Wind Energy Center transmission line NextEra in portions of 33 Sections in Mercer and Oliver Counties, North Dakota

Dear Melinda McCarthy,

We reviewed the report for ND SHPO Ref: 19-0332 Red Butte Wind Energy Center transmission line NextEra in portions of 33 Sections in Mercer and Oliver Counties, titled "Red Butte Transmission Line: A Class III Cultural Resource Inventory in Mercer and Oliver Counties, North Dakota" and find this AECOM report by Christina M. Huling, Melinda M. McCarthy, Marcia L. Bender, Rebecca N. Pace, Alexander D. Cassidy-Neumiller, and Robin M. Roberts acceptable. We will add it to our Manuscript Collection. We also concur with no significant archeological sites directly affected for this portion of the project.

If you have any questions, please contact either Andrew Clark, Chief Archeologist at (701) 328-3574 or andrewclark@nd.gov or Lorna Meidinger, Historic Preservation Specialist at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson PhD
State Historic Preservation Officer
(North Dakota)

19-0332

June 23, 2021

Melinda McCarthy
AECOM
1000 East Calgary Ave, Ste 1
Bismarck, ND 58503

ND SHPO Ref.: 19-0332 Red Butte Wind Energy Center transmission line NextEra in portions of 33 Sections in Mercer and Oliver Counties, North Dakota

Dear Melinda McCarthy,

We reviewed the report for ND SHPO Ref: 19-0332 Red Butte Wind Energy Center transmission line NextEra in portions of 33 Sections in Mercer and Oliver Counties, titled "A Class II/III Architectural Survey – Red Butte Wind Energy Center in Oliver County, North Dakota" and find this AECOM report by Melinda M. McCarthy acceptable. We will add it to our Manuscript Collection. We also concur with the eligibility recommendations within the report.

If you have any questions, please contact Lorna Meidinger, Historic Preservation Specialist at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson PhD
State Historic Preservation Officer
(North Dakota)

19-0332

July 14, 2021

Christina Huling
AECOM
1000 E Calgary Ave, Ste 1
Bismarck, ND 58503

ND SHPO Ref: 19-0332 Red Butte Wind Energy Center transmission line NextEra in portions of 33 Sections in Mercer and Oliver Counties, North Dakota

Dear Ms. Huling,

We received ND SHPO Ref: 19-0332 "Red Butte Wind Energy Center: Class III Cultural Resource Inventory Results for the 2019 and 2020 Field Seasons in Oliver County, North Dakota" in portions of [T141N R85W Sections 2, 11, & 14, T142N R85W Sections 5-9, 15-30, & 33-36, T142N R86W Sections 1-5, 8-15, 17, 25, 26, 35, & 36, T143N R85W Sections 7, 17, 19-22, 27, & 29-33 and T143N R86W Section 1, 12-14, 22-27, & 32-36] and find this AECOM report by Christina Huling, Melinda McCarthy, Kaleigh Perry, Rebecca Pace, Lucy Harrington, Robin Roberts, Max Bieber, Marcia Bender, and Alexander Cassidy-Neumiller acceptable. We will add it to our Manuscript Collection. We also concur with no significant sites affected.

If you have any questions, please contact either Andrew Clark, Chief Archeologist at (701) 328-3574 or andrewclark@nd.gov or Lorna Meidinger, Historic Preservation Specialist at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson PhD
State Historic Preservation Officer
(North Dakota)

19-0332

April 4, 2023

Dr. Lindsey Churchill
Merjent, Inc.
1 Main Street SE, Ste 300
Minneapolis, MN 55414

ND SHPO Ref: 23-0203 Oliver Wind IV Energy Center and Transmission Line in Oliver and Mercer Counties, North Dakota

Dear Dr. Churchill,

We reviewed your preliminary information on ND SHPO Ref: 23-0203 Oliver Wind IV Energy Center and Transmission Line in Oliver and Mercer Counties, North Dakota. We recommend survey for cultural resources as follows:

- A current Class I: Literature Search to determine any previously recorded cultural resources in the project area.

- A Class II (reconnaissance) and Class III (intensive) survey by a permitted architectural historian for standing buildings and structures (including cemeteries) over 45 years old in the visual Area of Potential Effect (APE). This is within a two-mile radius of individual turbine locations. The purpose is to evaluate any architectural or structural features that may be eligible for nomination to the National Register of Historic Places or the State Historic Sites Registry. At least three out of the seven aspects of integrity used to evaluate historic properties could be impacted by the proposed project: the setting, feeling, and association of historic sites.

- A Class III intensive archaeological survey of all areas of direct impact including crane paths, met towers, access roads, turbine locations and staging areas, unless the footprint has been recently surveyed for cultural resources.

Thank you for the opportunity to review this project to date. We look forward to review of the Class II/Class III surveys. Please include the ND SHPO reference number listed above in any further correspondence for this specific project. If you have any questions, please contact Lorna Meidinger, Lead Historic Preservationist, at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson, PhD
Director, State Historical Society of North Dakota

23-0203

September 12, 2023

Melinda McCarthy
Burns and McDonnell Engineering Company
3255 Greensboro Drive
Suite 104
Bismarck, ND 58503

SHSND Ref.: 23-0203 Oliver Wind IV Energy Center and Transmission Line in portions of 137 sections in Mercer and Oliver Counties, North Dakota

Dear Melinda,

Pursuant to our conversation today, this letter is to acknowledge that the State Historical Society of North Dakota does not currently require a viewshed analysis for the transmission line portion of the proposed project for SHSND Ref.: 23-0203 Oliver Wind IV Energy Center and Transmission Line provided it takes place in the location and manner described in the documentation.

The Knife River Indian Villages National Historic Site has voiced concern for the visual and auditory effects on their park unit as well as the Fort Clark State Historic Site, which is currently in-process of being nominated for a National Historic Landmark. It is our understanding that NextEra is communicating directly with that National Park Service unit regarding this concern.

Please include the SHSND Reference number listed above in further correspondence for this specific project. If you have any questions please contact Lorna Meidinger, Historic Preservation Specialist at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson, PhD
Director, State Historical Society of North Dakota

23-0203

Appendix C6
North Dakota Department of Trust Lands

1707 North 9th Street
PO Box 5523
Bismarck, ND 58506-5523
Phone: (701) 328 – 2800
Fax: (701) 328 – 3650

https://land.nd.gov

DEPARTMENT OF
NDTRUST LANDS
INVESTING FOR EDUCATION

Jodi A. Smith, Commissioner

August 12, 2019

LINDSEY (MEYERS) CHURCHILL
ENVIRONMENTAL PROJECT MANAGER
AECOM
1000 EAST CALGARY AVE, SUITE 1
BISMARCK, ND 58503

RE: Red Butte Wind Energy Center and 230 kV Transmission Line Project; Oliver and Mercer Counties, ND

Dear Ms. Churchill:

We received your letter dated July 31, 2019, regarding a request for information on the proposed Red Butte Wind Energy Center and 230 kV Transmission Line Project in Oliver and Mercer Counties.

To obtain an easement across trust Lands, an on-line application form must be completed. This application can be found at: https://www.land.nd.gov/SurfaceROW/RowApplicationForm . Any proposed towers or lines would be subject to review by the surface division staff and approval by the Land Commissioner on behalf of the Board of University and School Lands.

The following items may be considered in the review of an easement application:

1. Financial benefit to the trusts;
2. Availability of alternate encumbrance site or route;
3. The least environmentally damaging site or route regardless of property ownership;
4. Physical stability of the landscape;
5. Other potential future uses for the trust lands, including urban development;
6. Potential mineral and other material development including oil, gas, coal, cement materials, sodium sulfate, sand and gravel, road material, building stone, chemical substances, metallic ores, uranium ores, or colloidal or other clays;
7. Feasibility for reclamation;
8. Maintenance of existing wetlands and water flows;
9. Any cultural, historical, archeological, and paleontological resources;
10. Federally listed threatened and endangered species;
11. Location of the proposed route or site in relation to section lines, quarter section lines and corridors;
12. Potential liability to the trusts;
13. Applicant's past encumbrances on trust lands;
14. Applicant's financial stability; and
15. Any other information relevant to the application which would assist in the determination.

There are school trust surface interests that are managed by the North Dakota Department of Trust Lands on behalf of the Board of University and School Lands which are located within or near the proposed project area. These surface interests are as follows:

County	Township	Range	Section	Subdivision
Oliver	142	85	16	E2
Oliver	142	85	30	NW4
Oliver	142	86	36	E2
Oliver	143	86	26	NW4

There are no active Coal Leases on school trust lands within the project area. Attached for your information is a spreadsheet of state mineral interests within the project area.

Please be advised the Board of University and School Lands will not move forward on Wind Projects until site inspection and review have been completed and all local and state approvals have been obtained.

If you have any questions, feel free to contact our office at 701-328-2800.

Sincerely,

Michael Humann
Surface Division Manager

enc: State Mineral Interest spreadsheet

No.	County	Oil Lease	Legal	Subdv	Mineral Interest	Net Acres	Trust	Status	Acquisition
3300870	OLI	0000000	141-85-13-NW	NW4	0.05	8	L	A	L
3300880	OLI	0000000	141-85-14-NE	NE4	0.5	80	L	A	L
3300890	OLI	0000000	141-85-14-SE	SE4	0.5	80	L	A	L
3300900	OLI	0000000	141-85-15-NW	NW4	0.5	80	A	A	A
3302010	OLI	0000000	142-84-4-NE	SW4NE4, LOT 2	0.5	40.08	A	A	A
3302020	OLI	0000000	142-84-4-NW	S2NW4, LOTS 3,4	0.5	80.05	A	A	A
3302030	OLI	0000000	142-84-4-SE	S2SE4	0.5	40	L	A	L
3302040	OLI	0000000	142-84-4-SW	SW4	0.5	80	L	A	L
3302100	OLI	0000000	142-84-16-NE	NE4	0.5	80	A	A	G
3302110	OLI	0000000	142-84-16-NW	NW4	0.5	80	A	A	G
3302120	OLI	0000000	142-84-16-SE	SE4	0.5	80	A	A	G
3302130	OLI	0000000	142-84-16-SW	SW4	0.5	80	A	A	G
3302200	OLI	0000000	142-84-29-SE	SE4	0.5	80	L	A	L
3302210	OLI	0000000	142-84-29-SW	SW4	0.5	80	A	A	A
3302220	OLI	0000000	142-84-30-NW	E2NW4, LOTS 1,2	0.5	78.39	L	A	L
3302270	OLI	0000000	142-85-10-NE	N2NE4	0.5	40	B	A	A
3302280	OLI	0000000	142-85-11-NW	NW4	0.5	80	B	A	A
3302290	OLI	0000000	142-85-11-SW	SW4	0.5	80	B	A	A
3302300	OLI	0000000	142-85-16-NE	NE4	1	160	A	A	G
3302310	OLI	0000000	142-85-16-NW	NW4	1	160	A	A	G
3302320	OLI	0000000	142-85-16-SE	SE4	1	160	A	A	G
3302330	OLI	0000000	142-85-16-SW	SW4	0.5	80	A	A	G
3302340	OLI	0000000	142-85-20-NE	NE4	0.5	80	A	A	A
3302350	OLI	0000000	142-85-20-SE	SE4	0.5	80	A	A	A
3302360	OLI	0000000	142-85-22-SE	SE4 LESS 2.11 AC DEEDED TO CO	0.05	7.89	L	A	L
3302370	OLI	0000000	142-85-30-NW	E2NW4, LOTS 1,2	1	158.49	A	A	A
3302380	OLI	0000000	142-85-36-NE	NE4	0.5	80	A	A	G

3302390	OLI	0000000	142-85-36-NW	NW4	0.5	80	A	A	G
3302400	OLI	0000000	142-85-36-SE	SE4	0.5	80	A	A	G
3302410	OLI	0000000	142-85-36-SW	SW4	0.5	80	A	A	G
3302420	OLI	0000000	142-86-3-NW	SW4NW4, LOT 4	0.5	39.48	L	A	L
3302430	OLI	0000000	142-86-3-SW	SW4	0.5	80	L	A	L
3302440	OLI	0000000	142-86-4-NW	S2NW4, LOTS 3,4	0.5	79.52	L	A	L
3302460	OLI	0000000	142-86-12-SE	S2SE4	0.5	40	U	A	A
3304710	OLI	0000000	142-86-12-SW	S2SW4	0.5	40	U	A	A
3302510	OLI	0000000	142-86-24-SE	NW4SE4	0.05	2	L	A	L
3304720	OLI	0000000	142-86-24-SW	NE4SW4, S2SW4	0.05	6	L	A	L
3302520	OLI	0000000	142-86-25-NE	NE4	0.05	8	L	A	L
3302590	OLI	0000000	142-86-36-NE	NE4	1	160	A	A	G
3302600	OLI	0000000	142-86-36-NW	NW4	0.5	80	A	A	G
3302610	OLI	0000000	142-86-36-SE	SE4	1	160	A	A	G
3302620	OLI	0000000	142-86-36-SW	SW4	0.5	80	A	A	G
3303410	OLI	0000000	143-84-33-NW	NW4	0.5	80	N	A	A
3303420	OLI	0000000	143-84-36-NE	NE4	1	160	A	A	G
3303430	OLI	0000000	143-84-36-NW	NW4	1	160	A	A	G
3303440	OLI	0000000	143-84-36-SE	SE4	1	160	A	A	G
3303450	OLI	0000000	143-84-36-SW	SW4	1	160	A	A	G
3303470	OLI	0000000	143-85-10-NE	NE4	0.5	80	A	A	A
3303500	OLI	0000000	143-85-15-NE	NE4	0.05	8	L	A	L
3303510	OLI	0000000	143-85-15-SE	SE4	0.05	8	L	A	L
3303520	OLI	0000000	143-85-16-NE	NE4	0.5	80	A	A	G
3303530	OLI	0000000	143-85-16-NW	NW4	0.5	80	A	A	G
3303540	OLI	0000000	143-85-16-SE	SE4	1	160	A	A	G
3303550	OLI	0000000	143-85-16-SW	SW4	1	160	A	A	G
3303560	OLI	0000000	143-85-22-NE	NE4	0.05	8	L	A	L
3303570	OLI	0000000	143-85-22-SE	SE4	0.05	7.93	L	A	L
3303580	OLI	0000000	143-85-23-SE	S2SE4	0.5	40	U	A	A

3303590	OLI	0000000	143-85-26-NE	N2NE4, SW4NE4	0.5	60	U	A	A
3304820	OLI	0000000	143-85-26-NW	NE4NW4	0.5	20	U	A	A
3303600	OLI	0000000	143-85-35-SE	SE4	0.5	80	A	A	A
3303610	OLI	0000000	143-85-36-NE	NE4	0.5	80	A	A	G
3303620	OLI	0000000	143-85-36-NW	NW4	0.5	80	A	A	G
3303630	OLI	0000000	143-85-36-SE	SE4	0.5	80	A	A	G
3303640	OLI	0000000	143-85-36-SW	SW4	0.5	80	A	A	G
3303770	OLI	0000000	143-86-14-NE	N2NE4	0.5	40	L	A	L
3304840	OLI	0000000	143-86-14-NW	NE4NW4	0.5	20	L	A	L
3303850	OLI	0000000	143-86-22-SE	W2SE4	0.5	40	L	A	L
3304850	OLI	0000000	143-86-22-SW	E2SW4	0.5	40	L	A	L
3303860	OLI	0000000	143-86-26-NE	NE4	0.5	80	L	A	L
3303870	OLI	0000000	143-86-26-NW	NW4	1	160	D	A	A
3303900	OLI	0000000	143-86-36-NE	NE4	1	160	A	A	G
3303910	OLI	0000000	143-86-36-NW	NW4	1	160	A	A	G
3303920	OLI	0000000	143-86-36-SE	SE4	1	160	A	A	G
3303930	OLI	0000000	143-86-36-SW	SW4	1	160	A	A	G
2801220	MCL	0000000	144-84-16-NE	NE4	0.5	80	A	A	G
2801230	MCL	0000000	144-84-16-NW	NW4	0.5	80	A	A	G
2801240	MCL	0000000	144-84-16-SE	LOTS 1,2	0.5	52.15	A	A	G
2801250	MCL	0000000	144-84-16-SW	LOTS 3,4	0.5	42.65	A	A	G
2903020	MER	0000000	144-84-22-NE	NE4	0.05	8	L	A	L
2907450	MER	0000000	144-84-22-NW	NW4	0.05	8	L	A	L
2817070	MCL	0000000	144-84-23-NE	THAT PART OF NE4 RECEIVED AS ACCRETIONS TO 13: SW4	0.5	5.5	A	A	A
2903040	MER	0000000	144-84-28-NW	NW4	0.5	80	L	A	L
2903050	MER	0000000	144-84-29-NE	NE4	0.5	80	L	A	L
2903060	MER	0000000	144-84-29-NW	NW4	0.5	80	L	A	L
2903070	MER	0000000	144-84-30-NE	NE4	0.05	8	L	A	L
2903270	MER	0000000	144-85-20-SW	SW4	0.5	80	A	A	A

2903280	MER	0000000	144-85-26-NE	NE4	0.05	8	L	A	L
2903290	MER	0000000	144-85-26-NW	NW4	0.5	80	L	A	L
2903370	MER	0000000	144-85-36-NE	NE4	0.5	80	A	A	G
2903380	MER	0000000	144-85-36-NW	NW4	0.5	80	A	A	G
2903390	MER	0000000	144-85-36-SE	SE4	0.5	80	A	A	G
2903400	MER	0000000	144-85-36-SW	SW4	0.5	80	A	A	G

Legend: Coal Ownership

%	Trust	Acq Code	Ownership
5 & 50	L	L	Coal ownership unknown
50	A	A	Coal ownership unknown
50	A	G	Coal ownership dependent on year sold
100	A	G	State owns all coal
50	B	A	Coal ownership unknown
100	D	A	Coal ownership unknown
50	N	A	Coal ownership unknown
50	U	A	Coal ownership unknown

From:	Lindsey Churchill
To:	Spangelo, Kayla M.
Cc:	Dirk Churchill
Subject:	RE: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties.
Date:	Thursday, May 11, 2023 4:15:33 PM
Attachments:	image002.png image003.png

Received, thank you.

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

merjent.
1 Main Street SE, Suite 300
Minneapolis, MN 55414
612.746.3660 main
www.merjent.com

From: Spangelo, Kayla M. <kspangelo@nd.gov>
Sent: Thursday, May 11, 2023 4:11 PM
To: Lindsey Churchill <lindsey.churchill@merjent.com>
Subject: RE: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties.
Importance: High

Lindsey,

Please add the below information received from NDDTL's Mineral division regarding Coal Leases present in the specific provided Tract List(s) in the received comment letter.

Township Range	Section	Coal Lease Comment
143-85	35	Coal Lease CO1400038 covers 143-85-35 SE. The primary term of this lease has been extended to 4/30/2029.

Please let me know if you have any questions.

Thank you,

Kayla Spangelo
Natural Resources Professional - Rights of Ways

701.328.1916 • kspangelo@nd.gov • land.nd.gov • 1707 N 9th St • Bismarck, ND 58501

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From:	Lindsey Churchill
To:	Spangelo, Kayla M.
Cc:	Brown, Dina; Dirk Churchill
Subject:	RE: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties.
Date:	Monday, May 8, 2023 10:43:33 AM
Attachments:	image001.png image002.png

Kayla,

Thank you for the comment letter. To address your previous question below, the driving factor was that the ND Game and Fish Department has discouraged siting turbines on grasslands, with an emphasis on unbroken grasslands and restored native prairie. When we initially evaluated the land cover of the NDDTL parcels via desktop aerial imagery and windshield surveys, the parcels mostly or wholly contained unbroken grasslands and/or native prairie. The same land cover considerations were also given to private lands.

Thanks,

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

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Minneapolis, MN 55414
612.746.3660 main
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From: Spangelo, Kayla M. <kspangelo@nd.gov>
Sent: Thursday, May 4, 2023 11:53 AM
To: Lindsey Churchill <lindsey.churchill@merjent.com>
Subject: RE: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties.

Hello,

Comment letter is attached.

Thank you,

Kayla Spangelo
Natural Resources Professional - Rights of Ways

701.328.1916 • kspangelo@nd.gov • land.nd.gov • 1707 N 9th St • Bismarck, ND 58501

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From: Spangelo, Kayla M.
Sent: Thursday, April 27, 2023 8:27 AM
To: 'Lindsey Churchill' <lindsey.churchill@merjent.com>
Subject: RE: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties.

Nothing? There were several tracts within the project area identified on the received letter? Is there a reason no turbines were proposed on Trust Lands?

Thank you,

Kayla Spangelo

From: Lindsey Churchill <lindsey.churchill@merjent.com>
Sent: Wednesday, April 26, 2023 4:18 PM
To: Spangelo, Kayla M. <kspangelo@nd.gov>
Subject: RE: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties.

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Kayla,

At this time, infrastructure is not planned on NDDTL surface lands. If that changes, we will let you know as soon as possible.

Thanks,

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

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From: Spangelo, Kayla M. <kspangelo@nd.gov>

Sent: Wednesday, April 26, 2023 12:02 PM
To: Lindsey Churchill <lindsey.churchill@merjent.com>
Subject: RE: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties.

Yes, that should be fine, thank you. We are hopeful to still meet the requested time frame but as you can imagine, things are picking up for the spring.

If it is very likely that Trust lands are going to be included, can you please direct Oliver Wind to apply for a wind farm and a transmission line as soon as possible? Especially since they are already working towards PSC approval. NDDTL has nothing so we have no reviews and/or onsites planned to site so the timeline is not looking very encouraging.

Kayla Spangelo

From: Lindsey Churchill <lindsey.churchill@merjent.com>
Sent: Wednesday, April 26, 2023 11:07 AM
To: Spangelo, Kayla M. <kspangelo@nd.gov>
Subject: RE: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties.

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Kayla,

Yes, however, we are currently in the process of writing the PSC applications. Would you be able to respond by May 19?

Thanks,

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

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Minneapolis, MN 55414
612.746.3660 main
www.merjent.com

From: Spangelo, Kayla M. <kspangelo@nd.gov>
Sent: Wednesday, April 26, 2023 10:46 AM
To: Lindsey Churchill <lindsey.churchill@merjent.com>
Subject: EXTERNAL: RE: Proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver

and Mercer Counties.
Importance: High

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Lindsey,

The Department has been reviewing the proposed project(s) and area(s) listed in the letter received on April 3, 2023 regarding the proposed Oliver Wind IV Energy Center & 345-kV Transmission Line - Oliver and Mercer Counties. Is it possible to extend the timeframe for responses?

Thank you,

Kayla Spangelo
Natural Resources Professional - Rights of Ways

701.328.1916 • kspangelo@nd.gov • land.nd.gov • 1707 N 9th St • Bismarck, ND 58501

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May 4, 2023

MERJENT, INC.
ATTN: LINDSEY CHURCHILL
1 MAIN STREET SE, SUITE 300
MINNEAPOLIS, MN 55414

Hello,

The North Dakota Department of Trust Lands (NDDTL) has received your request for comment RE: NOTIFICATION OF THE PROPOSED OLIVER WIND IV ENERGY CENTER IN OLIVER COUNTY, NORTH DAKOTA AND ASSOCIATED 345-KV TRANSMISSION LINE IN OLIVER AND MERCER COUNTIES, ND.

NDDTL manages the below surface tracts on behalf of the Board of University and School Lands located within the proposed project boundary area(s). NDDTL has various existing agreements and ongoing negotiations within the proposed area for various types of activities and agreements.

DTL managed Surface Tracts within proposed project area:		
County	**Township-Range-Section**	**Subdivision**
Oliver	142-85-16	NE4
Oliver	142-85-16	SE4
Oliver	142-85-30	E2NW4, Lots 1,2
Oliver	143-86-26	NW4
Oliver	143-87-36	SW4

NDDTL has not received an application from Oliver Wind IV for this project (wind farm nor transmission line) at the time of this letter. Any proposed projects crossing NDDTL managed property would need to apply for a Rights of Way agreement and would be subject to review and approval by the Board of University and School Lands. NDDTL ROW applications can be completed by navigating to the NDDTL webpage, selecting Divisions, then selecting Surface & Minerals Management, and then selecting the Rights-of-Way and Special Access option on the left side of the screen OR by navigating to the following webpage: https://www.land.nd.gov/rightsofway. The Application can be found under the Form section.

NDDTL reviews the financial benefit to the trusts; availability of alternate encumbrance site or route; least environmentally damaging site or route regardless of property ownership; physical stability of the landscape; other potential future uses for the trust lands, including urban

Joseph A. Heringer COMMISSIONER
1707 North 9th Street | P.O. Box 5523 | Bismarck, ND 58506-5523
PHONE: 701-328-2800 | FAX: 701-328-3650 | https://land.nd.gov

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development; potential mineral and other material development including oil, gas, coal, construction aggregate, sodium sulfate, chemical substances, metallic ore, or uranium ore; feasibility for reclamation; maintenance of existing wetlands and water flows; any cultural, historical, archeological, and paleontological resources; habitat for federally listed threatened and endangered species; location of the proposed route or site in relation to section lines, quarter section lines and corridors; potential liability to the trusts; applicant's past encumbrances on trust lands; applicant's financial stability; and any other information relevant to the application which would assist in the determination.

Surveying/engineering companies completing surveys on Trust property must possess a valid planning and preconstruction survey permit and the entity requesting the right of way must have applied for a right of way and received a ROW tracking number from NDDTL prior to surveying on Trust property. Any survey or construction activities cannot begin on NDDTL managed property until the Commissioner has signed the appropriate documents.

If you have any questions, feel free to contact NDDTL via phone at 701-328-2800 or email to landrow@nd.gov.

Sincerely,

Kayla Spangelo

Kayla Spangelo
Natural Resources Professional

North Dakota Department of Trust Lands

Joseph A. Heringer COMMISSIONER
1707 North 9th Street | P.O. Box 5523 | Bismarck, ND 58506-5523
PHONE: 701-328-2800 | FAX: 701-328-3650 | https://land.nd.gov

Appendix C7
North Dakota Parks and Recreation Department

From: Lindsey Churchill
To: Dirk, Christine
Cc: Dirk Churchill; Brown, Dina
Subject: RE: EXTERNAL: Oliver Wind IV Energy Center and transmission line request
Date: Thursday, June 8, 2023 2:04:00 PM
Attachments: image001.png

Christine,

I wanted to follow up and see if you need anything additional from me or if you have a response for the Oliver IV project.

Thanks,

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

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Minneapolis, MN 55414
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From: Lindsey Churchill
Sent: Wednesday, May 3, 2023 3:53 PM
To: Dirk, Christine <cdirk@nd.gov>
Subject: RE: EXTERNAL: Oliver Wind IV Energy Center and transmission line request

Ok, thanks Christine.

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

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Minneapolis, MN 55414
612.746.3660 main
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From: Dirk, Christine <cdirk@nd.gov>
Sent: Wednesday, May 3, 2023 2:09 PM
To: Lindsey Churchill <lindsey.churchill@merjent.com>

Subject: RE: EXTERNAL: Oliver Wind IV Energy Center and transmission line request

Hi Lindsey,

I should have mentioned that my email won't accept zip files. No worries. I used the map to draw out the approximate boundary. Have a great day.

Chris

Christine Dirk
GIS Specialist

701.328.5368 • parkrec.nd.gov

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From: Lindsey Churchill <lindsey.churchill@merjent.com>
Sent: Monday, May 1, 2023 3:58 PM
To: Dirk, Christine <cdirk@nd.gov>
Cc: Brown, Dina <Dina.Brown@nexteraenergy.com>
Subject: RE: EXTERNAL: Oliver Wind IV Energy Center and transmission line request

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Christine,

The email I sent below containing the shapefiles was returned as undeliverable. Is there a preferred method for sending shapefiles? The attachment was only 125 KB, so I don't think it was due to size.

Thanks,

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

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Minneapolis, MN 55414
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www.merjent.com

From: Lindsey Churchill
Sent: Monday, May 1, 2023 3:54 PM
To: Dirk, Christine <cdirk@nd.gov>
Cc: Brown, Dina <Dina.Brown@nexteraenergy.com>
Subject: RE: EXTERNAL: Oliver Wind IV Energy Center and transmission line request

Christine,

Please see attached for the shapefiles of the wind and transmission project study areas. Let me know if you have any other questions.

Regards,

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

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From: Dirk, Christine <cdirk@nd.gov>
Sent: Wednesday, April 26, 2023 2:29 PM
To: Lindsey Churchill <lindsey.churchill@merjent.com>
Subject: EXTERNAL: Oliver Wind IV Energy Center and transmission line request

CAUTION: This email originated from outside of Merjent.

Hello,

I am working on a response to the Oliver Wind IV Energy Center and transmission line project. Do you happen to have a shapefile of the project areas that you could share with me? Thanks.

Christine Dirk
GIS Specialist

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Appendix C8
Natural Resources Conservation Service

USDA
United States Department of Agriculture

Natural Resources
Conservation Service

Bismarck State Office
PO Box 1458
Bismarck, ND
58502-1458

Voice 701.530.2000
Fax 855-813-7556

April 5, 2023

Lindsey Churchill, PhD, PWS
Merjent, Inc.
1 Main Street SE, Suite 300
Minneapolis, MN 55414

Dear Dr. Churchill:

The Natural Resources Conservation Service (NRCS) has reviewed your letter dated March 31, 2023 concerning the Proposed Oliver Wind IV (Wind Project) and associated infrastructure in Oliver and Mercer Counties, North Dakota.

NRCS has a major responsibility with the Farmland Protection Policy Act (FPPA) in documenting conversion of farmland (i.e., prime, statewide importance and local importance) to non-agriculture use when federal funding is utilized. Your solicitation letter does not mention a source of federal funding, therefore, FPPA does not apply, and no further action is needed.

The Wetland Conservation Provisions of the 1985 Food Security Act, as amended, provide that if a USDA participant converts a wetland for the purpose or to have the effect of making agricultural production possible, loss of USDA benefits could occur. The NRCS has developed the following guidelines for the installation of permanent structures where wetlands occur. If these guidelines are followed the impacts to the wetland will be considered minimal allowing USDA participants to continue to receive USDA benefits. Following are the requirements:

- Disturbance to the wetland must be temporary.
- No drainage of wetland is allowed (temporary or permanent).
- Mechanized landscaping necessary for installation is kept to a minimum and preconstruction contours are maintained.
- Temporary side cast material must be placed in such a manner not to be dispersed in the wetland.
- All trenches must be backfilled to the original wetland bottom elevation.

Potentially impacted USDA participants that wish to request a certified wetland determination can be directed to the USDA Farm Service Agency (FSA) to a Highly Erodible Land Conservation (HELC) and Wetland Conservation request (WC) Certification (AD-1026) or they may contact Casey Guetter, Designated Conservationist, NRCS, Bismarck, North Dakota at (701) 989-6160 for information about conservation compliance provisions related to the project.

NRCS recommends that impacts to wetlands be avoided.

If you have additional questions pertaining to FPPA, please contact Wade Bott, State Soil Scientist, NRCS, Bismarck, North Dakota, at (701) 530-2021.

Sincerely,

WADE BOTT Digitally signed by WADE BOTT
Date: 2023.04.05 08:19:12 -05'00'

WADE D. BOTT
State Soil Scientist

Appendix C9
North Dakota Department of Water Resources

NORTH Dakota | Water Commission
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August 30, 2019

Lindsey Churchill
AECOM
1000 East Calgary Avenue
Bismarck, ND 58503

Dear Ms. Churchill:

This is in response to your request for a review of the environmental impacts associated with the Red Butte Wind Energy center and 230 kV Transmission Line Project located in Oliver and Mercer Counties, ND.

The proposed project has been reviewed by State Water Commission staff, and the following comments are provided:

- Initial review indicates the project does not require a conditional or temporary permit for water appropriation. However, if surface water or groundwater will be diverted for construction of the project, a water permit will be required per North Dakota Century Code § 61-04-02. Please consult with the Water Appropriations Division of the Office of the State Engineer if you have any questions at (701) 328-2754 or waterpermits@nd.gov.

- The State Water Commission maintains a network of observation wells across the state for monitoring the water levels and quality in glacial and bedrock aquifers. These wells are often installed in road and highway rights-of-way to limit inconvenience to the adjacent landowners. State Water Commission observation wells have a yellow protective casing extending between 1 and 3 feet above ground surface, and their locations are marked with a stake. If an observation well is encountered during project activities and must be removed, please contact the Water Appropriations Division. The State Water Commission hopes to keep all observation wells, but otherwise will ensure the well is properly abandoned.

- There are floodplains identified and/or mapped where this proposed project is to take place. Areas are designated to be in Zone A. North Dakota has no formal 'permitting' authority as a state entity in NFIP identified floodplain areas. The permitting is always done by the local entity, which has jurisdiction in the area in question. Please work closely with the County Floodplain Administrator.

Thank you for the opportunity to provide review comments. Should you have further questions, please contact me at 701-328-4970 or stevebest@nd.gov.

Sincerely,

Steven Best
Planner III

SB:dm/1570

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April 25, 2023

Lindsey Churchill, PhD, PWS
Senior Project Manager
1 Main Street SE, STE 300
Minneapolis, MN 55414

Dear Ms. Churchill:

This is in response to your request for a review of the environmental impacts associated the Oliver Wind IV Energy Center in Oliver County ND & Associated 345-kV Transmission Line in Oliver & Mercer Counties, ND.

The proposed project has been reviewed by Department of Water Resources, and the following comments are provided:

- There is a FEMA National Flood Insurance Program (NFIP) regulatory floodplain identified or mapped where this proposed project is to take place. Impacted areas are designated to be in NFIP Zone A. The State of North Dakota has no formal NFIP permitting authority, as all NFIP permitting decisions are considered by impacted NFIP participating communities, which is the community with zoning authority for the area in question. Please work directly with the local floodplain administrator of the zoning authority impacted to achieve NFIP and community compliance.

- The Department of Water Resources (DWR) and Water Resource Districts are responsible for regulating drainage and water management in North Dakota. The DWR is also responsible for regulating the construction and modification of any dike, levee, or other device. Consequently, the DWR requests to be notified regarding a proposed project's impacts, if any, to water resources, such as watercourses (i.e. streams or rivers), agricultural drains, and wetlands (i.e. ponds, sloughs, lakes, or any series thereof), and dikes, levees, and other water control devices, as any alterations, modifications, improvements, or impacts to those may require a drainage permit(s) or a construction permit(s) from the DWR.

- Initial review indicates the project does not require a conditional or temporary permit for water appropriation. However, if surface water or groundwater will be diverted for construction of the project, a water permit will be required per North Dakota Century Code § 61-04-02. Please consult with the Department of Water Resources Water Appropriation Division if you have any questions at 701-328-2754 or appropinfo@nd.gov.

- The Department of Water Resources maintains a network of observation wells across the state for monitoring the water levels and quality in glacial and bedrock aquifers. These wells are often installed in road and highway rights-of-way to limit inconvenience to the adjacent landowners. Department of Water Resources observation wells have a yellow protective casing extending between 1 and 3 feet above ground surface, and their

locations are marked with a stake. If an observation well is encountered during project activities and must be removed, please contact the Water Appropriation Division. The Department of Water Resources hopes to keep all observation wells, but otherwise will ensure the well is properly abandoned.

Thank you for the opportunity to provide review comments. Should you have further questions, please contact me at 701-328-4970 or stevebest@nd.gov.

Sincerely,

Steven Best
Planner III

SB:dm/1570

Appendix C10
United States Army Corps of Engineers

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
NORTH DAKOTA REGULATORY OFFICE
3319 UNIVERSITY DRIVE
BISMARCK, NORTH DAKOTA 58504-7565

August 19, 2019

NWO-2016-01443-BIS

AECOM
Attn: Ms. Lindsey Churchill
1000 East Calgary Avenue Suite 1
Bismarck, North Dakota 58503

Dear Ms. Churchill:

This is in response to your letter dated July 31, 2019, requesting comments on the proposed Red Butte Wind LLC; Red Butte Wind Energy Center and 230 kV Transmission Line project. The project is located throughout Oliver and Mercer Counties, North Dakota.

U. S. Army Corps of Engineers Regulatory Offices administer Section 10 of the Rivers and Harbors Act (Section 10) and Section 404 of the Clean Water Act (Section 404). A Section 10 permit would be required for work impacting navigable waters, this includes work over, through, or under Section 10 waters. Section 10 waters in North Dakota are the Missouri River (including Lake Sakakawea and Lake Oahe), Yellowstone River, James River (south of the railroad tracks in Jamestown, North Dakota), Bois de Sioux River, Red River of the North, and Upper Des Lacs Lake. A Section 404 permit would be required for the discharge of dredge or fill material (temporarily or permanently) in waters of the United States. Waters of the United States may include, but are not limited to, rivers, streams, ditches, coulees, lakes, ponds, and their adjacent wetlands. Fill material includes, but is not limited to, rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mines or other excavation activities and materials used to create any structure or infrastructure in waters of the United States.

Based on the information contained in your letter, the Corps has determined that your proposed project may need a Clean Water Act Section 404 permit. The permit application and instructions for completing the application may be found at: http://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Obtain-a-Permit. Be sure to accurately describe all proposed work and construction methodology. Once the application is complete, mail it to the letterhead address or to the email address below.

The North Dakota Regulatory office can accept (and prefers) electronic submissions to the following email: CENWO-OD-RND@usace.army.mil.

Printed on Recycled Paper

Please refer to identification number NWO-2016-01443-BIS in any correspondence concerning this project. If you have any questions, please contact Jeremy Nygard at U.S. Army Corps of Engineers, North Dakota Regulatory Office, 3319 University Drive, Bismarck, North Dakota 58504-7565, by email at *Jeremy.S.Nygard@usace.army.mil*, or telephone at (701) 255-0015 X 2006. For more information regarding our program, please visit our website at *http://www.nwo.usace.army.mil/Missions/RegulatoryProgram/NorthDakota.aspx*.

