

March 31, 2022

VIA E-MAIL AND FEDERAL EXPRESS

Mr. Steven Kahl
Executive Secretary
North Dakota Public Service Commission
600 E. Boulevard, Dept. 408
Bismarck, ND 58505-0480

**Re: Northern States Power Company
Border Winds Energy Project Repower
Siting Application – Rolette County
Case Nos. PU-08-797, PU-14-31, and PU-17-362**

Dear Mr. Kahl:

Northern States Power Company (“NSP”) plans to repower the Border Winds Energy Project (“Repower Project”) located in Rolette County, North Dakota. In support of the Repower Project, and in accordance with NDAC § 69-06-04-01(3), enclosed for filing in the above-referenced cases are an original and four (4) copies of the following documents:

1. Certification of Christopher Clark with accompanying:
 - a. Exhibit A – Environmental and Regulatory Compliance Memorandum, with associated Figures and the following appendices:
 - i. Appendix A – Noise and Shadow Flicker Modeling Reports;
 - ii. Appendix B – Obstruction Evaluation and Microwave Beam Path Analysis;
 - iii. Appendix C – Cultural Resource Reports and Correspondence (PUBLIC VERSION);
 - iv. Appendix D – Delineated Wetland Review;
 - v. Appendix E – Natural Resources Impact Assessment and Correspondence; and
2. Application to Amend Orders and Certificate.

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47 PU-17-362 Filed 03/31/2022 Pages: 233
Application to Amend Orders and Certificate - redacted
Northern States Power Company
Mollie Smith, Fredrikson&Byron, P.A.
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Also enclosed is a USB drive containing associated public GIS data. A check in the amount of \$25,000.00 for the administrative fee required pursuant to NDCC § 49-22-22 has been sent under separate cover. NSP will provide the amendment application fee once set by the Commission.

Unredacted, non-public versions of the Class I Cultural Resource Literature Review and the 2013 Supplemental Class III Intensive Cultural Resources Inventory Report (part of above-referenced Appendix C) and associated GIS data will be provided under separate cover with an Application for Protection of Information.

Electronic copies of the enclosed documents and this letter were filed with the Commission today via e-mail. If you have any questions, please let me know.

Sincerely,

A handwritten signature in cursive script that reads "Mollie M. Smith".

MOLLIE M. SMITH

MMS/75560968v3
Enclosures

cc: Ellen Heine (w/ enclosures, via e-mail)

STATE OF NORTH DAKOTA
PUBLIC SERVICE COMMISSION

**Northern States Power Company
Border Winds Energy Project
Siting Application – Rolette County**

**Case Nos. PU-08-797, PU-14-31,
and PU-17-362**

Application to Amend Orders and Certificate

I. Introduction.

Pursuant to N.D.C.C. § 49-22-08(5), Northern States Power Company (“NSP”) submits an application to the North Dakota Public Service Commission (“Commission”) requesting an amendment of the Commission’s Findings of Fact, Conclusions of Law and Order, dated May 5, 2011 (Case No. PU-08-797) (“2011 Order”), as amended in an order Reissuing and Amending Certificate, dated April 9, 2014 (Case No. PU-14-31) (“2014 Order”), and an Order on Reissuing Certificate, dated January 10, 2018 (“2018 Order”) (Case No. PU-17-362), along with the Second Reissued First Amended Certificate No. 21 (collectively, “Orders and Certificate”) issued for the Border Winds Energy Project (“Project”). Specifically, NSP requests that the Commission amend the Orders and Certificate to remove the 150 megawatt (“MW”) nameplate capacity limitation.

II. Procedural History.

A brief overview of relevant procedural history is provided below:

- On October 24, 2008, a Certificate of Site Compatibility Application (“Application”) for the Project was filed with the Commission by then-owner Sequoia Energy US, Inc. (“Sequoia”) (Case No. PU-08-797).
- On May 5, 2011, the Commission issued its 2011 Order granting Certificate of Site Compatibility No. 21 to Sequoia for the Project (Case No. PU-08-797).

- On January 8, 2014, Sequoia and Border Winds Energy, LLC (“Border Winds Energy”) filed a joint application to transfer Site Certificate No. 21 to Border Winds Energy (Case No. PU-14-31). Also on that date, Border Winds Energy filed a petition to amend the 2011 Order to authorize site plan changes, including use of a smaller turbine model, changes to turbine locations, and the addition of turbine locations (Case No. PU-08-797).
- On April 9, 2014, the Commission issued its 2014 Order transferring Site Certificate No. 21, approving the turbine model change and resulting layout changes, and issuing First Reissued and First Amended Certificate of Site Compatibility No. 21 to Border Winds Energy (Case Nos. PU-08-797 and PU-14-31).
- On August 20, 2014, the Commission issued Certificate of Public Convenience and Necessity No. 5842 to NSP authorizing the purchase and operation of the Project (Case No. PU-13-743).
- Project construction occurred in 2014 and 2015, with the Project beginning commercial operations in Fourth Quarter 2015.
- On December 3, 2015, Border Winds Energy, LLC was merged into NSP.
- On September 22, 2017, NSP filed an application to transfer Site Certificate No. 21 from Border Winds Energy to NSP (Case No. PU-17-362).
- On January 10, 2018, the Commission approved the transfer and issued the 2018 Order and Second Reissued First Amended Certificate of Site Compatibility No. 21 to NSP (Case No. PU-17-362).

III. Planned Repowering Project.

As discussed further in the Certification of Christopher Clark, filed concurrently herewith, NSP plans to repower the Project. Repowering the Project will consist of removing and replacing the existing Vestas V100-2.0 blades, hub, gearbox, pad mount transformer, and generator with a new repower package of Vestas V110-2.2 blades, hub, gearbox, pad mount transformer, and generator. As a result of the technology change to repower the Project, the total nameplate generating capacity will be 165 MW; however, NSP will limit the output at the point of interconnection to 150 MW in accordance with its Generator Interconnection Agreement.

IV. Amendment Request – Removal of Capacity Limitation.

In order paragraph no. 3 of the 2011 Order, the permittee is authorized to site and construct wind turbines “totaling approximately 150 MW of generating capacity.”¹ Likewise, Second Reissued First Amended Certificate No. 21 designates a site for “approximately 150 MW of total wind generating capacity.” As noted above, when repowered, the Project’s nameplate capacity will be 165 MW, even though the megawatts delivered to the grid will be limited to 150 MW. Based on review of prior repower dockets, NSP understands that the Commission has previously concluded that order and certificate amendments are required where a megawatt limitation is specified.² Therefore, NSP requests that the Commission amend the Orders and Certificate to remove the megawatt limitation.

V. Conclusion.


For the reasons set forth above, NSP respectfully requests that its application to amend the Orders and Certificate to remove the capacity limitation be granted.

¹ The megawatt limitation was not changed by subsequent Commission orders.

² See Order, dated December 3, 2019, Ashtabula Wind Energy Center Repower (Case No. PU-19-284) and Order, September 5, 2018, Langdon Wind Energy Center Upgrade Project (Case No. PU-18-186).

Dated this 29th day of March, 2022.

FREDRIKSON & BYRON, P.A.

By 

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Appendix A
Noise and Shadow Flicker Modeling Reports

A REPORT FOR ENVIRONMENTAL SERVICES

Border Winds Repower

Noise Impact Analysis

FEBRUARY 10, 2022

PREPARED FOR:



PREPARED BY:

Westwood

Westwood

Noise Impact Analysis

Border Winds Repower

Rolette County, North Dakota

Prepared For:

Xcel Energy Services
414 Nicollet Mall
Minneapolis, MN 55401

Prepared By:

Jeff Fine
Westwood Professional Services
12701 Whitewater Drive, Suite 300
Minnetonka, MN 55343
(952) 937-5150

Project Number: R0003319.01

Date: February 10, 2022

Legal Notice and Disclaimer

Westwood's findings and opinions in this Noise and Shadow Flicker Assessment are exclusively for the use of the Applicant, Xcel Energy. Westwood will not distribute or publish the Noise and Shadow Flicker Assessment report without the consent of the Applicant, except as required by law or court order. No other party may rely on the Noise and Shadow Flicker Assessment report without Westwood's written consent. The findings and opinions contained herein are limited to use by the Applicant. Westwood's services for this project have been performed in a manner consistent with normal standards of the profession. No other warranty or guarantee, expressed or implied, is made.

Rev No.	Revision Purpose	Date	Revised by
0	Original	April 19, 2021	MML
1	Use STE Blades	February 10, 2022	JF

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Exhibits

- Exhibit 1: Project Turbine Locations
- Exhibit 2: Noise Level Model Results
- Exhibit 3: Noise Level Contour Maps

Executive Summary

Westwood Professional Services (Westwood) was contracted by Xcel Energy (Client) to support the repower of the Border Winds Project by completing a noise assessment. It is our understanding that the Applicant intends to replace components on up to 75 wind turbines during the 2024 or 2025 calendar year. Border Winds has a nameplate capacity of 165.0 megawatts (MW) and is located in northern North Dakota in Rolette County.

The noise assessment consisted of 36 participating and non-participating residential dwellings within 1-mile of proposed turbine locations, as well as the town limits for the closest town of St. John, ND. The residential dwellings were modeled by placing point-type noise receptors spaced 75 ft. apart around the perimeter of the dwelling, and at a distance of 150 ft. away from the dwelling center to ensure the highest noise level at least 100 ft. from the structure was captured. The boundary of St. John was buffered by 150 ft. beyond the town perimeter and modeled as points spaced 75 ft. apart evenly along the boundary. All noise receivers are assumed to have a relative height of 1.5 meters above ground level. Moderate ground attenuation was assumed.

The noise assessment has been completed in accordance with North Dakota regulations found in section 4 of Chapter 69-06-08-01 Energy conversion facility siting criteria.

The model was simulated assuming all turbines were using the standard edge blade which produces a higher noise level than the optional blade geometry which utilizes a serrated trailing edge (STE). When modeled with the standard blade the results indicate that seven (7) residences will be non-compliant to the 45 dBA regulation.

A second model simulation was done assuming sixty-five (65) of the turbines in the layout used the standard blade configuration and ten (10) turbines were modeled using the optional serrated trailing edge (STE) blade to reduce noise emissions at selected locations.

By utilizing the combination of the standard and STE blades the noise model results show all receptors including along the perimeter of the town of St. John are compliant to the 45 dBA at 100ft regulation.

1.0 Introduction

Westwood was contracted by Xcel Energy to support the repower of the Border Winds Project by completing a noise assessment. The site consists of 75 turbines with a nameplate capacity of 165.0 megawatts (MW). The noise model contains seventy-five (75) Vestas V110-2.2 MW turbines with a rotor diameter of 110m and a hub height of 95m. Turbine locations were provided to Westwood by the Applicant.

Receptor locations were created in 2014 as part of the original permitting effort for this project. This 2014 dataset was used as the basis for determining the participating and non-participating noise receptors inside and adjacent to the project area. There is no regulation detailing a distance criterion between proposed turbine locations and existing noise sensitive receptors, therefore, to be conservative a selection of the receptors up to 1 mile from any proposed repowered turbine location was chosen for this analysis. The selection of receivers consists of 36 residential dwellings and the town limit of St. John, ND.

The Project Area is located in Rolette County in northern North Dakota near the town of St. John. The Subject Property is located at an approximate elevation of 1,730 to 1,900 feet above mean sea level (AMSL) and is relatively flat. The Project Area is located within an agricultural and residential area.