Sincerely,

Patricia L. McQueary
State Program Manager
North Dakota

From: Nygard, Jeremy S CIV USARMY CENWO (USA)
To: Lindsey Churchill
Subject: EXTERNAL: NWO-2023-00553-BIS, Merjent; Oliver Wind IV, LLC; Oliver Wind IV Energy Center
Date: Monday, April 17, 2023 1:50:34 PM
Attachments: NWO-2023-00553_20230414_SOV Response.pdf
Eng_Form_6082_Sep 2022.pdf

Hi Lindsey,

Our office has reviewed the information you provided regarding the proposed project and determined that a U.S. Army Corps of Engineers Section 404 permit may be required for your project. Please see attached letter and blank application form. Thank you,

v/r

Jeremy Nygard
Regulatory Permit Assistant
U.S. Army Corps of Engineers
North Dakota Regulatory Office
3319 University Drive
Bismarck, ND 58504
701-255-0015 ext. 2006

The North Dakota Regulatory office prefers that all submissions are sent electronically to the following email address: CENWO-OD-RND@usace.army.mil instead of a hard copy by mail. Please split large attachments (>25 MB) into multiple emails if needed.

Appendix C11
Mercer County

From: Lindsey Churchill
Sent: Friday, September 15, 2023 1:12 PM
To: 'Zueger, Cyndi L.'
Subject: RE: EXTERNAL: FW: Thank you - Missouri River CCO Meeting for McLean, Mercer, and Oliver County

Thank you, Cyndi. We will use the FEMA maps for floodplain review. I appreciate the follow up.

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

merjent
1 Main Street SE, Suite 300
Minneapolis, MN 55414
612.746.3660 main
www.merjent.com

From: Zueger, Cyndi L. <czueger@nd.gov>
Sent: Friday, September 15, 2023 11:53 AM
To: Lindsey Churchill <lindsey.churchill@merjent.com>
Subject: EXTERNAL: FW: Thank you - Missouri River CCO Meeting for McLean, Mercer, and Oliver County

CAUTION: This email originated from outside of Merjent.

Lindsey,

I hope these are what you are asking for. I don't have copies of the actual maps.

Cyndi

Cyndi Zueger
Mercer County
Tax Director/Land Use Administrator
701-745-3294
410 Van Slyck Ave
Stanton ND 58571

From: Horner, Laura M. <lmhorner@nd.gov>
Sent: Tuesday, June 6, 2023 5:43 PM
To: Kroll, Noelle <nkroll@nd.gov>; Schreiner, Todd A. <tschreiner@nd.gov>; Zueger, Cyndi L. <czueger@nd.gov>; washaud@westriv.com; stanton@westriv.com; Neumiller, Jennifer L. <jlneumiller@nd.gov>; Reed, Carmen

<creed@nd.gov>
Cc: Pluss, Madeleine <madeleine.pluss@fema.dhs.gov>; Spomer, Tyler <tlspomer@nd.gov>; Gregg Thielman <cgthielman@houstoneng.com>; Nic Cullen <ncullen@houstoneng.com>; kgronsky@dewberry.com; Sutley, David <dsutley@Dewberry.com>; Adam Nies <anies@houstoneng.com>
Subject: Thank you - Missouri River CCO Meeting for McLean, Mercer, and Oliver County

Good evening Everyone,

Thank you for joining us for the **Missouri River (Mercer, McLean and Oliver County) CCO Meeting** on Wednesday, May 31, 2023. We enjoyed visiting with you all to help ensure a safer, stronger future.

As discussed during the meeting, we have plenty of follow-up resources available to you to help facilitate outreach and ensure stakeholders within your communities are aware of the upcoming map changes:

- **To view the preliminary maps, please visit the following online resources or contact the City, County or other jurisdictional authority:** We encourage you to review the mapping information with all of your community leaders and anyone that might have an interest.
    - FEMA Map Service Center
    - FEMA Preliminary/Changes Since Last FIRM Viewer

- PDFs of the **CCO Presentation slide deck**, **Sign-In Sheets, Meeting Minutes and additional Flood Insurance Material** have been posted to the State's .ftp site for download using the following link. I strongly encourage you to share this information with all of the elected officials and staff who were unable to attend the meeting hosted on May 31st regarding the Flood Insurance Rate Map (FIRM) update taking place in Mercer, McLean and Oliver County.
    - http://ftp.swc.nd.gov/_1gV8F0NkJYw5kR

- Please reach out if any residents located in the updated project area are in need of any additional material or an 1-on-1 conversation regarding any impacts of the updated flood risk information.

Thanks again for joining us – and as always, please feel free to reach out to me directly with any next steps, questions or concerns.

Sincerely,

Laura Horner
Risk MAP Program Manager

701.328.2759(m) • 701.328.3696 (f) • lmhorner@nd.gov • www.dwr.nd.gov

NORTH Dakota | Water Resources
Be Legendary.

701.328.2750 • dwr@nd.gov • 1200 Memorial Hwy • Bismarck, ND 58504

Appendix C12
North Dakota Department of Environmental Quality

NORTH Dakota | Environmental Quality
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August 20, 2019

Lindsey Churchill, PhD
Environmental Project Manager
AECOM
1000 East Calgary Avenue Suite 1
Bismarck, ND 58503

Re: Red Butte Wind Energy Center & 230 kV Transmission Line in Mercer, Oliver Counties

Dear Ms. Churchill:

The North Dakota Department of Environmental Quality has reviewed the information concerning the above-referenced project received at the department on August 05, 2019, with respect to possible environmental impacts.

This department believes that environmental impacts from the proposed construction will be minor and can be controlled by proper construction methods. With respect to construction, we have the following comments:

1. All necessary measures must be taken to minimize fugitive dust emissions created during construction activities. Any complaints that may arise are to be dealt with in an efficient and effective manner.

2. Care is to be taken during construction activity near any water of the state to minimize adverse effects on a water body. This includes minimal disturbance of stream beds and banks to prevent excess siltation, and the replacement and revegetation of any disturbed area as soon as possible after work has been completed. Caution must also be taken to prevent spills of oil and grease that may reach the receiving water from equipment maintenance, and/or the handling of fuels on the site. Guidelines for minimizing degradation to waterways during construction are attached.

3. Projects disturbing one or more acres are required to have a permit to discharge storm water runoff until the site is stabilized by the reestablishment of vegetation or other permanent cover. Further information on the storm water permit may be obtained from the department's website or by calling the Division of Water Quality (701-328-5210). Also, cities may impose additional requirements and/or specific best management practices for construction affecting their storm drainage system. Check with the local officials to be sure any local storm water management considerations are addressed.

4. The proposed construction project includes many individual projects located within Mercer and Oliver counties. It is possible that some projects may be located over defined glacial drift aquifers, defined sensitive glacial drift aquifers, or within wellhead or source water

protection areas. Care should be taken to avoid spills of any materials that may have an adverse effect on groundwater quality. All spills must be immediately reported to this department and appropriate remedial actions performed.

5. Noise from construction activities may have adverse effects on persons who live near the construction area. Noise levels can be minimized by ensuring that construction equipment is equipped with a recommended muffler in good working order. Noise effects can also be minimized by ensuring that construction activities are not conducted during early morning or late evening hours.

6. All solid waste materials must be managed and transported in accordance with the state's solid and hazardous waste rules. Appropriate efforts to reduce, reuse and/or recycle waste materials are strongly encouraged. As appropriate, segregation of inert waste from non-inert waste can generally reduce the cost of waste management. Further information on waste management and recycling is available from the department's Division of Waste Management at (701) 328-5166.

These comments are based on the information provided about the project in the above-referenced submittal. The U.S. Army Corps of Engineers may require a water quality certification from this department for the project if the project is subject to their Section 404 permitting process. Any additional information which may be required by the U.S. Army Corps of Engineers under the process will be considered by this department in our determination regarding the issuance of such a certification.

The department owns no land in or adjacent to the proposed improvements, nor does it have any projects scheduled in the area. In addition, we believe the proposed activities are consistent with the State Implementation Plan for the Control of Air Pollution for the State of North Dakota.

If you have any questions regarding our comments, please feel free to contact this office.

Sincerely,

L. David Glatt, P.E., Director
North Dakota Department of Environmental Quality

LDG:dlp
Attach.

NORTH Dakota | Environmental Quality
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Construction and Environmental Disturbance Requirements

The following are the minimum requirements of the North Dakota Department of Environmental Quality for projects that involve construction or environmental disturbance in or near waters of the State of North Dakota. They ensure that minimal environmental degradation occurs as a result of construction or related work which has the potential to affect waters of the state. All projects must be constructed to minimize the loss of soil, vegetative cover, and pollutants (chemical or biological) from a site.

Soils

Prevent the erosion of soil and sediment loss using erosion and sediment controls. Fragile and sensitive areas such as wetlands, riparian zones, delicate flora, and land resources must be protected against compaction, vegetation loss, and unnecessary damage.

Surface Waters

All construction must be managed to minimize impacts to aquatic systems. Follow safe storage and handling procedures to prevent the contamination of water from fuel spills, lubricants, and chemicals. Stream bank and stream bed disturbances must be controlled to minimize slit movement, nutrient upsurges, plant dislocations, and any physical, chemicals, or biological disruption. The use of pesticides or herbicides in or near surface waters is allowed under the department's pesticide application permit with notification to the department.

Fill Material

Any fill material placed below the ordinary high-water mark must be free of topsoil, decomposable materials, and persistent synthetic organic compounds; including, but not limited to, asphalt, tires, treated lumber, and construction debris. The department may require testing of fill materials. All temporary fill must be removed. Debris and solid wastes must be properly disposed or recycled. Impacted areas must be restored to near original condition.

918 East Divide Avenue | Bismarck ND 58501-1947 | Fax 701-328-5200 | deq.nd.gov

Director's Office 701-328-5150
Division of Air Quality 701-328-5188
Division of Municipal Facilities 701-328-5211
Division of Waste Management 701-328-5166
Division of Water Quality 701-328-5210
Division of Chemistry 701-328-6140 2635 East Main Ave Bismarck ND 58501

NORTH Dakota | Environmental Quality

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April 19, 2023

Lindsey Churchill, PhD
Merjent
1 Main Street SW, Ste 300
Minneapolis, MN 55414

Re: Oliver Wind IV Energy Center & Associated 345 kV Transmission Line in Mercer, Oliver Counties

Dear Ms. Churchill:

The North Dakota Department of Environmental Quality has reviewed the information concerning the above-referenced project received at the department on April 10, 2023 with respect to possible environmental impacts.

This department believes that environmental impacts from the proposed construction will be minor and can be controlled by proper construction methods. With respect to construction, we have the following comments:

1. Care is to be taken during construction activity near any water of the state to minimize adverse effects on a water body. This includes minimal disturbance of stream beds and banks to prevent excess siltation, and the replacement and revegetation of any disturbed area as soon as possible after work has been completed. Caution must also be taken to prevent spills of oil and grease that may reach the receiving water from equipment maintenance, and/or the handling of fuels on the site. Guidelines for minimizing degradation to waterways during construction are attached.

2. Projects disturbing one or more acres are required to have a permit to discharge stormwater runoff until the site is stabilized by the reestablishment of vegetation or other permanent cover. Further information on the stormwater permit may be obtained from the department's website or by calling the Division of Water Quality (701-328-5210). Also, cities may impose additional requirements and/or specific best management practices for construction affecting their storm drainage system. Check with the local officials to be sure any local stormwater management considerations are addressed.

3. The proposed construction project may include individual projects located within Mercer and Oliver Counties. It is possible that some projects may be located over defined glacial drift aquifers, defined sensitive groundwater areas, or within wellhead or source water protection areas. Care should be taken to avoid spills of any materials that may have an adverse effect on groundwater quality. All spills must be immediately reported to this Department and appropriate remedial actions performed.

4. All solid waste materials must be managed and transported in accordance with the state's solid and hazardous waste rules. Appropriate efforts to reduce, reuse and/or recycle waste materials are strongly encouraged. As appropriate, segregation of inert waste from non-inert waste can generally reduce the cost of waste management. Further information on waste management and recycling is available from the department's Division of Waste Management at (701) 328-5166.

The department owns no land in or adjacent to the proposed improvements, nor does it have any projects scheduled in the area. In addition, we believe the proposed activities are consistent with the State Implementation Plan for the Control of Air Pollution for the State of North Dakota.

If you have any questions regarding our comments, please feel free to contact this office.

Sincerely,

L. David Glatt, P.E., Director
North Dakota Department of Environmental Quality

LDG:csc
Attach.

Construction and Environmental Disturbance Requirements

The following are the minimum requirements of the North Dakota Department of Environmental Quality for projects that involve construction and environmental disturbance in or near waters of the State of North Dakota. They ensure that minimal environmental degradation occurs as a result of construction or related work which has the potential to affect waters of the state. All projects must be constructed to minimize the loss of soil, vegetative cover, and pollutants (chemical or biological) from a site.

Soils

Prevent the erosion and sediment loss using erosion and sediment controls. Fragile and sensitive areas such as wetlands, riparian zones, delicate flora, and land resources must be prohibited against compaction, vegetation loss and unnecessary damage.

Surface Waters

All construction must be managed to minimize impacts to aquatic systems. Follow safe storage and handling procedures to prevent the contamination of water from fuel spills, lubricants, and chemicals. Stream bank and stream bed disturbances must be contained to minimize silt movement, nutrient upsurges, plant dislocations, and any physical chemicals, or biological disruption. The use of pesticides or herbicides in or near surface waters is allowed under the department's pesticide application permit with notification to the department.

Fill Material

Any fill material place below the ordinary high-water mark must be free of topsoil, decomposable materials, and persistent synthetic organic compounds; including, but not limited to, asphalt, tires, treated lumber, and construction debris. The department may require testing of fill material. All temporary fills must be removed. Debris and solid waste must be properly disposed or recycled. Impacted areas must be restored to near original condition.

Appendix C13
North Dakota Geological Survey

North Dakota Geological Survey

Edward C. Murphy - State Geologist

Department of Mineral Resources

Lynn D. Helms - Director

North Dakota Industrial Commission

www.state.nd.us/ndgs

August 21, 2019

Lindsey Churchill, PhD
AECOM
1000 East Calgary Ave, Suite 1
Bismarck, ND 58503

Re: Red Butte Wind Energy Center and 230 kV Transmission Line Project: Oliver & Mercer Counties, ND

The North Dakota Geological Survey appreciates the notification and opportunity to review and provide comment on the proposed wind energy development project. Your comment solicitation letter of July 31, 2019 was reviewed by our office on August 21, 2019.

Based on the extent of the proposed project areas, it appears that there are some locations in the northeast portions of the wind energy center and transmission line corridor boundaries that contain areas mapped as landslides or features that suggest slope instability. These areas can be found depicted on our 1:24,000 scale landslide maps that have been completed for the Stanton, Hannover NW, and Hannover NE quadrangles and should be included in your project area evaluations.

Also, there appears to be several areas within the proposed project area boundaries that contain mineable coal resources as depicted on our detailed coal maps for this area. A review of the PSC's Abandoned Mine Land (AML) locations data also shows several AML locations just northeast of Center, N.D.

Our current Areas of Landslides maps, LiDAR elevation mapping and data products, and coal maps for the 1:24,000 and 1:100,000 scale quadrangles that encompass the proposed project area can be found on our website at:

https://www.dmr.nd.gov/ndgs/landslides/

You may also contact our offices directly, with any additional questions or comments, at (701) 328-8000.

Sincerely,

North Dakota Geological Survey:

Fred Anderson
Geologist
fjanderson@nd.gov

FJA\

Lindsey Churchill

From: Anderson, Fred J. <fjanderson@nd.gov>
Sent: Thursday, April 6, 2023 10:00 AM
To: Lindsey Churchill
Subject: EXTERNAL: N.D. Geological Survey: Geologic Review and Comments on the Proposed Oliver Wind IV Energy Center and Associated 345-kV Transmission Line in Oliver and Mercer Counties, North Dakota

CAUTION: This email originated from outside of Merjent.

Dr. Churchill,

The NDGS appreciates the opportunity to review and provide comments on your proposed energy infrastructure development project.

I have reviewed the project comment solicitation letter of March 31, 2023 and would offer the following comments:

- The project area is located just south of an area (i.e. the Hazen and Stanton Dunes) where several sand mining operations are currently located. The corridor for the proposed transmission line may pass through some of these current or planned future operations.
- The footprint of the proposed wind farm area does contain a few localized landslide features constrained to local drainages particularly in the northwestern portion of the project area that should be noted.
- The proposed transmission line corridor does pass through an area south of Stanton where several landslide features have been mapped, again associated with local drainages and the hilly topography in this area.
- Areas of landslides should be avoided when selecting locations for towers or transmission line support structures. Steep slopes in areas where mapped landslide density is high should also be evaluated with respect to the proximity of these areas to final site selections.

Landslide mapping and data products for this project area can be found on our website for site specific review at: https://www.dmr.nd.gov/ndgs/landslides/

Please feel free to contact our offices at any time if there are any additional questions or concerns.

Regards,

Fred J. Anderson
Geologist, North Dakota Geological Survey

701.328.8000 (Survey Main Office) • 701.328.8037 (Office Direct) • fjanderson@nd.gov • www.dmr.nd.gov/ndgs

NORTH Dakota | Mineral Resources
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701.328.8020 (Front Office) • oilandgasinfo@nd.gov • www.dmr.nd.gov • 600 E Boulevard Ave, Dept. 405 • Bismarck, ND 58505

Appendix C14
Military Aviation and Installation Assurance Siting Clearinghouse

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
3500 DEFENSE PENTAGON
WASHINGTON, DC 20301-3500

SUSTAINMENT

November 21, 2019

Lindsey Churchill
Environmental Project Manager, Environment
AECOM

Dear Dr. Churchill,

As requested, the Military Aviation and Installation Assurance Siting Clearinghouse coordinated within DoD an informal review of the Red Butte Wind Energy Center and Transmission Line Project. The results of our review indicated that the dual wind and transmission project, located in Oliver County, North Dakota, as proposed, will have minimal impact on military operations conducted in the area.

Please note that this informal review by the DoD Military Aviation and Installation Assurance Siting Clearinghouse does not constitute an action under 49 United States Code Section 44718 and that the DoD is not bound by the conclusion arrived at under this informal review. To expedite our review in the Obstruction Evaluation Airport Airspace Analysis (OE/AAA) process, please add the project number 2019-09-D-DEV-11 in the comments section of the filing. If you have any questions, please contact me at steven.j.sample4.civ@mail.mil or at 703-571-0076.

Sincerely,

Steven J. Sample
Deputy Director
Military Aviation and Installation
Assurance Siting Clearinghouse

Appendix C15
Minot Air Force Base

From: Lindsey Churchill
Sent: Thursday, May 18, 2023 3:30 PM
To: WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENP
Cc: Brown, Dina; Dirk Churchill
Subject: RE: EXTERNAL: Oliver Wind IV Project
Attachments: 20230517_OIV_Wind_Project_Alignment_Shapefiles.zip

Sam,

I hope this email finds you well. I wanted to provide you with an update on the proposed Oliver Wind IV Energy Center and associate 345-kV Transmission Line project in Oliver and Mercer counties, North Dakota.

The wind turbine locations have undergone a review and have been approved by both the DoD Siting Clearinghouse and the FAA. The DoD had no concerns, and the FAA has issued a Determination of No Hazard. The transmission line has not been filed with the FAA or reviewed by the DoD Siting Clearinghouse. We are actively working on completing these tasks and will keep you updated on the progress. For your reference, I have attached the approved wind turbine locations as well as the proposed transmission line pole locations.

The information presented in this email is also being shared with the Minot Air Force Base. If you have any questions or require further information, please do not hesitate to reach out to me.

Thank you for your attention to this matter.

Sincerely,

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

1 Main Street SE, Suite 300
Minneapolis, MN 55414
612.746.3660 main
https://nam12.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.merjent.com%2F&data=05%7C01%7Cdirk.churchill%40merjent.com%7C3a17a00b4684401c960e08db57deb102%7C1cc8bd10ce8b4c0ab3f7bcd338132bc0%7C0%7C0%7C638200387537824306%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=ZlBu3tZ2k%2FybXSQwXc1wA8LInOtKtNdaD%2BiCIEhF8q4%3D&reserved=0

-----Original Message-----
From: WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENP <samuele.warren.1@us.af.mil>
Sent: Thursday, April 6, 2023 3:24 PM
To: Lindsey Churchill <lindsey.churchill@merjent.com>
Subject: EXTERNAL: Oliver Wind IV Project

CAUTION: This email originated from outside of Merjent.

Ms. Churchill,

Received the following letter from 91 MW in regards to the Oliver Wind IV project within Mercer and Oliver Counties North Dakota. The 91 MW do not have any operations is these counties however the 5 BW on Minot AFB does have flying routes in this area. Have you pushed this project to the DoD Clearing House for them to do a review? (https://nam12.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.acq.osd.mil%2Fdodsc%2Fcontact%2Fdod-review-process.html&data=05%7C01%7Cdirk.churchill%40merjent.com%7C3a17a00b4684401c960e08db57deb102%7C1cc8bd10ce8b4c0ab3f7bcd338132bc0%7C0%7C0%7C638200387537824306%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=McexXJKtjUu4Vhy%2B7n4FF5yNem79ZAzmXxfoaLH3Vas%3D&reserved=0)

Along with DoD Clearing House, Minot AFB cannot really evaluate the project at this time without specific details of the project.

sam

Sam Warren
Community Planner
5 CES/CENP
445 Peacekeeper Place
Minot AFB, ND 58705
DSN: 312-453-1969
Comm:701-723-1969

Appendix C16
National Telecommunications and Information Administration

From: Brownlee, James
To: JHenry@ntia.gov
Cc: Labate, Daniel; Plyler, Angela
Subject: Wind Farm NTIA Notification - Red Butte Wind Energy Project Area in Oliver and Mercer Counties, ND
Attachments: Red Butte ND Wind Project NTIA Letter 2022-04-01.pdf

---

Dear Mrs. Henry,

Please find the attached letter serving as notification to the government that NextEra Energy Resources plans to install a wind energy facility in Oliver and Mercer Counties in North Dakota called the Red Butte Wind Energy Project. Included in the letter are maps showing the project location, project boundary coordinates, and turbine details. Please let me know if anything further is required or of any questions that may arise.

Regards,
James

James Brownlee
Sr. Resource Modeling Analyst
NextEra Analytics, Inc.
700 Universe Blvd
Juno Beach, FL 33408
(561) 694-4973 | James.Brownlee@fpl.com

April 1, 2022

Type of Notification: Update

Project: Red Butte

Counties: Oliver and Mercer

State: North Dakota

Project Sponsor: NextEra Energy Resources

Contact: James Brownlee
Email: James.Brownlee@fpl.com
Phone: 561-694-4973

To Whom It May Concern:

This letter and its attachments will serve as notification to the government that NextEra Energy Resources plans to install a wind energy facility in Oliver and Mercer Counties in North Dakota called the Red Butte Wind Energy Project. Enclosed are maps and tables that describe the location of this wind energy project.

- Table 1 contains boundary points (NAD83) of the Red Butte Wind Energy Project Area
- Figure 1 is a state level map showing the area where the Red Butte Wind Energy Project is located.
- Figure 2 is a local USGS topographical map of the Red Butte Wind Energy Project Area

The approximate dimensions of the wind turbines to be installed at this facility are as follows:

- Turbine Hub Height AGL: 117 meters
- Turbine Blade Diameter: 140 meters
- Maximum Blade Tip Height AGL: 187 meters
- Estimated Number of Turbines to be Installed: 140

Please review the attached information and contact me if any further information is required.

Sincerely,

James Brownlee
Senior Resource Modeling Analyst
NEXTEra Analytics Inc.
700 Universe Blvd
Juno Beach, FL 33408

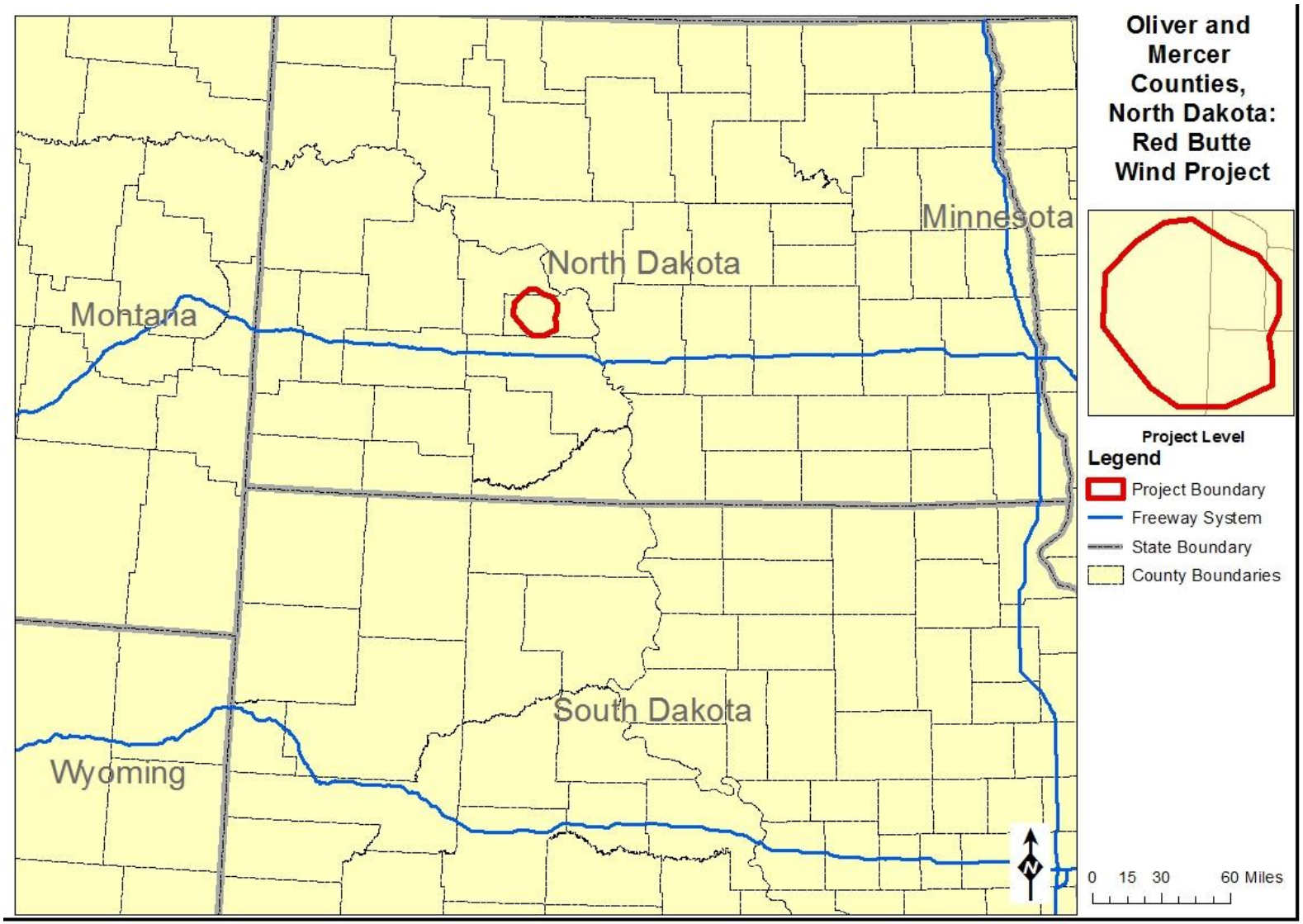

Figure 1: Location of the Red Butte Wind Energy Project

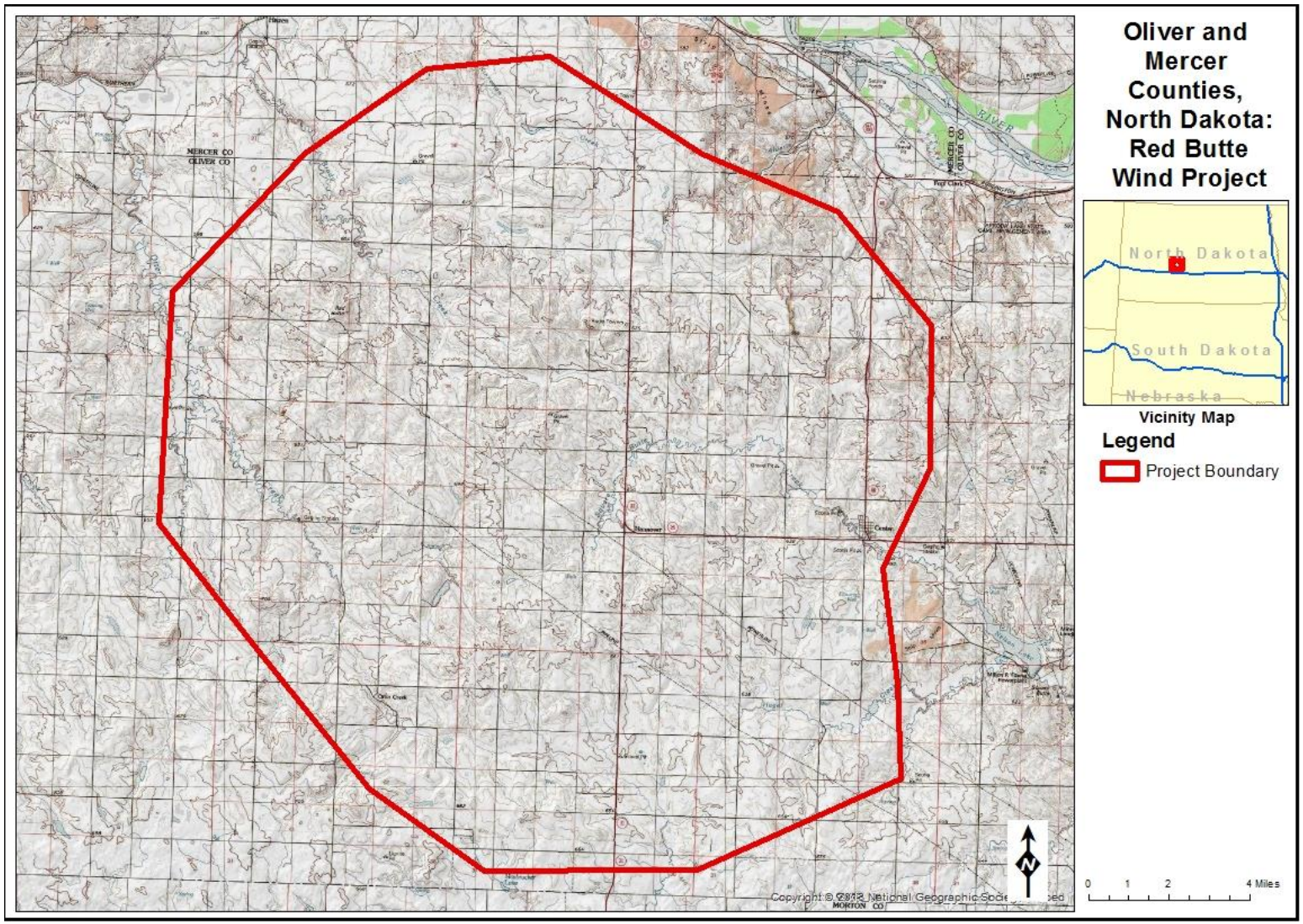

Figure 2: USGS map of the Red Butte Wind Energy Project

Identifier	Longitude	Latitude
1	101:28:25.75772W	47:16:53.61757N
2	101:23:27.50957W	47:14:53.95033N
3	101:19:09.57841W	47:13:44.68234N
4	101:16:04.38383W	47:11:20.63843N
5	101:15:59.02102W	47:08:15.59822N
6	101:17:22.97699W	47:06:05.24685N
7	101:16:48.39284W	47:03:36.78948N
8	101:16:37.50097W	47:01:33.57310N
9	101:20:40.28498W	47:00:13.08462N
10	101:22:57.35869W	46:59:27.54944N
11	101:24:23.71621W	46:59:25.74250N
12	101:29:39.02910W	46:59:17.70520N
13	101:33:21.85268W	47:00:59.50880N
14	101:37:10.62647W	47:03:59.48865N
15	101:40:17.09014W	47:06:33.32968N
16	101:40:05.73019W	47:11:33.17910N
17	101:36:02.05099W	47:14:38.79151N
18	101:32:17.42097W	47:16:32.79708N
19	101:28:25.75772W	47:16:53.61757N

Table 1: Project Boundary Coordinates (NAD83) of the Red Butte Wind Project Site

UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Washington, D.C. 20230

May 19, 2022

James Brownlee
Senior Resource Modeling Analyst
NextEra Analytics, Inc.

Re: Red Butte Project, Revision 1: Oliver & Mercer Counties, ND

Dear Mr. Brownlee:

In response to your request on April 1, 2022, the National Telecommunications and Information Administration provided to the federal agencies represented in the Interdepartment Radio Advisory Committee (IRAC) the plans for the Red Butte Wind Project, Revision 1, located in Oliver and Mercer Counties, North Dakota.

After a 45+ day period of review, one agency, the Department of Commerce, had minor issues with turbine placement in this area. Their comments are noted below:

Commerce has completed our review of the subject wind farm proposal and found the project area is over 48 km NW of the Bismarck, ND NEXRAD. It is within the notification zone of that radar. However, there will be low impact and only the lowest elevation angle will be contaminated. Further contact with the developer is requested only if the project area changes or the turbine heights increase by 10 meters or more.

While the other IRAC agencies did not identify any concerns regarding radio frequency blockage, this does not eliminate the need for the wind energy facilities to meet any other requirements specified by law related to these agencies. For example, this review by the IRAC does not eliminate any need that may exist to coordinate with the Federal Aviation Administration concerning flight obstruction.

Thank you for the opportunity to review this proposal.

Sincerely,

John R. McFall
Deputy Chief, Spectrum Services Division
Office of Spectrum Management

Appendix C17
National Park Service - Knife River Indian Villages National Historic Site

From: Todd, Brenda
To: Bender, Marcia
Cc: Adam Yarina
Subject: Re: [EXTERNAL] Red Butte Wind - Knife River Indian Villages NHS
Date: Monday, November 04, 2019 5:05:56 PM

Dear Marcia,

I am the Superintendent of Knife River Indian Villages NHS. I would be very happy to re-engage in consultation about this project.

How would you like to proceed? You are always welcome at our offices in Stanton.

I look forward to hearing more.

Thank you,
Brenda

On Wed, Oct 30, 2019 at 11:22 AM Yarina, Adam <adam_yarina@nps.gov> wrote:

> Here's what I received from the consultant at AECOM re Red Butte Wind. I'm around all this week to chat; my cube is on the second floor in the northeast corner of the building, near Bob Bryson and Carmen Thompson's offices.
>
> Best,
>
> Adam Yarina
> Regional Energy Specialist
> National Parks Service, Interior Region 3, 4, & 5
> Office: 402-661-1528
> adam_yarina@nps.gov
>
> ---------- Forwarded message ---------
> From: **Bender, Marcia** <marcia.bender@aecom.com>
> Date: Fri, Oct 18, 2019 at 1:03 PM
> Subject: [EXTERNAL] Red Butte Wind - Knife River Indian Villages NHS
> To: adam_yarina@nps.gov <adam_yarina@nps.gov>
>
> Hello Mr. Yarina,
>
> I received your contact information from the staff at Knife River Indian Villages (KRIV) near Stanton, North Dakota. I called and left you a voicemail regarding Red Butte Wind Energy Center (project). I'm Marcia Bender and I work for AECOM Technical Services (AECOM) in Bismarck. AECOM has been contracted by Red Butte Wind, LLC (Red Butte Wind) to continue the environmental studies needed to prepare an application for a Certificate of Site Compatibility for the proposed Red Butte Wind Energy Center in Olive County, North Dakota. The project is located approximately 5 miles west of the town of Center and approximately 5 miles south of the town of Stanton, in Oliver County. Red Butte Wind purchased this project from the original developer and is working toward finalizing the design for a new

application. AECOM completed a Class I: Literature Review for the project study area and are currently finishing our Class III: Intensive Cultural Resources Inventory and Traditional Cultural Properties (TCP) surveys, with interested tribes, among other environmental studies, in order to site the locations of wind turbines, access roads, a transmission line, and ancillary facilities for the project while minimizing impacts to natural and cultural resources.

On behalf of Red Butte Wind, AECOM would like to reengage the NPS regarding the project, due to its proximity to the Knife River Indian Villages (KRIV), near Stanton, North Dakota. In 2016, the North Dakota State Historic Preservation Office (SHPO) Chief Archaeologist had advised Red Butte Wind's consultants to confer with NPS about the project and KRIV once the project design was complete. Heidi Riddle was working with the previous consultant about getting the spatial data for the project that would be needed to conduct the visual analysis to at least determine if the project would be visible from the KRIV. It appears a meeting with NPS at Stanton to discuss the project was the last interaction. That is where my paper trail ends. At that time, NPS had requested that the consultant conduct a visual analysis from the KRIV toward the project, once the cultural resources studies were complete and the locations of all of the project facilities were locked in. AECOM would like to reengage NPS regarding this matter so we can continue these discussions. I can be reached at this email address or any of the phone numbers below. Thank you and I look forward to talking to you.

Best regards,

Marcia

Marcia L. Bender, MA, RPA
Principal Investigator

Archaeologist

Design and Consulting Services Group
M: 303-524-5121

D: 701-255-5501

O: 701-221-4140

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AECOM

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Bismarck, ND 58503, United States

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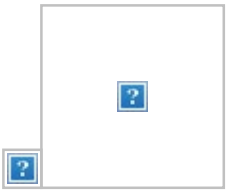
Brenda K. Todd, PhD
Superintendent, Knife River Indian Villages National Historic Site
564 County Road 37
Stanton, ND 58571
(office) (701) 745-3300
(cell) (701) 301-0166



From: Brown, Dina <Dina.Brown@nexteraenergy.com>
Sent: Saturday, September 2, 2023 4:14 PM
To: Lindsey Churchill
Cc: Dirk Churchill
Subject: EXTERNAL: FW: [EXTERNAL] RE: NextEra Oliver Wind IV follow up

CAUTION: This email originated from outside of Merjent.

From: Snyder, Natasha <Natasha.Snyder@nexteraenergy.com>
Sent: Tuesday, August 8, 2023 11:35 AM
To: Deegan, Alisha M. <alisha_deegan@nps.gov>
Cc: Brown, Dina <Dina.Brown@nexteraenergy.com>; Bender, Marcia L <mlbender@burnsmcd.com>; McCarthy, Melinda M <mmmccarthy@burnsmcd.com>; McEnaney, Marla J. <Marla_McEnaney@nps.gov>; Sanford, Dena L. <Dena_Sanford@nps.gov>; Schilling, Timothy M <Tim_Schilling@nps.gov>
Subject: RE: [EXTERNAL] RE: NextEra Oliver Wind IV follow up

Alisha – thank you so much for all this information!
(I was just thinking I needed to follow up on all this with you, so you read my mind.)

I did reach out to Andrew Clark at SHPO about the draft NHL nomination for Fort Clark.

Very kind regards,

N.

Natasha B. Snyder
Environmental Specialist
NextEra Energy Resources, LLC
Environmental Services (JES/JB)
700 Universe Boulevard
Juno Beach, Florida 33408
Mobile: (561) 427-9059
Natasha.Snyder@nexteraenergy.com

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From: Deegan, Alisha M. <alisha_deegan@nps.gov>
Sent: Tuesday, August 8, 2023 1:02 PM

To: Snyder, Natasha <Natasha.Snyder@nexteraenergy.com>
Cc: Brown, Dina <Dina.Brown@nexteraenergy.com>; Bender, Marcia L <mlbender@burnsmcd.com>; McCarthy, Melinda M <mmmccarthy@burnsmcd.com>; McEnaney, Marla J. <Marla_McEnaney@nps.gov>; Sanford, Dena L. <Dena_Sanford@nps.gov>; Schilling, Timothy M <Tim_Schilling@nps.gov>
Subject: Re: [EXTERNAL] RE: NextEra Oliver Wind IV follow up

Good Morning, Natasha,

In response to your request, we provide the following information and additional explanation.

The Big Hidatsa Village National Historic Landmark (NHL) and the 1989 National Register nominations are available online at National Archives NextGen Catalog.

The documents contain sensitive information; the NPS provides this for your reference. Please do not distribute the documents beyond staff participating in this project. The focus of both of these nominations is archeological. The NHL revision will propose an expanded boundary to include the collection of village sites in the KNRI area, and the cultural landscape. As we have discussed during our conference calls, the NPS concern about the proposed energy project is not just impacts to archeological sites, but to a cultural landscape that is significant to the Mandan Hidatsa and Arikara.

The Cultural Landscape Report is in draft form and has not been reviewed by all relevant parties nor approved. Because the document contains sensitive information, it is inappropriate to share the draft at this time. I am, however, providing an excerpt that addresses the significance of the site:

> "The landscape at Knife River Indian Villages is significant and sacred to the Hidatsa, Mandan, and Arikara peoples... "Landscape significance and periods of significance are derived from the significance statements listed in the Foundation Document for the NHS, completed in 2013. These significance statements encompass the themes and areas of significance established in the 1964 NHL nomination and a National Register of Historic Places nomination prepared in 1987 ...In addition to the significance identified in the Foundation Document, research conducted for this CLR has identified the cultural landscape at Knife River Indian

Villages as potentially eligible for listing in the National Register of Historic Places

as a Traditional Cultural Place (TCP)."

I am also summarizing important excerpts from the draft CLR, pages 3-37 and 3-61 that identify important viewsheds from within KNRI.

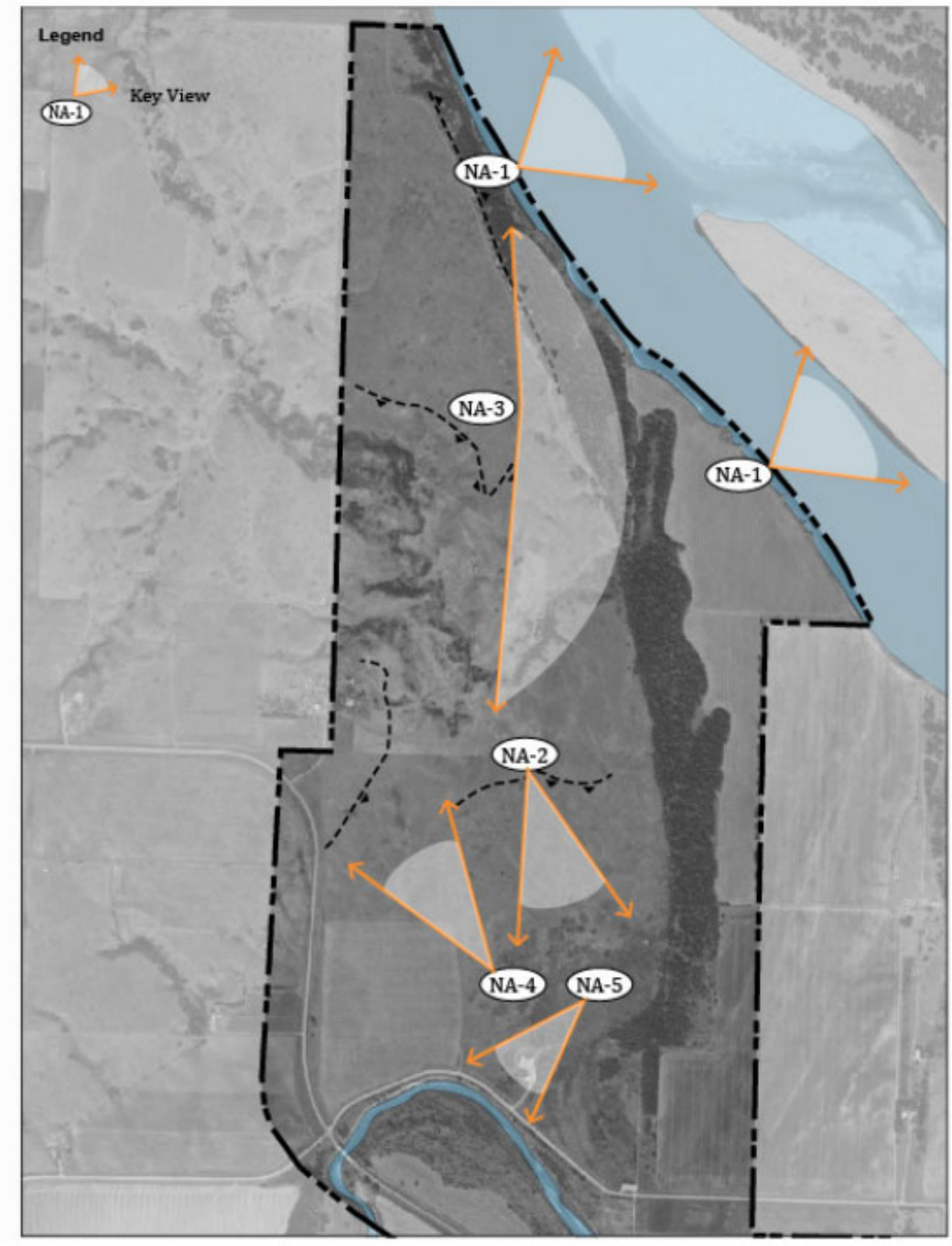

Figure 3-67. North
Views Diagram (QE, 2

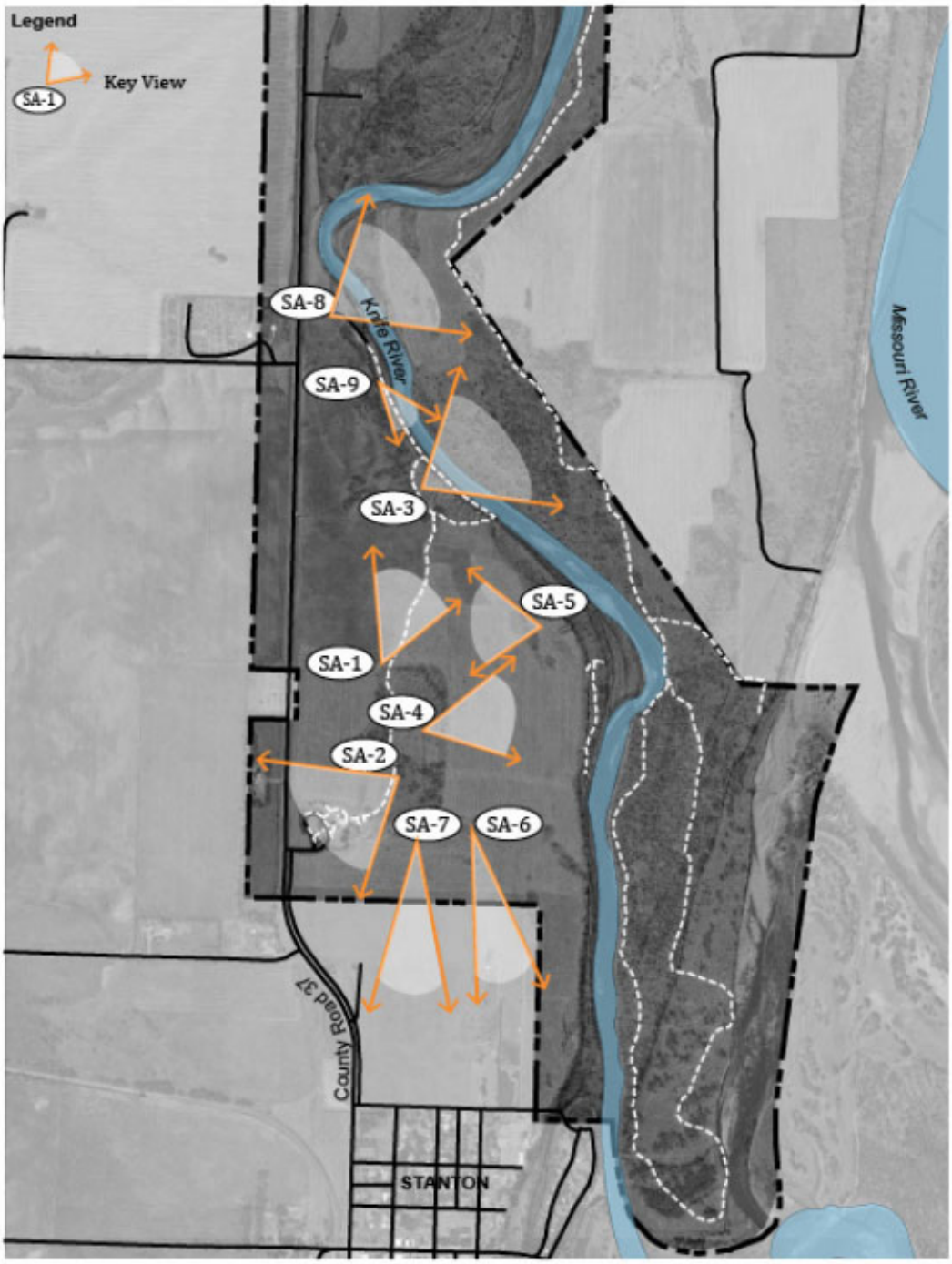

Figure 3-29. South
Views Diagram (QE, 2

As noted in the draft document, views are an important part of landscape character both within the park and from the park to external locations. Views of the natural landscape surrounding the villages within the NPS park boundary contribute to understanding the historic landscape. The draft CLR notes that views throughout the park are threatened by resource extraction and other types of development within the park's viewshed. Maintaining the integrity

of the viewshed as it currently exists, to the maximum extent possible, is therefore important to our organization.

While I cannot share the draft CLR at this time, the overarching significance of KNRI and its resources, and management and treatment needs are addressed in the June 2013 Foundation Document, which is attached for your reference.

The Fort Clark NHL nomination is in draft stage and is undergoing edits with the North Dakota State Historic Preservation Office. Please contact Andrew Clark with the North Dakota SHPO to determine if the draft document can be made available for your information.

Thank you,
Alisha

Alisha Deegan
Superintendent (Park Manager)
Knife River Indian Villages National Historic Site

Chair of Council of Indigenous Relevance Communication Leadership and Excellence (CIRCLE)

Hidatsa/Sahnish
She/Her

PO Box 9
564 County Road 37
Stanton, ND 58571

P:701-745-3300 ext 1202
C:701-301-0467

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From: Snyder, Natasha <Natasha.Snyder@nexteraenergy.com>
Sent: Tuesday, July 18, 2023 3:31 PM
To: Deegan, Alisha M. <alisha_deegan@nps.gov>; dena_sanford@nps.com <dena_sanford@nps.com>
Cc: Brown, Dina <Dina.Brown@nexteraenergy.com>; Bender, Marcia L <mlbender@burnsmcd.com>; McCarthy, Melinda M <mmmccarthy@burnsmcd.com>
Subject: [EXTERNAL] RE: NextEra Oliver Wind IV follow up

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Good afternoon, Superintendent Deegan.

I am following up on our call on Thursday, July 6, 2023 about the NextEra Oliver Wind IV project with National Park Service (NPS) staff, the NextEra project team, and our cultural resources contractor staff from Burns & McDonnell. NextEra greatly appreciates the time and expertise of all the NPS staff participating in the call and looks forward to addressing NPS' comments.
(I know that in addition to Ms Sanford, Mary Kreuger, Jim Schilling, and Brian Curran [sp?] were also on the call, but I do not have their emails – please forward as appropriate.]

On the call, NPS staff expressed concerns about potential visual impacts of the project on the setting of three specific resources:

- the Knife River Indian Villages National Historic Site (KRIV);
- the National Historic Landmark (NHL) within the KRIV; and.
- Fort Clark, a State Park with associated TCPs that is being considered for designation as an NHL.

When discussing concerns for the KRIV, NPS staff mentioned that there is a draft Cultural Landscape for the KRIV.

- I am respectfully asking if a copy of the draft report could be made available to us so that we could understand the significance of the cultural landscape to the KRIV NHS?
- If there is a KRIV management plan or similar type of comprehensive/planning document that addresses cultural resources in general that would be helpful as well.

With regard to the NHL at the KRIV, I am unable to find a copy of the KRIV NHL nomination form in the NPS' NHL database (possibly because of its archaeological associations?).

- I am respectfully asking if a copy of the KRIV NHL nomination form could also be made available to us so that we could understand the significance of setting to this NHL.

With regard to Fort Clark, there is information online for the state park and we will be able to contact ND SHPO for as much information for TCPs that can be disclosed, but the draft NHL nomination would not be available in the NPS' NHL database and I do not know who is preparing it (e.g., NPS Midwestern Regional Office, ND SHPO, etc.).

- I am not sure that KRIV is involved in the preparation of the draft NHL nomination for Fort Clark, so I am respectfully requesting confirmation that Jim Schilling at NPS Midwestern Regional office is the appropriate NPS staff to contact.

I understand from KRIV staff that you are on vacation this week.
I will be in the field or on vacation next week myself (including 3 days in a remote setting with no internet/cell phone access).

Hopefully we can coordinate via email.
In the event that I am not immediately available, Dina Brown (my Dina; the NextEra Environmental Permitting Lead) and Marcia Bender and Melinda McCarthy (Burns & McDonnell, our cultural resources contractors) are cc'd to facilitate receiving the information and/or following up with anyone else.

Thank you very much in advance for your assistance with my inquiries.
I look forward to hearing from you as soon as you are available.

Kindest regards,

N.

P.S., In the event that there are concerns for access to confidential information, I have attached my CV for your records.

Natasha B. Snyder
Environmental Specialist
NextEra Energy Resources, LLC
Environmental Services (JES/JB)
700 Universe Boulevard
Juno Beach, Florida 33408
Mobile: (561) 427-9059
Natasha.Snyder@nexteraenergy.com

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Appendix C18
North Dakota Game and Fish Department and United States Fish and Wildlife Service

Red Butte Wind Energy Center
Wildlife Agency Meeting

Date: 18 July 2018
Time: 13:00 – 15:00h
Location: North Dakota Game and Fish Department, 100 N. Bismarck Expressway, Bismarck, ND 58501. Call in number for USFWS: (305) 552-3001 access number 49701129.

AGENDA

1) Sign-in sheet
2) Introductions
3) Red Butte Wind Energy Center (Project) information
   a. Project originally developed by PRC Wind starting in 2016. Further developments conducted by Tenaska in 2018. NextEra purchased and will complete development and permitting.
   b. Wind project area to be determined
   c. Planned for 200 MW, approximately 75 turbines
   d. PSC application anticipated submission November 2019
   e. Anticipated construction start date in Q2 2020 with Commercial Operation by December 2020
4) Discussion items
   a. Previous meetings with USFWS and NDGFD
      i. Study plan development/review and data sharing in 2016
      ii. Meetings in 2017 to review Tier 2 and 3 study results
      iii. Meeting in 2018 to discuss additional Dakota skipper habitat surveys
   b. Studies completed prior to and discussed with agency by previous Project proponents
      i. WEG Tier 1 and 2 Studies: Critical Issue Analyses and Desktop Studies – desktop review of existing data from North Dakota Parks and Recreation Department (NDPRD) Natural Heritage Inventory (NHI) GIS data, U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (IPaC) federally listed species, North Dakota Game and Fish (NDGF) Wildlife Management Areas (WMAs), NDGF Private Land Open to Sportsman (PLOTS) land, USFWS Natural Wildlife Refuges and Waterfowl Production Areas (WPAs), Audubon Society Important Bird Areas (IBAs), North American Breeding Bird Survey (BBS) data, National Wetland Inventory (NWI) maps, and other readily available databases, public records, GIS data, and websites.

         Conclusion based on layout in 2016 was that additional information was needed to better define potential impacts for avoidance and minimization. Moved to conducting Tier 3 studies.

      ii. WEG Tier 3 Wildlife Surveys Previously Conducted and Discussed with Agencies

         1. 2016 Spring/Summer/Fall avian point-count surveys
            a. 35 points in spring within larger survey area, 26 points in summer and fall. Each point surveyed for 5 minutes.
            b. 45.5 survey hours. Most common were red-winged blackbirds, cowbirds, Canada geese, western meadowlark, and cliff swallow. Species of concern identified included marbled godwit, upland sandpiper, western meadowlark, chestnut collared longspur, bobolink, grasshopper sparrow, Swainson's hawk, and northern harrier.
            c. Use rates variable across Project but generally higher in southern portion.

2. 2016 Spring/Summer/Fall Eagle point-count surveys
    a. 24 points surveyed in spring within larger survey area then reduced to 16 points. Each point surveyed for 1-2 hours once per month. 224 hours of survey.
    b. 2 adult bald eagles observed during surveys, both flying > 200 m above ground.
3. 2016-2017 Aerial raptor nest surveys (including bald and eagle nests)
    a. Conducted from helicopter, out to 10 miles for eagle nests.
    b. Limited number of non-eagle nests found within survey area.
    c. 10+ active bald eagle nests within 10 mile survey area.
    d. Most bald eagle nests to the east along the Missouri River, more than 7 miles from the survey area.
4. 2016 Grassland breeding bird surveys
    a. 247 point count locations along transects spaced more than 200 m apart. Surveys conducted 4 times in May/June.
    b. 75 species recorded. Most common species included western meadowlark, brown headed cowbird, red-winged blackbird, bobolink, horned lark, savannah sparrow, and clay-colored sparrow. Special status species observed included dickcissel, chestnut-collared longspur, lark bunting, bobolink, Sprague's pipit, Baird's sparrow, grasshopper sparrow, golden eagle, northern harrier, Swainson's hawk, sharp-tailed grouse, marbled godwit, upland sandpiper, and Franklin's gull.
5. General bat acoustic study
    a. Three paired stations, one microphone at 5 m and other approximately 45 m AGL. Surveys completed from May to November.
    b. Generally low bat use at all three stations and at both heights, passage rates varied from 0.66 ± 0.16 to 2.57 ± 0.54 bat passes/night. Activity was highest from late July to September.
    c. Most calls were from low frequency species (e.g., hoary bat, silver haired bat). Calls from three species of conservation priority were potentially identified: big brown, little brown, and northern long-eared bat. As only two calls were identified as northern long-eared bat, it is questionable as to if these were actually NLEB given difficulty in distinguishing from eastern red bats in open landscapes.
6. Native prairie evaluation
    a. A native prairie evaluation was conducted to identify potential native prairie areas. Four levels of vegetation quality were assigned to each parcel: poor, fair, good, and excellent. A total of approximately 43.2% of the Study Area classified as poor-excellent native prairie.
7. Whooping crane likelihood of occurrence report
    a. Project is within overall whooping crane migration corridor.
    b. Given Project characteristics (e.g., generally dry) determined that whooping cranes had a low likelihood of occurrence.
8. Sharp-tailed grouse lek survey
    a. One survey conducted concurrently with aerial raptor nesting surveys. Additional ground surveys were conducted by vehicle along all accessible roads.
    b. Six leks were documented.

c. Agency Comments Received

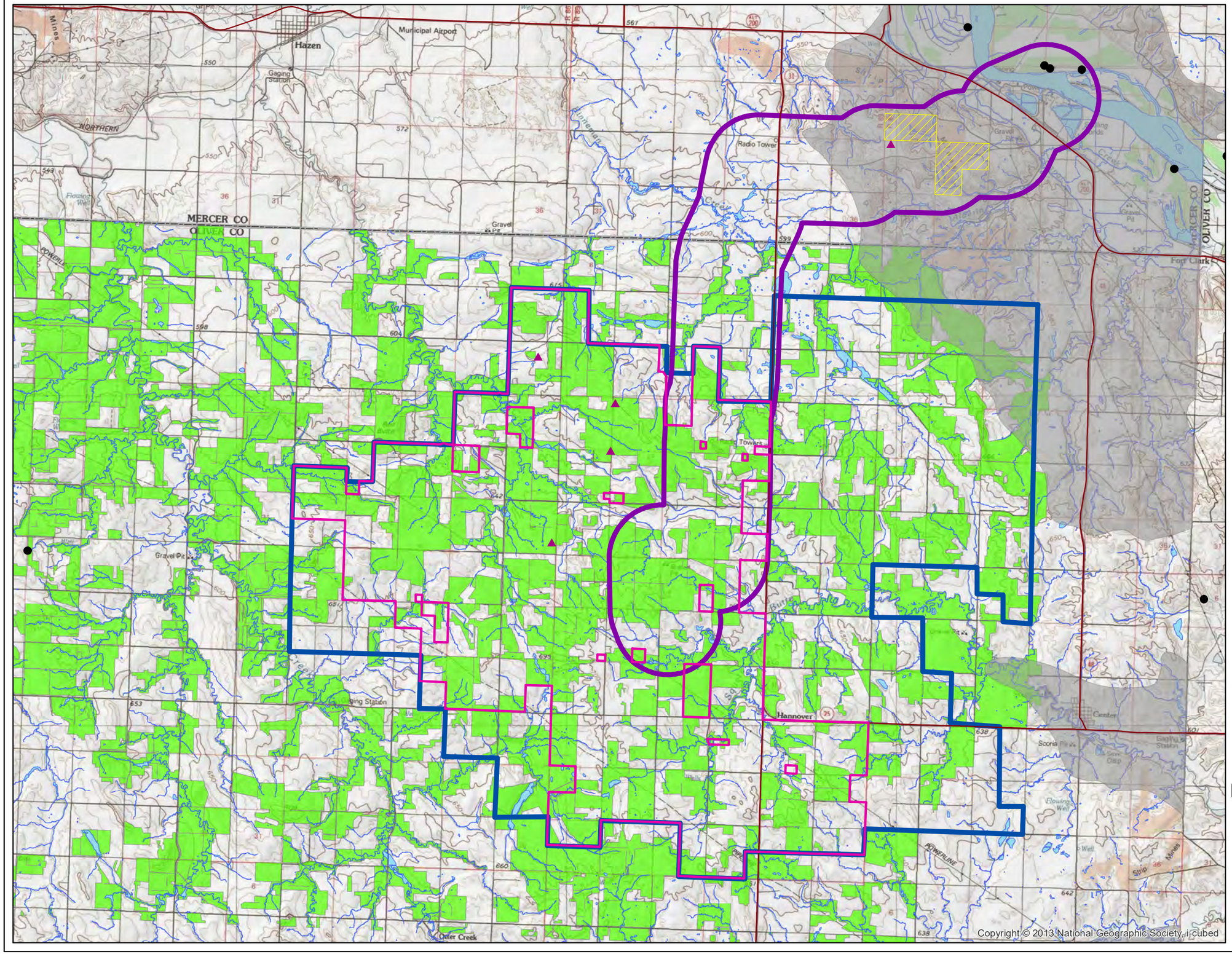
i. Concern regarding impacts to native grasslands and wetlands, attempt to avoid impacts was recommended.
ii. Discussion of voluntary offsets for direct and indirect impacts to grasslands and wetlands where avoidance was not possible.
iii. Request for additional Dakota skipper habitat evaluations.

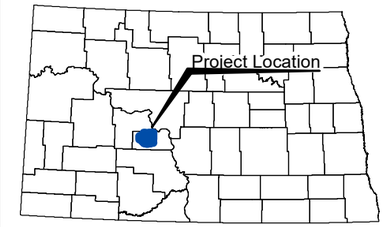
d. Additional Studies Completed or Planned Since 2018
   i. Dakota skipper habitat evaluation
      1. One historic observation of DASK in county from 1990's, 10+ miles to east along Missouri River.
      2. USFWS indicated considers species extirpated from county.
      3. Additional habitat evaluation within high quality native prairie conducted for potential DASK habitat. One area found to contain prairie constituent elements for reproductive habitat of needed grasses and forbs.
      4. Was the DASK report provided?
   ii. 2019 sharp-tailed grouse lek survey
      1. Partial survey due to timing and weather. One ground survey of accessible roads plus check of leks found previously. One aerial survey completed.
      2. Two confirmed leks and three probable leks located.
   iii. Eagle/Avian use surveys
      1. Large Project area being surveyed. 64 points, surveyed for one hour per month, for one year planned.
      2. Surveys started in June 2019.
   iv. Wetland and waterbody delineations – Field surveys planned for 2019.
   v. Grassland/DASK habitat assessment – Desktop and field verification for unbroken grassland and potential DASK habitat, ongoing in 2019.
   vi. NLEB presence/absence surveys – Combination of acoustic and mist-netting planned, as approved by USFWS survey protocols. Surveys planned for late July/early August 2019.
   vii. Whooping crane habitat assessment – Desktop comparison of current Project area and reference areas to evaluate relative habitat quality of Project to region.
   viii. 2020 eagle nest survey
   ix. 2020 sharp-tailed grouse lek survey – Full aerial survey planned.
   x. Wildlife Conservation Strategy – To be developed following USFWS WEG.

5) Agency Input
   a. Leks
   b. WMAs
   c. Consideration and process for voluntary offsetting measures
6) Action Items / Next Steps

ATTACHMENTS

- Overview Map





Legend

- County Boundary
- 2017 Project Area
- Preliminary Project Boundary
- Preliminary Transmission Line Corridor

Environmental Constraints:

- Bald Eage Nest
- 2019 Lek
- National Wetlands Inventory
- SWAP Focus Area
- Unbroken Grassland*
- Wildlife Management Area

* Unbroken grassland analysis not completed for Transmission line corridor

0 1 2 4 Miles

Red Butte Wind Energy Center Mercer and Oliver Counties, North Dakota

N W E S

AECOM

Red Butte Wind Energy Center
Wildlife Agency Meeting Notes

Date: 18 July 2018
Time: 13:00 – 15:00h
Location: North Dakota Game and Fish Department, 100 N. Bismarck Expressway, Bismarck, ND 58501.

Attendees (in person):
Steve Dyke (NDGF)
Sandy Johnson (NDGF)
Dustin Jones (NEER)
Clay Cameron (NEER)
Clayton Derby (WEST)
Lindsey Churchill (AECOM)

Attendees (via phone):
Natalie Gates (USFWS)
Jeffrey Bryce (NEER)
Trey Hadley (NEER)

1) Dustin introduced Project and gave an overview of studies completed by previous developer and studies to be completed by NEER.
2) NEER discussed intent to avoid siting infrastructure on unbroken grasslands to the extent possible by other exclusion/avoidance areas and constraints.
    a. Map provided of desktop unbroken grassland analysis completed by AECOM.
3) Sandy requested Whooping Crane and avian reports be updated using Neal Niemuth's models for whooping cranes and breeding birds.
    a. Sandy provided example model maps for chestnut-collared longspur, Baird's sparrow, Sprague's pipit, upland sandpiper, and grasshopper sparrow.
4) Sandy provided large map of NDGF lek data.
    a. NDGF stressed that the Red Butte Project area is not entirely covered by NDGF lek data due to limits of lek census blocks. NEER expressed their understanding of the data limitations and would ensure data is accurately presented if NDGF chooses to share.
    b. Additional surveys will still need to be completed for leks to supplement data.
    c. Currently in low cycle for grouse populations; avoiding unbroken grassland is best way to avoid lek impacts.
    d. Sandy provided lek survey methods from Jesse Kolar and NDGF Draft Guidelines.
5) Discussed if transmission line can span Wildlife Management Areas (WMAs)
    a. NDGF – unknown, will depend on how the WMA is owned/purchased.
6) Discussed new North Dakota Century Code rules
    a. Comments from Agencies required 30 days before the scheduled PSC hearing date
    b. Agencies would like to receive reports and other documents for which they are expected to review or comment 75 or more days before this date
7) Action Items / Next Steps
    a. NEER to provide previous reports and summary of prior agency correspondence
    b. WEST to integrate Neal Niemuth's models into updated reports
    c. NDGF to investigate WMA restrictions and ownership type for the transmission line

d. NEER to schedule follow-up meeting following turbine micrositing and survey and provide post-microsited turbine array; NEER will share new/updated wildlife reports as they are available for agency review

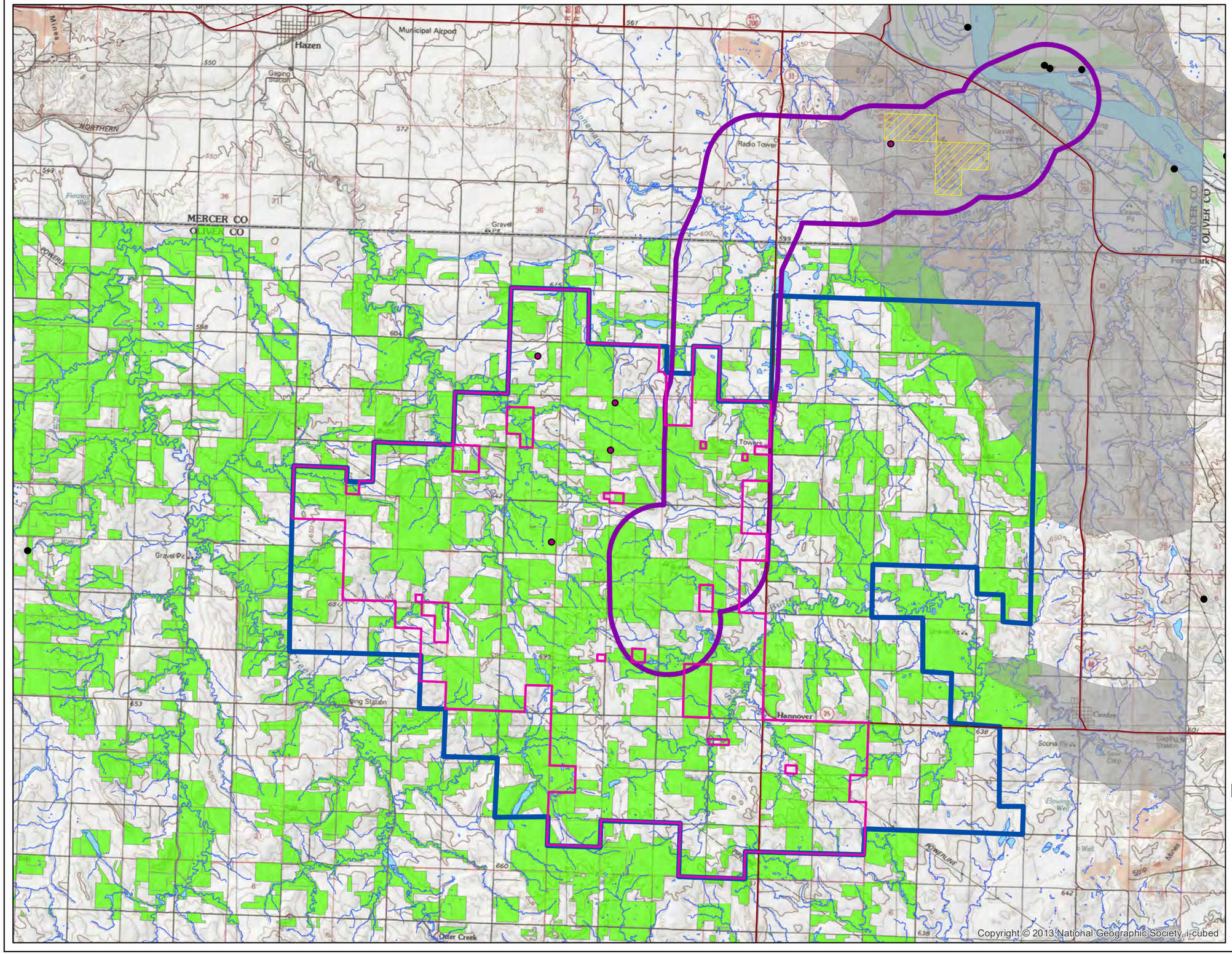
Attachments:

NEER Unbroken Grassland Map

Grassland Breeding Bird Model Maps

NDGF Lek Map

NDGF Lek Survey Methods



Legend

- County Boundary
- 2017 Project Area
- Preliminary Project Boundary
- Preliminary Transmission Line Corridor

Environmental Constraints:

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- SWAP Focus Area
- Unbroken Grassland*
- Wildlife Management Area