2.0 Background – Noise

In order to verify that the turbine array at Border Winds is within compliance of the noise allowance levels, Westwood analyzed the site specifics through a model built in windPRO. The model assumed the turbines were operating at the loudest noise emission level. An additional uncertainty margin of 2 dBA was added to the noise emission levels. These assumptions were made to ensure a "worst case" scenario was analyzed to produce a model more conservative than realistic operational conditions.

The noise assessment has been completed in accordance with North Dakota regulations found in section 4 of Chapter 69-06-08-01 Energy conversion facility siting criteria, 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."

According to the Vestas noise emission documentation reviewed by Westwood, the maximum normal operational noise emission level from a standard blade on the V110-2.2 MW is 107.7 dBA at the hub height of the turbine. The maximum noise emission level of the optional serrated trailing edge (STE) blade of the V110-2.2, which is designed to reduce noise emissions produces 106.1 dBA at hub height.

GIS data of noise sensitive receivers was developed by Westwood using receptor data from the 2014 permit application for this project. Additionally, aerial imagery was used to determine whether any new construction occurred since 2014, however no additional receptors were added to the model. Three locations were excluded as they are not residential or inhabited structures.

These receptors include areas such as habitable residences, schools, churches, and other noise sensitive areas. There is no regulation regarding distance criteria between proposed turbine locations and noise receptors that must be included in a predictive model.

To be conservative, noise at receptors up to 1 mile from the proposed repowered turbines was calculated. Details of the turbines used in the noise analysis are found below in **Table 1**.

Table 1: Turbines Included in the Noise Model

Manufacturer	Model	Hub Height (m)	Rotor Diameter (m)	Cut-in Speed (m/s)	Cut-out Speed (m/s)	Noise Emission (dBA)
Vestas	V110-2.2	95.0	110	3	20	107.7
Vestas	V110-2.2 STE	95.0	110	3	20	106.1

3.0 Study Methodology

This noise analysis was performed utilizing windPRO, a sophisticated wind modeling software program. windPRO calculates detailed noise maps across an entire area of interest or at site-specific locations using noise sensitive receptors. The analysis assumed the ISO 9613-2 General noise calculation model with General ground attenuation and an attenuation factor of 0.5, which represents typical mixed vegetation and crop cover. A safety margin of +2 dBA was added to the turbine manufacturer's noise emission data and results are compared to the 45 dBA limit at 100 feet of an occupied residence. Using these assumptions, realistic noise levels were calculated at 1.5 m AGL at the potential occupied structures. The term "realistic" in this case, means that some amount of ground attenuation is accounted for.

The inputs for the windPRO noise calculation include the following:

- Turbine Coordinates
- Turbine Specifications
- Wind Turbine Noise Emission Data
- Noise Receptor Coordinates
- Ambient Background Noise Data
- USGS Digital Elevation Model
- Uncertainty Factor
- Meteorological Conditions
- Ground Attenuation
- Existing Wind Turbines

A description of each input variable and how they affect the noise calculation are included below.

Turbine Coordinates: The location of a wind turbine in relation to a noise receptor is one of the most important factors in determining noise impacts. Noise levels drop as they travel farther from the source of emission. The attenuation comes from atmospheric absorption as well as from absorption by the ground cover between the turbine and the receptor. The noise can also be reflected by hard or smooth surfaces such as ice or water.

Noise is also absorbed by trees and reflected by structures such as buildings or walls, although these effects (trees and buildings) are ignored in the model. Turbine coordinates can be found in **Exhibit 1**.

Turbine Specifications: Wind turbine specifications from the manufacturer were supplied to Westwood by the Applicant. Wind turbine specifications included in the model were the power curves, blade types (standard non STE), and hub heights.

Turbine Noise Emission Data: Noise emission data including 1/3rd octave data supplied by the manufacture is used assuming the loudest noise levels are being emitted at the hub height of the turbine. A safety margin of 2 dBA was added to the wind turbine noise emission profiles for the analysis in order to produce more conservative results, meaning that the model will predict higher noise levels.

Noise Receptor Coordinates: As with the wind turbine coordinates, the elevation, and distance of a noise receptor in relation to the wind turbines are the main factors in determining the noise impacts. Westwood developed the coordinates for the Applicant for all existing occupied structures found to be within 10 KM of the 75 proposed wind turbine locations. A subset of receptors within 1 mile of repowered turbine locations were selected for inclusion in the model.

Per the regulation found in section 4 of Chapter 69-06-08-01, the noise requirement is set at a distance of 100 ft from the receptor center point. In order to be conservative receptor points were modeled by placing point-type noise receptors spaced 75 ft. apart around the perimeter of the dwelling, and at a distance of 150 ft. away from the center to ensure the highest noise level at least 100 ft. from the structure was captured. Due to concerns at seven (7) specific receptors it was decided that using a 150 ft. buffer was overly conservative. For the seven select locations the rooftop shape was digitized from aerial imagery to form a polygon in the exact shape of the receptor footprint, and then buffered by 100 ft.

The boundary of St. John was buffered by 150 ft. beyond the town perimeter and modeled as points spaced 75 ft. apart evenly along the boundary. All noise receivers are assumed to have a relative height of 1.5 meters above ground level.

Ambient Background Noise Data: No ambient background noise level is used in the compliance criteria. Turbine project noise contribution at occupied residences is modeled.

USGS Digital Elevation Model (DEM) (height contour data): For this study, 1/3 arc-second USGS National Elevation Database (NED) DEM's were used for the windPRO noise model. The DEM grid information is important to the noise calculation since it allows the model to place the wind turbines and the noise receptors at the correct elevations.

Uncertainty Factor: No uncertainty factor was provided by the wind turbine manufacturer. In this situation, it is common practice based on experience and studies to add 2 dBA to the noise emission levels of each wind turbine. For this analysis, the 2 dBA were added to all wind turbine noise emission profiles.

Meteorological Conditions: A temperature of 10°C (50°F) and a relative humidity of 70% were assumed for the analysis. These conditions represent an atmospheric "worst case" scenario where noise will travel farther with less atmospheric absorption. This will lead to more conservative (higher predicted noise levels) results. All wind turbines are assumed to be

operating simultaneously at maximum noise output levels. All receptors are assumed to be downwind of turbines, which is another conservative assumption.

Ground Attenuation: A ground attenuation factor of 0.5 was assumed for this analysis. It represents “mixed ground” consisting of half hard and half soft (porous) ground. No other sources of noise attenuation such as trees, air turbulence or wind shadow effects were assumed in the analysis.

Existing Wind Turbines: There are no existing wind turbines outside the immediate vicinity of the Border Winds Project area. Only the noise contributions from the 75 Border Winds turbines are included in the modeling results. A table of the proposed turbines can be found in **Exhibit 1**.

4.0 Results of Analysis – Noise

Using the layout configured with 65 standard edge blade turbines and 10 turbines utilizing the serrated trailing edge (STE) the noise analysis found that there are no instances of noise levels above 45 dBA at 100 ft. from a receptor.

See **Table 2** below for a table depicting the noise level distributions for the Project Area. Please see **Exhibit 2** for the full noise analysis results.

Table 2: Distribution of Realistic Noise Modeled at Occupied Structures

Realistic Noise (dBA)	# Participant Receivers	# Non-Participant Receivers
0	0	0
0 to 25	0	0
25 to 30	0	0
30 to 35	0	5
35 to 40	2	11
40 to 45	10	8
>45	0	0

In addition to modeling the noise levels at noise sensitive receivers the operational noise expected at the town limits of St. John, ND was also calculated. The assessment determined that there are no instances where the expected noise 100 feet away from the town perimeter exceeds 45 dBA. See **Table 3** below for a table characterizing the noise levels found at points along the town perimeter. Please see **Exhibit 2** for the full noise analysis results.

Table 3: Distribution of Realistic Noise Modeled Along St. John Perimeter

Realistic Noise (dBA)	Noise Level at Points 150 ft from St. John Town Boundary
40	Maximum
35	Mean
31	Minimum

5.0 Conclusions

The results of the noise assessment are that all thirty six (36) of the receptors are modeled at or below 45 dBA at 100 ft. away from the dwelling for any period of time and are therefore in compliance with North Dakota section 4 of Chapter 69-06-08-01 Energy conversion facility siting criteria. Additionally, no area 100 ft. away from the perimeter of the town of St. John, ND is modeled with noise levels in excess of 45 dBA.

The following assumptions were used during the noise assessment:

- Project turbine locations are Vestas V110-2.2, 95-meter hub height wind turbines.
- 65 turbines use the standard blade and 10 turbines have serrated trailing edge (STE) blades.
- No external existing wind turbines are present in the project area.
- All turbines were assumed to be operating simultaneously at maximum noise emission levels.
- All receptors were assumed to be downwind of all turbines.
- Atmospheric conditions were assumed to be most favorable for noise propagation.
- An additional 2 dBA was added to the noise emission levels.

Due to the above conservative assumptions, the noise will likely be less than those predicted by this assessment.

Exhibit 1 – Project Turbine Locations

Proposed re-power turbine Configuration
x65 Vestas V110-2.2 Mode 0 & x10 Vestas V110-2.2 Mode 0 STE

Turbine ID	Easting (m)	Northing (m)	Elevation AGL (m)	Turbine \ Blade Type	Hub Height (m)	Rotor Diameter (m)	Noise Emission (dBA) + Uncertainty
T01	447437.0	5424821.0	578.3	Vestas V110-2.2	95	110	109.7
T02	447926.0	5424971.0	578.4	Vestas V110-2.2	95	110	109.7
T03	448372.0	5425158.0	571.9	Vestas V110-2.2	95	110	109.7
T04	448934.0	5425612.0	567.9	Vestas V110-2.2	95	110	109.7
T05	449682.0	5425760.0	570.0	Vestas V110-2.2	95	110	109.7
T06	450094.0	5425994.0	562.0	Vestas V110-2.2	95	110	109.7
T07	450685.0	5426251.0	560.3	Vestas V110-2.2	95	110	109.7
T08	450967.0	5426434.0	559.1	Vestas V110-2.2	95	110	109.7
T09	452163.0	5426461.0	558.7	Vestas V110-2.2	95	110	109.7
T10	452480.0	5426672.0	559.1	Vestas V110-2.2	95	110	109.7
T11	448458.0	5422497.0	582.0	Vestas V110-2.2 (STE)	95	110	108.1
T12	449178.0	5422518.0	576.2	Vestas V110-2.2	95	110	109.7
T13	449512.0	5422906.0	573.9	Vestas V110-2.2	95	110	109.7
T14	449979.0	5423089.0	572.4	Vestas V110-2.2	95	110	109.7
T15	450523.0	5423345.0	570.3	Vestas V110-2.2 (STE)	95	110	108.1
T16	450912.0	5423498.0	567.5	Vestas V110-2.2 (STE)	95	110	108.1
T17	451327.0	5424341.0	563.5	Vestas V110-2.2 (STE)	95	110	108.1
T18	452143.0	5424264.0	559.9	Vestas V110-2.2 (STE)	95	110	108.1
T19	452431.0	5424572.0	560.7	Vestas V110-2.2 (STE)	95	110	108.1
T20	452812.0	5424801.0	557.7	Vestas V110-2.2	95	110	109.7
T21	453148.0	5425041.0	560.1	Vestas V110-2.2	95	110	109.7
T22	453862.0	5425539.0	559.3	Vestas V110-2.2	95	110	109.7
T23	454563.0	5425529.0	555.5	Vestas V110-2.2	95	110	109.7
T24	454948.0	5425693.0	556.9	Vestas V110-2.2	95	110	109.7
T25	455404.0	5426064.0	554.4	Vestas V110-2.2	95	110	109.7
T26	455751.0	5426442.0	554.9	Vestas V110-2.2	95	110	109.7
T27	456090.0	5426732.0	553.7	Vestas V110-2.2	95	110	109.7
T28	456480.0	5426964.0	553.3	Vestas V110-2.2	95	110	109.7
T29	457215.0	5427150.0	551.6	Vestas V110-2.2	95	110	109.7
T30	457628.0	5427267.0	547.3	Vestas V110-2.2	95	110	109.7
T31	458064.0	5427376.0	544.3	Vestas V110-2.2	95	110	109.7
T32	453314.0	5422345.0	563.0	Vestas V110-2.2	95	110	109.7
T33	453647.0	5422510.0	565.0	Vestas V110-2.2	95	110	109.7
T34	454001.0	5422810.0	562.2	Vestas V110-2.2	95	110	109.7
T35	454330.0	5423259.0	561.1	Vestas V110-2.2	95	110	109.7
T36	454819.0	5423392.0	556.1	Vestas V110-2.2	95	110	109.7
T37	455670.0	5424356.0	554.7	Vestas V110-2.2 (STE)	95	110	108.1
T38	455995.0	5424635.0	556.2	Vestas V110-2.2	95	110	109.7
T39	456276.0	5424924.0	557.9	Vestas V110-2.2	95	110	109.7
T40	456163.0	5421413.0	552.4	Vestas V110-2.2	95	110	109.7