* Unbroken grassland analysis not completed for Transmission line corridor

0 1 2 4 Miles

Red Butte Wind Energy Center Mercer and Oliver Counties, North Dakota

N W E S

AECOM

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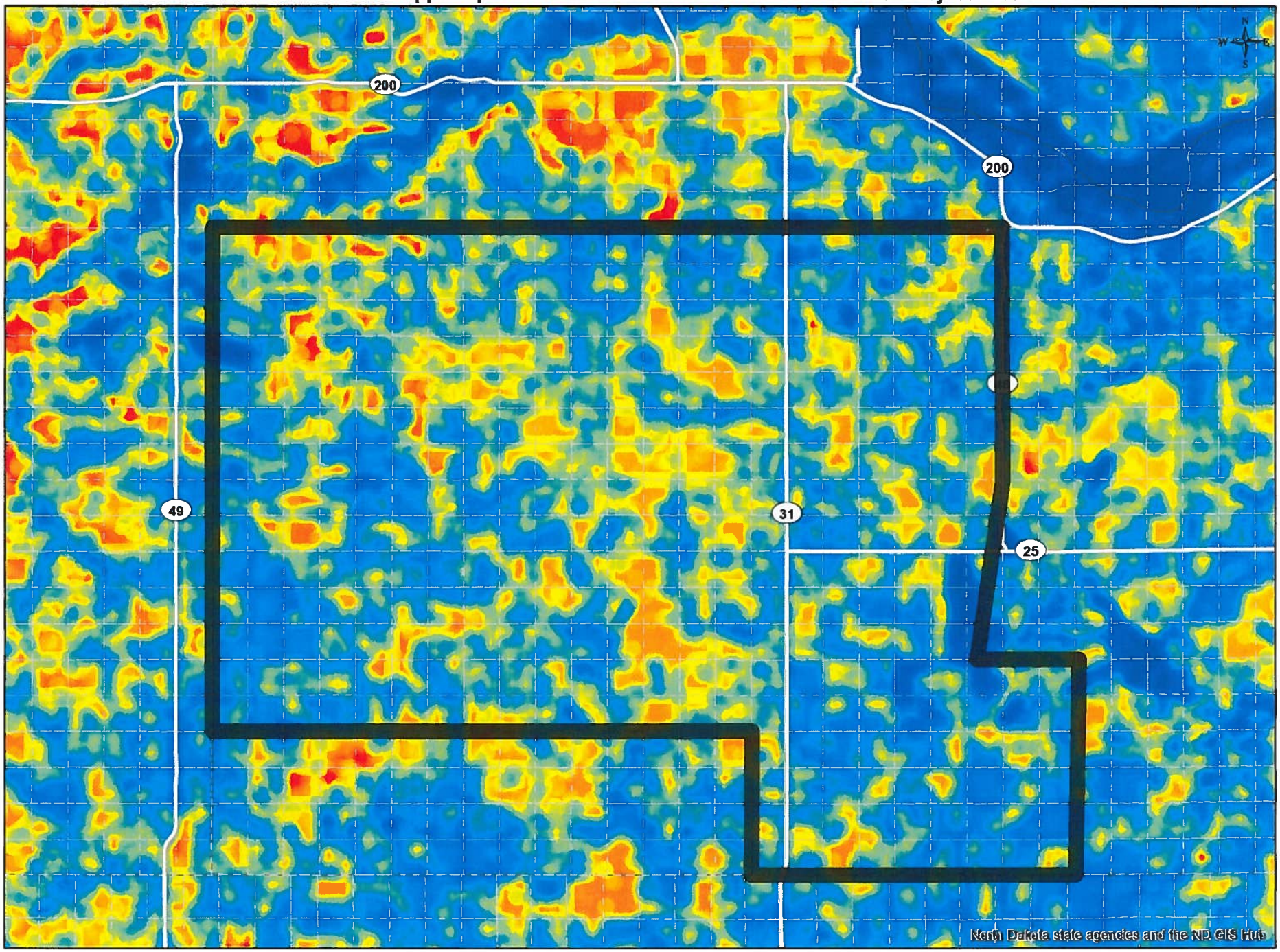
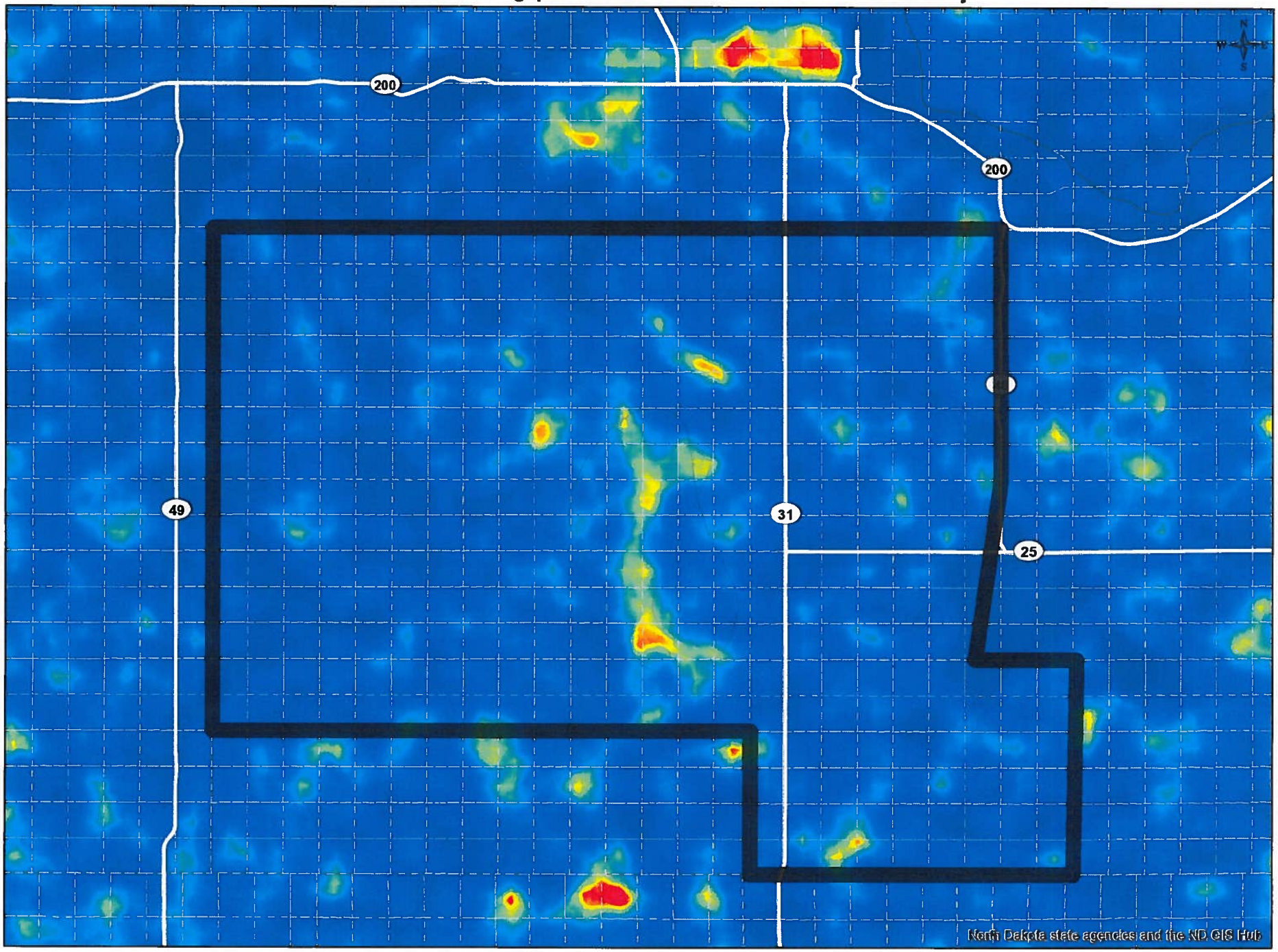
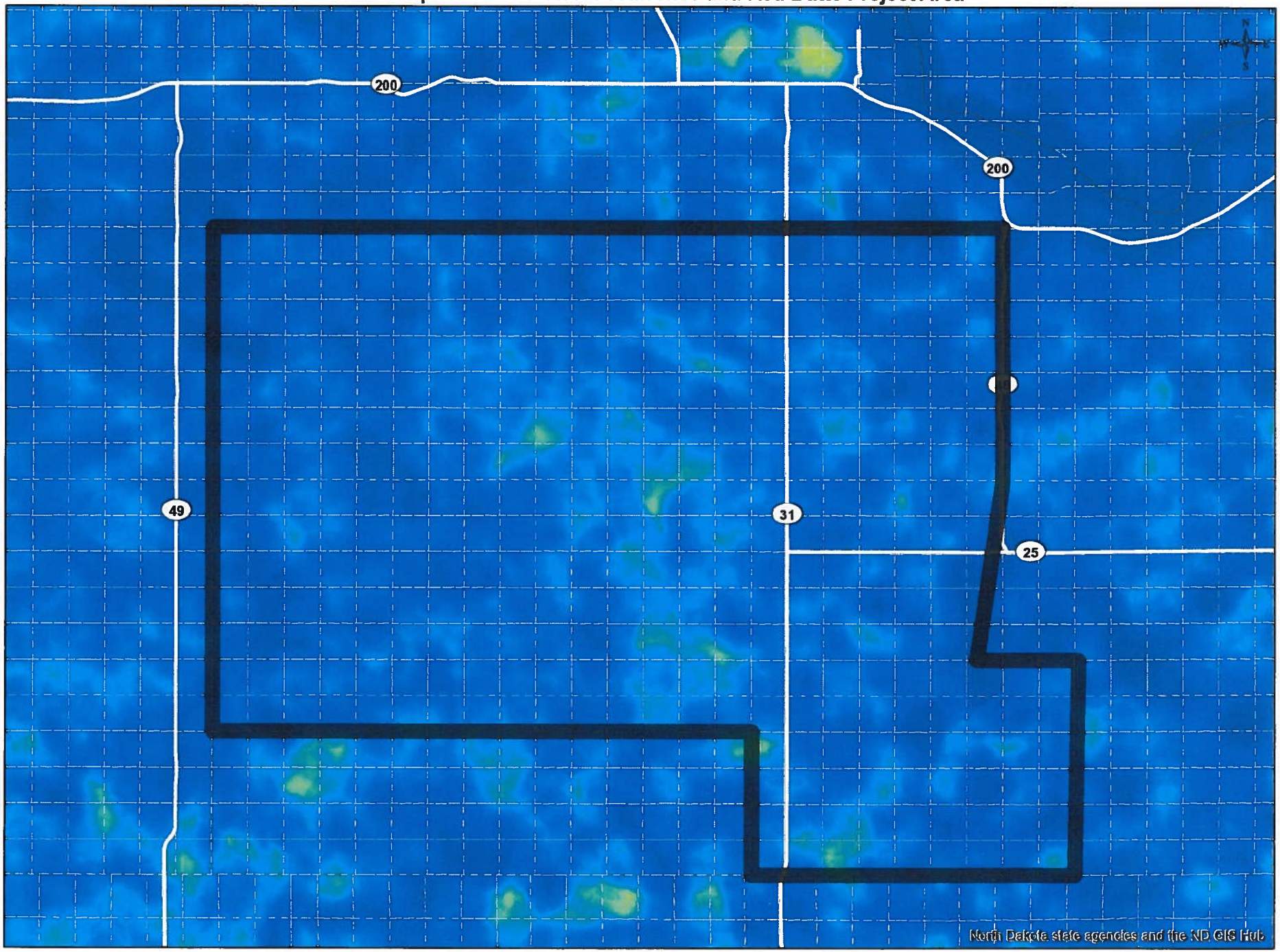
Grasshopper Sparrow Predicted Occurrence and Red Butte Project Area



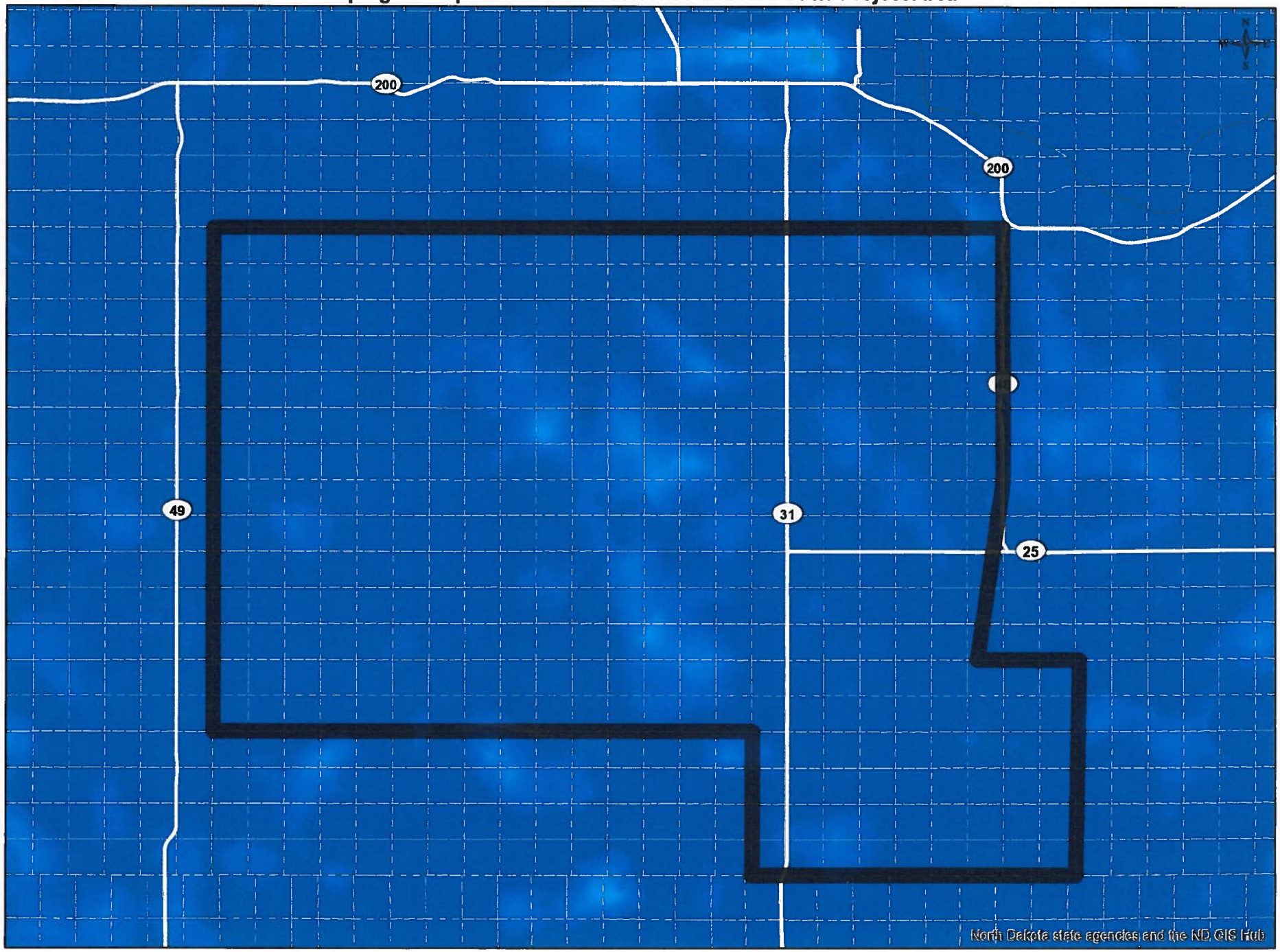
Chestnut-collared Longspur Predicted Occurrence and Red Butte Project Area



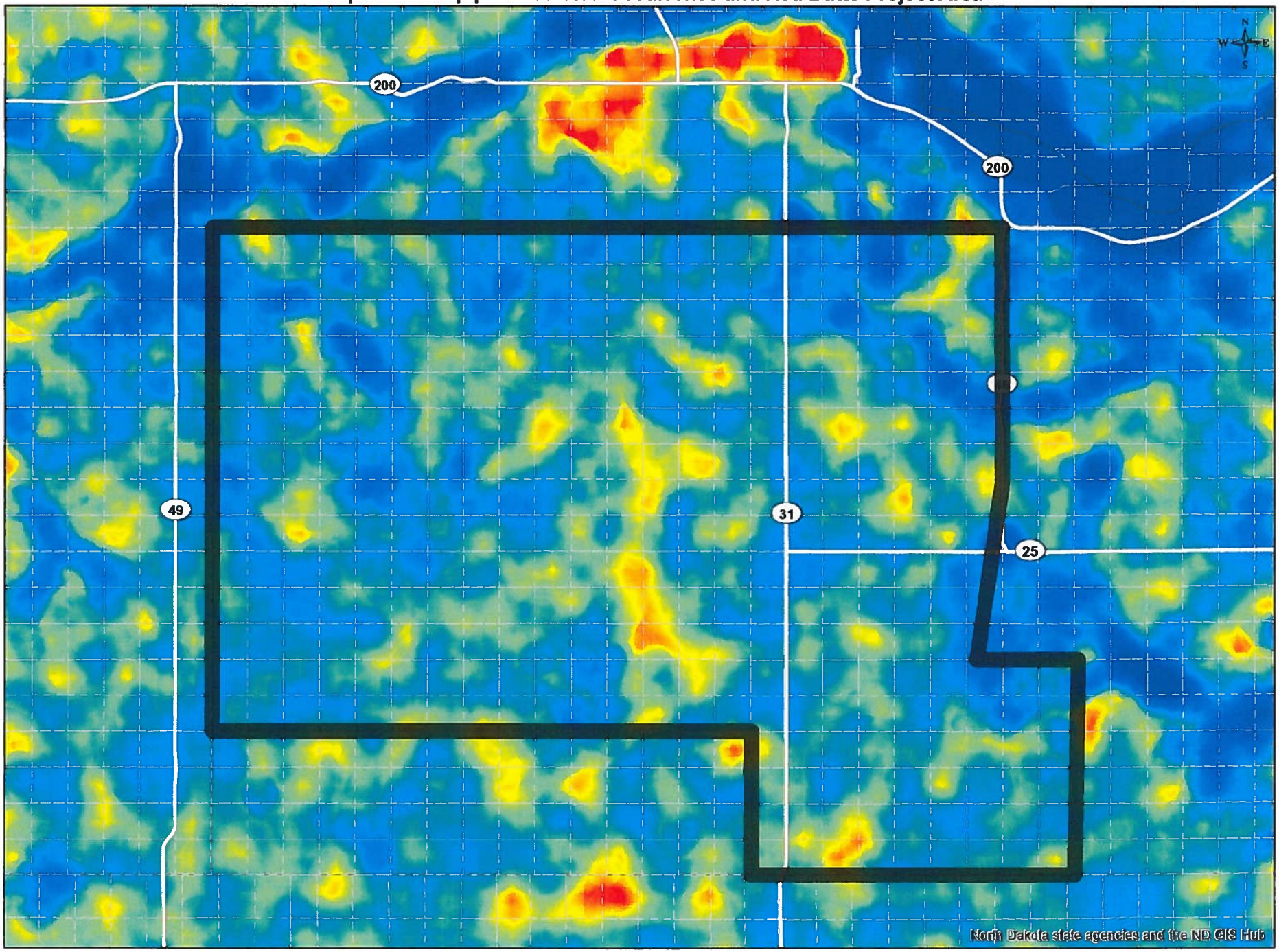
Baird's Sparrow Predicted Occurrence and Red Butte Project Area

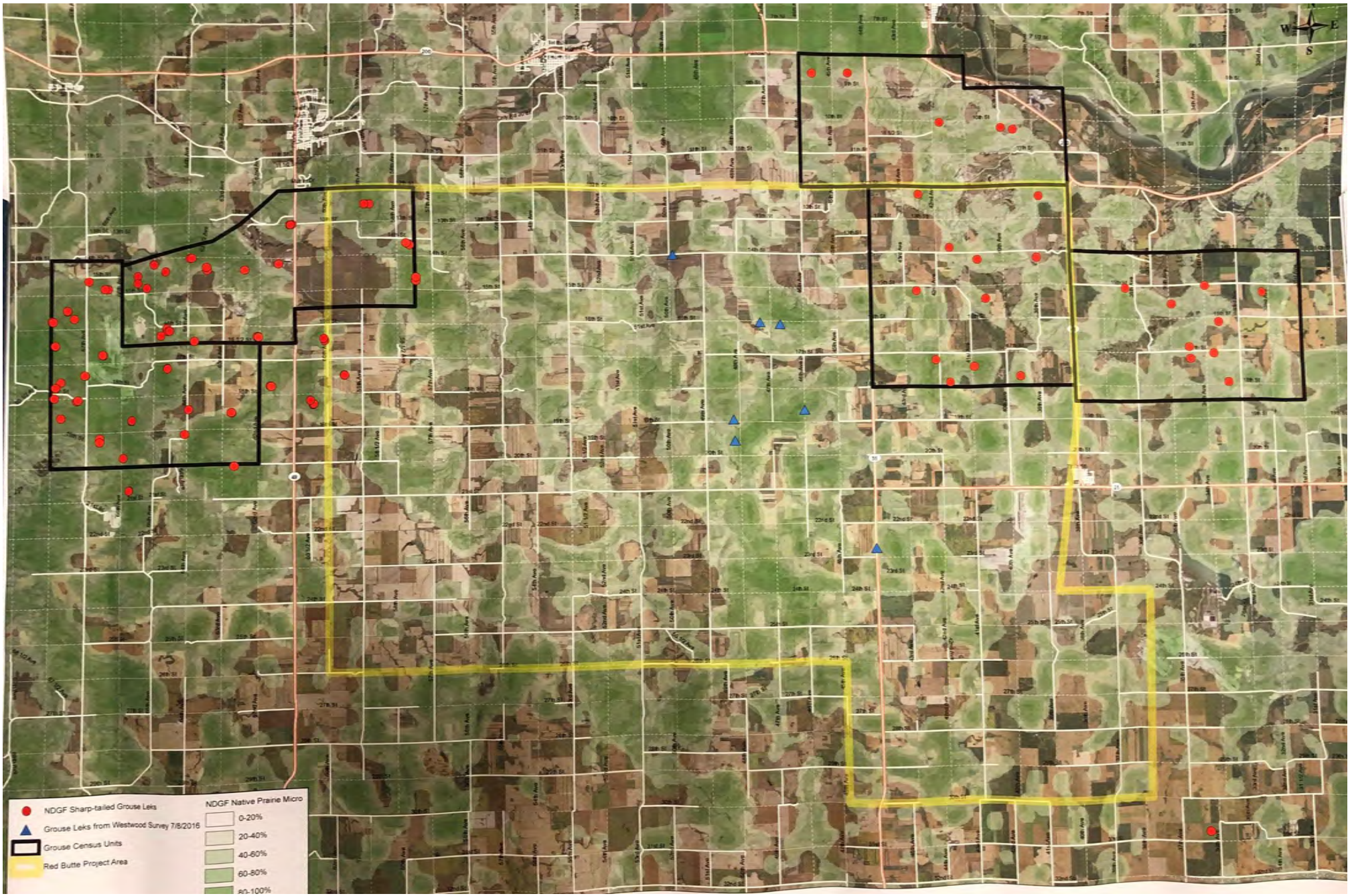


Sprague's Pipit Predicted Occurrence and Red Butte Project Area



Upland Sandpiper Predicted Occurrence and Red Butte Project Area




NDGF Sharp-tailed Grouse Leks
Grouse Leks from Westwood Survey 7/8/2016
Grouse Census Units
Red Butte Project Area
NDGF Native Prairie Micro
0-20%
20-40%
40-60%
60-80%
80-100%
W
E
S

Message from Jesse Kolar, NDGF Upland Game Supervisor

We've attached our protocols; however, these might not be appropriate for detecting presence/absence of sharptail grouse leks. The North Dakota Game and Fish Department conducts surveys on established survey blocks to monitor population trends. (Also, we extrapolate our population trends from small survey blocks; we do not survey the entire state.) Note the grouse census protocol were written for NDGF internal guidance, not for consultants. They're not written to search new areas for leks, but to monitor existing survey blocks. They work for us because we have a good idea where the leks have been historically.

Leks are variable over time (in size and location), so to survey for lek presence/absence, it would take multiple years. We do not use data from our surveys until they have been conducted for a minimum of 5 years. A more thorough protocol would be required to determine presence/absence of a lek for a given land parcel (e.g. 2-3 years with repeated (at least 3x) listening runs per parcel (the protocols for listening runs are in the first section of our survey protocol (attached).

Currently the sharptail grouse population is in a low cycle, so many historic leks might not be active, or have few, hardly-displaying males (and hence be hard to detect). However, even if leks disappear for a few years during low population cycles, the grouse often reappear at the same spot when the population rebounds. Thus, even a thorough search of an area during a low cycle in the population should carry the caveat that leks may be present when the population is higher.

North Dakota Game & Fish Department Prairie Grouse Census Protocols

I. Listening runs/locating grounds

Dates: 15 Mar - 30 Apr (extend up to 15 May during years with late spring).
Listening runs can begin in spring as soon as travel conditions permit. There are a limited number of "good" mornings so start as early as possible. ("Good" is defined in Conditions below.)

Peak of attendance by females on grounds in North Dakota is usually 15-25 April but may vary up to a week depending on weather.

Time: 30 minutes before sunrise to 1 hour after sunrise. Use a sunrise table to determine local sunrise times. Grouse activity begins about 45 minutes before sunrise and continues for up to 2 hours after sunrise. Monitoring can continue to 2 hours after sunrise, but routes should be run so that no area is repeatedly monitored >1 hour after sunrise.

Conditions:

Wind - Low wind speeds (<10 mph). Wind (<10 mph) normally does not affect counts, but winds > 5 mph limit the ability to hear grouse. If the winds are less than 5 mph, please do not spend time counting, and instead try to make as many listening stops as possible to locate grounds. (Counts can be completed on poorer mornings—winds up to 20 mph—or up to 2 hours after sunrise.)

Precipitation - no precipitation. Grouse are often inactive while it is raining or snowing.

Sky - Visibility > 5 miles. Cloud cover does not affect counts, but fog limits the ability to detect grouse.

Temperature - Temperature does not affect counts.

Ground - Use care to avoid muddy conditions, particularly if your travel is on private land.

Protocol:

1. Stop within ½ mile of every point in a census block. Plot your travel and listening stops on a map each day to see that the census area is monitored thoroughly.
2. Turn off engine and walk at least 30 feet from your vehicle to avoid interference of cooling noises, etc., from the vehicle.
3. Listen for 3-5 minutes per stop. Grouse activity is not continuous and sometimes wind or interference necessitates longer listening periods.
4. While listening, use binoculars to glass surrounding terrain. When prairie grouse are dancing their white tails are often visible and easily seen from a distance, providing the vegetation is not too tall. Even in tall vegetation grouse often "flutter jump" about 5 feet into the air which can help locate grounds.
5. Knolls and flats are likely areas to search for grounds but grounds can be anywhere (even summer fallow), so do not neglect areas simply because they are not "grouse habitat."
6. Grouse ordinarily use the same courtship grounds each year but move on occasion. Listening runs are necessary *EVERY* year (both to locate grounds that moved or are newly established).
7. Listening runs may be supplemented by monitoring during the last 2 hours before sunset. Grouse are occasionally active then, but attendance is generally lower (counts must only be made during mornings).
8. Aerial surveys can also help locate grounds but are not recommended for thoroughly locating grounds, nor for counts.

II. Counts

Dates: 01 Apr - 30 Apr (may extend to 15 May during years with late spring).

Peak of attendance by females on grounds in North Dakota is usually 15-25 April but may vary up to a week depending on weather.

Time: 30 minutes before sunrise to 2 hours after sunrise. Additional counts can be made as long as grouse are active on grounds. Use a sunrise table to determine local sunrise times. Grouse activity begins about 45 minutes before sunrise and continues for up to 2 hours after sunrise. Counts can continue to 2 hours after sunrise, but routes should be run so that no area is repeatedly monitored >1 hour after sunrise.

Conditions:

Wind - Wind speeds <20 mph).
If the winds are less than 5 mph, please do not spend time counting, and instead try to make as many listening stops as possible to locate grounds. (Counts can be completed on poorer mornings—winds up to 20 mph—or up to 2 hours after sunrise.)

Precipitation - no precipitation. Grouse are often inactive while it is raining or snowing.

Sky - Visibility > 5 miles. Cloud cover does not affect counts, but fog limits the ability to detect grouse.

Temperature - Temperature does not affect counts.

Ground - Use care to avoid muddy conditions, particularly if your travel is on private land.

Protocol:

1. Approach the ground slowly with your vehicle. Grouse will flush when approached on foot but normally will allow a close approach with a vehicle. Use the closest vantage point to the ground to count from, which normally means a spot higher than the breeding ground. This may not always be possible but certainly is the ideal and preferred situation.
2. Use binoculars (or a spotting scope); they are essential for a good count.
3. Classify and count all males and females on each ground. Our census was designed around accurate counts of males. The main objective is to get an accurate count of males. Count of females is desired but not critical. We use the number of females on grounds to determine when peak of breeding is, but not for population estimates. If you do not get an accurate count of females that is ok.
    a. If the ground has birds actively displaying, those actively displaying birds are males. Display activity is sporadic, but males frequently display and stop as a group. It is easier to count males while they are actively dancing, not while the ground is at a halt.
    b. Pan across the ground and count males while they are dancing, when they stop, you stop but hold your place and when activity resumes your count can resume also. Continue until you have covered the entire ground and you have a count of all males.
    c. *Classification tips.* If dancing activity is vigorous but not all are dancing, then you have to determine which non-dancers are male and female. This may take some time and involve several counts.
        i. *Males.* Only males have yellow eye combs (usually evident in spring and a spotting scope will help notice this). Only males display. If the bird attempts to enter the ground and is chased out, it is likely a male. Males occupy the grounds later in the morning after females move off. If the ground has grouse present, you

see no dancing activity for several minutes, birds are feeding, squared off, or preening, chances are they are all males. If a female were present, or one arrives, dancing immediately begins and usually continues until the female leaves. If a few birds dance, square off and stop, and wait long periods between dancing, all birds are probably males, even those around the perimeter of the ground.

ii. *Females.* If it enters the ground and is not chased by a known male, it is a female. Females will occasionally chase each other but not as vigorously or as far as males. If no yellow eye spot is present, the bird never displays, and is ignored when close to a known male, the bird is a female.

iii. *Both.* If you arrive at a ground and some birds are dancing and some are not it may take a little longer to sex the birds. Non-dancers around the perimeter of a ground are the most difficult to sex. Again, if the bird seems to be loafing on the perimeter, you can usually spot the yellow eyespot if it is a male.

iv. Experience is the best teacher for identifying sex of birds and it will come much easier with each count you make. It helps to make a few counts with an experienced observer.

d. Each morning you visit a ground you should make several counts to be sure you have counted all birds present. Do not leave until you feel you have made an accurate count. Spend as much time as necessary at each ground to locate all birds. Tall vegetation, dips, and mounds may hide some birds so take enough time to be sure all birds have been seen. If grouse are still arriving at the ground you may have to remain at the ground longer to get an accurate count.

4. Do not neglect the area around a ground. Even though activity seems to be centered in one area, isolated males or small groups may be several yards or several hundred yards from the center of activity. Glass all surrounding terrain for these "satellite grounds". Occasionally if a hen or group of hens leave a ground, some males may follow and display at locations other than the ground proper.

5. If the birds flush upon your arrival, park and wait. If the time period is mid-April and you are at the ground early in the morning the males should return to the ground. However, if it is late in the morning and they fly a long distance, chances are they will not return.

6. *If* you have a ground that is impossible to count from a vehicle (it is on the highest knoll around and there are always birds on the other side; no ready access due to land ownership; poor road conditions; fences; etc.) you might have to make a flush count.

a. To decrease the chance of counting females: flush birds late in the morning after most dancing activity is done. Males remain on the ground long after females leave. If you can tell the birds are not active (listen for a while or glass a portion of the ground to check activity) all birds on the ground are probably males and a flush count can be made.

b. Use flush counts later in the census period (in late April or early May) since few females are present then, even during the peak activity period of the morning. Keep in mind that attendance by males begins to decline later in the season so late morning counts are a better option than late season counts.

c. Flush difficult grounds at least 3 times. If counts do not vary over a bird or two, the count will be ok.

7. On your first visit to a ground, if no birds are present but you feel the ground should be active you can check the site for evidence of activity. If birds have been using the ground there will be feathers, droppings, and flattened vegetation present. If so, additional visits are necessary.

8. If you feel a ground has moved, most times you can hear birds at the new ground by listening at the old location.

9. Count each ground at least three times (three different days). Vary your counts so that you have

at least one early count (before sunrise) on each ground near the peak of breeding activity. Do not use the same route for counts each day but vary the route so count times vary on each ground.

10. Fill in your census form *COMPLETELY!* Include all weather data, and be sure to record time for each ground counted. Make a note of unusual circumstances (as raptor or coyote on ground) that may have influenced the count. Be sure to record if the count was a flush count.
11. After your survey each day, please send a copy of that morning's survey to the biologist in charge of the survey. They will be able to summarize the data and contact you if additional counts or coverage are needed. At the conclusion of the seasonal survey, include a map of the area showing dancing ground locations.
12. If you find grouse dancing in a new location, this could be either a new ground or simply a ground that has moved. The biologist and observer will decide whether to assign a new number to the ground or to use a number from a former ground.

APPENDIX E. RECOMMENDED WILDLIFE SURVEY METHODS

Raptor Surveys

Grouse Surveys

These instructions are intended to aid personnel in obtaining distribution data for prairie grouse display grounds. The collection of this data will help developers understand the risk of a project to prairie grouse.

Survey Efforts

1. Approximately a dozen mornings are needed to census a township (36 square miles).
2. Secure permission to access area by vehicle.
    - It is recommended that the surveyor be able to drive within 1/2 mile of any spot in the area to listen for displaying grouse and be able to count each ground from a vehicle. Displaying grouse will allow a much closer approach by a vehicle than a person on foot. If grouse are spooked, detection of leks is very unlikely unless the birds flush.
3. Increased effort is required to survey grouse near highways, power plants, or other sources of noise pollution. Most grounds should be located by sound so any interference should be avoided to the extent possible.
    - Wetland areas are also a source of interference due to large numbers of waterfowl, blackbirds and other noisy critters.

Survey Methods

1. Set up a 0.5 x 0.5 mile grid of points that area accessible by vehicle or ATV.
2. Drive to each point, shut off vehicle, and walk at least 20 m from the vehicle (to avoid vehicular noises, such as engine cooling.)
3. Listen for 3-5 minutes during peak activity time.
    - 45 minutes before to 45 minutes after sunrise.
4. Listen for 5-10 minutes during decreased activity time.
    - 45 minutes after sunrise to 2 hours after sunrise.
5. While listening, use binoculars to glass surrounding terrain.

Oliver IV Wind 000926

- When grouse are dancing their white tails are very visible and easily seen from a distance, providing the vegetation is not too tall.
- In tall vegetation grouse often "flutter jump" about 5 feet into the air which can help locate grounds.
- Knolls and flats are likely areas to search for grounds but grounds can be anywhere (even summer fallow) so do not neglect areas that may initially appear unsuitable.

6. Plot travel and listening stops on a map each day. This will help determine areas of missed coverage and aid in covering the entire area.

   Note: Aerial surveys can be made to locate grounds but are not sufficient to declare an area free of grouse display grounds (e.g. they are prone to false negatives). Grouse tend to hunker down when aerial threats are perceived, and grouse are very difficult to detect from the air when they are hunkered down.

Survey Conditions

- Surveys should occur between 15 March and 15 May.
  - Peak of attendance by females on grounds in North Dakota is usually 15-25 April but may vary depending on weather.
- Each area should be surveyed entirely 3 times wi h at least 2 weeks between survey efforts.
- Survey effort should only take place 45 minutes before sunrise to 2 hours after sunset.
- Conditions should be clear (no precipitation) and calm (wind < 10mph).
  - Do not attempt surveys during any sort of precipitation; grouse are not active at that time.

Bat Surveys

Bats are long-lived (up to 30 years), reproduce at slow rates (as low as one young per year) and can move long distances during spring and fall, making them particularly susceptible to population declines. High bat fatalities at some Eastern wind facilities (4,000 annual deaths at one facility in West Virginia) have brought recent attention to the potential negative impacts to these species posed by wind facilities (Arnett 2005).

Acoustic monitoring is the most cost effective and common method to determine bat activity in the proposed area. Bats use echolocation calls to navigate and forage for prey during

Oliver IV Wind 000927

Meeting

Dustin Jones initiated a meeting with North Dakota Game and Fish Department (NDGFD) as an opportunity to provide a status update on the subject projects and generally discuss offset expectations.

Subject

Northern Divide Wind (NDW) and Red Butte Wind (RBW)

Attendees

NDGFD: Greg Link and Elisha Mueller
Nextera (NEER): Dustin Jones and Clay Cameron

Date

Wednesday, 28 August 2019

Notes

1. NDW
    a. Updates:
        i. Shared a map of the latest "preliminary, not for distribution" project layout.
        ii. Turbine micrositing complete and field surveys in progress. Explained array is very similar to the last one NEER recently provided to NDGFD, but that some turbines have shifted slightly to accommodate local and state setbacks and/or landowner requests.
        iii. All turbines and the substation remain sited outside of unbroken grassland and areas where pintail duck density is ≤20 pairs/sq.mi.
        iv. No direct impacts to wetlands.
        v. Transmission line modification required to accommodate the shift in turbines, and that the route considers landowner participation and preferences (e.g. follow property lines) and environmental.
        vi. Offsets
            1. Explained we are currently reviewing proposals from Ducks Unlimited (DU) and Magnolia. Each proposal is based on the same baseline; e.g., 80 acres of grassland, 100 2-acre wetlands, 30-year term. The proposals have differences, but each offer ways to deliver the offsets, and that NEER may evaluate using both providers in some capacity to take advantage of select components from each proposal.
            2. Explained DU is considering having NDGFD hold and manage the "conservation agreement" with the landowners. NDGFD said they have had these conversations with DU and are considering the possibility of being the agreement holder.
2. RBW
    a. Updates:
        i. Shared a map of the latest "preliminary, not for distribution" project layout.
        ii. Substantial reduction in project area size and number of potential turbines since last meeting (mainly due to coal lease and grassland issues).
        iii. Turbine micrositing complete and field surveys in progress.
        iv. All turbines and proposed substation locations sited outside of unbroken grassland.

v. Transmission routing is currently evaluating various alternatives and that coal leases, cultural resources, grouse leks, and landowner preferences are presenting the most challenges to-date.

b. Offsets:
    i. Awaiting post-micrositing array to perform initial evaluation.
    ii. Expect wetlands to be of low concern due to minimal number of wetlands and low use by breeding waterfowl.

3. Offsets (general discussion)
    a. NDGFD stated the following:
        i. Avian displacement is the primary ecological service that is being offset, but that it is used as a proxy for other potential wildlife effects. Thus, they feel the displacement model results are equitable, irregardless
            1. If sited in low habitat value areas,
            2. Of avoidance and minimization efforts,
            3. If the indirect effects (acreage) are relatively large compared to the direct effects, and
            4. Of the fact that many of the functions the avoided grasslands and wetlands offer are still intact (e.g., sedimentation and runoff control, groundwater recharge, carbon sequestration, etc.).
        ii. They may recognize the aforementioned, but there is no reduction in the offset ask.
        iii. The acreages are their primary concern, not the dollar values.
        iv. The science that is currently available regarding avian displacement was based on studies that took place in fragmented landscapes with existing impacts, thus those “discounts” are inapplicable to the offset calculations.
4. Agency Letters
    a. NDGFD commented they were amenable to having NEER review and structure NDGFD’s letter to the PSC, including language addressing NEER’s efforts to avoid and minimize impacts.
5. NDGFD appreciated the meeting and the opportunity to discuss how the projects are progressing, re-acknowledged the significant commitment to avoid and minimize impacts, and welcomed the frequent updates (email, calls, in-person) NEER has provided.

GOVERNOR, Doug Burgum
DIRECTOR, Terry Steinwand
DEPUTY, Scott A. Peterson

"VARIETY IN HUNTING AND FISHING"

NORTH DAKOTA GAME AND FISH DEPARTMENT
100 NORTH BISMARCK EXPRESSWAY BISMARCK, NORTH DAKOTA 58501-5095 PHONE 701-328-6300 FAX 701-328-6352

September 12, 2019

Lindsey Churchill, PhD, PWS
Environmental Project Manager
1000 East Calgary Avenue Suite 1
Bismarck, ND 58503

Dear Ms. Churchill:

RE: Red Butte Wind Energy Center and 230 kV Transmission Line Project Oliver and Mercer Counties, ND

The North Dakota Game and Fish Department has been in discussion with developers of the Red Butte Wind Energy Center since June but will use this opportunity to provide official comments as requested in a letter dated 8/16/2019. Based on our initial review, the project appears to fall within an area with low to moderate risk to our native wildlife; however, valuable habitat for these species does exist within the project area and careful consideration should be made when siting turbines, roads, and associated infrastructure.

Though portions of the project landscape have been significantly altered, there is still a noteworthy amount of relatively undisturbed native habitats. Native prairie is the most endangered ecosystem in North Dakota and, as we are a grassland state, the majority of our native species are linked to prairie. Disturbance, fragmentation, and loss of native prairie have adversely impacted a wide variety of species and these negative impacts will only continue to compound as more development takes place on the landscape. The remaining tracts of unbroken prairie are becoming more and more vital to many declining bird and pollinator species. This habitat supports 30 or more of the 115 Species of Conservation Priority identified in the North Dakota State Wildlife Action Plan (Dyke et. al 2015) and for species of conservation priority, such as the Chestnut-collared Longspur which has declined -86% or the Loggerhead Shrike which has declined -74% since 1974 (Rosenberg et. al 2016) the loss and fragmentation of native prairie in the project area may further negatively impact these rapidly declining species.