T41	456540.0	5421638.0	555.0	Vestas V110-2.2	95	110	109.7
T42	456187.0	5422414.0	556.1	Vestas V110-2.2	95	110	109.7
T43	456610.0	5422925.0	556.4	Vestas V110-2.2	95	110	109.7
T44	456955.0	5423153.0	556.1	Vestas V110-2.2	95	110	109.7
T45	457302.0	5423450.0	555.9	Vestas V110-2.2	95	110	109.7
T46	457608.0	5423946.0	553.5	Vestas V110-2.2	95	110	109.7
T47	458024.0	5424400.0	552.9	Vestas V110-2.2	95	110	109.7
T48	458532.0	5424641.0	548.2	Vestas V110-2.2	95	110	109.7
T49	458751.0	5425023.0	548.1	Vestas V110-2.2	95	110	109.7
T50	459348.0	5425498.0	543.3	Vestas V110-2.2	95	110	109.7
T51	459701.0	5425697.0	541.5	Vestas V110-2.2	95	110	109.7
T52	459375.0	5426586.0	541.5	Vestas V110-2.2	95	110	109.7
T53	459641.0	5427093.0	537.1	Vestas V110-2.2	95	110	109.7
T54	460235.0	5427144.0	534.1	Vestas V110-2.2	95	110	109.7
T55	460633.0	5427294.0	529.8	Vestas V110-2.2	95	110	109.7
T56	460984.0	5427353.0	528.3	Vestas V110-2.2	95	110	109.7
T57	457921.0	5421004.0	555.5	Vestas V110-2.2 (STE)	95	110	108.1
T58	458575.0	5420951.0	553.2	Vestas V110-2.2 (STE)	95	110	108.1
T59	458848.0	5421223.0	549.4	Vestas V110-2.2	95	110	109.7
T60	459494.0	5422283.0	550.8	Vestas V110-2.2 (STE)	95	110	108.1
T61	459751.0	5422539.0	545.8	Vestas V110-2.2	95	110	109.7
T62	460055.0	5422752.0	545.1	Vestas V110-2.2	95	110	109.7
T63	460469.0	5423046.0	544.8	Vestas V110-2.2	95	110	109.7
T64	460891.0	5423213.0	539.1	Vestas V110-2.2	95	110	109.7
T65	461306.0	5423386.0	538.1	Vestas V110-2.2	95	110	109.7
T66	459597.0	5418893.0	550.9	Vestas V110-2.2	95	110	109.7
T67	459992.0	5419352.0	549.9	Vestas V110-2.2	95	110	109.7
T68	460355.0	5419584.0	547.5	Vestas V110-2.2	95	110	109.7
T69	460712.0	5419898.0	545.2	Vestas V110-2.2	95	110	109.7
T70	461084.0	5420170.0	542.6	Vestas V110-2.2	95	110	109.7
T71	459719.0	5417430.0	545.0	Vestas V110-2.2	95	110	109.7
T72	460169.0	5417528.0	546.8	Vestas V110-2.2	95	110	109.7
T73	460514.0	5417598.0	547.2	Vestas V110-2.2	95	110	109.7
T74	460981.0	5417933.0	547.1	Vestas V110-2.2	95	110	109.7
T75	461245.0	5418284.0	542.9	Vestas V110-2.2	95	110	109.7

Exhibit 2 – Noise Level Model Results

Predicted noise level at receptor center point
Receptor sorted by noise level from highest to lowest

Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AGL (m)	Noise Level (dBA)	Noise Limit (dBA)	Compliant
NSA-4-NP	Non-Participant	452504.0	5425967.0	558.0	44	45	Yes
NSA-3-P	Participant	453958.0	5426091.0	556.6	44	45	Yes
NSA-20-NP	Non-Participant	452736.0	5422169.0	567.5	43	45	Yes
NSA-7-NP	Non-Participant	450275.0	5424031.0	570.1	43	45	Yes
NSA-13-P	Participant	449581.0	5423776.0	569.9	42	45	Yes
NSA-29-P	Participant	457673.0	5421642.0	557.3	42	45	Yes
NSA-18-NP	Non-Participant	452686.0	5422192.0	567.2	42	45	Yes
NSA-36-P	Participant	461435.0	5417361.0	537.3	42	45	Yes
NSA-21-NP	Non-Participant	457472.0	5422144.0	555.6	42	45	Yes
NSA-15-P	Participant	458916.0	5423625.0	550.3	41	45	Yes
NSA-1-P	Participant	452037.0	5427371.0	558.5	41	45	Yes
NSA-6-NP	Non-Participant	446982.0	5424161.0	584.9	39	45	Yes
NSA-17-NP	Non-Participant	462143.0	5423557.0	534.3	39	45	Yes
NSA-34-P	Participant	458634.0	5418979.0	551.1	39	45	Yes
NSA-23-NP	Non-Participant	450472.0	5422032.0	567.9	39	45	Yes
NSA-19-NP	Non-Participant	450912.0	5422188.0	567.5	38	45	Yes
NSA-8-NP	Non-Participant	447051.0	5423941.0	584.8	38	45	Yes
NSA-5-NP	Non-Participant	446523.0	5424701.0	585.9	38	45	Yes
NSA-33-P	Participant	458352.0	5419430.0	553.0	38	45	Yes
NSA-11-NP	Non-Participant	447038.0	5423858.0	585.2	37	45	Yes
NSA-2-NP	Non-Participant	447273.0	5426113.0	572.6	37	45	Yes
NSA-24-NP	Non-Participant	447723.0	5421934.0	594.7	37	45	Yes
NSA-35-NP	Non-Participant	462530.0	5418513.0	533.2	36	45	Yes
NSA-16-NP	Non-Participant	446984.0	5423568.0	587.2	36	45	Yes
NSA-14-NP	Non-Participant	446637.0	5423641.0	591.0	34	45	Yes
NSA-30-NP	Non-Participant	447421.0	5421579.0	601.1	33	45	Yes
NSA-25-NP	Non-Participant	447146.0	5421869.0	600.6	33	45	Yes
NSA-28-NP	Non-Participant	447271.0	5421656.0	602.2	33	45	Yes
NSA-31-NP	Non-Participant	447414.0	5421421.0	605.9	33	45	Yes

**Predicted noise level at selected residences modeled as area features buffered by 100 ft.
 Receptor sorted by noise level from highest to lowest**

Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AGL (m)	Noise Level (dBA)	Noise Limit (dBA)	Compliant
House-27-NP	Non-Participant	459596.0	5421823.0	549.6	45	45	Yes
House-9-P	Participant	451593.0	5423943.0	565.0	45	45	Yes
House-26-NP	Non-Participant	459648.0	5421826.0	548.6	45	45	Yes
House-10-P	Participant	455483.0	5423901.0	554.9	45	45	Yes
House-12-P	Participant	450282.0	5423784.0	567.9	45	45	Yes
House-32-P	Participant	458212.0	5420580.0	554.5	45	45	Yes
House-22-NP	Non-Participant	448720.0	5422108.0	583.3	45	45	Yes

Predicted noise level at points 150 ft. from St. John boundary
Receptor sorted by noise level from highest to lowest

Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AGL (m)	Noise Level (dBA)	Noise Limit (dBA)	Compliant
St. John Boundary 7	Non-Participant	448507.0	5421802.0	574.5	40	45	Yes
St. John Boundary 8	Non-Participant	448484.0	5421804.0	574.7	40	45	Yes
St. John Boundary 38	Non-Participant	447969.0	5422115.0	577.8	40	45	Yes
St. John Boundary 39	Non-Participant	447956.0	5422134.0	578.4	40	45	Yes
St. John Boundary 40	Non-Participant	447943.0	5422153.0	580.4	40	45	Yes
St. John Boundary 6	Non-Participant	448526.0	5421790.0	574.6	40	45	Yes
St. John Boundary 9	Non-Participant	448461.0	5421803.0	575.2	40	45	Yes
St. John Boundary 35	Non-Participant	448006.0	5422058.0	577.6	40	45	Yes
St. John Boundary 36	Non-Participant	447994.0	5422077.0	578.1	40	45	Yes
St. John Boundary 37	Non-Participant	447981.0	5422096.0	579.1	40	45	Yes
St. John Boundary 41	Non-Participant	447931.0	5422172.0	576.2	40	45	Yes
St. John Boundary 42	Non-Participant	447916.0	5422190.0	575.9	40	45	Yes
St. John Boundary 5	Non-Participant	448541.0	5421773.0	574.8	40	45	Yes
St. John Boundary 10	Non-Participant	448438.0	5421803.0	576.3	40	45	Yes
St. John Boundary 11	Non-Participant	448416.0	5421802.0	578.0	40	45	Yes
St. John Boundary 33	Non-Participant	448032.0	5422020.0	579.4	40	45	Yes
St. John Boundary 34	Non-Participant	448019.0	5422039.0	577.3	40	45	Yes
St. John Boundary 12	Non-Participant	448393.0	5421802.0	579.6	40	45	Yes
St. John Boundary 32	Non-Participant	448044.0	5422001.0	578.7	40	45	Yes
St. John Boundary 43	Non-Participant	447895.0	5422199.0	577.2	40	45	Yes
St. John Boundary 4	Non-Participant	448555.0	5421755.0	575.0	40	45	Yes
St. John Boundary 13	Non-Participant	448370.0	5421802.0	579.4	40	45	Yes
St. John Boundary 31	Non-Participant	448057.0	5421982.0	578.7	40	45	Yes
St. John Boundary 14	Non-Participant	448347.0	5421801.0	578.6	40	45	Yes
St. John Boundary 30	Non-Participant	448070.0	5421963.0	578.7	40	45	Yes
St. John Boundary 3	Non-Participant	448570.0	5421737.0	575.1	40	45	Yes
St. John Boundary 15	Non-Participant	448324.0	5421801.0	579.1	40	45	Yes
St. John Boundary 28	Non-Participant	448095.0	5421925.0	579.5	40	45	Yes
St. John Boundary 29	Non-Participant	448082.0	5421944.0	578.7	40	45	Yes
St. John Boundary 44	Non-Participant	447873.0	5422198.0	578.6	40	45	Yes
St. John Boundary 2	Non-Participant	448584.0	5421719.0	575.1	40	45	Yes
St. John Boundary 16	Non-Participant	448301.0	5421800.0	579.4	40	45	Yes
St. John Boundary 27	Non-Participant	448108.0	5421906.0	580.2	40	45	Yes
St. John Boundary 17	Non-Participant	448279.0	5421800.0	578.8	39	45	Yes
St. John Boundary 26	Non-Participant	448120.0	5421887.0	579.9	39	45	Yes
St. John Boundary 1	Non-Participant	448592.0	5421698.0	575.9	39	45	Yes
St. John Boundary 45	Non-Participant	447854.0	5422185.0	580.8	39	45	Yes
St. John Boundary 236	Non-Participant	448593.0	5421694.0	576.2	39	45	Yes
St. John Boundary 18	Non-Participant	448256.0	5421800.0	578.6	39	45	Yes
St. John Boundary 25	Non-Participant	448133.0	5421868.0	579.8	39	45	Yes
St. John Boundary 19	Non-Participant	448233.0	5421799.0	579.0	39	45	Yes
St. John Boundary 24	Non-Participant	448146.0	5421849.0	580.4	39	45	Yes
St. John Boundary 46	Non-Participant	447843.0	5422165.0	583.5	39	45	Yes
St. John Boundary 20	Non-Participant	448210.0	5421799.0	579.5	39	45	Yes
St. John Boundary 23	Non-Participant	448158.0	5421830.0	581.5	39	45	Yes
St. John Boundary 235	Non-Participant	448588.0	5421672.0	576.7	39	45	Yes
St. John Boundary 21	Non-Participant	448187.0	5421798.0	580.9	39	45	Yes

St. John Boundary 22	Non-Participant	448171.0	5421811.0	581.9	39	45	Yes
St. John Boundary 47	Non-Participant	447842.0	5422142.0	584.3	39	45	Yes
St. John Boundary 48	Non-Participant	447843.0	5422120.0	587.5	39	45	Yes
St. John Boundary 234	Non-Participant	448573.0	5421655.0	576.4	39	45	Yes
St. John Boundary 233	Non-Participant	448552.0	5421647.0	576.4	39	45	Yes
St. John Boundary 49	Non-Participant	447838.0	5422099.0	588.7	39	45	Yes
St. John Boundary 232	Non-Participant	448530.0	5421641.0	576.5	39	45	Yes
St. John Boundary 231	Non-Participant	448508.0	5421635.0	576.4	39	45	Yes
St. John Boundary 50	Non-Participant	447823.0	5422082.0	589.7	38	45	Yes
St. John Boundary 230	Non-Participant	448485.0	5421629.0	576.9	38	45	Yes
St. John Boundary 51	Non-Participant	447818.0	5422060.0	590.3	38	45	Yes
St. John Boundary 229	Non-Participant	448463.0	5421623.0	579.1	38	45	Yes
St. John Boundary 52	Non-Participant	447818.0	5422037.0	590.9	38	45	Yes
St. John Boundary 228	Non-Participant	448441.0	5421617.0	582.9	38	45	Yes
St. John Boundary 227	Non-Participant	448427.0	5421608.0	584.1	38	45	Yes
St. John Boundary 53	Non-Participant	447819.0	5422014.0	591.2	38	45	Yes
St. John Boundary 226	Non-Participant	448441.0	5421590.0	584.1	38	45	Yes
St. John Boundary 54	Non-Participant	447819.0	5421991.0	591.4	38	45	Yes
St. John Boundary 225	Non-Participant	448455.0	5421572.0	585.2	38	45	Yes
St. John Boundary 55	Non-Participant	447820.0	5421969.0	591.9	38	45	Yes
St. John Boundary 224	Non-Participant	448465.0	5421552.0	586.8	38	45	Yes
St. John Boundary 56	Non-Participant	447820.0	5421946.0	592.3	38	45	Yes
St. John Boundary 57	Non-Participant	447821.0	5421923.0	592.3	37	45	Yes
St. John Boundary 223	Non-Participant	448465.0	5421529.0	587.7	37	45	Yes
St. John Boundary 58	Non-Participant	447822.0	5421900.0	592.7	37	45	Yes
St. John Boundary 222	Non-Participant	448454.0	5421510.0	587.7	37	45	Yes
St. John Boundary 59	Non-Participant	447818.0	5421881.0	592.7	37	45	Yes
St. John Boundary 221	Non-Participant	448437.0	5421495.0	587.8	37	45	Yes
St. John Boundary 60	Non-Participant	447795.0	5421882.0	592.6	37	45	Yes
St. John Boundary 220	Non-Participant	448422.0	5421479.0	587.9	37	45	Yes
St. John Boundary 219	Non-Participant	448434.0	5421460.0	587.7	37	45	Yes
St. John Boundary 61	Non-Participant	447772.0	5421883.0	593.0	37	45	Yes
St. John Boundary 62	Non-Participant	447749.0	5421884.0	593.3	37	45	Yes
St. John Boundary 218	Non-Participant	448446.0	5421440.0	587.3	37	45	Yes
St. John Boundary 217	Non-Participant	448450.0	5421418.0	587.0	37	45	Yes
St. John Boundary 63	Non-Participant	447727.0	5421883.0	593.5	36	45	Yes
St. John Boundary 216	Non-Participant	448444.0	5421396.0	587.3	36	45	Yes
St. John Boundary 64	Non-Participant	447706.0	5421873.0	593.6	36	45	Yes
St. John Boundary 215	Non-Participant	448428.0	5421381.0	587.9	36	45	Yes
St. John Boundary 65	Non-Participant	447693.0	5421855.0	593.6	36	45	Yes
St. John Boundary 214	Non-Participant	448408.0	5421369.0	588.2	36	45	Yes
St. John Boundary 66	Non-Participant	447691.0	5421832.0	594.1	36	45	Yes
St. John Boundary 213	Non-Participant	448388.0	5421357.0	588.6	36	45	Yes
St. John Boundary 67	Non-Participant	447699.0	5421811.0	593.2	36	45	Yes
St. John Boundary 212	Non-Participant	448369.0	5421345.0	589.3	36	45	Yes
St. John Boundary 68	Non-Participant	447696.0	5421793.0	592.5	36	45	Yes
St. John Boundary 211	Non-Participant	448349.0	5421334.0	589.9	36	45	Yes
St. John Boundary 69	Non-Participant	447682.0	5421775.0	592.4	36	45	Yes
St. John Boundary 210	Non-Participant	448330.0	5421322.0	590.2	36	45	Yes
St. John Boundary 70	Non-Participant	447667.0	5421758.0	592.8	35	45	Yes
St. John Boundary 209	Non-Participant	448310.0	5421310.0	590.4	35	45	Yes
St. John Boundary 71	Non-Participant	447653.0	5421740.0	593.0	35	45	Yes
St. John Boundary 208	Non-Participant	448290.0	5421298.0	590.6	35	45	Yes
St. John Boundary 207	Non-Participant	448271.0	5421287.0	590.7	35	45	Yes

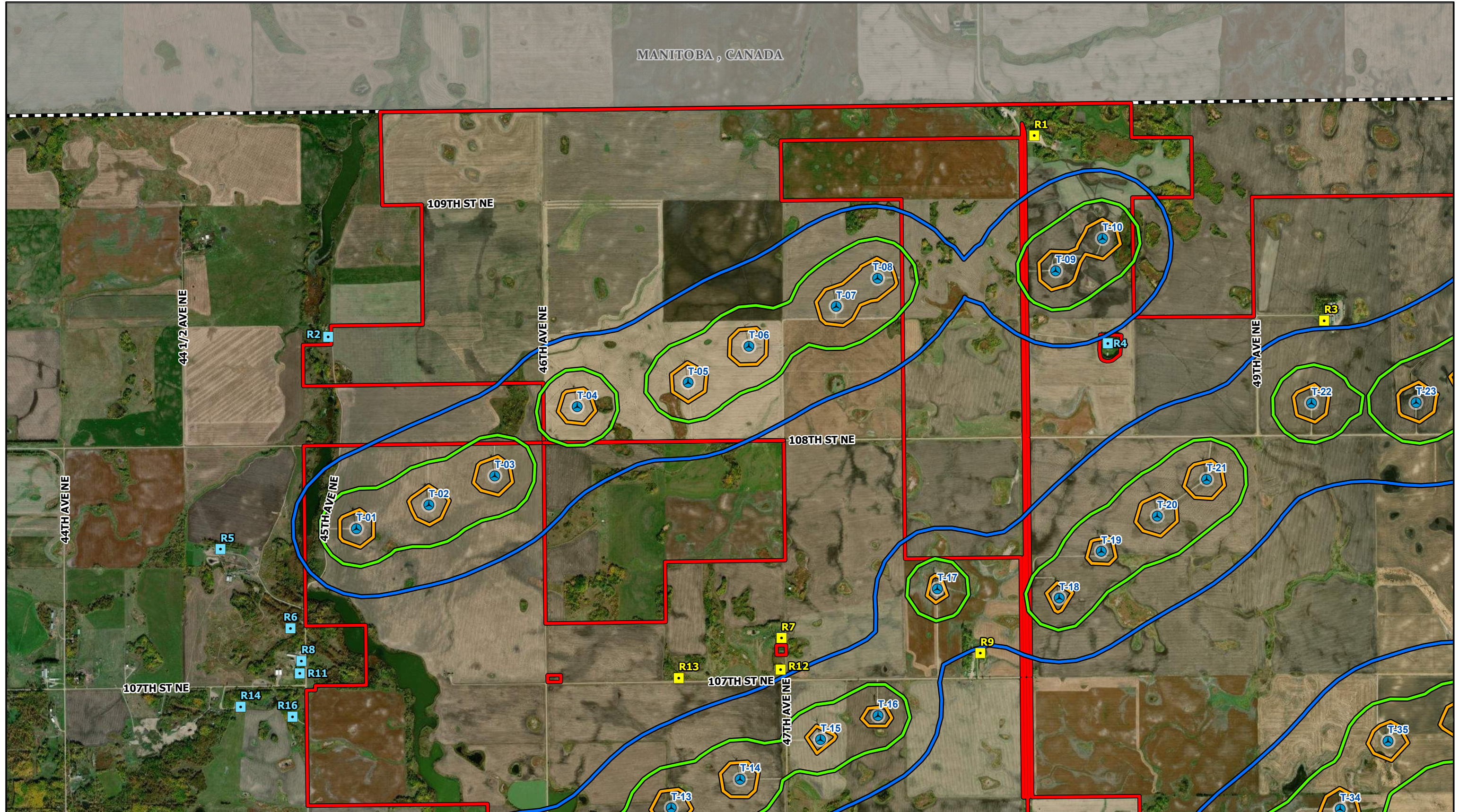
St. John Boundary 72	Non-Participant	447639.0	5421722.0	593.0	35	45	Yes
St. John Boundary 206	Non-Participant	448251.0	5421275.0	591.6	35	45	Yes
St. John Boundary 73	Non-Participant	447624.0	5421704.0	593.4	35	45	Yes
St. John Boundary 205	Non-Participant	448232.0	5421263.0	591.6	35	45	Yes
St. John Boundary 74	Non-Participant	447611.0	5421686.0	593.8	35	45	Yes
St. John Boundary 204	Non-Participant	448212.0	5421252.0	591.2	35	45	Yes
St. John Boundary 75	Non-Participant	447608.0	5421663.0	594.0	35	45	Yes
St. John Boundary 203	Non-Participant	448202.0	5421235.0	590.5	35	45	Yes
St. John Boundary 76	Non-Participant	447615.0	5421642.0	593.7	35	45	Yes
St. John Boundary 77	Non-Participant	447625.0	5421622.0	593.1	35	45	Yes
St. John Boundary 202	Non-Participant	448205.0	5421213.0	590.0	35	45	Yes
St. John Boundary 78	Non-Participant	447623.0	5421599.0	593.0	34	45	Yes
St. John Boundary 201	Non-Participant	448208.0	5421190.0	589.8	34	45	Yes
St. John Boundary 79	Non-Participant	447619.0	5421577.0	593.0	34	45	Yes
St. John Boundary 199	Non-Participant	448229.0	5421150.0	590.1	34	45	Yes
St. John Boundary 200	Non-Participant	448216.0	5421169.0	589.9	34	45	Yes
St. John Boundary 80	Non-Participant	447616.0	5421554.0	593.4	34	45	Yes
St. John Boundary 198	Non-Participant	448242.0	5421131.0	591.1	34	45	Yes
St. John Boundary 81	Non-Participant	447612.0	5421531.0	593.9	34	45	Yes
St. John Boundary 197	Non-Participant	448254.0	5421112.0	591.4	34	45	Yes
St. John Boundary 82	Non-Participant	447591.0	5421530.0	594.6	34	45	Yes
St. John Boundary 195	Non-Participant	448280.0	5421074.0	591.1	34	45	Yes
St. John Boundary 196	Non-Participant	448267.0	5421093.0	591.1	34	45	Yes
St. John Boundary 83	Non-Participant	447568.0	5421530.0	595.5	34	45	Yes
St. John Boundary 194	Non-Participant	448293.0	5421055.0	591.0	34	45	Yes
St. John Boundary 84	Non-Participant	447545.0	5421530.0	596.3	34	45	Yes
St. John Boundary 193	Non-Participant	448305.0	5421036.0	590.3	34	45	Yes
St. John Boundary 85	Non-Participant	447522.0	5421531.0	597.2	34	45	Yes
St. John Boundary 192	Non-Participant	448318.0	5421017.0	590.1	34	45	Yes
St. John Boundary 86	Non-Participant	447500.0	5421531.0	598.1	34	45	Yes
St. John Boundary 191	Non-Participant	448330.0	5420998.0	590.9	34	45	Yes
St. John Boundary 87	Non-Participant	447477.0	5421531.0	598.4	33	45	Yes
St. John Boundary 190	Non-Participant	448332.0	5420975.0	590.9	33	45	Yes
St. John Boundary 88	Non-Participant	447454.0	5421530.0	599.2	33	45	Yes
St. John Boundary 189	Non-Participant	448330.0	5420953.0	591.2	33	45	Yes
St. John Boundary 188	Non-Participant	448328.0	5420930.0	592.1	33	45	Yes
St. John Boundary 89	Non-Participant	447433.0	5421521.0	600.5	33	45	Yes
St. John Boundary 187	Non-Participant	448326.0	5420907.0	592.3	33	45	Yes
St. John Boundary 90	Non-Participant	447420.0	5421503.0	602.3	33	45	Yes
St. John Boundary 91	Non-Participant	447416.0	5421481.0	603.1	33	45	Yes
St. John Boundary 186	Non-Participant	448324.0	5420884.0	591.6	33	45	Yes
St. John Boundary 92	Non-Participant	447415.0	5421458.0	604.3	33	45	Yes
St. John Boundary 185	Non-Participant	448322.0	5420861.0	592.7	33	45	Yes
St. John Boundary 93	Non-Participant	447415.0	5421435.0	604.8	33	45	Yes
St. John Boundary 94	Non-Participant	447415.0	5421412.0	606.2	33	45	Yes
St. John Boundary 184	Non-Participant	448320.0	5420839.0	593.1	33	45	Yes
St. John Boundary 95	Non-Participant	447415.0	5421390.0	605.0	33	45	Yes
St. John Boundary 183	Non-Participant	448318.0	5420816.0	593.3	33	45	Yes
St. John Boundary 96	Non-Participant	447414.0	5421367.0	604.3	33	45	Yes
St. John Boundary 182	Non-Participant	448317.0	5420793.0	593.3	33	45	Yes
St. John Boundary 97	Non-Participant	447414.0	5421344.0	604.1	32	45	Yes
St. John Boundary 181	Non-Participant	448315.0	5420770.0	592.7	32	45	Yes
St. John Boundary 98	Non-Participant	447414.0	5421321.0	603.5	32	45	Yes
St. John Boundary 180	Non-Participant	448313.0	5420748.0	592.6	32	45	Yes