Wetlands are another productive wildlife habitat in North Dakota, supporting 54 Species of Conservation Priority, as well as a considerable number of waterfowl, shorebirds and cranes throughout the year. Though the project area only includes a small number of wetlands, the resources they provide are still of value to many of our native species. The USFWS's Habitat and Population Evaluation Team (HAPET) has developed a Local Siting Decision Support Tool

(DST) to estimate the number of duck pairs that are displaced based on research conducted in the Dakotas (Loesch et al. 2013, Loesch 2016). We highly recommend NextEra contact HAPET office to request the DST to evaluate project impacts on wetland resources.

Finally, though the Department believes the best way to protect our species of conservation priority is by taking a habitat-focused approach, we would also like to reiterate the following species-specific concerns.

- Nearly 31% of the entire Sharp-tailed Grouse population falls within North Dakota and declines to the state's population will likely lead to range-wide population declines. Sharp-tailed Grouse are a high-valued upland game bird, and because research indicated that prairie grouse may be adversely affected by energy development, it is vital that lek surveys be conducted to understand the risk associated with development.

- Bats are long-lived, reproduce slowly, and migrate long distances, making them particularly susceptible to wind development. Acoustic surveys should begin at a minimum two years pre-construction to assess the risk the project poses to local bat populations.

- The Whooping Crane's migration corridor enters North Dakota in the northwest corner of the state, angling through Burke County and directly through the proposed project area. The migration corridor then proceeds south to just north of the Van Hook Arm on Lake Sakakawea and follows just east of the Missouri River and its reservoirs until it exits the southern portion of the state. This federally listed endangered species uses a wide variety of shallow wetlands for roosting and foraging. While no fatalities have been documented of Whooping Cranes from collision with wind turbines in the United States, collisions with transmission lines are the leading known cause of death in the wild for whooping cranes. We suggest that NextEra contact HAPET in Bismarck to request the Whooping Crane model of predicted use of landscapes.

- The Bald Eagle population and number of nest sites is increasing significantly in North Dakota. The number of nest sites has increased from 10 known sites in the year 2000 to more than 300 in the year 2017. Due to the continual increase and selection of non-traditional nest sites, it is possible that Bald Eagle nests may be found anywhere across the state where large trees are present. Therefore, it is recommended that NextEra conduct searches for raptor nests during the breeding season to understand the risk associated with development.

The Department has a number of resources available for the benefit of the developer and consultant, including maps and information on native habitats, priority areas, and sensitive species. Core native habitat layers are available via Esri REST Services https://gf.nd.gov/maps/data then selecting North Dakota Game and Fish Department Species Range and Habitats. The Department also recommends working with the U.S. Fish and Wildlife Service, as any state guidelines do not relieve the developer of its obligations to comply with any applicable federal regulations.

As we continue to address the challenges of stemming the decline of our state's most sensitive species, we cannot endorse or consent to the disturbance, fragmentation, and loss of the remaining high value habitats essential to Species of Conservation Priority without recommending that suitable replacement or offsets be applied back onto the landscape. Ensuring these habitats remain on the landscape is the only way to stem the decline of these species and prevent listings through the Endangered Species Act, which could impact both the state and its citizens by limiting further construction of infrastructure, energy development, recreational activities, grazing, vegetation control, and land-use changes or conversion on both public and private land. The Department has stressed the importance of following the best available science in determining impacts and voluntary offsets. The best science addressing North Dakota resources are Loesch et al. 2013 and Shaffer and Buhl 2016 and these papers should be used to help guide NextEra in developing a voluntary offset package.

As NextEra moves forward with this project, the Department requests to remain informed. To accurately analyze the project and provide valuable feedback to the PSC, it is important that the Department receives all documents, including wildlife surveys, spatial data, and any voluntary offsets being proposed 100 days prior to the hearing date.

Sincerely,

Greg Link
Chief, Conservation and Communications Division

Cc: Scott Larson, US Fish and Wildlife Service
ND Public Service Commission

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Dakota Ecological Services
420 South Garfield Avenue, Suite 400
Pierre, South Dakota 57501-5408
(605) 224-8693, southdakotafieldoffice@fws.gov

IN REPLY REFER TO
RED BUTTE WIND
ENERGY CENTER

October 17, 2019

Ms. Lindsey Churchill
AECOM
Environmental Project Manager
1000 East Calgary Avenue, Suite 1
Bismarck, North Dakota 58503

Dear Ms. Churchill:

This letter is in response to your request dated August 16, 2019, for environmental comments regarding the above referenced Red Butte Wind Energy Center (WEC). This proposed wind energy facility, purchased by NextEra in 2019, is a 200 MW wind energy facility with a 15-mile 230kV transmission line in Oliver and Mercer Counties, North Dakota. It is our understanding that the turbine layout is still undergoing modifications (per a September 19, 2019, email exchange with NextEra's Dustin Jones), and that additional wildlife surveys are occurring on this project (per a July 18, 2019, call/meeting on this project introducing NextEra as new owners). Staffing limitations in our agency's Ecological Services office in Bismarck, North Dakota, precluded significant U.S. Fish and Wildlife Service (Service) coordination on this project to date; our office appreciates the opportunity to provide input.

In this letter and attachment we provide information and recommendations regarding important wildlife habitats and Service trust resources including federally listed species, eagles, birds of conservation concern, and other migratory birds that may occur in the project area and vicinity. We have included guidelines and methods to apply to various components of a wind farm including turbines, meteorological towers, and power lines in order to avoid, minimize and/or compensate for impacts to trust resources and assist the developer in achieving compliance with Federal laws. Much of this information applies to most, if not all, wind energy facilities in North Dakota, but comments and considerations specific to this project based on information received to date, including study reports, are provided as well.

Our foremost concerns regarding the proposed Red Butte WEC and associated transmission line are:

- Grasslands/Avian Impacts. Per Red Butte WEC reports, the project area is comprised of about 68% grasslands. Unbroken prairie represents about 43% of the project area, and the transmission line corridor is comprised of 18% native prairie as well. The original

native prairie of North Dakota has been, and continues to be, lost to such an extent that it is considered the most endangered ecosystem in the state. Our primary recommendation on all wind energy facilities in North Dakota is to avoid impacting all grasslands, particularly native prairie, focusing instead on areas that are currently disturbed (e.g. cropland). This recommendation applies both at the large scale (choosing project areas dominated by disturbed lands), as well as turbine siting/micro-siting scale (placing structures within the project area on disturbed lands).

Projects in areas that are primarily grasslands are more likely to incur impacts to wildlife than those in disturbed areas due to the resulting loss and degradation of habitat. Grassland nesting birds in particular are known to be displaced by wind turbines. Population declines among this group of birds is greater than for any avian groups reliant on any other biomes in North America (Rosenberg et al. 2019). Population level impacts begin with, and are exacerbated by, local impacts to individuals. Development of the Red Butte WEC in this grassland dominated project site will impact local nesting grassland birds and contribute to their continued decline.

We recommend seeking an alternate area with less intact habitat for this project. Previously disturbed areas do overlap with suitable wind energy resources – see Fargione et al. 2012. If the Red Butte WEC is to proceed at this location, then we recommend avoidance to the maximum extent possible of grasslands, particularly native prairie. If such areas cannot be avoided, it is imperative to analyze the anticipated impacts of the project and develop plans to adequately compensate for the expected lost value of this area for wildlife. To date, we are unaware of development of such a plan. Tools to quantify these impacts are described in the attachment.

- Whooping Crane. The project area is within the whooping crane migration corridor and whooping cranes have been reported near the proposed Red Butte WEC. Wind turbines may pose a collision risk to these birds, or cause displacement if the cranes avoid otherwise suitable habitat. Overhead transmission lines are a known source of mortality for this species. If the project cannot be moved from the whooping crane migration corridor, measures to reduce the collision mortality risks to this species (e.g. active monitoring, turbine shutdowns, line marking devices) should be applied to reduce the risk of unauthorized take of this species under section 9 of the Endangered Species Act (ESA). Without a federal nexus to this project, development of a Habitat Conservation Plan (HCP) is the means by which to ensure ESA compliance (see: https://www.fws.gov/endangered/what-we-do/hcp-overview.html).

- Northern long-eared bat. Preconstruction surveys at Red Butte WEC revealed the presence of northern long-eared bats both on-site and in adjacent habitats during summer The latter is currently pending genetic verification; we request the results of that testing when available. Proposed Red Butte WEC bat survey plans indicated telemetry studies would be performed to determine potential location of maternity roosts; we request results of that effort if/when those studies are conducted.

The current ESA 4(d) rule for this species does not prohibit incidental take of the northern long-eared bat at wind facilities that are not located near hibernacula or maternal roosts. However, since the bat has been detected in/near the proposed facility in the summer, roosts may exist nearby. At this point, we recommend proactive measures be taken to protect individual bats, i.e. feather blades below cut-in speeds and increase cut-in speeds to at least 5.0 m/s when bats may be present. This is in support of conservation of this federally listed species, as well as other bat species known to be susceptible to wind turbine collision mortality.

- Dakota skipper. Dakota skipper surveys were not conducted despite the presence of suitable reproductive habitat for the species within the Red Butte WEC project area and historic records of the species in Oliver County. The commitment by NextEra in current documents regarding the Dakota skipper is to avoid such areas to the extent "practicable". Since this is not a commitment of complete avoidance, it appears the potential exists for this suitable Dakota skipper habitat to be impacted by the project and without survey information to indicate otherwise, the species may be present. This small butterfly species spends the majority of its annual life cycle on the ground in the egg, larval, or pupal stage. Ground-disturbing activities in suitable habitat could harm individuals. We recommend complete avoidance of impacts to these areas to ensure Dakota skipper unauthorized take under section 9 of the ESA does not occur, or as noted above, development of a HCP to ensure ESA compliance.

- Eagles. Bald and golden eagles are protected via the Bald and Golden Eagle Protection Act (BGEPA). The Red Butte WEC is relatively near the Missouri River which is known to attract bald eagles for both nesting and roosting. At least 11 bald eagle nests have been identified in the project area per the *Spring, Summer & Fall Pre-Construction Avian Survey Report, Red Butte Wind Project, Oliver and Mercer Counties, North Dakota, November 18, 2016*. The presence of golden eagles, whether nesting or migratory, is also a concern as this species was also documented during preconstruction surveys. If prey base, such as prairie dogs, exist within/near the project area, placement of project infrastructure in/near these areas would increase risks to golden eagles; such areas should be avoided. We recommend adhering closely to the recommended eagle guidance herein.

The attachment provides additional information pertaining to the above concerns as well as other issues and species related to the Red Butte Wind Energy Center. If changes are made in the project plans or operating criteria, or if additional information becomes available, the Service should be informed so that the determinations herein can be reconsidered.

The Service appreciates the opportunity to provide comments. If you have any questions on these comments, please contact Natalie Gates of this office at (605) 224-8693, Extension 227.

Sincerely,

Scott Larson

Scott Larson
Field Supervisor
North and South Dakota Field Offices

Attachment/Enclosures

cc: NDGF, Greg Link, Bismarck, ND

Attachment: U.S. Fish and Wildlife Service Additional Information Regarding the Red Butte Wind Energy Center and Transmission Line, Oliver and Mercer Counties, North Dakota.
October 17, 2019

2012 Land-Based Wind Energy Guidelines

We recognize that NextEra is aware of and has been using the voluntary 2012 *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines* (WEG) (available online at: http://www.fws.gov/windenergy/) which were developed in consultation with wind industry companies. We recommend close adherence to these guidelines, using the information gathered to first determine whether the project should be placed in the area of interest at all. The WEG invokes a tiered approach in which information is collected with increasing levels of detail in order to evaluate risk posed to habitats and wildlife at potential wind energy sites. Tiers 1-3 each represent a preconstruction decision point to either move forward to development, gather more information and move to the next tier, or to abandon project plans at a given site, thereby avoiding areas where development is precluded or where wildlife impacts are likely to be high and difficult or costly to remedy or mitigate at a later stage. Sites dominated by grasslands with a high component of native prairie, as is the case for the Red Butte WEC, may fit that description. If the project is to proceed at the chosen location, then the information gathered per the WEG is used to guide project specifics, such as turbine locations, and any needed mitigation measures. Wind energy facility impacts are incurred to both habitat and wildlife, typically including wildlife collision mortality, loss of habitat due to the footprint of the turbines/roads/other facilities, habitat fragmentation, wildlife displacement, encroachment of invasive weeds, and more. Currently, the best strategy to reduce impacts to wildlife is to develop wind energy facilities within areas dominated by cropland wherever possible to preclude direct impacts to valuable wildlife habitats, and siting turbines away from adjacent wildlife habitat as much as possible to reduce indirect effects.

Eagle Guidance

Golden eagles (*Aquila chrysaetos*) are year-round residents in western North Dakota and may be found throughout the state in winter or during migration. Bald eagles (*Haliaeetus leucocephalus*) occur throughout North Dakota in all seasons. These species are protected from a variety of harmful actions via take prohibitions in both the Migratory Bird Treaty Act[1] (MBTA;

[1] On December 22, 2017, the Department of the Interior's (DOI) Office of the Solicitor Memorandum M-37050 titled The Migratory Bird Treaty Act Does Not Prohibit Incidental Take (https://www.doi.gov/sites/doi.gov/files/uploads/m-37050.pdf) concludes that the MBTA's prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same apply only to affirmative actions that have as their purpose the taking or killing of migratory birds, their nests, or their eggs. The MBTA list of protected species includes bald and golden eagles, and the law has been an effective tool to pursue incidental take cases involving eagles. However, the primary law protecting eagles is the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S. Code § 668), since the bald eagle was delisted under the Endangered Species Act in 2007. Memorandum-37050 does not affect the ability of the Service to refer entities for prosecution that have violated the take prohibitions for eagles established by the BGEPA.

16 U.S.C. 703-712) and the Bald and Golden Eagle Protection Act (BGEPA; 16 U.S.C. 668–668d). The BGEPA, enacted in 1940 and amended several times, prohibits take of bald eagles and golden eagles, including their parts, nests, young, or eggs, except where otherwise permitted pursuant to federal regulations. Incidental take of eagles from actions such as electrocutions from power lines or wind turbine strikes are prohibited unless specifically authorized via an eagle incidental take permit from US Fish and Wildlife Service (Service). BGEPA provides penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." BGEPA defines take to include the following actions: "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." The Service expanded this definition by regulation to include the term "destroy" to ensure that "take" also encompasses destruction of eagle nests. Also the Service defined the term disturb which means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

The Service has developed guidance for the public regarding means to avoid take of bald and golden eagles:

- The 2007 *National Bald Eagle Management Guidelines* serve to advise landowners, land managers, and others who share public and private lands with bald eagles when and under what circumstances the protective provisions of BGEPA may apply. They provide conservation recommendations to help people avoid and/or minimize such impacts to bald eagles, particularly where they may constitute "disturbance," which is prohibited by the BGEPA. https://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf
- The 2013 *Eagle Conservation Plan Guidance, Module 1- Land-based Wind Energy, Version 2* is specific to wind energy development and provides in-depth guidance for conserving bald and golden eagles in the course of siting, constructing, and operating wind energy facilities. Development of an Eagle Conservation Plan per these guidelines may serve as the basis for applying for an eagle incidental take permit for wind energy facilities. Applications for such eagle incidental take permits must include an Eagle Conservation Plan. https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf

The Service also has promulgated new permit regulations under BGEPA:

- Eagle permit regulations, as allowed under BGEPA, were promulgated by the Service in 2009 (74 FR 46836; Sept. 11, 2009) and revised in 2016 (81 FR 91494; Dec. 16, 2016). The regulations authorize the limited take of bald and golden eagles where the take to be authorized is associated with otherwise lawful activities. These regulations also establish permit provisions for intentional take of eagle nests where necessary to ensure public health and safety, in addition to other limited circumstances.

The revisions in 2016 included changes to permit issuance criteria and duration, definitions, compensatory mitigation standards, criteria for eagle nest removal permits, permit application requirements, and fees in order to clarify, improve implementation and increase compliance while still protecting eagles. https://www.gpo.gov/fdsys/pkg/ FR-2016-12-16/pdf/2016-29908.pdf

The Service's Office of Law Enforcement carries out its mission to protect eagles through investigations and enforcement, as well as by fostering relationships with individuals, companies, industries and agencies that have taken effective steps to avoid take, including incidental take of these species, and encouraging others to implement measures to avoid take. The Office of Law Enforcement focuses its resources on investigating individuals and entities that take eagles without identifying and implementing all reasonable, prudent, and effective measures to avoid that take. Those individuals and entities are encouraged to work closely with Service biologists to identify available protective measures, and to implement those measures during all activities or situations where their action or inaction may result in the take of an eagle(s).

Note that the Service has also developed recommendations for wind developers specific to the Mountain-Prairie Region (Region 6):

- *Region 6 Recommendations for Avoidance and Minimization of Impacts to Golden Eagles at Wind Energy Facilities* –The goal of this document is to contribute to maintaining stable or increasing breeding populations of eagles by recommending conservation measures that will maintain breeding territories and minimize impacts to other important eagle use areas (e.g., eagle nests, foraging areas, and communal roosts). https://www.fws.gov/coloradoes/documents/Final_GOEA_Buffer_Recommendations_AvoidanceMinimization_WindFacilities_April_10_2013.pdf.

- *U.S. Fish and Wildlife Service, Region 6, Recommended Approach for Development and Submission of Eagle Conservation Plans submitted to Region 6, Migratory Management Office in support of an Eagle Incidental Take Permit Application for Wind Energy Projects* – finalized in July 2019, this guidance replaces an earlier outline version of ECP recommendations by the Service's Mountain-Prairie Region (Region 6) entitled "Final Outline and Components of an Eagle Conservation Plan (ECP) for Wind Development: Recommendations from USFWS, Region 6". The purpose of the new guidance is to eliminate unnecessary work and expense by permit applicants and shorten/streamline the process of applying for an eagle incidental take permit (EITP). The guidance will reduce the ECP process to only those items necessary for the USFWS to conclude that the ECP is sufficient to support the EITP application, and ensure that we have what we need both for our review of the application and our required NEPA compliance.

We recommend close adherence to the guidelines above, including modeling of eagle data to determine the level of risk posed by the project and possible need for an eagle take permit. As noted earlier, we are aware that both species of eagle have been observed at the Red Butte WEC; we request results of all eagle data collected for this project.

Threatened/Endangered Species

In accordance with section 7(c) of the Endangered Species Act (ESA), as amended, 16 U.S.C. 1531 et seq., we have determined that the following federally listed species may occur in the project area (this list is considered valid for 90 days):

Species	Status	Expected Occurrence
Dakota Skipper (*Hesperia dacotae*)	Threatened	Resident in native prairie
Least Tern (*Sterna antillarum*)	Endangered	Migrant or nesting
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Summer resident, seasonal migrant
Piping Plover (*Charadrius melodus*)	Threatened	Migrant or nesting
Rufa Red Knot (*Calidris canutus rufa*)	Threatened	Rare migrant
Whooping Crane (*Grus Americana*)	Endangered	Spring and fall migrant

Dakota Skipper

The Dakota skipper is a small prairie butterfly listed federally as a threatened species. Dakota skippers are obligate residents of high quality prairie ranging from wet-mesic tallgrass prairie to dry-mesic mixed grass prairie. Their dispersal ability is very limited due in part to their short adult life span and single annual flight. Extirpation from a site may be permanent unless it occurs within about 0.6 miles of an inhabited site that generates a sufficient number of emigrants. Avoidance of impacts to native prairie habitat is recommended to reduce the risk of adverse effects to this species. Critical habitat has been designated for this species; for details and locations see: http://www.fws.gov/Midwest/endangered/insects/dask/index.html. Survey protocols have been developed for North Dakota; the *2018 Dakota Skipper (Hesperia dacotae) North Dakota Survey Protocol* is available online at: https://www.fws.gov/mountain-phttps//www.fws.gov/mountain-prairie/es/protocols/2018_FINAL%20Dakota%20Skipper%20Survey%20Protocol_4202018.pdf. The species is difficult to detect and identify; only experienced, qualified personnel can accurately conduct surveys for this species. Our primary recommendation to avoid impacting this species when survey data is lacking is to avoid development in native prairie within the species' range.

Least Tern and Piping Plover

Least terns and piping plovers occur along the Missouri River and use alkaline wetlands/lakes in in North Dakota. Their habitats include sparsely vegetated interchannel sandbars, islands, and shorelines used for nesting, foraging and brood-rearing. They are sensitive to human

disturbances which can limit reproduction. No construction should take place within 1/4 mile of any known piping plover or least tern nest. The specific migration habits of the least tern and piping plover in North Dakota are not known, but it may be possible for the birds to nest in the project area, or occur there as they move to/from nesting areas while foraging, dispersing from natal areas and migrating. Both species typically occur in North Dakota May through August.

Northern Long-eared Bat:
The northern long-eared bat is a medium-sized brown bat that roosts singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees in the summer and migrates to hibernacula (often caves) in the winter. White nose syndrome - a fungus affecting hibernating bats - is considered a significant threat to this species, but individuals may be harmed by other activities such as modifications to hibernacula, timber harvest, human disturbance, and collisions with wind turbines. As indicated earlier, a 4(d) rule has been published that exempts take of Northern long-eared bats at wind facilities that are not located near maternity roosts or hibernacula (see: https://www.fws.gov/Midwest/Endangered/mammals/nleb/index.html). At this time, we have not located maternity roosts or hibernacula in North Dakota. However, since bat acoustic surveys conducted within the Red Butte WEC project site and mist-net surveys conducted adjacent to the site have revealed the species' presence in the summer, maternity roosts may be nearby. The project site is not heavily forested, but riparian corridors within the project area may serve as habitat for the species, particularly since they are connected to the Missouri River corridor. We recommend proactive measures to protect individual bats that may be at risk from this development including feathering turbine blades and increasing cut-in speeds to 5 m/s or more to reduce the risk of bat mortality at wind generation facilities. Post-construction mortality studies per the WEG are recommended to determine impacts to bats and inform the need for additional adaptive management strategies.

Rufa Red Knot:
The rufa red knot is a robin-sized shorebird that migrates annually between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast United States, the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. Although it is primarily a coastal species, small numbers of rufa red knots are reported annually across the interior United States (i.e., greater than 25 miles from the Gulf or Atlantic Coasts) during spring and fall migration. These reported sightings are concentrated along the Great Lakes, but multiple reports have been made from nearly every interior state, including North Dakota. The species does not breed in this state.

Whooping Crane:
The proposed Red Butte WEC location is within the documented migration corridor of the Aransas/Wood Buffalo population of whooping cranes - the only self-sustaining migratory population of whooping cranes in existence. Whooping cranes migrate through North Dakota twice annually on their way to northern breeding grounds and southern wintering areas, occupying numerous habitats such as cropland and pastures; wet meadows; shallow marshes; shallow portions of rivers, lakes, reservoirs, and stock ponds; and both freshwater and alkaline basins for feeding and loafing. Overnight roosting sites frequently require shallow water in which to stand and rest. Use of the proposed project area by sandhill cranes may be indicative of the potential presence of whooping cranes since the two species are often observed utilizing the

same habitats and migrating together. Sightings of whooping cranes should be reported to this office. These are large birds with low maneuverability. Line strike mortality is the greatest known threat to fledged whooping cranes and the Red Butte WEC includes a new overhead transmission line perpendicular to the whooper corridor. More information on this topic is provided herein (see enclosure: *Region 6 Guidance for Minimizing Effects from Power Line Projects within the Whooping Crane Migration Corridor*, and Power Lines section below). Mortality via turbine strikes may also pose a risk if the birds utilize habitat at/near wind farm sites and loss of stopover habitat in the migration corridor is a concern that may be realized if whooping cranes tend to avoid wind farms. Additionally, should construction occur during spring or fall migration, the potential for whooping crane disturbances (flushing the birds) exists. Disturbance stresses them at critical times of the year and should be avoided.

These issues should be addressed prior to wind farm development. According to the *Whooping Crane Likelihood of Occurrence Report, Red Butte Project, Oliver and Mercer Counties, North Dakota, November 11, 2016,* the risk to whooping cranes at this project site is deemed low, despite the project location being within the 75% band of the corridor (encompassing 75% of documented sightings). As noted in the report, however, the nature of whooping crane stopovers is opportunistic, the birds use a variety of habitats, and only 4% of stopovers are estimated to be reported. Additionally the existence of a stopover report within 2 miles of the project is indicative that the birds can and do use the general area. Potential whooping crane habitat in North Dakota has been modeled by the Service's Habitat and Population Evaluation Team in Bismarck (Neimuth et al. 2018) and was recommended to NextEra during our July 18, 2019 call/meeting as an additional source of information helpful in assessing risks to whooping cranes. The most effective means to reduce the risks posed to this species is to locate the project outside the whooping crane migration corridor.

If a federal nexus exists for this project (i.e. a federal agency is funding, permitting or otherwise authorizing the project), and the federal action agency, or their designated representative determines that the project "may adversely affect" listed species in North Dakota, they should request formal consultation from this office. If a "may affect - not likely to adversely affect" determination is made for this project, they should submit it to us for concurrence. If a "no effect" determination is made, further consultation may not be necessary; however, a copy of the determination should be sent to this office. If no federal agency is involved with the proposed project and take of federally listed species may occur, ESA compliance may be achieved by private entities via coordination with this office and development of a Habitat Conservation Plan (HCP). Our website provides more information on HCPs at: http://www.fws.gov/endangered/what-we-do/hcp-overview.html.

Wetlands

According to National Wetlands Inventory maps, available online at: https://www.fws.gov/wetlands/, numerous wetlands exist within the proposed project area. If a project may impact wetlands or other important fish and wildlife habitats, the Service, in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4347) and other environmental laws and rules, recommends complete avoidance of these areas, if possible; then minimization of any adverse impacts; and finally, replacement of any lost acres; in that order.

Alternatives should be examined and the least damaging practical alternative selected. If wetland impacts are unavoidable, a mitigation plan addressing the number and types of wetland acres to be impacted and the methods of replacement should be prepared and submitted to the resource agencies for review.

Native Grasslands and Grassland Dependent Birds

Native prairie is a particularly important and imperiled habitat in North Dakota. In addition to the intrinsic value of diverse native prairie plant communities, these areas represent a fraction of the prairie acres that once existed in the state and remaining tracts have become increasingly critical to many declining bird and pollinator species. These habitats harbor numerous native wildlife species, some of which cannot survive outside the native plant community. The North Dakota Game and Fish Department's September 12, 2019, letter regarding this project highlighted that native prairie supports more than 30 of the 115 Species of Conservation Priority (SCP) identified by the state, some of which have experienced population declines of 74% or more.

Some of the State's SCP species are also identified by the Service as Birds of Conservation Concern (BCC) (see below) due to their declining numbers. Further overlap occurs between the list of BCC species and Service-identified avian Species of Habitat Fragmentation Concern in North Dakota. The majority of North American bird species are known to be in decline, incurring a 29% reduction in abundance since 1970, equating to a loss of 2.9 billion birds across almost all biomes (Rosenberg et al. 2019). Among those, grassland birds have experienced the largest magnitude of total population loss: 53%, or more than 700 million breeding individuals across 31 species (Rosenberg et al. 2019). Population level declines begin with local impacts to individuals and/or habitats; development of the Red Butte WEC will impact local nesting grassland birds. Birds are important components of the prairie ecosystem and their loss has cascading effects. Our overarching recommendation to wind energy developers is to avoid grassland habitats to the maximum extent possible by seeking out areas dominated by previously disturbed lands (e.g. cropland) for developments in order to reduce or eliminate impacts to these grassland dependent species.

Also note that while native prairie is considered a conservation priority in the state, lesser-quality grasslands (e.g. grasslands with a high non-native plant component, overgrazed grasslands) can still provide some habitat for wildlife, and we recommend avoidance of these plant communities whenever possible as well. Project impacts should instead be directed toward previously disturbed land (e.g. cropland).

Birds of Conservation Concern

The Migratory Birds Division of the Service has published *Birds of Conservation Concern* [BCC] *2008*, which may be found online at: https://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf. This document is intended to identify species in need of coordinated and proactive conservation efforts among State, Federal, and private entities, with the goals of precluding future evaluation of these species for ESA protections and promoting/conserving long-term avian diversity. There are 28 species listed in the BCC

document that occur within Bird Conservation Region 17 (Badlands and Prairies) where the Red Butte WEC project area is proposed. Direct and indirect effects to these species will occur with establishment of this wind facility. Primary threats impacting grassland species that occur in North Dakota are habitat loss and fragmentation. In accordance with Executive Order 13186 regarding migratory bird protection, we recommend avoidance, minimization, and finally compensation to reduce the impacts to species protected by the MBTA, including BCC species. Compliance with this law may be partially addressed in a Bird and Bat Conservation Strategy (BBCS) (identified within the WEG and explained further below).

Avian Avoidance of Wind Turbines

As indicated in the WEG, wind turbines are known to impact migratory birds directly via collision with turbines, thus post-construction mortality surveys are typically recommended for 1-2 years (or more) to quantify that mortality and compare it with pre-construction risk assessments. Importantly, the WEG also identify other effects of wind energy facilities such as habitat fragmentation and wildlife avoidance of turbines. While direct mortality can readily be observed and quantified, displacement impacts are more difficult to document/quantify and require more time and effort. The Before-After-Control-Impact (BACI) method for avian studies is recommended in the WEG. This study design is particularly useful in determining indirect effects of wind projects on wildlife, but such studies are rarely conducted typically due to those time/effort constraints. In the absence of robust project-specific research at every wind farm, two relatively recent studies are of particular importance to this issue of quantifying avoidance/displacement: Loesch et al. (2013) and Shaffer and Buhl (2016).

Loesch et al. (2013) evaluated breeding waterfowl pairs on wetlands at existing wind farms and reference sites in the Prairie Pothole Region. Displacement of 18% of pairs, among five waterfowl species was detected within 805 meters (0.5 mile) of wind turbines (C. Loesch, USFWS, pers. comm., 2019).

Similarly, Shaffer and Buhl (2016) evaluated wind farms and reference sites in the Prairie Pothole Region, but their research was on grassland nesting birds and also included pre-construction data, thus this study applied the BACI method. Their results detected avoidance of turbines by seven species. The average rate of displacement out to 300 meters (0.19 mile) from wind turbines was 53% by the 5th year post construction (J. Shaffer, USGS, pers. comm., 2019). This research also detected a trend: displacement rates of grassland nesting birds continued to increase over time during that 5 years post-construction (J. Shaffer, USGS, pers. comm. 2019).

Both of these peer-reviewed/published studies occurred in North and South Dakota over multiple years, on multiple wind farms, and involved large sample sizes and reference sites that were used for comparison with impacted sites. Many of the species found to be displaced during these studies occur at Red Butte WEC.

In addition to the above recent research, an older study of shorter duration was conducted at a wind facility in Minnesota and also documented avoidance of wind turbines by birds, this time on Conservation Reserve Program (CRP) lands: Leddy et al. (1999). CRP grasslands are areas typically planted with grass species after being cropped. CRP grasslands without turbines and

areas located 180 m from turbines supported higher densities (261.0-312.5 males/100 ha) of grassland birds than areas within 80 m of turbines (58.2-128.0 males/100 ha) (Leddy et al. 1999).

If the Red Butte WEC proceeds, we recommend using C. Loesch's 18% displacement of waterfowl pairs within ½ mile of turbines to quantify the number of wetlands needed to compensate for waterfowl displacement at the site and develop a plan to achieve those offsets. We also recommend quantifying grasslands within 300 m of turbines and applying the 53% displacement value via Shaffer and Buhl (2016) to determine and disclose anticipated indirect impacts to grassland nesting birds, and adding this to the offset plan. Methods used to obtain appropriate grassland and wetland offsets are described in Shaffer et al. 2019. Finally, if CRP or other non-native grassland habitats will be affected by the Red Butte WEC, we recommend using the displacement information in Leddy et al. (1999) to develop appropriate offsets for this impact in the plan as well. This information is needed to adequately develop appropriate compensation for this form of habitat loss and its associated effect on grassland nesting birds and we encourage project developers to provide that plan as part of the project.

Mitigation

The Service's mitigation policy, available online at: https://www.fws.gov/policy/a1npi89_02.pdf, was established in 1981 to help assure consistent and effective mitigation recommendations that help federal action agencies and developers plan for mitigation measures early, avoid delays, and assure equal consideration of fish and wildlife resources with other project features and purposes. Our policy adopts the definition of the term "mitigation" as stated in the NEPA regulations which includes:

> ***"(a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation;*** *(c) rectifying the impact by restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments."*

As noted above, loss/degradation of habitats and mortality/displacement of wildlife are known to occur at wind energy facilities. We recommend analysis and quantification of these impacts, followed by application of the above mitigation methods during each step of project development - but particularly during early planning stages - to help ensure full implementation of any necessary mitigation measures.

Bird and Bat Conservation Strategy

Bird and bat conservation strategies are recommended in the WEG. We have developed a regional document to further assist companies in following our established national guidance on BBCSs: *U.S. Fish and Wildlife Service, Region 6, Mountain-Prairie Region Outline for a Bird and Bat Conservation Strategy: Wind Energy Projects,* available online at: https://www.fws.gov/coloradoes/documents/Final%20R6%20BBCS%20Outline%20with%20annotation.pdf. As stated in the introduction of that document: a BBCS "…is a life-of-a-project framework for

identifying and implementing actions to conserve birds and bats during wind energy project planning, construction, operation, maintenance, and decommissioning. It is the responsibility of wind energy project developers and operators to effectively assess project-related impacts to birds, bats and their habitats, and to work to avoid and minimize those impacts." A BBCS explains the actions taken by developers as they progress through the tiers of the WEG, describing the analyses, studies, and reasoning implemented with the purpose of mitigating for potential avian and bat impacts. It also addresses post-construction monitoring and habitat impacts. We recommend completion of a BBCS for this proposed energy wind facility.

Meteorological Towers

Meteorological towers associated with Red Butte WEC are similar to other communication towers in that they are a known mortality hazard to wildlife, particularly birds. Of primary concern is the risk of avian collision mortality. Communication towers are currently estimated to kill 6.8 million birds per year in the United States and Canada (Longcore et al. 2012). To assist developers in establishing communications towers that are more compatible with wildlife, we have developed our 2018 *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning*, available online at: https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds/collisions/communication-towers.php. These recommendations incorporate the state of the science and the 2015 Federal Aviation Administration's *Obstruction Marking and Lighting Advisory Circular AC 70/7460-1L*, online at: https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_70_7460-1L_with_chg_1.pdf. Among the primary concerns addressed within our guidelines are the establishment of new towers on the landscape, the heights of these towers, their lighting scheme, and means of structural support. Collocation of new tower facilities on an existing structure is strongly recommended to avoid any additional impacts to migratory birds. If a new tower is necessary, placement of the new tower near other existing structures is recommended to concentrate the risk posed by the towers to relatively small areas. Minimization of tower height (below 200 feet to preclude the need for Federal Aviation Administration lighting requirements), use of only strobe or flashing lights (avoid steady-burning lights), and avoidance of guy wires (a great deal of avian mortality is a result of collisions with supporting guy wires) are important components intended to minimize potential impacts to migratory birds. The habitat at a tower location and surrounding area can also affect its level of risk to wildlife. Tower placement should occur in degraded sites avoiding ridgelines, coastal areas, wetlands or other bird concentration areas such as staging areas, rookeries, leks, and state or federal refuges. Please see the website provided above for additional information.

Overhead Power Lines

The construction of additional overhead power lines associated with wind farms creates the threat of avian electrocution, particularly for raptors. Thousands of these birds, including endangered species, are killed annually as they attempt to utilize overhead power lines as nesting, hunting, resting, feeding, and sunning sites. The Service recommends the installation of underground, rather than overhead, power lines whenever possible/appropriate to minimize environmental disturbances. For all new overhead lines or modernization of old overhead lines, we recommend incorporating measures to prevent avian electrocutions. The publication entitled

Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006 includes many measures to reduce risk to birds including pole extensions, modified positioning of live phase conductors and ground wires, placement of perch guards and elevated perches, elimination of cross arms, use of wood (not metal) braces, and installation of various insulating covers. You may obtain this publication by contacting the Edison Electric Institute via their website at: http://www.eei.org/resourcesandmedia/products/Pages/products.aspx, or by calling 202-508-5000.

Please note that utilizing just one of the "*Suggested Practices . . .*" methods may not entirely remove the threat of electrocution to raptors. In fact, improper use of some methods may increase electrocution mortality. Perch guards, for example, may be only partially effective as some birds may still attempt to perch on structures with misplaced or small-sized guards and suffer electrocution as they approach too close to conducting materials. Among the most dangerous structures to raptors are poles that are located at a crossing of two or more lines, exposed above-ground transformers, or dead end poles. Numerous hot and neutral lines at these sites, combined with inadequate spacing between conductors, increase the threat of raptor electrocutions. Perch guards placed on other poles has, in some cases, served to actually shift birds to these more dangerous sites, increasing the number of mortalities. Thus, it may be necessary to utilize other methods or combine methods to achieve the best results. The same principles may be applied to substation structures.

Please also note that the spacing recommendation within the "*Suggested Practices . . .*" publication of at least 60 inches between conductors or features that cause grounding may not be protective of larger raptors such as eagles. This measure was based on the fact that the skin-to-skin contact distance on these birds (i.e., talon to beak, wrist to wrist, etc.) is less than 60 inches. However, an adult eagle's wingspan (distance between feather tips) may vary from 66 to 96 inches depending on the species (golden or bald) and gender of the bird, and unfortunately, wet feathers in contact with conductors and/or grounding connections can result in a lethal electrical surge. Thus, the focus of the above precautionary measures should be: a) provide more than 96 inches of spacing between conductors or grounding features, b) insulate exposed conducting features so that contact will not cause raptor electrocution, and/or c) prevent raptors from perching on the poles in the first place.