St. John Boundary 99	Non-Participant	447413.0	5421298.0	603.6	32	45	Yes
St. John Boundary 179	Non-Participant	448311.0	5420725.0	592.8	32	45	Yes
St. John Boundary 100	Non-Participant	447413.0	5421275.0	603.6	32	45	Yes
St. John Boundary 101	Non-Participant	447413.0	5421252.0	603.6	32	45	Yes
St. John Boundary 178	Non-Participant	448311.0	5420702.0	592.4	32	45	Yes
St. John Boundary 102	Non-Participant	447413.0	5421230.0	603.6	32	45	Yes
St. John Boundary 177	Non-Participant	448311.0	5420679.0	592.1	32	45	Yes
St. John Boundary 103	Non-Participant	447412.0	5421207.0	605.1	32	45	Yes
St. John Boundary 132	Non-Participant	447797.0	5420909.0	603.4	32	45	Yes
St. John Boundary 176	Non-Participant	448311.0	5420656.0	592.3	32	45	Yes
St. John Boundary 104	Non-Participant	447412.0	5421184.0	606.3	32	45	Yes
St. John Boundary 130	Non-Participant	447752.0	5420909.0	605.6	32	45	Yes
St. John Boundary 131	Non-Participant	447774.0	5420909.0	604.9	32	45	Yes
St. John Boundary 133	Non-Participant	447803.0	5420892.0	604.1	32	45	Yes
St. John Boundary 134	Non-Participant	447804.0	5420869.0	605.0	32	45	Yes
St. John Boundary 175	Non-Participant	448310.0	5420633.0	592.5	32	45	Yes
St. John Boundary 105	Non-Participant	447412.0	5421161.0	607.3	32	45	Yes
St. John Boundary 106	Non-Participant	447411.0	5421138.0	608.9	32	45	Yes
St. John Boundary 128	Non-Participant	447706.0	5420910.0	605.8	32	45	Yes
St. John Boundary 129	Non-Participant	447729.0	5420910.0	605.7	32	45	Yes
St. John Boundary 135	Non-Participant	447805.0	5420846.0	607.0	32	45	Yes
St. John Boundary 139	Non-Participant	447874.0	5420805.0	604.6	32	45	Yes
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St. John Boundary 142	Non-Participant	447917.0	5420778.0	602.8	32	45	Yes
St. John Boundary 174	Non-Participant	448310.0	5420611.0	592.9	32	45	Yes
St. John Boundary 107	Non-Participant	447411.0	5421115.0	607.6	32	45	Yes
St. John Boundary 127	Non-Participant	447683.0	5420910.0	606.3	32	45	Yes
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St. John Boundary 137	Non-Participant	447830.0	5420810.0	605.3	32	45	Yes
St. John Boundary 138	Non-Participant	447851.0	5420804.0	605.6	32	45	Yes
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St. John Boundary 126	Non-Participant	447660.0	5420910.0	607.1	32	45	Yes
St. John Boundary 144	Non-Participant	447918.0	5420733.0	604.4	32	45	Yes
St. John Boundary 153	Non-Participant	448068.0	5420657.0	597.7	32	45	Yes
St. John Boundary 172	Non-Participant	448310.0	5420565.0	593.4	32	45	Yes
St. John Boundary 109	Non-Participant	447411.0	5421070.0	606.7	31	45	Yes
St. John Boundary 123	Non-Participant	447592.0	5420911.0	613.0	31	45	Yes
St. John Boundary 124	Non-Participant	447614.0	5420911.0	613.9	31	45	Yes
St. John Boundary 145	Non-Participant	447919.0	5420710.0	604.9	31	45	Yes
St. John Boundary 151	Non-Participant	448022.0	5420657.0	600.7	31	45	Yes
St. John Boundary 152	Non-Participant	448045.0	5420657.0	598.8	31	45	Yes
St. John Boundary 154	Non-Participant	448068.0	5420634.0	598.2	31	45	Yes
St. John Boundary 171	Non-Participant	448310.0	5420542.0	594.4	31	45	Yes
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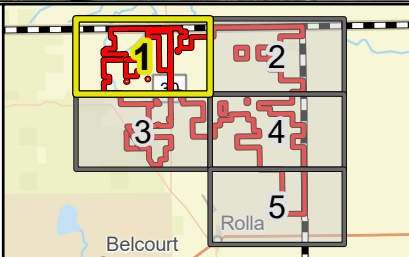
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St. John Boundary 155	Non-Participant	448068.0	5420611.0	598.9	31	45	Yes
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St. John Boundary 167	Non-Participant	448248.0	5420493.0	596.4	31	45	Yes
St. John Boundary 114	Non-Participant	447409.0	5420955.0	610.0	31	45	Yes
St. John Boundary 115	Non-Participant	447416.0	5420934.0	608.5	31	45	Yes
St. John Boundary 116	Non-Participant	447433.0	5420918.0	608.4	31	45	Yes
St. John Boundary 117	Non-Participant	447455.0	5420912.0	608.6	31	45	Yes
St. John Boundary 158	Non-Participant	448069.0	5420543.0	601.1	31	45	Yes
St. John Boundary 159	Non-Participant	448074.0	5420521.0	602.1	31	45	Yes
St. John Boundary 162	Non-Participant	448133.0	5420496.0	599.9	31	45	Yes
St. John Boundary 163	Non-Participant	448156.0	5420495.0	598.9	31	45	Yes
St. John Boundary 164	Non-Participant	448179.0	5420495.0	598.2	31	45	Yes
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St. John Boundary 161	Non-Participant	448111.0	5420496.0	601.4	31	45	Yes

Exhibit 3 – Noise Level Contour Maps

MANITOBA, CANADA



Data Source(s): Westwood (2022); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).

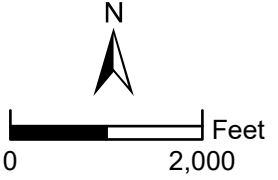


Legend

- Project Area
- County Boundary
- Canada
- Turbine
- St. John Receptor Boundary
- Receptor Location**
- Participating
- Not Participating

Noise Impact in Decibels

- 45 dB(A)
- 50 dB(A)
- 55 dB(A)

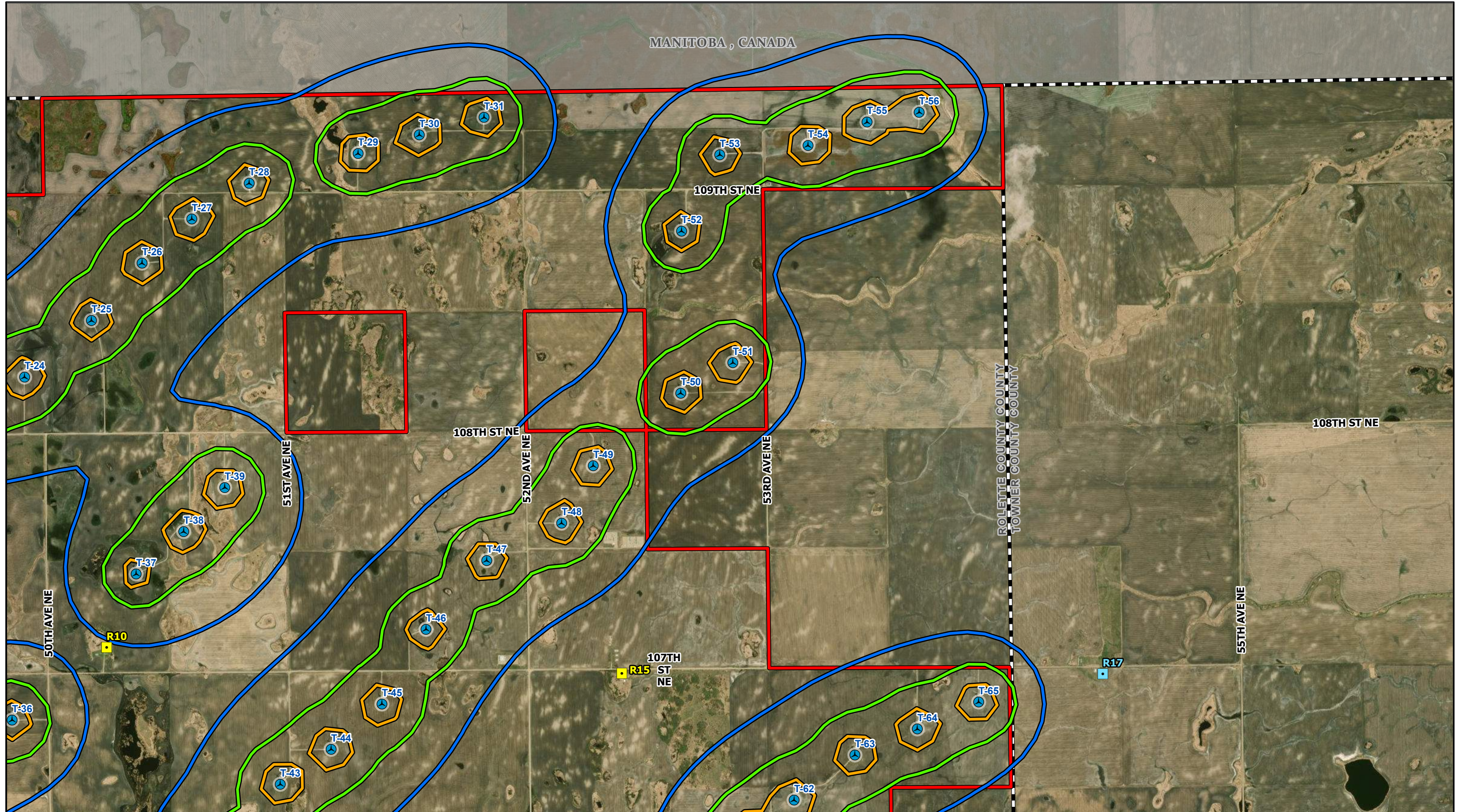


Border Winds Project

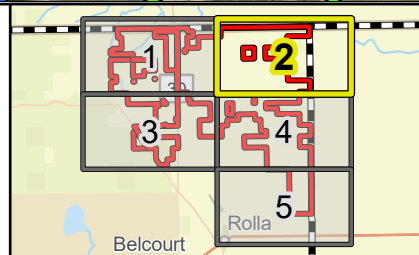
Rolette County, North Dakota

Wind Noise Impacts Map Book

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Data Source(s): Westwood (2022); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).



Legend

- Project Area
- County Boundary
- Canada
- Turbine

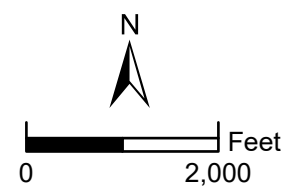
- St. John Receptor Boundary

Receptor Location

- Participating
- Not Participating

Noise Impact in Decibels

- 45 dB(A)
- 50 dB(A)
- 55 dB(A)

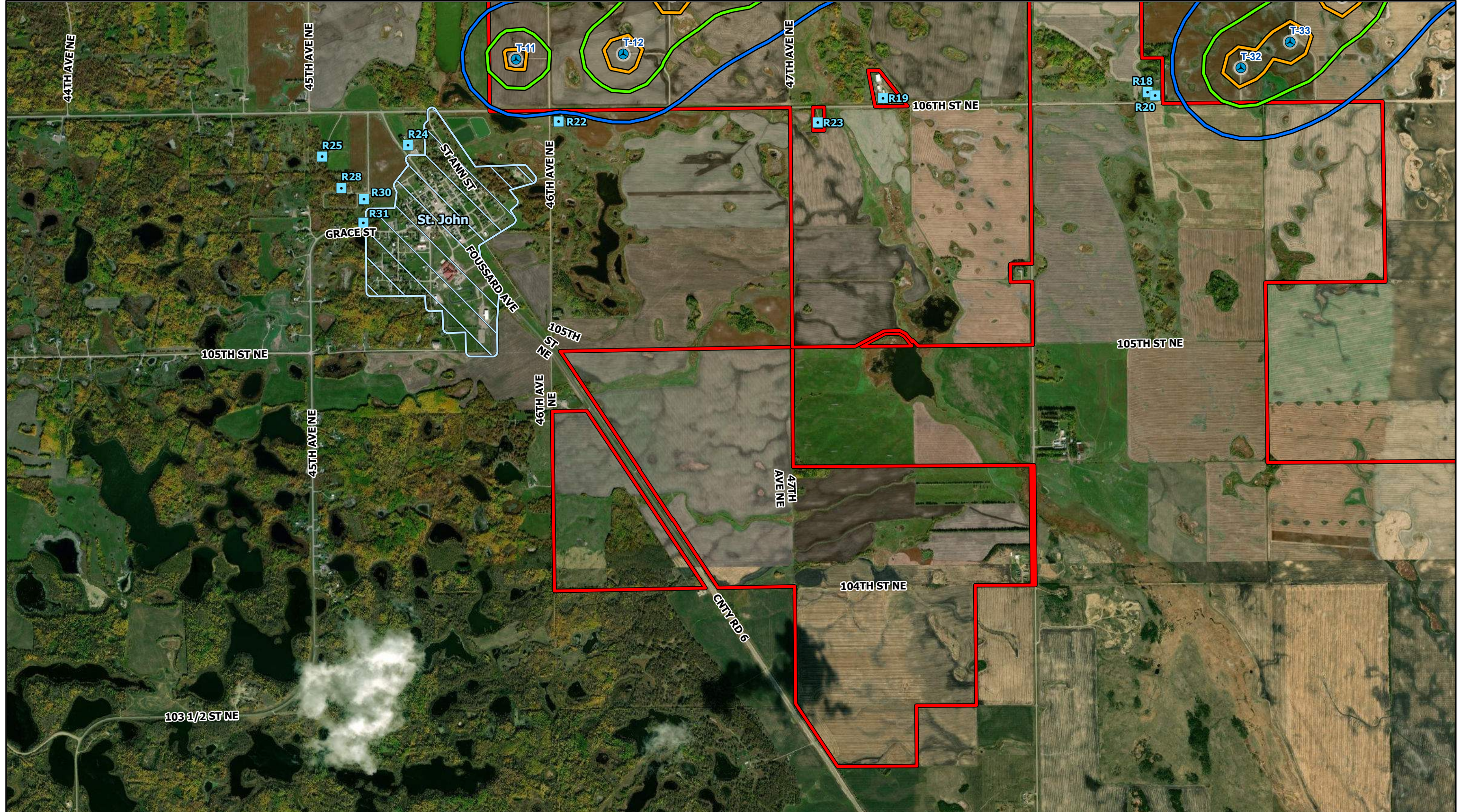


Border Winds Project

Rolette County, North Dakota

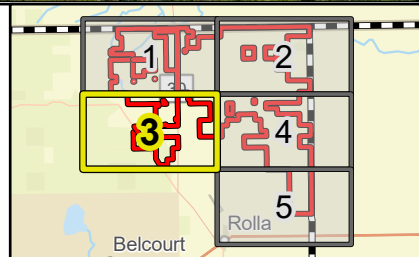
Wind Noise Impacts Map Book

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Data Source(s): Westwood (2022); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).

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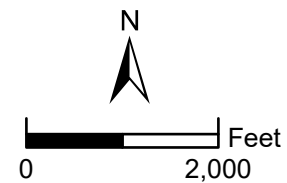


Legend

- Project Area
- County Boundary
- Canada
- Turbine
- Participating
- Not Participating
- St. John Receptor Boundary

Noise Impact in Decibels

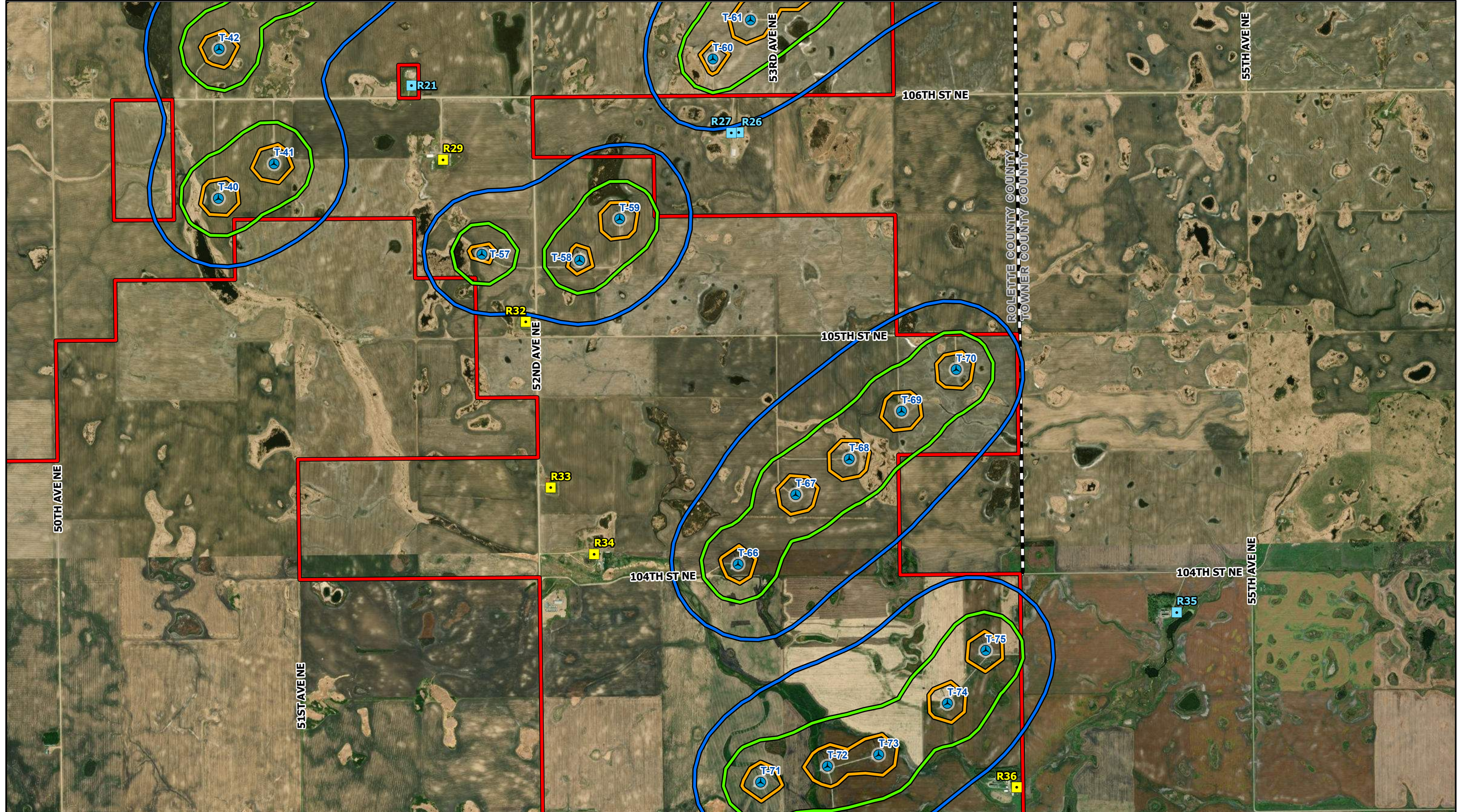
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- 50 dB(A)
- 55 dB(A)