Additional information regarding simple, effective ways to prevent raptor electrocutions on power lines is available in video form. *Raptors at Risk* may be obtained by contacting EDM International, Inc. at 4001 Automation Way, Fort Collins, Colorado 80525-3479, Telephone No. (970) 204-4001, or by visiting their website at: https://www.edmlink.com/component/zoo/item/video-raptors-at-risk.

In addition to electrocution, overhead power lines also present the threat of avian line strike mortality. Particularly in situations where these lines are adjacent to wetlands or where waters exist on opposite sides of the lines, we recommend marking them in order to make them more visible to birds. For more information on bird strikes, please see *Reducing Avian Collisions with Power Lines: The State of the Art in 2012* which, again, may be obtained by contacting the Edison Electric Institute via their website at: http://www.eei.org/resourcesandmedia/products/Pages/products.aspx, or by calling 202-508-5000.

While marking of power lines reduces line strike mortality, it does not preclude it entirely. Thus, marking of additional, existing, overhead lines is recommended to further offset the potential for avian line strike mortality. As noted above, the whooping crane is particularly susceptible to this type of mortality, and your project occurs within the whooping crane migratory corridor. Marking of existing lines elsewhere in the species' corridor is recommended.

Summary

Below we reiterate items above that are pertinent to the proposed project:

- Wind energy guidelines:
  - *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines* http://www.fws.gov/windenergy/

- Eagle guidance:
  - Bald and Golden Eagle Protection Act (BGEPA)
  - *National Bald Eagle Management Guidelines* https://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf
  - *Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy Version 2* https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf
  - Eagle take permit https://www.gpo.gov/fdsys/pkg/FR-2016-12-16/pdf/2016-29908.pdf
  - *Region 6 Recommendations for Avoidance and Minimization of Impacts to Golden Eagles at Wind Energy Facilities* https://www.fws.gov/coloradoes/documents/Final_GOEA_Buffer_Recommendations_AvoidanceMinimization_WindFacilities_April_10_2013.pdf
  - *U.S. Fish and Wildlife Service, Region 6, Recommended Approach for Development and Submission of Eagle Conservation Plans submitted to Region 6, Migratory Management Office in support of an Eagle Incidental Take Permit Application for Wind Energy Projects* (enclosed)

- Threatened/endangered species - Endangered Species Act (ESA):
  - Dakota skipper
  - Least tern
  - Northern long-eared bat
  - Piping plover
  - Rufa red knot
  - Whooping crane

- Wetlands – avoid, minimize, compensate for unavoidable impacts,
  - National Wetlands Inventory: https://www.fws.gov/wetlands/

- Native Grasslands and Grassland Dependent Birds – identify, avoid, minimize:

- Birds of Conservation Concern:
  - *Birds of Conservation Concern 2008:* https://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf

- Avian Avoidance of Wind Turbines - compensate for unavoidable indirect impacts:
  - Loesch et al. (2013) – displacement of waterfowl
  - Shaffer and Buhl (2016) – displacement of grassland nesting birds
  - Shaffer et al. (2019) – methods to determine displacement compensation
  - Leddy et al. (1999) – displacement of grassland nesting birds in CRP

- Mitigation:
  - 1981 Service Mitigation Policy: https://www.fws.gov/policy/a1npi89_02.pdf

- Bird and Bat Conservation Strategy:
  - *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines*
  - *U.S. Fish and Wildlife Service, Region 6, Mountain-Prairie Region Outline for a Bird and Bat Conservation Strategy: Wind Energy Projects:* https://www.fws.gov/coloradoes/documents/Final%20R6%20BBCS%20Outline%20with%20annotation.pdf

- Meteorological Towers:
  - *2018 Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning* https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds/collisions/communication-towers.php
  - 2015 Federal Aviation Administration Obstruction Marking and Lighting Advisory Circular AC70/7460-1L, https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_70_7460-1L_with_chg_1.pdf

- Overhead Power Lines:
  - *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006,* http://www.eei.org/resourcesandmedia/products/Pages/products.aspx
  - *Raptors at Risk* video, https://www.edmlink.com/component/zoo/item/video-raptors-at-risk
  - *Reducing Avian Collisions with Power Lines: The State of the Art in 2012,* http://www.eei.org/resourcesandmedia/products/Pages/products.aspx

Literature Cited

Fargione, J, J. Kiesecker, M. J. Slaats, S. Olimb. 2012. Wind and wildlife in the Northern Great Plains: identifying low-impact areas for wind development.

Leddy, K. L, K. F. Higgins, D. E. Naugle. 1999. Effects of wind turbines on upland nesting birds in Conservation Reserve Program grasslands. Wilson Bulletin 111(1):100-104.

Loesch, C. R., J. A. Walker, R. E. Reynolds, J. S. Gleason, N. D. Niemuth, S. E. Stephens, and M. A. Erickson. 2013. Effect of wind energy development on breeding duck densities in the Prairie Pothole Region. Journal of Wildlife Management 77(3):587-598.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, M.L. Avery, R.L. Crawford, A.M. Manville, E.R. Travis, and D. Drake. 2012. An estimate of avian mortality at communication towers in the United States and Canada. PLoS One 7(4): 1-17.

Niemuth, N. D., A. J. Ryba, A. T. Pearse, S. M. Kvas, D. A. Brandt, B. Wangler. 2018. Opportunistically collected data reveal habitat selection by migrating whooping cranes in the U.S. Northern Plains. Condor 120:343-356.

Shaffer, J. A. and D. A. Buhl. 2016. Effects of wind-energy facilities on breeding grassland bird distributions. Conservation Biology 30(1):59-71.

Shaffer, J. A., C. R. Loesch, and D. A. Buhl. 2019. Estimating offsets for avian displacement effects of anthropogenic impacts. Ecological Applications 0(0), 2019,e01983. [Online at: https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/eap.1983].

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

IN REPLY REFER TO
FWS/R6
ES

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FEB 04 2010

Memorandum

To: Field Office Project Leaders, Ecological Services, Region 6
Montana, North Dakota, South Dakota, Nebraska, Kansas

From: Assistant Regional Director, Ecological Services, Region 6

Subject: Region 6 Guidance for Minimizing Effects from Power Line Projects Within the Whooping Crane Migration Corridor

This document is intended to assist Region 6 Ecological Services (ES) biologists in power line (including generation lines, transmission lines, distribution lines, etc.) project evaluation within the whooping crane migration corridor. The guidance contained herein also may be useful in planning by Federal action agencies, consultants, companies, and organizations concerned with impacts to avian resources, such as the Avian Power Line Interaction Committee (APLIC). We encourage action agencies and project proponents to coordinate with their local ES field office early in project development to implement this guidance.

The guidance includes general considerations that may apply to most, but not every, situation within the whooping crane migratory corridor. Additional conservation measures may be considered and/or discretion may be applied by the appropriate ES field office, as applicable. We believe that in most cases the following measures, if implemented and maintained, could reduce the potential effects to the whooping crane to an insignificant and/or discountable level. Where a Federal nexus is lacking, we believe that following these recommendations would reduce the likelihood of a whooping crane being taken and resulting in a violation of Endangered Species Act (ESA) section 9. If non-Federal actions cannot avoid the potential for incidental take, the local ES field office should encourage project proponents to develop a Habitat Conservation Plan and apply for a permit pursuant to ESA section 10(a)(1)(B).

Finally, although this guidance is specific to impacts of power line projects to the whooping crane within the migration corridor, we acknowledge that these guidelines also may benefit other listed and migratory birds.

If you have any questions, please contact Sarena Selbo, Section 7 Coordinator, at (303) 236-4046.

Region 6 Guidance for Minimizing Effects from Power Line Projects Within the Whooping Crane Migration Corridor

1) Project proponents should avoid construction of overhead power lines within 5.0 miles of designated critical habitat and documented high use areas (these locations can be obtained from the local ES field office).

2) To the greatest extent possible, project proponents should bury all new power lines, especially those within 1.0 mile of potentially suitable habitat[1].

3) If it is not economically or technically feasible to bury lines, then we recommend the following conservation measures be implemented:

   a) Within the 95-percent sighting corridor (see attached map)

      i) Project proponents should mark[2] new lines within 1.0 mile of potentially suitable habitat and an equal amount of existing line within 1.0 mile of potentially suitable habitat (preferably within the 75-percent corridor, but at a minimum within the 95-percent corridor) according to the U.S. Fish and Wildlife Service (USFWS) recommendations described in APLIC 1994 (or newer version as updated).

      ii) Project proponents should mark replacement or upgraded lines within 1.0 mile of potentially suitable habitat according to the USFWS recommendations described in APLIC 1994 (or newer version as updated).

   b) Outside the 95-percent sighting corridor within a State's borders

      Project proponents should mark new lines within 1.0 mile of potentially suitable habitat at the discretion of the local ES field office, based on the biological needs of the whooping crane.

   c) Develop compliance monitoring plans

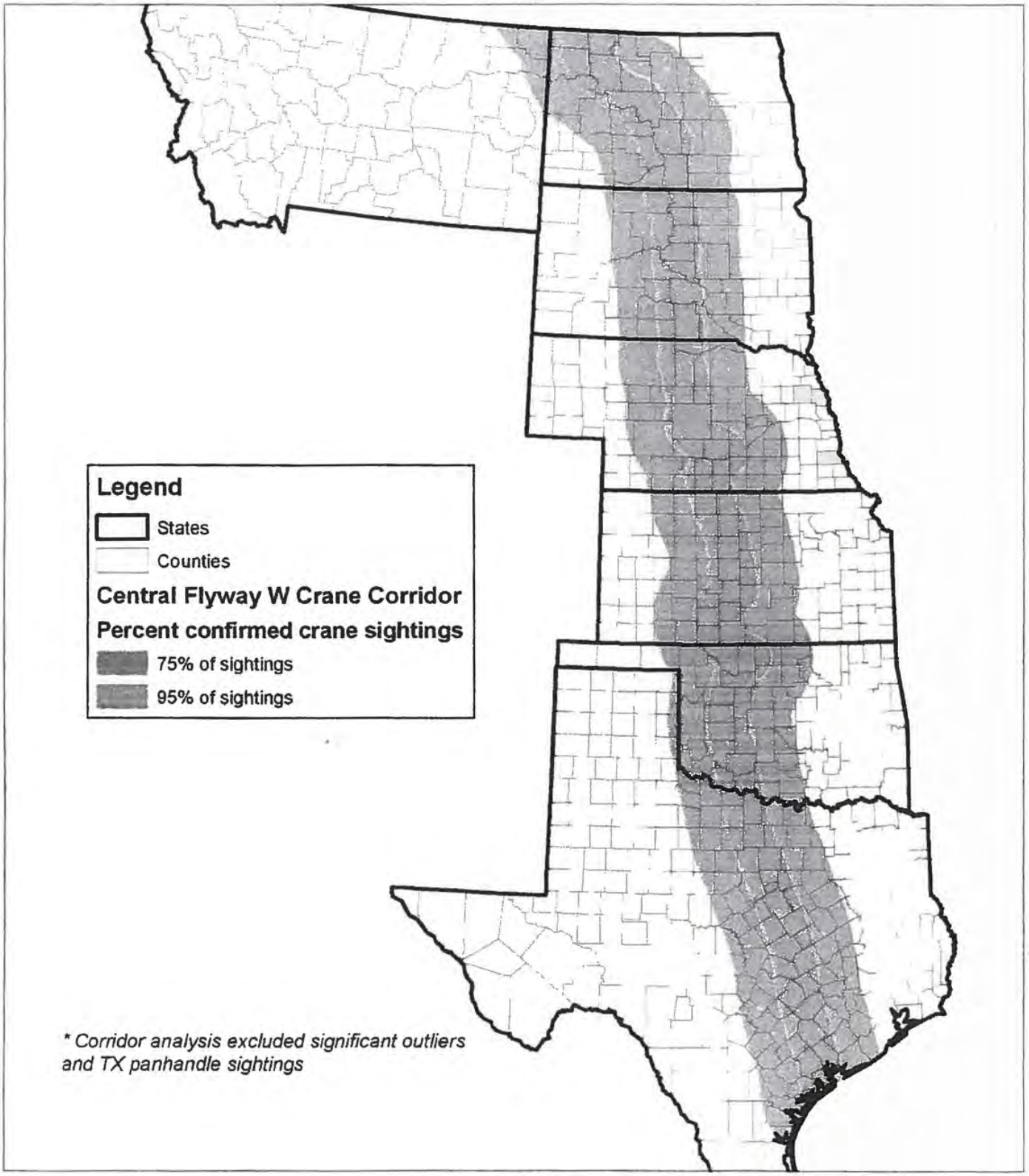
      Field offices should request written confirmation from the project proponent that power lines have been or will be marked and maintained (i.e., did the lines recommended for marking actually get marked? Are the markers being maintained in working condition?)

[1] Potentially suitable migratory stop over habitat for whooping cranes includes wetlands with areas of shallow water without visual obstructions (i.e., high or dense vegetation) (Austin & Richert 2001; Johns et al. 1997; Lingle et al. 1991; Howe 1987) and submerged sandbars in wide, unobstructed river channels that are isolated from human disturbance (Armbruster 1990). Roosting wetlands are often located within 1 mile of grain fields. As this is a broad definition, ES field office biologists should assist action agencies/applicants/companies in determining what constitutes potentially suitable habitat at the local level.

[2] Power lines are cited as the single greatest threat of mortality to fledged whooping cranes. Studies have shown that marking power lines reduces the risk of a line strike by 50 to 80 percent (Yee 2008; Brown & Drewien 1995; Morkill & Anderson 1991). Marking new lines and an equal length of existing line in the migration corridor maintains the baseline condition from this threat.

U.S. Fish & Wildlife Service

United States Central Flyway Whooping Crane Migration Corridor *



Produced for Ecological Services
Grand Island, NE
Current to: 2008
Basemap (Date): U.S. Counties
Meridian:
File:

0 70 140 280 420 560 Miles

N W E S

Literature Cited

Armbruster, M.J. 1990. Characterization of habitat used by whooping cranes during migration. U.S. Fish and Wildlife Service. Biological Report 90(4). 16 pp.

Austin, E.A., and A.L. Richert. 2001. A comprehensive review of observational and site evaluation data of migrant whooping cranes in the United States, 1943-99. U.S. Geological Survey. Northern Prairie Wildlife Research Center, Jamestown, North Dakota, and State Museum, University of Nebraska, Lincoln, Nebraska. 157 pp.

Avian Power Line Interaction Committee. 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute. Washington, D.C. 99 pp.

Brown, W.M., and R.C. Drewien. 1995. Evaluation of two powerline markers to reduce crane and waterfowl collision mortality. Wildlife Society Bulletin 23(2):217-227.

Howe, M.A. 1987. Habitat use by migrating whooping cranes in the Aransas-Wood Buffalo corridor. Pp 303-311, in J.C. Lewis and J.W. Ziewitz, eds. Proc. 1985 Crane Workshop. Platte River Whooping Crane Habitat Maintenance Trust and U.S. Fish and Wildlife Service, Grand Island, Nebraska.

Johns, B.W., E.J. Woodsworth, and E.A. Driver. 1997. Habitat use by migrant whooping cranes in Saskatchewan. Proc. N. Am. Crane Workshop 7:123-131.

Lingle, G.R., G.A. Wingfield, and J.W. Ziewitz. 1991. The migration ecology of whooping cranes in Nebraska, U.S.A. Pp 395-401 in J. Harris, ed. Proc. 1987 International Crane Workshop, International Crane Foundation, Baraboo,Wisconsin.

Morkill, A.E., and S.H. Anderson. 1991. Effectiveness of marking powerlines to reduce sandhill crane collisions. Wildlife Society Bulletin 19:442-449.

Yee, M.L. 2008. Testing the effectiveness of an avian flight diverter for reducing avian collisions with distribution power lines in the Sacramento Valley, California. California Energy Commission; Publication CEC-500-2007-122.

U.S. Fish and Wildlife Service, Region 6, Recommended Approach for Development and Submission of Eagle Conservation Plans submitted to Region 6, Migratory Management Office in support of an Eagle Incidental Take Permit Application for Wind Energy Projects.

23 July, 2019

U.S. Fish and Wildlife Service, Region 6, Migratory Bird Management Office

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Introduction: U.S. Fish and Wildlife Service (USFWS), Region 6, Migratory Bird Management Office (MBMO) and USFWS Ecological Services Field Offices (ESFO) in Region 6, have been jointly reviewing Eagle Conservation Plans (ECPs) submitted to USFWS in support of Eagle Incidental Take Permits (EITPs) for eagle take authorization at wind energy facilities that are already operational, or that are being constructed, in Region 6 states. These applicants are seeking EITPs for their wind energy projects pursuant to the Bald and Golden Eagle Protection Act (BGEPA) and its implementing regulations (CFR Title 50, Part 22). This ECP review process has been ongoing in Region 6 for at least five years. Based on this collective experience we present a new recommended and preferred approach to development of ECPs written and submitted by wind energy companies applying to USFWS, Region 6 for EITPs. Our intent in developing this new ECP guidance, is to make the ECP development and EITP application submission process go more quickly and efficiently, and to eliminate unnecessary work and expense by our EITP applicants. Also, adopting this new approach to ECPs will allow USFWS to get to our National Environmental Policy Act (NEPA) compliance work on these EITP applications much more quickly, another benefit for the applicant. **A key caveat with this new ECP process is that the EITP applicant must engage USFWS, and work with us to develop and apply avoidance and minimizations measures for the wind energy project, to the maximum extent practicable, as early on in the project development process as possible, and prior to submission of the ECP.** The BGEPA 22.26 permit regulations (CFR Title 50, Part 22) for EITPs do not specify what the contents of an ECP should be. Hence, there is latitude for USFWS Regions responsible for administering EITPs in terms of how this process occurs. The major purpose of this USFWS, Region 6, MBMO guidance memo is to reduce the ECP process to only those items necessary for USFWS: 1) to conclude that the ECP is sufficient to support the EITP application; 2) that we have what we need for our review of the application; 3) and that we have what we need to complete our required NEPA compliance, relative to any USFWS decision about whether or not to issue an EITP to a wind energy facility in Region 6. Last, this guidance and recommended process replaces and supersedes our previous USFWS, Region 6, Mountain-Prairie Region ECP guidance memo issued in 2013 entitled "*Final Outline and Components of an Eagle Conservation Plan (ECP) for Wind Development: Recommendations from USFWS, Region 6*".

A. The following are all the items USFWS, Region 6, MBMO recommends that entities applying for EITPs for wind energy facilities include in an ECP, or submit to USFWS, as part of the permit application process:

1. Provide a statement that the ECP was prepared to support an application for an EITP for a wind energy facility, the name of the facility, and relevant company/subsidiary names of the applicant/owner/operator.

2. Provide a map showing the location of the wind energy facility that USFWS can use for our NEPA document.

3. Provide a statement indicating how many years the applicant is requesting eagle take for. Note that per the USFWS 2016 Revised Eagle Rule (FRN Vol 81, 91494) all applications for EITPs submitted after July 14, 2017 will be processed under the 2016 BGEPA regulations.

4. Endangered Species Act Compliance:
   Before Region 6, MBMO can process an EITP, we need documentation which demonstrates that compliance with the Endangered Species Act (ESA), for federally listed species and critical habitat (designated or proposed), has already been completed for the wind energy project. If the wind energy project will not result in take of listed wildlife, fish, or plants, or adversely modify critical habitat for listed species (designated or proposed), pursuant to the ESA, provide a statement with the ECP submission documenting this. Alternately, if the wind project will result in adverse effects to federally listed species (wildlife, fish, and plants) and/or critical habitat (designated or proposed), provide written documentation which demonstrates that compliance with section 7 or section 10 of the ESA has already been completed for the project. Also, include a copy of the final USFWS document which demonstrates this. The USFWS ESFO in the state the wind project is located in will assist the EITP applicant with meeting any required section 7 or section 10 compliance under the ESA.

5. Department of Defense and Federal Aviation Administration:
   The Department of Defense (DoD) may have concerns about a wind energy project in relation to wind turbines creating interference with DoD radar systems at DoD installations. DoD concerns about wind turbine interference with DoD radar systems includes DoD installations such as Air Force Bases, U.S. Army Bases, missile sites, etc. Similarly, the Federal Aviation Administration may have concerns about wind turbine interference with radar systems at civil or commercial airports. If the wind energy project that an EITP is being submitted for occurs in proximity to a DoD defense installation, or a civil or commercial airport, or both, include a statement that the permit applicant is coordinating with these entities regarding the wind project. Also in such cases the EITP applicant must provide documentation that DoD, FAA, or both have reviewed the wind project and that they do not have any issues with the project design and layout relative to their radar systems and other infrastructure.

6. Project Description:
   The project description should include a list of all infrastructure for the project (i.e., wind

turbines, roads, power lines, met towers, substations, O&M building, etc.). Quantify how much of each project component will be built. For wind turbines: how many are there, what is the rotor diameter(s), total megawatts of the project, tower height, and total height with tower? For roads and power lines: how many miles of each will be constructed? The power line description also should include the voltage of the lines and whether the lines will be constructed above or below ground. Also, for any new power line construction include a statement that indicates whether or not they will be constructed following the Avian Power Line Interaction Committee (APLIC) 2006 Suggested Practices for Avian Protection on Power Lines and the 2012 Reducing Avian Collisions with Power Lines APLIC manuals. Provide map(s) that clearly shows the location of all of the project infrastructure. All maps should be provided as both PDF versions and as GIS shape files. Note that any changes in this information as the project moves forward will necessitate a delay in USFWS action on the application.

7. Eagle Data for the Project:
Submit copies of all eagle data collected for the project. If there were both bald and golden eagles documented at the project break out the responsive results and data by eagle species. This includes eagle use surveys, eagle roost surveys, eagle nest surveys, eagle migration surveys, eagle prey base surveys, eagle mortality monitoring, etc. If there was no eagle roosting habitat, or the project was not located in an eagle migration corridor, such that these surveys were not needed, then note this in the submission. At a minimum, provide a listing of the types of pre-construction monitoring conducted as well as the start and end dates for each type of survey, how many total surveys of each type were conducted, when surveys were conducted (specific dates), a written description of the protocols used to conduct each survey type (this can be in a consultants monitoring report, etc.), and figures that clearly show the sample points or the survey area used for the surveys. If the wind project is already operational include all the same items listed above for all post-construction surveys that were conducted.

   - For pre-construction eagle use surveys: Submit a spreadsheet with a record of all the surveys conducted (following USFWS Region 6-provided spreadsheet that provides required fields), and the results from all the surveys including the flight paths (on a project area base map) or perch locations for all eagles recorded. Provide an estimate of the project area (percentage) surveyed by eagle use survey efforts. Provide a written protocol describing how the pre-construction eagle use surveys were conducted (this can be in a consultants monitoring report, etc.). All maps should be provided as both PDF versions and as GIS shape files. If a report was prepared that included the eagle use survey work include a copy of this with the ECP submission.
   - For eagle nest surveys: Include a map showing the buffer around the project where surveys were conducted and the location of all eagle nests found (both in-use and alternate nests). In regard to survey results for all eagle nests documented as in-use, provide information on occupancy, productivity, and nest success to the extent this information was recorded. An in-use eagle nest means a bald or golden eagle nest characterized by the presence of one or more eggs, dependent young, or adult eagles on the nest in the past 10 days during the breeding season per the definition provided in the USFWS 2016 Revised Eagle Rule (FRN Vol 81, 91494). This information should be

summarized in a data table to be included with the submission. If a mean inter-nest distance was calculated for the project, provide this by eagle species and clearly indicate what nests were used to do the calculation and which year(s) of survey effort was used for the calculation (per USFWS 2013, Eagle Conservation Plan Guidance, Appendix H). Also, indicate whether or not the eagle nest surveys conducted for the wind project complied with the USFWS, Region 6, MBMO recommended protocol for conducting these surveys. All maps should be provided as both PDF versions and as GIS shape files. If a report was prepared that included the eagle nest survey work include a copy of this with the ECP submission.

- For eagle roosts include a map of the project area showing the locations of all documented roosts. If surveys were conducted to locate suitable eagle roosting habitat and then subsequently to determine whether or not this habitat was used for roosting, or to determine if a known documented eagle roost in the project area was used by eagles, provide the written protocols for how these surveys were conducted, a listing of all the surveys conducted by date, and the survey results. All maps should be provided as both PDF versions and as GIS shape files. If a report was prepared that included the eagle roost survey work include a copy of this with the ECP submission.

- For concentrated areas or sources of eagle prey base such as prairie dog colonies and sage or sharp-tailed grouse or prairie chicken leks, include a map of the project area showing all such locations. If surveys were conducted for prairie dog colonies and sage or sharp-tailed grouse or prairie chicken leks, provide the written protocols for how these surveys were conducted, a listing of all the surveys conducted by date, and the survey results. Indicate the specific species the surveys were conducted for. If there are big game parturition (birthing) areas located within the project area provide a map that shows where these were located. For domestic livestock, clearly indicate which type of livestock are present (i.e. cattle, sheep, horses or some combination thereof). Also, if there are lambing or calving areas within the project area, provide the location of each, and how many such lambing or calving areas there are. All maps should be provided as both PDF versions and as GIS shape files. If a report was prepared that included the eagle prey base assessment work include a copy of this with the ECP submission.

- For post-construction eagle mortality monitoring surveys: If the project is already operational, provide a written protocol describing how the surveys were conducted (this can be in a consultants monitoring report, etc.). Also submit a spreadsheet (USFWS, Region 6, MBMO will provide an Excel spreadsheet that includes the required data fields to be included in the submission) that includes all the records of all the mortality monitoring surveys conducted, including date of each survey and survey results. This spreadsheet should include all the data fields shown on page 97 of Appendix H of the USFWS Eagle Conservation Plan Guidance (USFWS 2013). Provide the total number of surveys conducted. Include full documentation of all bias trials (searcher efficiency and carcass persistence) conducted as part of the eagle mortality monitoring, including methods used, dates the trials were conducted, results, and the total number of such

trials by season. Include definitions for the survey seasons used to complete the eagle mortality monitoring. Provide a map that shows where the surveys were conducted. If the wind energy project has killed or injured eagles, provide a table listing all these mortalities/injuries. This table should include the eagle species, number of eagles, and the date each incident was documented. For each documented eagle mortality/injury, include all the fields shown on page 97 of Appendix H of the USFWS Eagle Conservation Plan Guidance (USFWS 2013) to the extent possible. Also provide a map of the project wind turbine layout showing the wind turbine identification number and the location of all eagle mortalities or injuries. For all incidental finds of dead or injured eagles, provide full documentation of each record separate from those documented during protocol carcass searches. Also, for incidental eagle mortality finds provide documentation of how these were handled relative to the bias trials. All maps should be provided as both PDF versions and as GIS shape files. If a report was prepared for that included the post-construction mortality monitoring work include a copy of this with the ECP submission.

8. Avoidance and Minimization Measures Implemented for the Project:
   There needs to be avoidance and minimization discussions between the EITP applicant and USFWS, Region 6. These discussions are a very important step in the permit process. This step should be completed well in advance of the submission of an EITP application by a wind company to USFWS, Region 6, MBMO. Typically these discussions should occur after the eagle data collection for the project is completed, although in some cases they could occur before the eagle survey work is completed. Information provided by eagle surveys for the project are highly important in informing the number and types of avoidance and minimization measures that USFWS, Region 6 will recommend for the wind project. These avoidance and minimization discussions are especially important for wind projects that are still in the planning stages and that have not yet been constructed. From the USFWS, Region 6 perspective, our best opportunity to achieve eagle risk reduction for a wind energy project is in the stages where we can provide input on project siting, micrositing of wind turbines, etc. Our USFWS, Region 6 recommendations to a company for a wind project may include moving the project to a different location, eliminating specific wind turbines, relocating wind turbines, seasonal curtailment of specific turbines, etc. For wind energy projects that are already constructed and operational there will be fewer opportunities to implement avoidance and minimization recommendations, hence these discussions are more constrained. Nevertheless, even for online wind facilities these avoidance and minimization discussions should still occur. With the ECP submission, provide documentation of all avoidance and minimization measures provided by the USFWS, Region 6 for the wind project. State which of these avoidance and minimization measures were implemented for the project. For those avoidance and minimization measures provided by USFWS that could not be implemented for the wind project, list these items and provide documentation as to the reason(s) why they could not be implemented.

9. Eagle Conservation Measures for the Project:
   Provide a list of all conservation measures (pre-construction, construction, and post-construction) that were or will be specifically implemented to reduce risk to eagles associated with the project. The Best Management Practices (BMPs) included in Chapter 7 of the USFWS,

Land-based Wind Energy Guidelines (USFWS, 2012) should be implemented at wind energy projects to benefit wildlife and wildlife habitat generally. However, many of these BMPs, such as using appropriate erosion control in project construction and operation to control or minimize runoff into water bodies, do not provide any direct conservation benefit to eagles. Hence, they should not be included with the ECP submission. If the EITP applicants elects to also develop a separate Bird and Bat Conservation Strategy for their wind facility this information should be included in this document. Include in the ECP only those measures that provide a direct conservation benefit to eagles, such as a measure establishing that all big game and livestock carcasses will be removed (or at least covered until they can be removed to prevent eagle access) from the wind facility within 24 hours of their discovery.

10. Compensatory Mitigation:
For wind projects that will include take of golden eagles, provide a statement indicating that all predicted golden eagle takes for the initial phase of the project will be offset through compensatory mitigation. In such cases the statement needs to clearly state a commitment from the applicant to completing all required compensatory mitigation. At present the only compensatory mitigation method for which the USFWS has developed a Resource Equivalency Analysis (REA) to establish mitigation credits is power pole retrofits. USFWS does not have the resources to develop other REAs for other mitigation methods at this time. However, should other credible REAs be developed for other types of mitigation alternatives (roadside carcass removal, lead abatement, conservation easements, etc.) in the future, USFWS would accept these other methods for the compensatory mitigation requirement. In these cases the EITP applicant would need to first submit the REA for the alternative compensatory mitigation method to USFWS. Then the REA associated with the alternative compensatory mitigation method would need to be reviewed by USFWS, a Department of the Interior (DOI) economist, and DOI Solicitors. If following this review the USFWS finds that the REA provides the necessary documentation that the alternative compensatory mitigation method is credible, then we will accept this alternate mitigation method for the required compensatory mitigation under an EITP to offset take of eagles. Include a statement with the ECP submission indicating that a power pole retrofit plan will be developed for the project to meet the compensatory mitigation requirements, and provide all necessary data that USFWS would need as input to the USFWS REA spreadsheet to calculate the required number of power pole retrofits for the project (see Appendix G of the USFWS Eagle Conservation Plan Guidance (USFWS 2013)). However, if the EITP applicant chooses to use the In Lieu Fee program provided by Eagle Electrocution Solutions, LLC (or another USFWS endorsed in lieu fee mitigation bank) for the required compensatory mitigation to offset the take of golden eagles, then a fully detailed power pole retrofit plan is not required. In these cases, the project proponent need only provide USFWS with a memo documenting the intent to use an in lieu fee mitigation provider, the name of the mitigation banker, and key information USFWS would need to complete an REA analysis for the project. Relative to bald eagles, applicants should work with USFWS to determine whether or not compensatory mitigation will be required for their wind project – this is rarely necessary.

11. Adaptive Management:
Adaptive management is a component of every EITP issued by USFWS, Region 6 to companies

for wind energy facilities. If a wind company negotiated with USFWS, Region 6 and reached agreement on an adaptive management table for the wind project, with various eagle take thresholds and the corresponding actions or conservation measures that will be implemented once that threshold is reached, then include this in the ECP submission. At a minimum the applicant and USFWS need to discuss what actions will be taken if eagle take approaches or reaches the amount authorized by an EITP issued by USFWS, Region 6 to the company. The ECP submission should include the outcomes from these discussions.

12. Other USFWS Permits:
    If an applicant intends to apply for any other permits to USFWS, Region 6, MBMO, for other authorizations needed for their wind project, either under the Migratory Bird Treaty Act (MBTA) or BGEPA, include a statement indicating which permits are needed and clearly indicating that they will apply for them. For example many wind energy companies apply for MBTA 21.27 Special Purpose Utility permits so that they can legally collect migratory birds and hold them at their facility for use in post-construction mortality monitoring work. In some cases construction of a wind project may occur in close proximity to an in-use eagle nest such that a BGEPA 22.26 permit is necessary, so that there is legal coverage under a permit, if this construction work were to cause disturbance take of eagles at the nest.

B. The following are things that should <u>not</u> be included in the ECP submission to USFWS, Region 6, MBMO to support an application for an EITP for a wind energy facility:

1. Do not submit the longer, more extensive type of ECPs previously submitted to USFWS, Region 6, MBMO to support applications for EITPs for wind energy facilities. With the process outlined above in Part A of this guidance memo, we are trying to substantially reduce the time required for ECP development and submission to USFWS, as well as the volume of material. Following our new recommended process reduces the ECP development work to providing responses to the specific questions above, plus submission of all of the project-specific eagle survey information (e.g. survey methods, maps of survey areas, survey results on maps or in data tables, etc. as described under Eagle Data for the Project section in Part A above). There is no need for back and forth review and editing efforts on individual chapters or lengthy ECP documents. Instead, if a company submits all of the requested information per the Part A of this guidance memo above, then they are done with the process. There may still be instances with the new ECP process where something that was requested was not provided. In these cases we will only ask for the missing data, or map, or other information, etc. If a company does submit longer ECP documents vs. following the streamlined approach outlined in this memo, their EITP application will receive a lower priority for processing by USFWS, Region 6, MBMO. Also for these types of submissions USFWS, Region 6, MBMO will put a note to the official EITP application file that we did not review the full document and that we only reviewed the ECP to see if it provided the specific information requested above under Part A of this memo.

Applicants for EITPs for wind energy projects that follow the new recommended approach provided by USFWS, Region 6, will find that the ECP process is shorter, more efficient, and less costly. Also, their EITP application reviews will be prioritized by USFWS, Region 6, MBMO for processing over and above those permit applicants who do not follow the recommended approach.

2. Do not provide overall risk categorization for the wind energy project per USFWS, Eagle Conservation Plan Guidance (USFWS, 2013).

3. Do not include descriptions of federal laws such as BGEPA, MBTA, ESA, and NEPA, or state laws applicable to the project.

4. An applicant may well choose to take the eagle use data collected for their wind energy project and run the USFWS Collision Risk Model (CRM) to determine predictions of eagle take associated with their wind project. We understand that many companies will want to conduct such analyses. However, do not submit any of these model runs, or related interpretations, or explanations of these CRM runs to USFWS, Region 6, MBMO. The USFWS, 2016 Revised Eagle Rule (FRN Vol 81, 91494) is clear that the USFWS will be the party using the eagle survey data provided by the applicant to run the CRM to determine a predicted level of eagle take for a project, and the related take authorization level in a EITP, if a permit is issued for the project. USFWS, will complete the CRM runs to determine a predicted level of eagle take as part of the NEPA process, and the outcomes of this analysis will be shared with the applicant.

5. Do not include any Local Area Population (LAP) analysis for the wind project. USFWS, Region 6, is responsible for completing this analysis using USFWS eagle density information for Eagle Management Units, information on other eagle take that USFWS has previously authorized within the LAP associated with the wind project, and information USFWS has on unpermitted eagle take in this same LAP. It is not the responsibility of any EITP applicant to complete this analysis. USFWS will complete the LAP analysis as part of our NEPA compliance work on an EITP application and share outcomes of that analysis with the applicant.

6. Wind energy companies developing projects that will have associated golden eagle take will need to provide compensatory mitigation to offset this take as discussed in the Compensatory Mitigation section under Part A, above. In such cases the EITP applicant may choose to use a copy of the REA provided by USFWS to conduct their own REA analysis, which is fine. However, results from applicant conducted REA analysis should not be included with the ECP submission, nor should written interpretations of these same results. USFWS will complete an REA analysis using input from the EITP applicant as part of the NEPA process and share the results with them.

7. Some wind energy companies applying to USFWS, Region 6 for EITPs will be seeking take authorization for wind projects that are already operating. And the company may already be conducting post-construction mortality monitoring specific to eagles. In these cases EITP applicants may want to use the post-construction mortality monitoring data they have collected to run analyses with the Evidence of Absence tool, or other tools, and this is fine. However, do

not submit results of these types of analyses, or interpretations of these results with the ECP submission to USFWS. USFWS will conduct an analysis using post-construction mortality monitoring data provided by the EITP applicant as part of the NEPA process and share results with them.

Literature Cited:

16 U.S.C. §§ 668–668d Bald and Golden Eagle Protection Act

Avian Power Line Interaction Committee, 2006. Suggested Practices for Avian Protection on Power Lines: the State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission, Washington, D.C., and Sacramento, CA.

Avian Power Line Interaction Committee, 2012. Reducing Avian Collisions with Power Lines: the State of the Art in 2012. Edison Electric Institute and APLIC, Washington, D.C.

Code of Federal Regulations, Title 50: Fisheries and Wildlife, Part 22- Eagle Permits, March 13, 2019 version.

Federal Register. Vol 81, 91494, December 16, 2016.

U.S. Fish and Wildlife Service. 2012. U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines, March 23, 2012.

U.S. Fish and Wildlife Service. 2013. Eagle Conservation Plan Guidance, Module 1-Land-based Wind Energy, Version 2, April, 2013.

U.S. Fish and Wildlife Region, Region 6, Mountain-Prairie Region. 2013 Final Outline and Components of an Eagle Conservation Plan (ECP) for Wind Development: Recommendations from USFWS, Region 6.

Red Butte Wind Energy Center
Wildlife Agency Meeting

Date: 14 July 2022
Time: 14:00 – 16:00h
Location: North Dakota Game and Fish Department, 100 N. Bismarck Expressway, Bismarck, ND 58501. Call in number for USFWS: (469) 480-4154 access number 15171238#.

AGENDA

1) Introductions
2) Red Butte Wind Energy Center (Project) information
   a. Project originally developed by PRC Wind starting in 2016. Further developments conducted by Tenaska in 2018. NextEra purchased and will complete development and permitting.
   b. Planned for 400 MW (split into two 200 MW phases).
      i. Anticipate filing PSC application for first phase in Q1/Q2 2023 with interconnection to Leland Olds for 2024 COD.
      ii. Anticipate filing PSC application for second phase in late 2023 with interconnection to Square Butte for 2024 or 2025 COD.
3) Discussion items
   a. Previous meetings with USFWS and NDGFD
      i. Study plan development/review and data sharing in 2016.
      ii. Meetings in 2017 to review Tier 2 and 3 study results.
      iii. Meeting in 2018 to discuss additional Dakota skipper habitat surveys.
      iv. Meeting in 2019 to discuss prior studies and proposed studies for 2019 and 2020.
   b. Project Development Review (2016 – 2022)
      i. Since original layout in 2016, the project has adapted to avoid and minimize potential impact to wildlife and their habitats (Map 1).
      ii. Newest layouts include avoidance of unbroken grasslands for permanent disturbance (Map 2) and associated buffers for eagles and leks (Map 3). Additionally, this layout focusses development on cultivated croplands while avoiding coal lease land (Map 4), and avoids most high impact lands as described in NDGFD Key Wildlife Habitat (Map 5).
   c. WEG Tier 3 Wildlife Surveys Previously Conducted (since 2018) and Discussed with Agencies
      i. Table 1 lists the wildlife and habitat surveys conducted since the 2019 agency meeting and future surveys and analyses to be conducted.

Table 1*. List of wildlife and habitat surveys

Study	Survey Effort and Analysis
Lek Surveys 2019	April 2019 - July 2020
Avian Use Surveys 2019-2020	May 2019 - September 2020
Bat Summer Presence/Absence Surveys 2019	July 2019 - September 2019
Whooping Crane Habitat Assessment 2019	August 2019 - October 2019
Raptor nest surveys 2020	February 2020 - September 2020
Lek Surveys 2020	March 2020 - August 2020

Table 1*. List of wildlife and habitat surveys

Study	Survey Effort and Analysis
Bat Summer Presence/Absence Surveys 2020	July 2020 - March 2021
Northern Long-eared Bat Presence/Absence Surveys 2020 - 2022	June 2020 - October 2022
Eagle and Raptor Nest Surveys 2022	March 2022 - September 2022
Eagle/Large Bird Surveys 2022	March 2022 - February 2023
Dakota Skipper Habitat Assessment	June 2022 - August 2022
Whooping Crane Habitat Assessment (Revised)	June 2022 – September 2022
Wildlife Conservation Strategy	June 2022 – Pre-COD
Raptor Nest Surveys	February 2023 – August 2023
Lek Surveys	March 2023 – May 2023

* Shaded cells indicated those survey efforts that are completed through analysis and draft reporting.

1. Lek Surveys (Map 3)
    a. In 2019 a total of 5 Leks identified: 2 Confirmed and 3 Probable.
    b. In 2020 a total of 5 Leks identified: 2 Confirmed and 3 Probable.
2. Raptor Nest Surveys (Map 3)
    a. 135 nest structures identified/searched.
    b. 1 bald eagle nest; 1 historic bald eagle nest could not be located during multiple efforts.
    c. 2 occupied active Swainson's hawk nests.
    d. 21 occupied active great horned owl nests.
    e. 57 occupied active red-tailed hawk nests.
    f. 2 occupied active unidentified raptor nests.
    g. 51 inactive unidentified raptor nests.
3. 2019-2020 Avian Use Surveys (Map 6)
    a. 64 avian and eagle use survey points (800-m survey radius) surveyed for 12 months.
    b. Completed 745 hours of surveys.
    c. Eagles resulted in 28 observations.
        i. 2 observations for GOEA for 3 minutes (2 "exposure" minutes; within 800m and below 200m).
        ii. 26 observations for BAEA for 150 minutes (47 "exposure" minutes).
    d. No federally-listed species identified.
4. Northern-long Eared Bat Acoustics and P/A Surveys
    a. 2019 P/A surveys.
        i. 7 acoustic survey sites resulted in potential NLEB calls at 2 sites.
            1. 2 follow-up mist-nest surveys captured a total of 4 NLEB.
        ii. 3 mist-netting locations.
            1. No NLEB captured.
    b. 2020 P/A acoustic surveys.

i. 7 acoustic survey sites within the Study Area and 5 survey sites along the T-line.
    1. 2 locations had possible NLEB calls (1 within the study area and 1 along the T-line).
    2. No follow up mist-netting efforts were conducted in 2020.

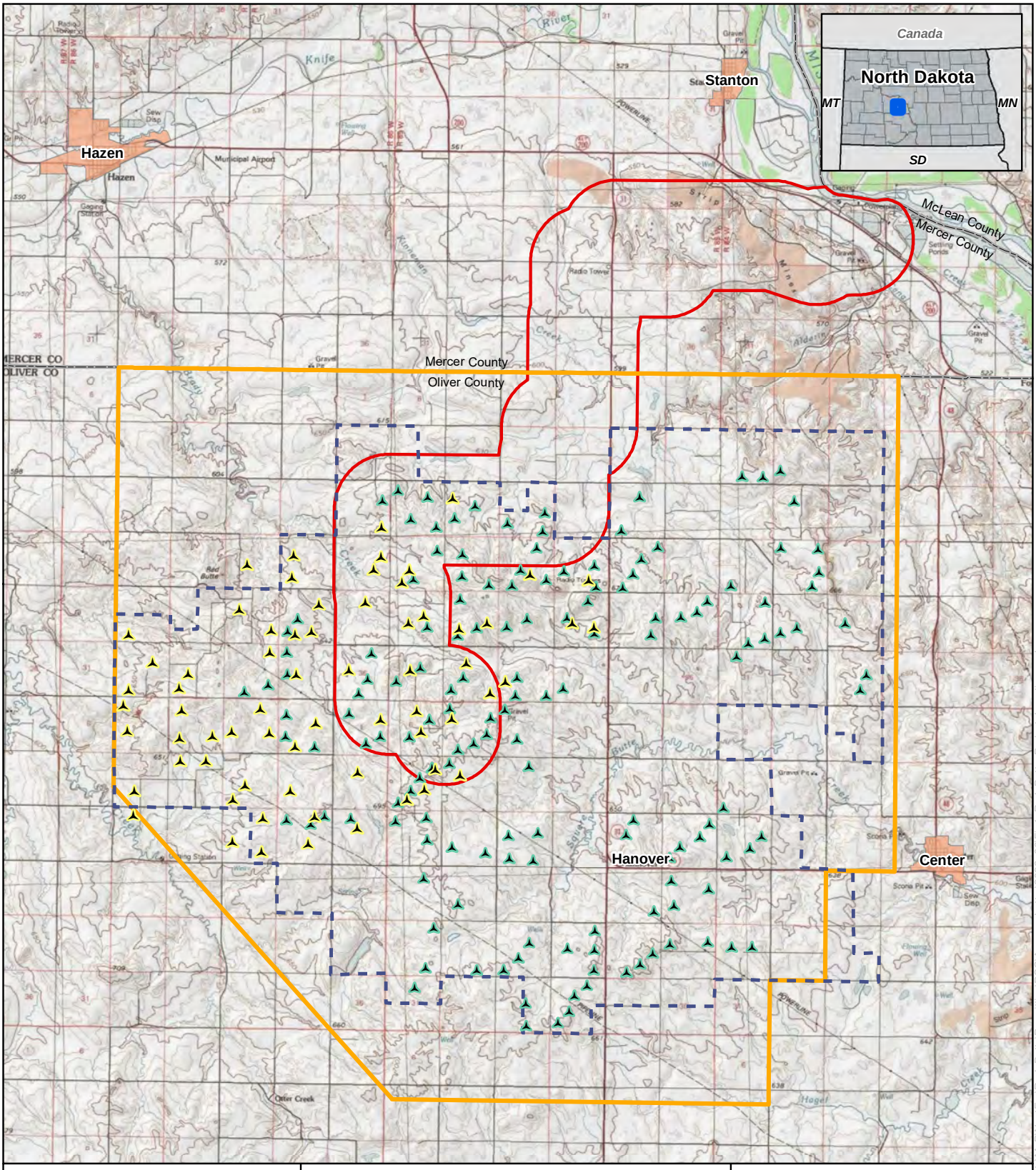
d. Current Studies (2022)
    1. NLEB P/A mist-netting.
        a. 2 survey locations (1 t-line and 1 within project).
        b. Locations based on previous potential NLEB calls, where no follow-up surveys could be conducted at the time.
    2. Eagle and Raptor Nest Surveys (no new eagle nests).
    3. Large Bird/ Eagle Use surveys (March 2022 – February 2023).
    4. Whooping Crane Likelihood of Occurrence Report.
        a. Project is within whooping crane migration corridor.
        b. Niemuth et al. (2018) predicted whooping crane use model suggests relatively low use as compared to other areas to the north and east of the proposed Project area. This is being updated based on revised Project areas.
        c. No documented sightings within the Project area; however, there are several recorded in vicinity.
    5. Additional DASK Habitat Surveys.

e. Proposed Survey Efforts for 2023
    1. Raptor Nest Surveys.
    2. Sharp-tailed Grouse Lek Surveys.
    3. Wildlife Conservation Strategy.

4) Action Items / Next Steps

ATTACHMENTS

- Map 1 - Overview Map
- Map 2 – Unbroken Grasslands
- Map 3 – Lek and Raptor Efforts
- Map 4 – Land Cover (crop and coal lease)
- Map 5 – Key Wildlife Habitats
- Map 6 – 2019 - 2020 Avian and Eagle Use Survey Efforts



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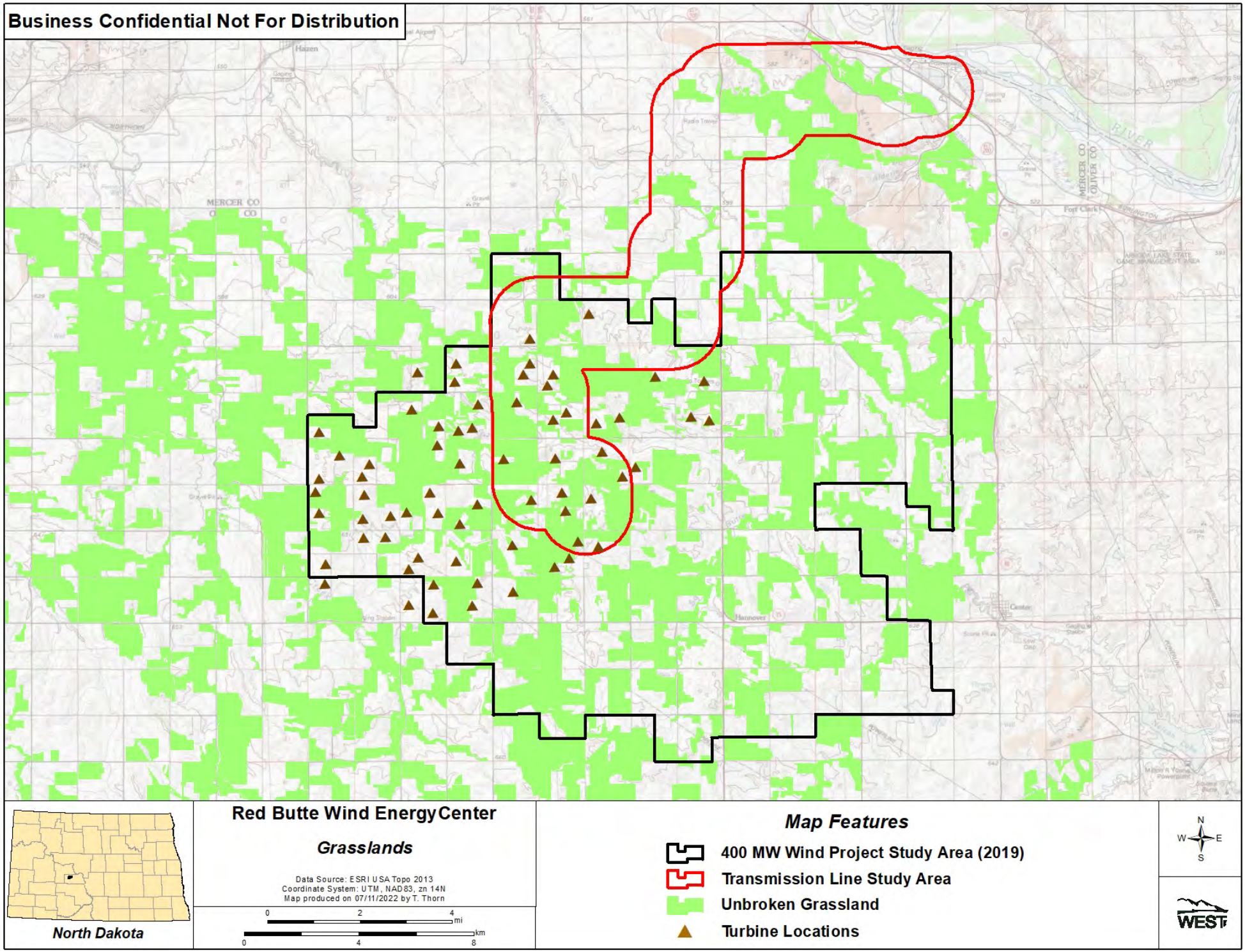
For Environmental Review Purposes Only

Figure 1
Study Area
Red Butte Wind Energy Center and Transmission Line
Mercer and Oliver Counties, North Dakota

- 400 MW Array (2019)
- 200 MW Array (2022)
- Transmission Line Study Area
- PRC Study Area (2016)
- Wind Project Study Area (2019)
- County Boundary
- City Boundary

Source: Z:\Clients\M_P\NextEra\Red_Butte\Permitting\PSC\Agency_Letter\2022_06\Fig1_Red_Butte_Project_Location.mxd

Date: (7/12/2022)


Business Confidential Not For Distribution
Red Butte Wind Energy Center
Grasslands
Data Source: ESRI USA Topo 2013
Coordinate System: UTM, NAD83, zn 14N
Map produced on 07/11/2022 by T. Thorn
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North Dakota
Map Features
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Transmission Line Study Area
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Turbine Locations
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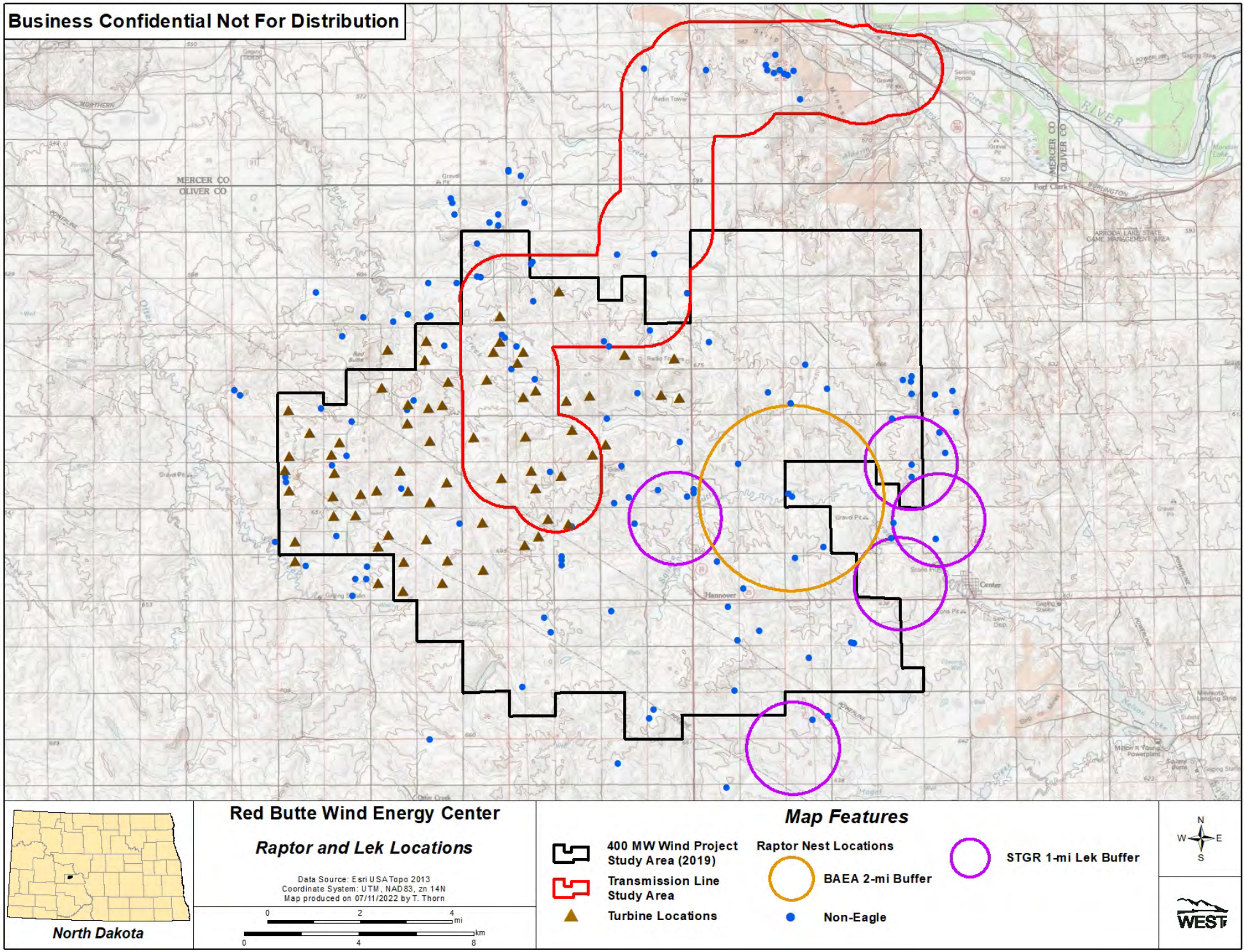
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MERCER CO
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Red Butte Wind Energy Center
Raptor and Lek Locations
Data Source: Esri USA Topo 2013
Coordinate System: UTM, NAD83, zn 14N
Map produced on 07/11/2022 by T. Thorn
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North Dakota
Map Features
400 MW Wind Project Study Area (2019)
Transmission Line Study Area
Turbine Locations
Raptor Nest Locations
BAEA 2-mi Buffer
Non-Eagle
STGR 1-mi Lek Buffer
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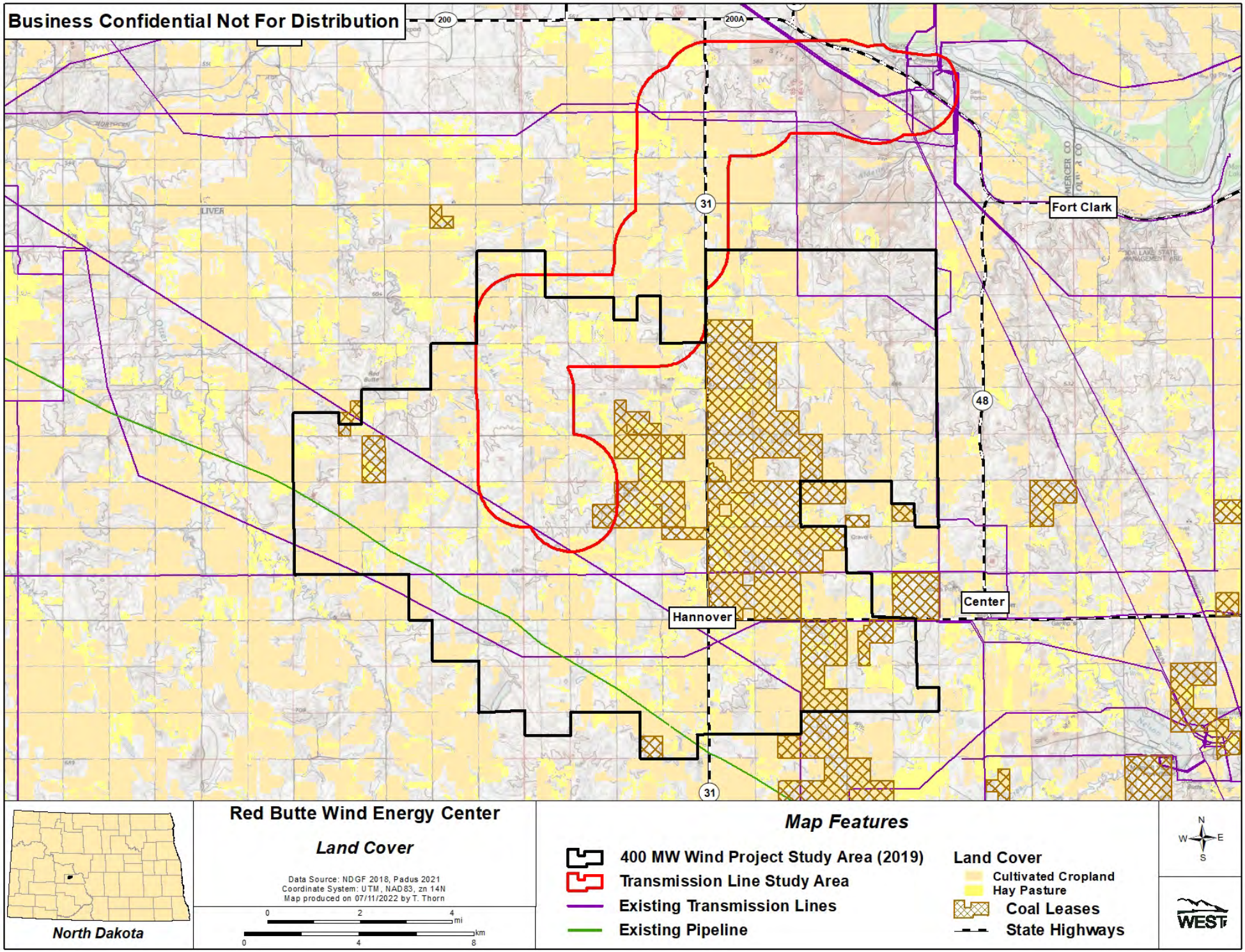
Business Confidential Not For Distribution
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Red Butte Wind Energy Center
Land Cover
Data Source: NDGF 2018, Padus 2021
Coordinate System: UTM, NAD83, zn 14N
Map produced on 07/11/2022 by T. Thorn
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400 MW Wind Project Study Area (2019)
Transmission Line Study Area
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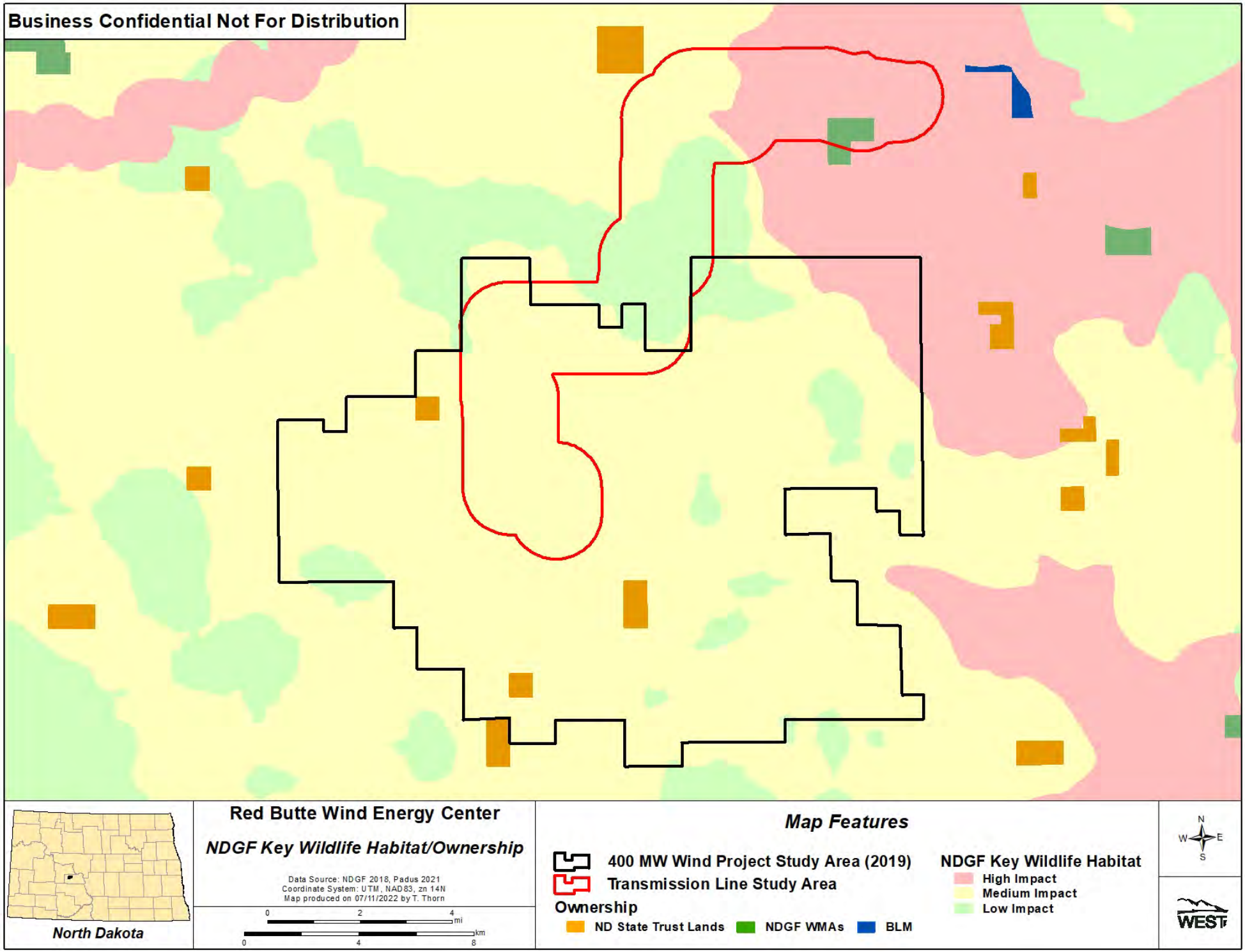
Business Confidential Not For Distribution
North Dakota
Red Butte Wind Energy Center
NDGF Key Wildlife Habitat/Ownership
Data Source: NDGF 2018, Padus 2021
Coordinate System: UTM, NAD83, zn 14N
Map produced on 07/11/2022 by T. Thorn
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Map Features
400 MW Wind Project Study Area (2019)
Transmission Line Study Area
Ownership
ND State Trust Lands
NDGF WMAs
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NDGF Key Wildlife Habitat
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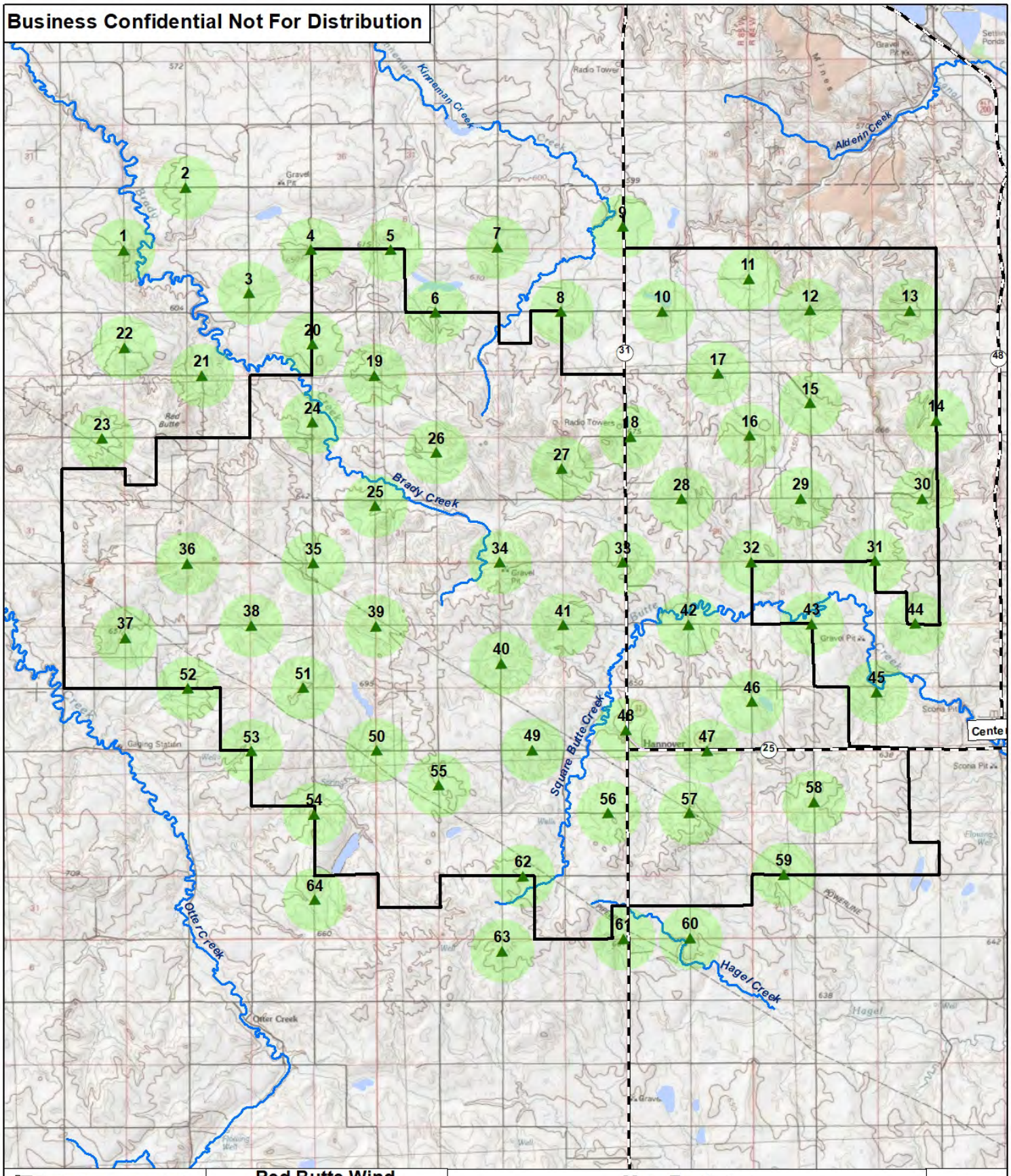
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Kirkeman Creek
Alderin Creek
Brady Creek
Square Butte Creek
Otter Creek
Hagel Creek
Red Butte
Radio Towers
Gaging Station
Hannover
Gravel Pit
Scona Pit
Flowing Well
Spring
Hagel
POWERLINE
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Red Butte Wind Energy Center
Avian Use Survey Locations
Data Source: ESRI USA Topo 2013
Coordinate System: UTM, NAD83, zn 14N
Map produced on 07/13/2022 by T. Thorn
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0 2 4 km
North Dakota
Map Features
400 MW Wind Project Study Area (2019)
Avian Use Survey Locations
with 800 m plot
State Highways
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NextEra Energy Resources
North Dakota Projects
Wildlife Agency Meeting Notes

Date: 14 July 2022
Time: 14:00 – 16:00h
Location: North Dakota Game and Fish Department, 100 N. Bismarck Expressway, Bismarck, ND 58501 and via Teams.

Meeting Notes

1) Introductions
2) NextEra presented updated Red Butte Wind Energy Center (Project) information
    a. Transmission line is routed north of NDGFD WMA
        i. Exact distance is to be determined
    b. NextEra/WEST provided overview of the survey results to date and current studies
        i. Surveys cover the full 400 MW study area
        ii. WEST to follow up with NDGFD regarding any new nest/lek data
            1. Make request from Elisha and Sandy
        iii. USFWS (Drew) requested the bat reports
            1. Reports not finalized – WEST will look at what is available to share
            2. Genetic samples to provide bats are NLEB
                a. WEST asked if Drew can get a permit to do genetic sampling on this Project
                b. Agencies are surprised that NLEB were captured
        iv. NDGFD asked about post-construction surveys along the t-line
            1. NextEra does not plan to do post-construction surveys along the t-line
    c. NDGFD (Elisha) asked if NextEra has wind BMP document
        i. NextEra has the document
        ii. NDGFD suggests doing an impact analysis and including in the WCS
        iii. NDGFD requests NextEra share turbine locations, site plan
            1. NDGFD will run the impact analysis internally
3) NextEra mentioned upcoming projects, showed locations
    a. New Salem – 200 MW, t-line to Square Butte substation
    b. Prairie – 200 MW, direct tap

Summary of Action Items

Request updated nest/lek data from NDGFD

Send USFWS additional information on NLEB captures

NLEB genetic sampling permit

Send array, site plan to NDGFD

Attendee List

Elisha Mueller (NDGFD)

Steve Dyke (NDGFD)

Clay Cameron (NextEra)

Dustin Jones (NextEra)

Jill Kotwasinski (NextEra)

Sarah Montone (NextEra)

Clayton Derby (WEST)

Martin Piorkowski (WEST)

Lindsey Churchill (Merjent)

Drew Becker (USFWS)

Heidi Riddle (USFWS)

*Attendees in italics attended via Teams

NextEra Energy Resources - North Dakota Projects
Wildlife Agency Meeting

Date: 15 March 2023
Time: 13:30 – 15:30h
Location: North Dakota Game and Fish Department, 100 N. Bismarck Expressway, Bismarck, ND 58501.
Call in number for remote access: (469) 480-4154 access number 15171238#.

AGENDA

1) Sign-in Sheet
2) Introductions and Meeting Overview
3) Oliver Wind IV Project Information
   a. Project originally developed by PRC Wind starting in 2016. Further development conducted by Tenaska in 2018. NextEra purchased and will complete development and permitting.
   b. Planned for 400 MW (split into two 200 MW units): Oliver Wind IV and Red Butte Wind (Map 1)
   c. Anticipated PSC application submission date: Oliver Wind IV Q3 2023 / Red Butte Wind Q3 2024
   d. Anticipated construction start date: Oliver Wind IV Q2 2024 / Red Butte Wind Q2 2025
   e. Anticipated Commercial Operation Date (COD): Oliver Wind IV Q4 2024 / Red Butte Wind Q4 2025
4) Discussion Items
   a. Previous Project Meetings with USFWS and NDGFD
      i. Study plan development/review and data sharing in 2016
      ii. Meetings in 2017 to review Tier 2 and 3 study results
      iii. Meeting in 2018 to discuss additional Dakota skipper habitat surveys
      iv. Meeting in 2019 to discuss prior studies and proposed studies for 2019 and 2020
      v. Meeting in 2022 to review Tier 3 study results
   b. Project Development Review (2016 – 2023)
      i. The Project has been continually developed to avoid and minimize potential impacts to wildlife and their habitats.
      ii. The Project turbines currently avoid unbroken grasslands (Map 2) and associated buffers for eagles and leks (Map 3). Additionally, the wind Projects avoid coal lease land and existing infrastructure (Map 4) and most high impact lands per NDGFD Key Wildlife Habitat (Map 5).
   c. WEG Tier 3 Wildlife Surveys Previously Conducted (since 2019) and Discussed with USFWS and NDGFD
      i. Table 1 lists the wildlife and habitat surveys conducted since 2019 and surveys and analyses in progress.

Table 1*. List of Wildlife and Habitat Surveys

Study	Survey Effort and Analysis
Sharp-tailed Grouse Lek Surveys 2019	April 2019 - July 2020
Avian Use Surveys 2019 - 2020	May 2019 - September 2020
Bat Summer Presence/Absence Surveys 2019	July 2019 - September 2019
Whooping Crane Habitat Assessment 2019	August 2019 - October 2019
Raptor Nest Surveys 2020	February 2020 - September 2020
Sharp-tailed Grouse Lek Surveys 2020	March 2020 - August 2020

Table 1*. List of Wildlife and Habitat Surveys

Study	Survey Effort and Analysis
Bat Summer Presence/Absence Surveys 2020	July 2020 - March 2021
Northern Long-eared Bat Presence/Absence Surveys 2020 - 2022	June 2020 - October 2022
Eagle and Raptor Nest Surveys 2022	March 2022 - September 2022
Eagle/Large Bird Surveys 2022	March 2022 - February 2023
Dakota Skipper Habitat Assessment	June 2022 - August 2022
Whooping Crane Habitat Assessment (Revised)	June 2022 – September 2022
Wildlife Conservation Strategy	June 2023 – Pre-COD
Raptor Nest Surveys	February 2023 – August 2023
Lek Surveys	March 2023 – May 2023

* Shaded cells indicated those survey efforts that are completed through analysis and draft reporting.