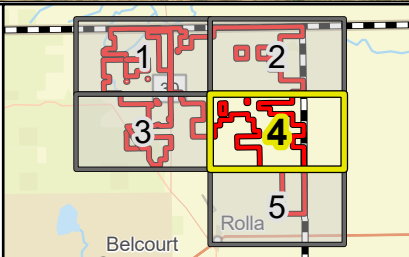
Border Winds Project

Rolette County, North Dakota

Wind Noise Impacts Map Book



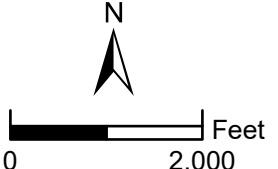
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Legend

- Project Area
- County Boundary
- Canada
- Turbine
- St. John Receptor Boundary
- Receptor Location**
- Participating
- Not Participating

- Noise Impact in Decibels**
- 45 dB(A)
 - 50 dB(A)
 - 55 dB(A)

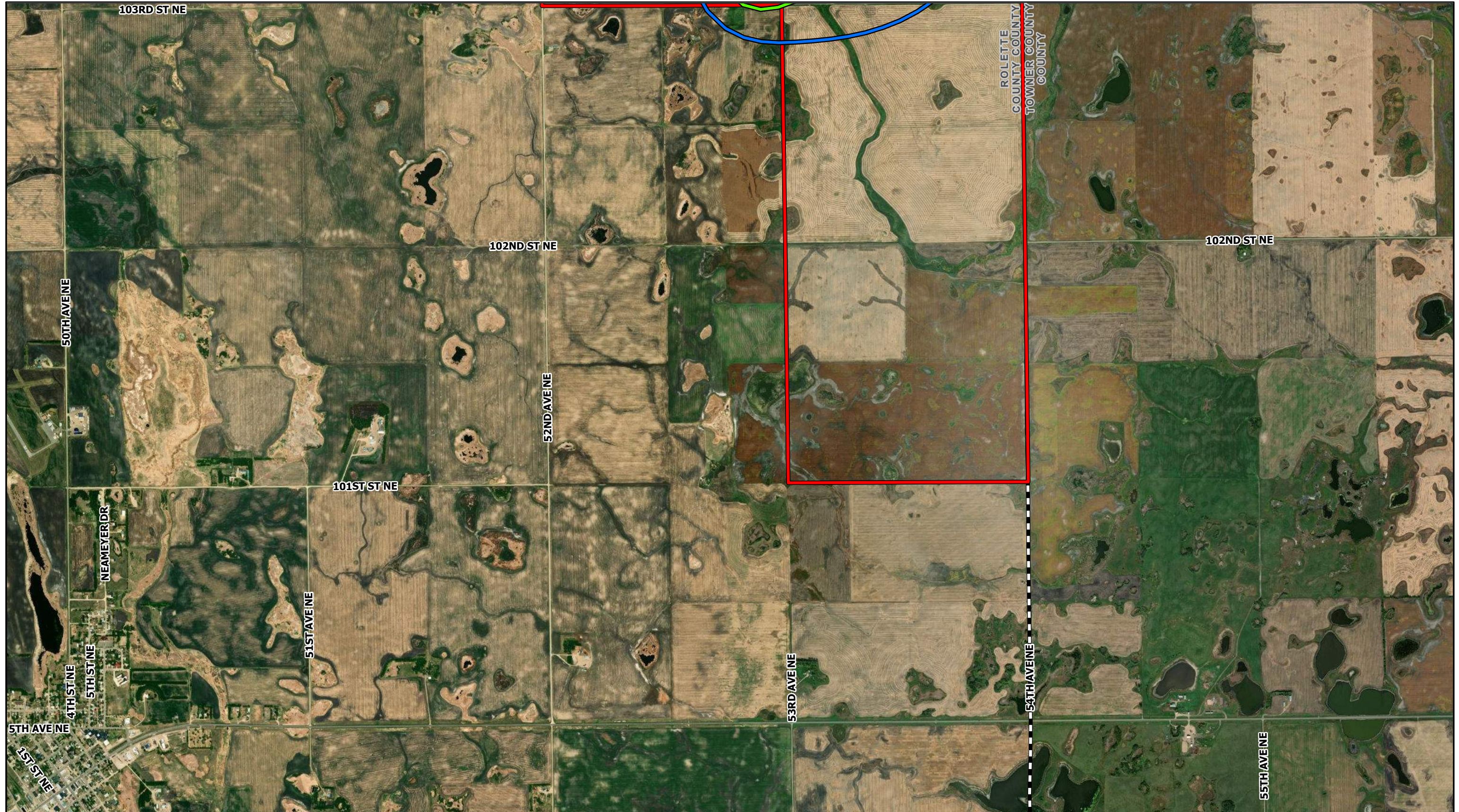


Border Winds Project

Rolette County, North Dakota

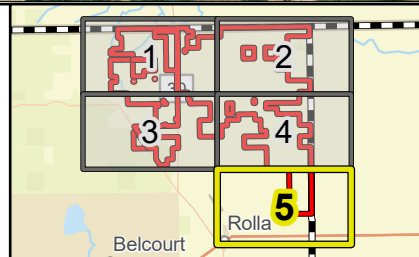
Wind Noise Impacts Map Book

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Data Source(s): Westwood (2022); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).

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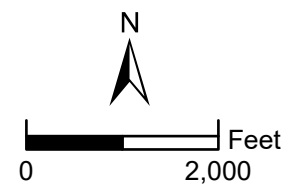
Legend

- Project Area
- County Boundary
- Canada
- Turbine

- St. John Receptor Boundary
- Receptor Location**
- Participating
- Not Participating

Noise Impact in Decibels

- 45 dB(A)
- 50 dB(A)
- 55 dB(A)



Border Winds Project

Rolette County, North Dakota

Wind Noise Impacts Map Book

Map Document: \\westwoodps.local\Global Projects\0003319_011040_Environmental\Noise and Shadow\text\10622_Update\DW_NoiseAndShadow_210622.aprx 2/17/2022 11:16 PM NGBryant

A REPORT FOR ENVIRONMENTAL SERVICES

Border Winds Repower

Noise and Shadow Impact Analysis

AUGUST 23, 2021

PREPARED FOR:



PREPARED BY:

Westwood

Westwood

Noise and Shadow Impact Analysis

Border Winds Repower

Rolette County, North Dakota

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Project Number: R0003319.01

Date: August 23, 2021

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Rev No.	Revision Purpose	Date	Revised by
0	Original	April 19, 2021	MML
1	Update to all 2.2 MW	August 23, 2021	JF

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Exhibits

- Exhibit 1: Project Turbine Locations
- Exhibit 2: Noise Level Results and Maps
- Exhibit 3: Shadow Flicker Results and Maps

Executive Summary

Westwood Professional Services (Westwood) was contracted by Xcel Energy (the Applicant) to support the repower of the Border Winds Project by completing a noise and shadow flicker assessment. It is our understanding that the Applicant intends to replace components on up to 75 wind turbines during the 2024 or 2025 calendar year. Border Winds has a nameplate capacity of 165.0 megawatts (MW) and is located in northern North Dakota in Rolette County.

The noise assessment consisted of 36 participating and non-participating residential dwellings within 1-mile of proposed turbine locations, as well as the town limits for the closest town of St. John, ND. The residential dwellings were modeled by placing point-type noise receptors spaced 75 ft. apart around the perimeter of the dwelling, and at a distance of 150 ft. away from the dwelling center to ensure the highest noise level at least 100 ft. from the structure was captured. The boundary of St. John was buffered by 150 ft. beyond the town perimeter, and modeled as both an area feature in which the loudest noise at any point along the boundary of the feature is reported, as well as at points spaced evenly along the boundary. All noise receivers are assumed to have a relative height of 1.5 meters above ground level. Moderate ground attenuation was assumed.

The shadow flicker assessment consisted of 36 participating and non-participating residential dwellings within 1-mile of proposed repowered turbine locations, as well as the town limits for the closest town of St. John, ND. The residence locations were modeled using a greenhouse simulation consisting of a 1 meter x 1 meter window located 1 meter about ground level. The boundary of St. John was modeled as an area with a relative height of 1 meter above the ground. Reductions based on turbine operational time, operational direction, and site-specific meteorological data were used to calculate probable yearly shadow flicker hours. Obstacles such as trees, structures, and billboards were not included in the model run(s) and therefore the results can be considered conservative.

The noise assessment has been completed in accordance with North Dakota regulations found in section 4 of Chapter 69-06-08-01 Energy conversion facility siting criteria.

The noise model results show seven (7) receptors are expected to measure above 45 dBA and are therefore not in compliance. Provisions that may allow for a landowner to waive their right to the 45dBA limit at their residence is not considered in this analysis and only receptors above 45 dBA are reported. All other receptors and the perimeter of the town of St. John were found to be less than 45 dBA.

The shadow flicker model results shows that all 36 participating and non-participating residential dwellings as well as the perimeter of St. John, ND are expected to experience no more than 29 hours and 26 minutes of shadow flickering per year; therefore, these receptors are within accordance with the generally-accepted industry-standard limit of 30 cumulative hours per year per residence.

1.0 Introduction

Westwood Professional Services (Westwood) was contracted by Xcel Energy (the Applicant) to support the repower of the Border Winds Project by completing a noise and shadow flicker assessment. The site consists of 75 turbines with a nameplate capacity of 165.0 megawatts (MW). The noise model contains seventy-five (75) Vestas V110-2.2 MW turbines with a rotor diameter of 110m and a hub height of 95m. The shadow flicker model assumes the same layout configuration. Turbine locations were provided to Westwood by the Applicant.

Receptor locations were created in 2014 as part of the original permitting effort for this project. This 2014 dataset was used as the basis for determining the participating and non-participating noise and shadow flicker receptors inside and adjacent to the project area. Aerial imagery was also used to add receptors that were built after 2014. There is no regulation detailing a distance criterion between proposed turbine locations and existing noise sensitive receptors, therefore, to be conservative a selection of the receptors up to 1 mile from any proposed repowered turbine location was chosen for this analysis. The selection of receivers consists of 36 occupied and unoccupied residential dwellings and the town limit of St. John, ND.

The Project Area is located in Rolette County in northern North Dakota near the town of St. John. The Subject Property is located at an approximate elevation of 1,730 to 1,900 feet above mean sea level (AMSL) and is relatively flat. The Project Area is located within an agricultural and residential area.

2.0 Background – Noise

In order to verify that the turbine array existing at Border Winds is within compliance with the noise allowance levels, Westwood analyzed the site specifics through a model built in windPRO. The model assumed the turbines were operating at the loudest noise emission level. An additional uncertainty margin of 2 dBA was added to the noise emission levels. These assumptions were made to ensure a "worst case" scenario was analyzed to produce a model more conservative than realistic operational conditions.

The noise assessment has been completed in accordance with North Dakota regulations found in section 4 of Chapter 69-06-08-01 Energy conversion facility siting criteria, 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."

According to the Vestas noise emission documentation reviewed by Westwood, the loudest normal operational noise level emission from a standard blade edge on the V110-2.2 MW is 107.7 dBA at 10 m/s at 95m above ground level.