1. Eagle and Raptor Nest Surveys (no new eagle nests) (Map 3)
2. Large Bird/ Eagle Use Surveys (March 2022 – February 2023) (Map 6)
3. NLEB Presence/Absence Mist-netting
    a. 2 survey locations (1 t-line and 1 within project)
    b. Locations based on previous potential NLEB calls, where no follow-up surveys could be conducted at the time.
4. Whooping Crane Likelihood of Occurrence Report
    a. The Project is within whooping crane migration corridor
    b. Niemuth et al. (2018) predicted whooping crane use model suggests relatively low use as compared to other areas to the north and east of the proposed Project area. This is being updated based on revised Project areas
    c. No documented sightings within the Project area; however, there are several recorded in vicinity
5. Additional DASK Habitat Surveys

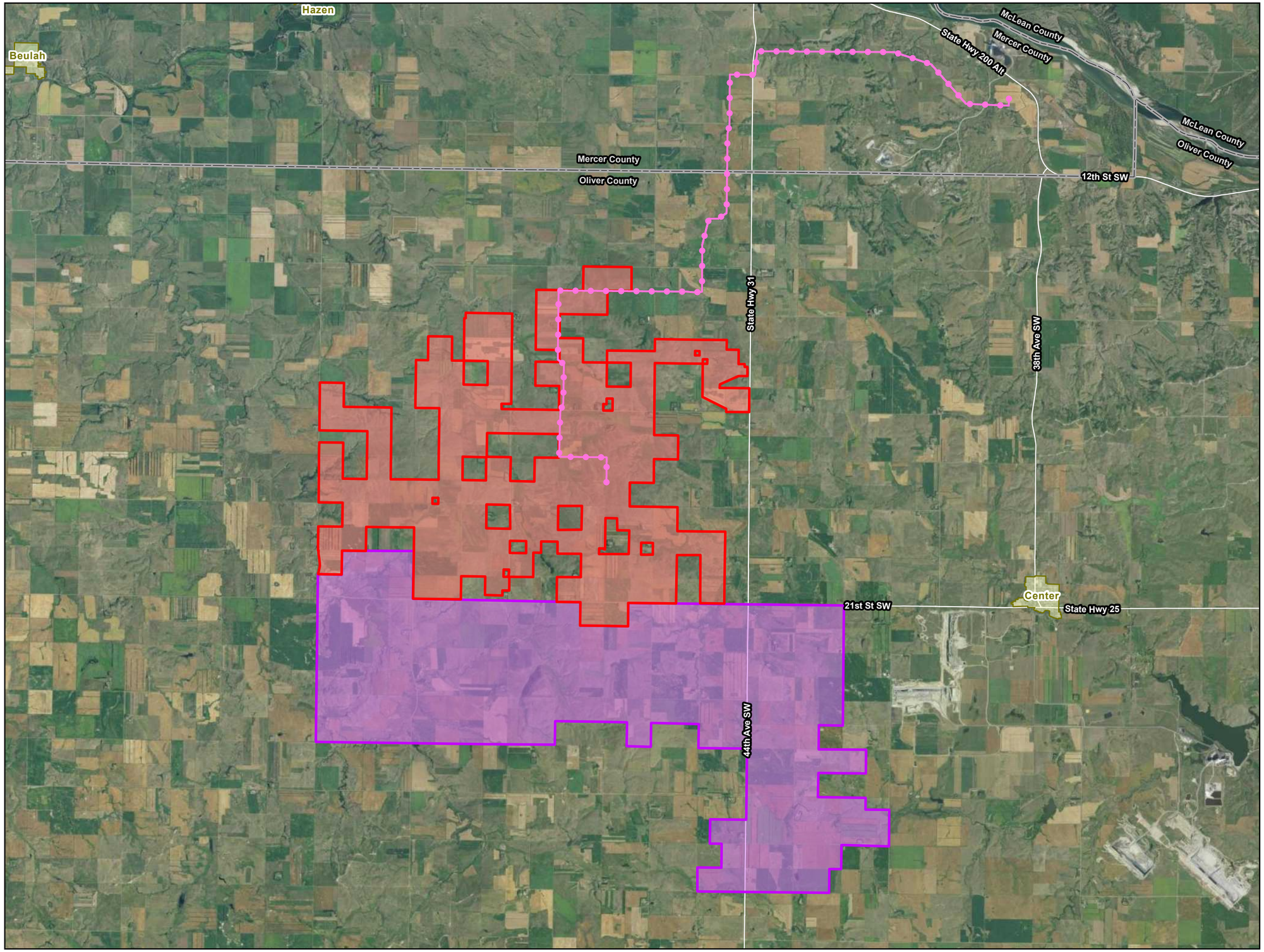
d. Current/Final Studies for 2023

5) Brief Update on Other NextEra Projects in Development (Map 7)

New Salem Wind, Prairie Wind, Emmons-Logan Storage, Northern Divide Storage

Attachments

- Map 1 – Overview Map
- Map 2 – Unbroken Grasslands
- Map 3 – Lek and Eagle Results
- Map 4 – Existing Infrastructure
- Map 5 – Key Wildlife Habitats
- Map 6 – Avian Use Survey
- Map 7 – Project Development Map



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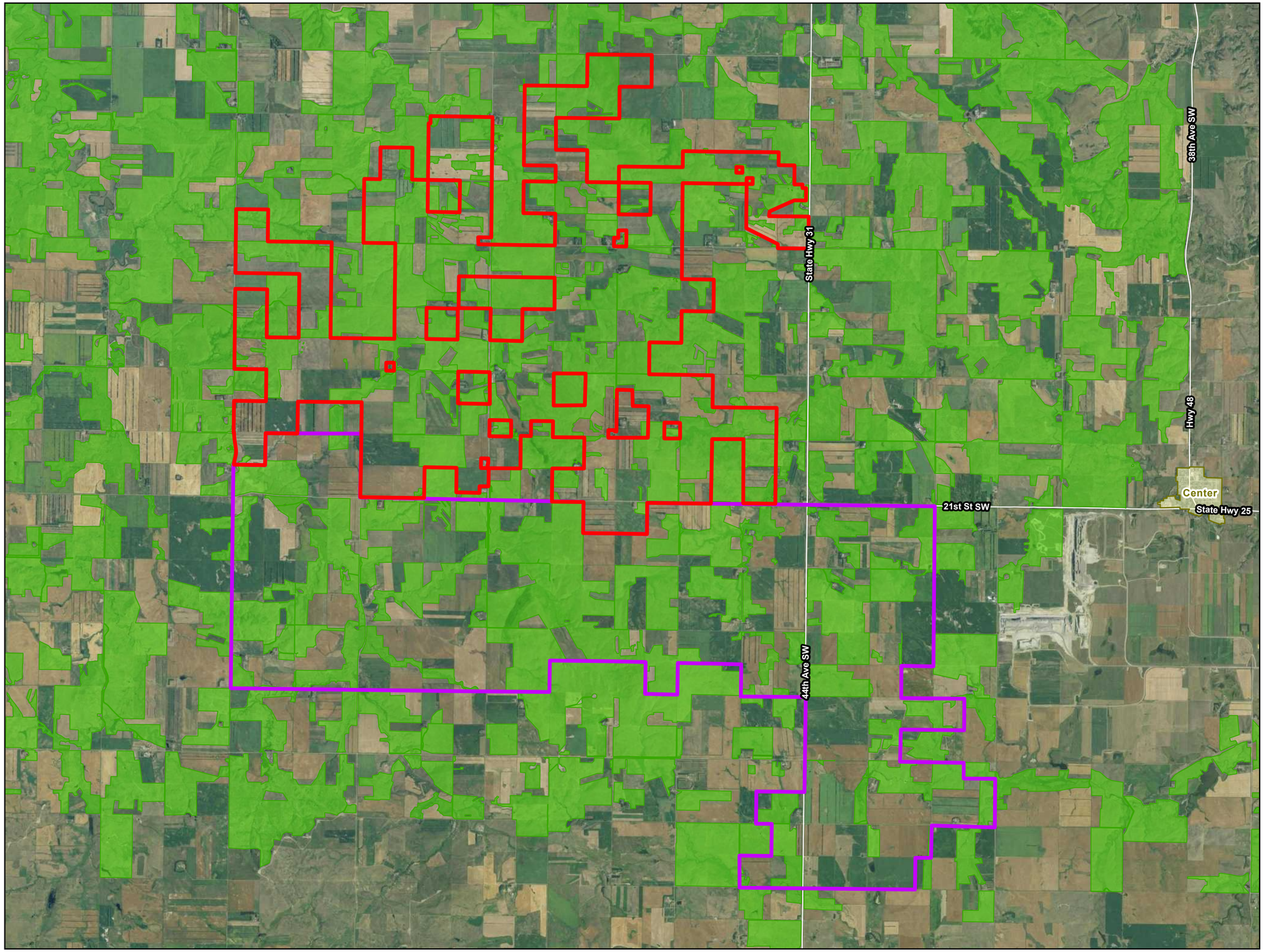
- Project Transmission Line
- Oliver Wind IV
- Red Butte Wind
- County Boundary
- Municipal Boundary

Map 1:
Project Overview
Oliver Wind IV and Red Butte Wind
Mercer and Oliver Counties, North Dakota

Confidential
For Environmental Review Purposes Only

Source: Z:\Clients\M_P\NextEra\Red_Butte\ArcGIS\Client_Meeting\OIV_RBW_ClientMeeting.aprx
Date: (5/14/2022)



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- Oliver Wind IV
- Red Butte Wind
- Municipal Boundary
- Unbroken Grassland

Map 2:
Unbroken Grassland
Oliver Wind IV and Red Butte Wind
Oliver County North Dakota

Confidential
For Environmental Review Purposes Only

Date: (3/14/2023) Source: Z:\Clients\M_P\Navitas\Red_Butte\ArcGIS\Client_Meeting\OIV_RBW_ClientMeeting.aprx

Map 3. Eagle and Lek Results

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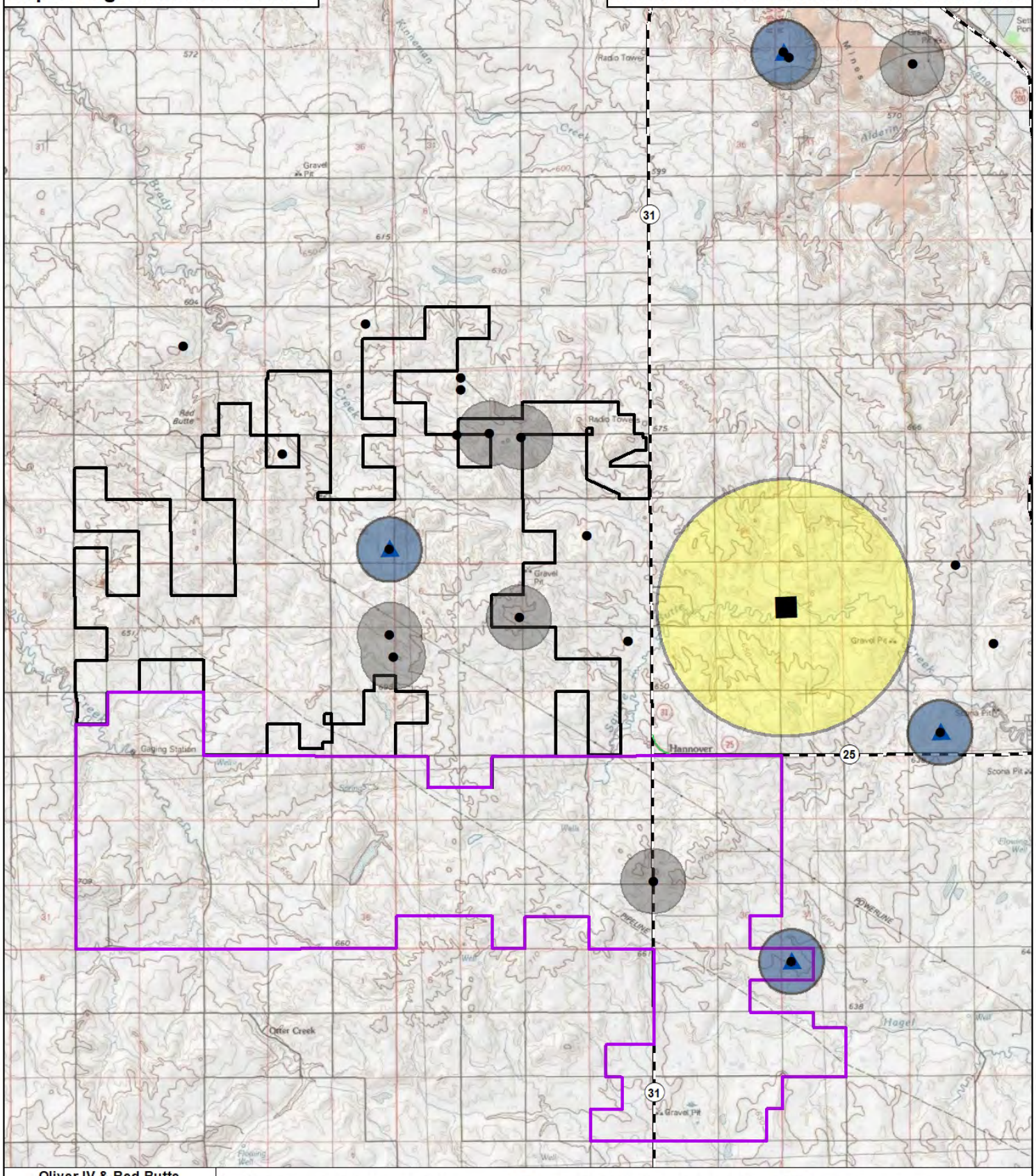

Oliver IV & Red Butte Wind Projects
Oliver County, ND

- Oliver IV Wind Project Area
- Red Butte Wind Project Area
- State Highways
- Sharp-tailed Grouse Leks With 0.5-Mile Buffer
- Historic Sharp-tailed Grouse Leks With 0.5-Mile Buffer
- Bald Eagle Nest With 2-Mile Buffer

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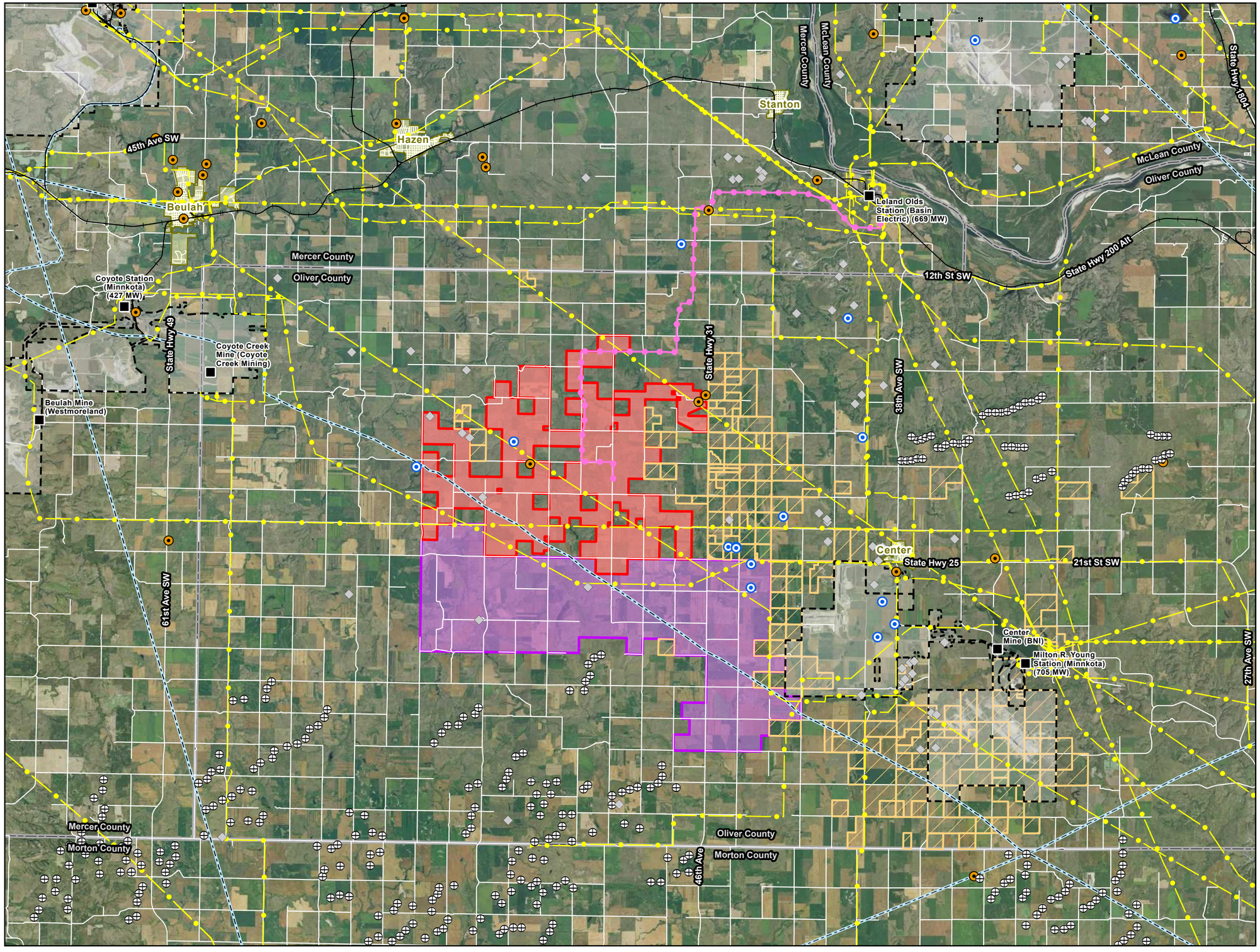
Data Source: Esri USA Topo 2013
Coordinate System: UTM,WGS84, zn 14
Map Produced: 03/14/2023. Created by: T. Thorn

WEST



0 1.5 3 Miles

1:180,000

N
W E
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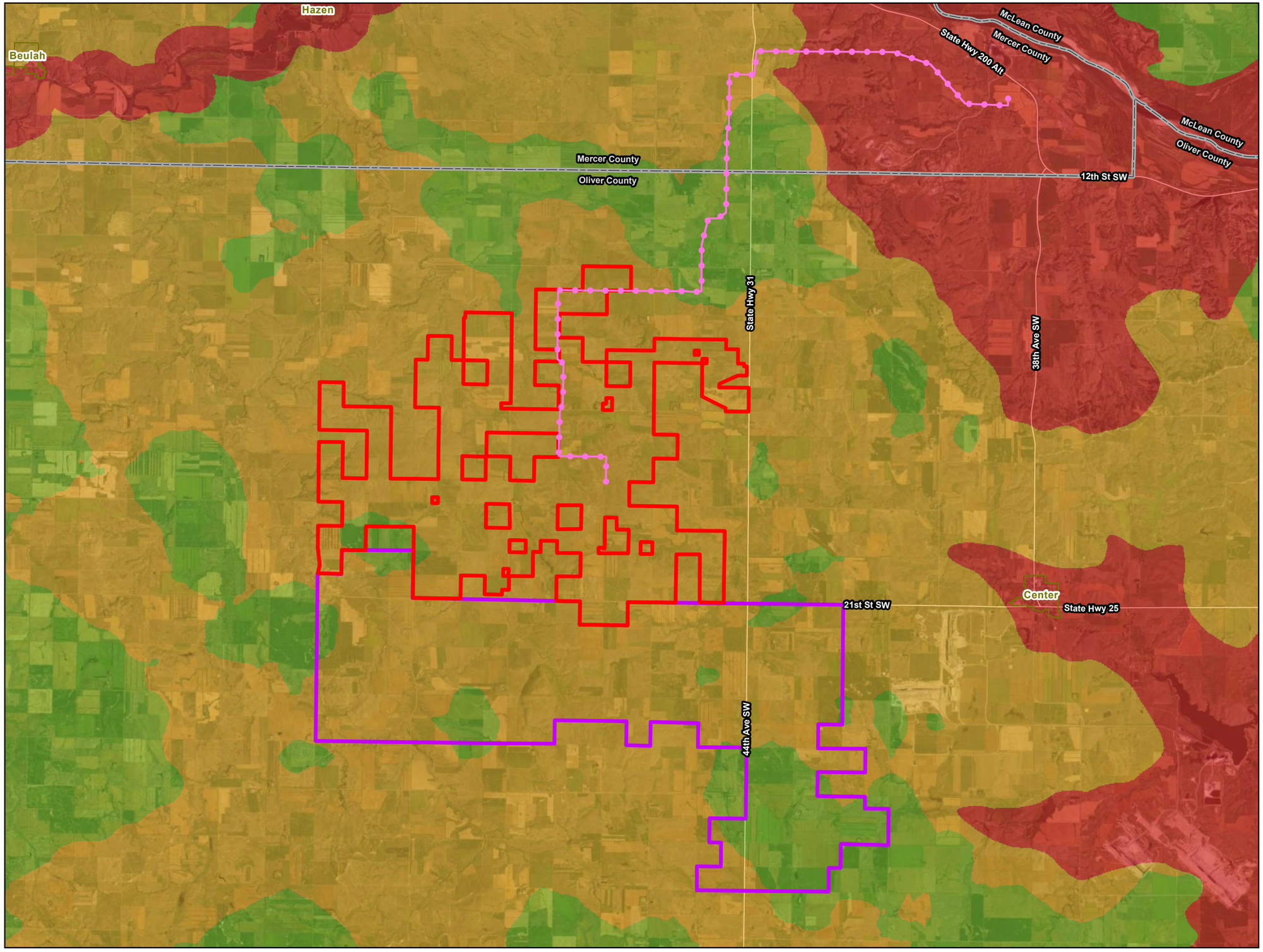
- Project Transmission Line
- Oliver Wind IV
- Red Butte Wind
- County Boundary
- Municipal Boundary
- Coal Lease
- Coal Mine Permit Boundary
- Wind Turbine
- Energy Facility
- Antenna Structure
- Abandoned Mine
- Oil & Gas Well
- Oil & Gas Pipeline
- Transmission Line
- Railroad

Map 4:
Existing Infrastructure
Oliver Wind IV and Red Butte Wind
Mercer and Oliver Counties, North Dakota

Confidential
For Environmental Review Purposes Only

Date: 07/14/2021 Source: Z:\Clients\M_P\NextEra\Red_Butte\GIS\Client_Meeting\OIV_RBW_ClientMeeting.aprx



0 1 2 Miles

1:120,000

N
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Project Transmission Line
Oliver Wind IV
Red Butte Wind
County Boundary
Municipal Boundary

Key Wildlife Habitat Area
High Impact
Medium Impact
Low Impact

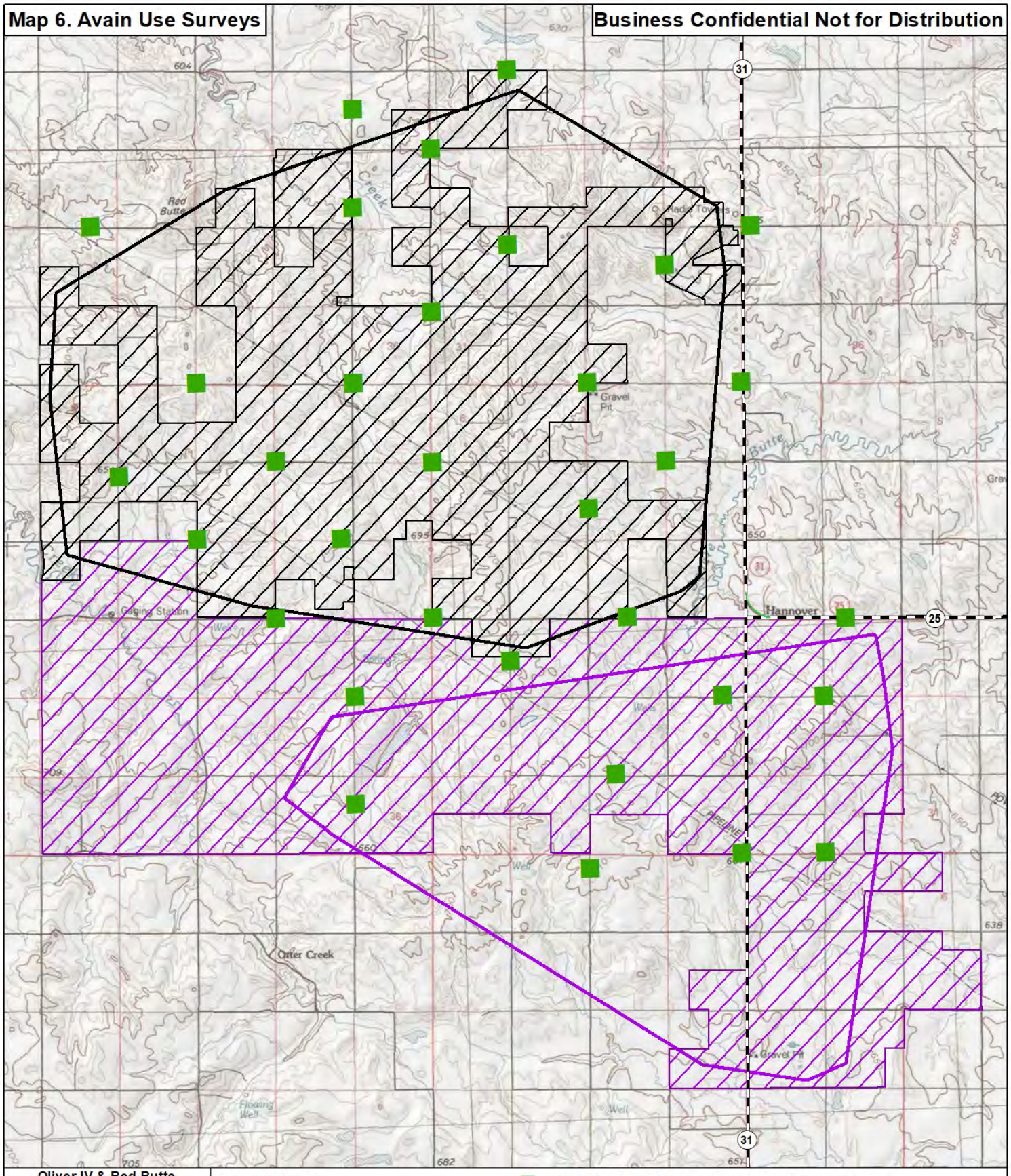
Map 5:
Key Wildlife Habitats
Oliver Wind IV and Red Butte Wind
Mercer and Oliver Counties, North Dakota

Confidential
For Environmental Review Purposes Only

Date (2/14/2025) Source: Z:\Clients\MI_P\Nextera\Red_Butte\MXDs\Client_Meeting\OIV_RBW_ClientMeeting.aprx

Map 6. Avain Use Surveys

Business Confidential Not for Distribution



Oliver IV & Red Butte Wind Projects
Oliver County, ND

Oliver IV Wind
MCP and Project Area
Project Area

Red Butte Wind
MCP and Project Area
Project Area

2019 And 2022 Avian Use Survey Locations
State Highways

N
W E
S

0 1 2 mi
0 2 4 km

Data Source: Esri USA Topo 2013
Coordinate System: UTM,WGS84, zn 14
Map Produced: 03/14/2023. Created by: T. Thorn

WEST

From:	Brown, Dina
To:	Mueller, Elisha K. (ekmueller@nd.gov); Martin Piorkowski; Clayton Derby (cderby@west-inc.com); Lindsey Churchill; Cameron, Clay; Montone, Sarah
Cc:	Riddle, Heidi L (heidi_riddle@fws.gov); Jones, Dustin
Subject:	EXTERNAL: NextEra Red Butte Wind Update Meeting with NDGFD
Date:	Tuesday, April 4, 2023 8:30:06 AM
Attachments:	Red_Butte_Oliver_IV_NDGFD__NEER_March_2023_MeetingNotes_04032023.pdf

CAUTION: This email originated from outside of Merjent.

All,

Please find attached notes from the NextEra Energy and NDGFD meeting that occurred on March 15, 2023. The meeting allowed NextEra to provide an update on our Oliver Wind IV and Red Butte Wind energy projects as well as an overview of other current North Dakota projects. Let me know if you have any questions.

Thanks,
Dina

Dina E. Brown | Project Manager
Environmental Services | Central Region | NextEra Energy Resources, LLC
C: 281-570-7108 | Dina.Brown@nexteraenergy.com
We Are Committed to Excellence | We Do the Right Thing | We Treat People With Respect

NextEra Energy Resources
North Dakota Projects
Wildlife Agency Meeting Notes

Date: 15 March 2023
Time: 13:30 – 15:00h
Location: North Dakota Game and Fish Department, 100 N. Bismarck Expressway, Bismarck, ND 58501

Meeting Notes

Objective: Provide an update on the proposed development schedule of the original Red Butte Wind Project with timelines and PSC submission expectations. Additionally, NextEra wanted to provide brief updates on other Projects in North Dakota being proposed including: New Salem, Prairie Winds, Emmons-Logan Battery Storage, and Northern Divide Battery Storage.

1) Introductions
2) NextEra presented updated Red Butte Wind Energy Center (Project) information
    a. Original project was split into two: Oliver Wind IV (~200MW) and Red Butte Wind (~200MW)
    b. Oliver Wind IV is on track to submit a PSC application approximately August 2023 with a COD in Q4 2024
        i. Proposed GE 2.82MW turbines with <500 ft tip height.
        ii. An estimated 18 miles of new overhead transmission line to a new Basin Electric substation near Leland Olds.
        iii. Numerous constraints have been examined and included in layout scenarios.
        iv. All unbroken grassland are being avoided for turbine placement.
        v. Turbines are sited to avoid sharp-tailed grouse leks by 0.5-mile.
    c. Red Butte Wind is proposed approximately one year behind Oliver Wind IV with COD in Q4 2025
    d. NextEra/WEST provided reference to previous meeting (July 15, 2022) for survey results.
        i. Oliver Wind IV (updates)
            1. Most field surveys have been completed for the full area of development and have been discussed previously.
            2. Additional DASK surveys will need to be completed for the finalized construction layout this summer (2023).
            3. Development of a Wildlife Conservation Strategy will be developed over the spring and summer.
        ii. Red Butte Wind (updates)
            1. This project is following approximately one year behind Oliver Wind IV.
            2. Additional studies are being evaluated based on project design and potential gaps in information.
    e. NDGFD Comments
        i. Sharp-tailed Grouse Leks
            1. E. Mueller asked if 2-mi avoidance of nesting habitat was used in turbine layouts and how many turbines might be sited within broken grasslands. She stated that she was encouraged to see that all unbroken grasslands were being avoided for turbine placement. She stated she would rather see turbines in croplands and within 2-mi of leks than see turbines on grasslands. She also stated that there were other options that could be considered including post construction monitoring of known leks and timing restrictions for construction.
            2. C. Cameron reiterated that based on previous discussion with NDGFD that all unbroken grasslands are avoided in the latest turbine arrays.
        ii. WHCR and DASK Habitat

1. E. Mueller expressed concern for DASK across unbroken grasslands for the Oliver Wind IV t-line. She suggested to follow-up with H. Riddle (FWS) to discuss further.
2. A similar concern was made for WHCR and E. Mueller suggested to reach out to H. Riddle on the topic of WHCR and the t-line.

iii. PSC Application

1. E. Mueller reiterated that NDGFD would need to get a letter to the PSC 30 days prior to the hearing. She suggested to get all data to NDGFD at about the time of the PSC application submission for review. She commented on the good relationship that NDGFD and NextEra has had to date with these projects and looks forward to providing a strong supportive letter. She added that NextEra should conduct an impact analysis on their own, as NDGFD will be doing the same, and she would need to report any remaining impacts (even if it is only five acres) to the PSC in their letter.

f. Additional North Dakota Projects

i. New Salem – C. Cameron described New Salem as a 375 MW Project. However, this could be split into two projects (New Salem I and New Salem II) depending on project development. M. Piorkowski described current planned sharp-tailed grouse lek survey strategy (one aerial survey for larger study area and two ground surveys in the smaller project area; Appendix A).

ii. Prairie Wind – C. Cameron provided a high-level description of the project to be approximately 200 MW in size with a COD late in 2025. There would be no t-line associated with this project and would be a direct tap to the existing line that runs through the proposed project.

iii. Emmons-Logan Battery Storage – C. Cameron explained battery storage for the project as storage containers with batteries inside, each with their own heating and cooling systems. This effort requires a PSC application, but has been scaled back from 200 MW to 100 MW. This is to help provide efficiencies for the wind project and more stable energy generation. This storage would impact approximately 20 ac adjacent to the existing Emmons-Logan substation.

iv. Northern Divide Battery Storage – Similar to the Emmons-Logan battery storage, this project would also include an approximately 20 ac location adjacent to the existing Northern Divide substation that would house storage for up to 100 MW.

Summary of Action Items

- NextEra will send along finalized report for Oliver Wind IV to NDGFD prior to/at time of the PSC application submission.
- NextEra will continue to provide NDGFD updates on project status and summarize field survey results as project development continues for other projects.

Attendee List

Elisha Mueller (NDGFD)

Dina Brown (NextEra)

Clay Cameron (NextEra)

Sarah Montone (NextEra)

Clayton Derby (WEST)

Martin Piorkowski (WEST)

Lindsey Churchill (Merjent)

Appendix A

Meeting Notes

Objective: To provide NDGFD a proposed survey strategy for sharp-tailed grouse leks at the New Salem Wind Project to meet their expectations for survey efforts.

3) WEST/NextEra presented a proposed survey strategy for New Salem Wind for 2023
   a. NextEra will be considering grasslands (broken and unbroken) when developing turbine layout designs for the New Salem Wind Project (Project). Priority will be to avoid unbroken grasslands followed by broken grasslands for turbine placement and maximize placement in croplands and other disturbed landscapes.
   b. The Project may be split into two (New Salem Wind I & II) with more certainty of development in the eastern portion of the Study Area (see Focus Area; Figure 1).
   c. Due to uncertainty of turbine locations at this early stage of development, WEST/NextEra proposes to conduct lek surveys at the proposed Project.
   d. M. Piorkowski described current planned sharp-tailed grouse lek survey strategy to include one aerial survey effort across the larger extent of the Study Area (Figure 1) and two ground survey efforts along publically accessible roads within the Focus Area (Figure 1). Surveys will be completed by stopping approximately every 0.5 – 1.0 mi apart depending on topography and habitat types with wider spacing between stopping points in flatter, cropland landscapes.

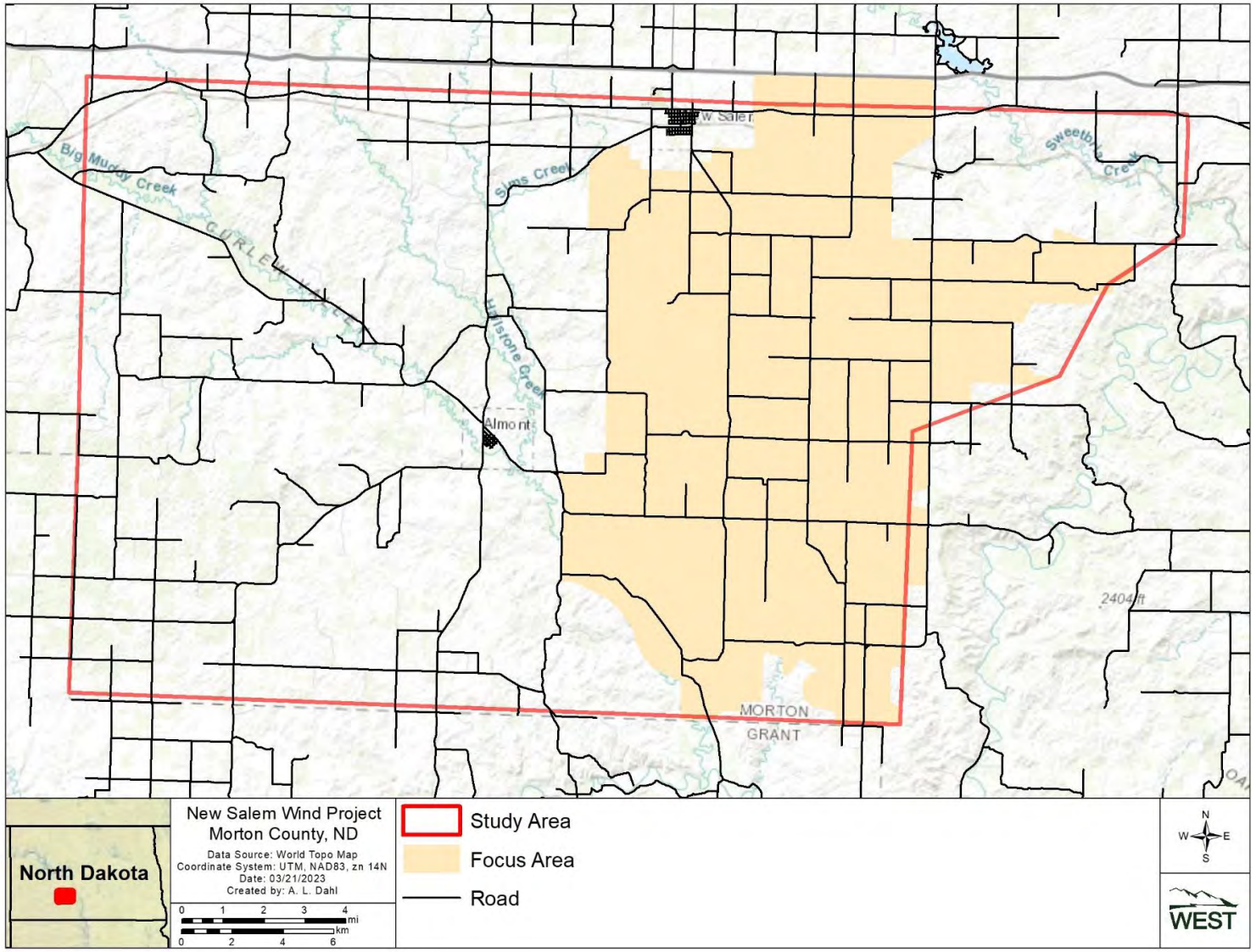


Figure 1. Boundaries of the New Salem Wind Project for proposed 2023 lek surveys, Morton County, North Dakota.

From: Lindsey Churchill
Sent: Thursday, May 11, 2023 4:19 PM
To: Riddle, Heidi L
Cc: Brown, Dina; Dirk Churchill
Subject: RE: EXTERNAL: Red Butte - Oliver IV
Attachments: 20230501_StudyArea_OIV.zip

Heidi,

Please see attached for the study areas shared in the outreach letter. Our final project areas will be smaller footprints.

Thank you,

Lindsey Churchill, PhD, PWS
Bismarck, North Dakota
651.428.7398 mobile
lindsey.churchill@merjent.com

1 Main Street SE, Suite 300
Minneapolis, MN 55414
612.746.3660 main
www.merjent.com

From: Riddle, Heidi L <heidi_riddle@fws.gov>
Sent: Tuesday, May 9, 2023 5:32 PM
To: Lindsey Churchill <lindsey.churchill@merjent.com>
Cc: Brown, Dina <Dina.Brown@nexteraenergy.com>
Subject: EXTERNAL: Red Butte - Oliver IV

CAUTION: This email originated from outside of Merjent.

Hello Lindsey,

I received your request for comments on the subject-mentioned project last week. Can you please share the shapefiles for the project area? I am cc'ing Dina Brown on this email as well, as I believe we are planning to discuss the project overall.

Thank you,
Heidi

Heidi Riddle, CWB®
Fish and Wildlife Biologist
USFWS North Dakota Ecological Services Field Office
3425 Miriam Ave
Bismarck, ND 58501
(701) 319-6708