GIS data of noise sensitive receivers was developed by Westwood using receptor data from the 2014 permit application for this project as well as supplementing the model input with updated aerial imagery to identify areas built since 2014.

These receptors include areas such as habitable residences, schools, churches, and other noise sensitive areas. There is no regulation regarding distance criteria between proposed turbine locations and noise receptors that must be included in a predictive model.

To be conservative, noise at receptors up to 1 mile from the proposed repowered turbines was calculated. Details of the turbines used in the noise analysis are found below in Table 1.

Table 1: Turbines Included in the Noise Model

Manufacturer	Model	Hub Height (m)	Rotor Diameter	Cut-in-Wind Speed (m/s)	Cut-out Wind Speed (m/s)	Noise Emission (dBA)
Vestas	V110-2.2	95.0	110	3	20	107.7

3.0 Study Methodology – Noise

This noise analysis was performed utilizing windPRO, a sophisticated wind modeling software program. windPRO calculates detailed noise maps across an entire area of interest or at site-specific locations using noise sensitive receptors. The analysis assumed the ISO 9613-2 General noise calculation model with General ground attenuation and an attenuation factor of 0.5, which represents typical mixed vegetation and crop cover. A safety margin of +2 dBA was added to the turbine manufacturer’s noise emission data and results are compared to the 45 dBA limit at 100 feet of an occupied residence. Using these assumptions, realistic noise levels were calculated at 1.5 m AGL at the potential occupied structures. The term “realistic” in this case, means that some amount of ground attenuation is accounted for.

The inputs for the windPRO noise calculation include the following:

- Turbine Coordinates
- Turbine Specifications
- Wind Turbine Noise Emission Data
- Noise Receptor Coordinates
- Ambient Background Noise Data
- USGS Digital Elevation Model
- Uncertainty Factor
- Meteorological Conditions
- Ground Attenuation
- Existing Wind Turbines

A description of each input variable and how they affect the noise calculation are included below.

Turbine Coordinates: The location of a wind turbine in relation to a noise receptor is one of the most important factors in determining noise impacts. Noise levels drop as they travel farther from the source of emission. The attenuation comes from atmospheric absorption as well as from absorption by the ground cover between the turbine and the receptor. The noise can also be reflected by hard or smooth surfaces such as ice or water.

Noise is also absorbed by trees and reflected by structures such as buildings or walls, although these effects (trees and buildings) are ignored in the model. Turbine coordinates can be found in Exhibit 1.

Turbine Specifications: Wind turbine specifications from the manufacturer were supplied to Westwood by the Applicant. Wind turbine specifications included in the model were the power curves, blade types (standard non LNTE), and hub heights.

Turbine Noise Emission Data: Noise emission data including 1/3rd octave data supplied by the manufacture is used assuming the loudest noise levels are being emitted at the hub height of the turbine. A safety margin of 2 dBA was added to the wind turbine noise emission profiles for the analysis in order to produce more conservative results, meaning that the model will predict higher noise levels.

Noise Receptor Coordinates: As with the wind turbine coordinates, the elevation, and distance of a noise receptor in relation to the wind turbines are the main factors in determining the noise impacts. Westwood developed the coordinates for the Applicant for all existing occupied structures found to be within 10 KM of the 75 proposed wind turbine locations. A subset of receptors within 1 mile of repowered turbine locations were selected for inclusion in the model.

Ambient Background Noise Data: No ambient background noise level is used in the compliance criteria. Turbine project noise contribution at occupied residences is modeled.

USGS Digital Elevation Model (DEM) (height contour data): For this study, 1/3 arc-second USGS National Elevation Database (NED) DEM's were used for the windPRO noise model. The DEM grid information is important to the noise calculation since it allows the model to place the wind turbines and the noise receptors at the correct elevations.

Uncertainty Factor: No uncertainty factor was provided by the wind turbine manufacturer. In this situation, it is common practice based on experience and studies to add 2 dBA to the noise emission levels of each wind turbine. For this analysis, the 2 dBA were added to all wind turbine noise emission profiles.

Meteorological Conditions: A temperature of 10⁰ C (50⁰ F) and a relative humidity of 70% were assumed for the analysis. These conditions represent an atmospheric “worst case” scenario where noise will travel farther with less atmospheric absorption. This will lead to more conservative (higher predicted noise levels) results. All wind turbines are assumed to be operating simultaneously at maximum noise output levels. All turbines are assumed to be downwind of all receptors, which is another conservative (higher predicted noise levels) assumption.

Ground Attenuation: A ground attenuation factor of 0.5 was assumed for this analysis. It represents “mixed ground” consisting of half hard and half soft (porous) ground. No other sources of noise attenuation such as trees, air turbulence or wind shadow effects were assumed in the analysis.

Existing Wind Turbines: There are no existing wind turbines outside the immediate vicinity of the Border Winds Project area. Only the noise contributions from the 75 Border Winds turbines are included in the modeling results. A table of the proposed turbines can be found in Exhibit 1.

4.0 Results of Analysis – Noise

The noise assessment determined that seven (7) residential dwellings will be impacted by noise levels exceeding 45 dBA. Of the dwellings more than 45 dBA four (4) are located on project participant property.

Provisions that may exist in a wind energy ground lease and/or setback waiver agreement between individuals or entities and the Applicant are not considered in this analysis. Existence of receptors above 45 dBA according to North Dakota section 4 of Chapter 69-06-08-01 Energy conversion facility siting criteria are reported. See Table 2 below for a table depicting the noise level distributions for the Project Area. Please see Exhibit 2 for the full noise analysis results.

Table 2: Distribution of Realistic Noise Modeled at Occupied Structures

Realistic Noise (dBA)	Number of Noise Receptors
0 to 25	0
25 to 30	0
30 to 35	5
35 to 40	13
40 to 45	11
45 to 50	7
50 to 55	0

In addition to modeling the noise levels at noise sensitive receivers the operational noise expected at the town limits of St. John, ND was also calculated. The assessment determined that there are no instances where the expected noise 100 feet away from the town perimeter exceeds 45 dBA. See Table 3 below for a table depicting the noise level found at the location of maximum noise along the town perimeter modeled. Please see Exhibit 2 for the full noise analysis results.

Table 3: Distribution of Realistic Noise Modeled at Highest Noise Level Along Town Perimeter

Realistic Noise (dBA)	Noise Characterization Along St. John Boundary
41.2	Maximum
35.3	Mean
31.0	Minimum

5.0 Background – Shadow Flicker

Shadow flicker from wind turbines occurs when rotating wind turbine blades move between the sun and the observer. Shadow flicker is generally experienced in areas near wind turbines where the distance between the observer and wind turbine blade is short enough that sunlight has not been significantly diffused by the atmosphere.

When the blades rotate, this shadow creates a pulsating effect, known as shadow flicker. If the blade's shadow is passing over the window of a building, it will have the effect of increasing and decreasing the light intensity in the room at a low frequency in the range of 0.4 to 0.78 Hz, hence the term "flicker." This flickering effect can also be experienced outdoors, but the effect is typically less intense, and becomes less intense when farther from the wind turbine causing the flicker.

This flickering effect is most noticeable within approximately 1,000 meters of the turbine and becomes more and more diffused as the distance increases.

Beyond 1,700 meters, the shadow flicker effects are indistinguishable. There are no uniform standards defining what distance from the turbine is regarded as an acceptable limit beyond which the shadow flicker is considered to be insignificant. The same applies to the number of hours of flickering that is deemed to be acceptable.

Shadow flicker is typically greatest in the winter months when the angle of the sun is lower and casts longer shadows. The effect is also more pronounced around sunrise and sunset when the sun is near the horizon and the shadows are longer. A number of factors influence the amount of shadow flicker on the shadow receptors.

One consideration is the environment around the shadow receptor. Obstacles such as terrain, trees or buildings between the wind turbine and the receptor can significantly reduce or eliminate shadow flicker effects. Deciduous trees may block the shadow flickering effect to some degree, depending on the tree density, species present and time of year. Deciduous trees can lead to a reduction of shadow flicker during the summer when the trees are bearing leaves. However, during the winter months, these trees are without their leaves and their impact on shadow flicker is not as significant. Coniferous trees tend to provide mitigation from shadow flicker year round. For this study, no credit was taken for any potential shading effects from any type of trees or other obstacles that would reduce the number of shadow flickering hours at the structures which will make the shadow flicker prediction more conservative (higher than in reality).

Another consideration is the time of day when shadow flicker occurs. For example, it may be more acceptable for private homes to experience the shadow flickering during daytime hours when family members may be at work or school. Likewise, a commercial property would not be significantly affected if all the shadow flicker impact occurred before or after business hours.

The climate also needs to be considered when assessing shadow flicker. In areas with a significant amount of overcast weather, there would be less shadow flicker, as there are no shadows if the sun is blocked by clouds. Also, if the wind is not blowing, the turbines would not be operational and therefore not creating shadow flickering.

There is no known regulation on allowable limits of shadow flicker at occupied residences for Rolette County, ND however, 30 hours/year of shadow flicker is a well known and accepted standard for which impacts can be measured against.

Shadow flicker hours are calculated at receivers such as habitable residences, schools, churches and other sensitive areas. For this study, in the interest of being conservative, any occupied structure within 1 mile of proposed repowered turbines were included in the analysis, as well modeling impacts at the town limits of St. John, ND. Contours of expected shadow hours / year indicating areas of 0, 10, 20, 30 hours/year are also mapped and overlaid on the project area. Details of the turbines used in the shadow flicker analysis are found below in Table 4.

Table 4: Turbines Included in the Shadow Flicker Model

Manufacturer	Model	Hub Height (m)	Rotor Diameter	Cut-in-Wind Speed (m/s)	Cut-out Wind Speed (m/s)
Vestas	V110-2.2	95.0	110	3	20

6.0 Study Methodology – Shadow Flicker

This shadow flicker analysis was performed utilizing windPRO, which has the ability to calculate detailed shadow flicker maps across an entire area of interest or at site-specific locations using shadow receptors.

Shadow maps which indicate where the shadows will be cast and for how long, are generated using windPRO, calculating the shadow flicker in varying user-defined resolutions. Fine resolution was used for this study and represents shadow flicker being calculated every two minutes of every 3rd day over the period of an entire year over a grid with a 10 m x 10 m resolution.

In addition to generating a shadow flicker map, the amount of shadow flicker that may occur at a specific point can be calculated more precisely by placing a shadow receptor at the location of interest and essentially “recording” the shadow flicker that occurs as the relative sunrise to sunset motion of the sun is simulated throughout an entire year.

The point-specific shadow flicker calculation is run at a higher resolution as compared to the shadow flicker map calculation to utilize the highest precision available within windPRO. Shadow flicker at each shadow receptor location is calculated every minute of every day for an entire year. Shadow receptors can be configured to represent an omni-directional window of a specific size at a specific point (greenhouse mode) or a window facing a single direction of a specific size at a specific point (single direction mode). The shadow receptors used in this analysis were configured as greenhouse-mode receptors representing a 1 m x 1 m window located 1 m above ground level. This represents more of a “worst-case” scenario and thus will produce more conservative results since it assumes that all windows are always in direct line of sight with the turbines and the sun.

As a part of the calculation method, windPRO must determine whether or not a turbine will be visible at the receptor locations and not blocked by local topography or obstacles. It does this by performing a preliminary Zones of Visual Influence (ZVI) calculation, utilizing 10 m grid spacing. If a particular turbine is not visible within the 10 m x 10 m area that the shadow receptor is contained within, then that turbine is not included in the shadow flicker calculation for that receptor.

The inputs for the windPRO shadow flicker calculation include the following:

- Turbine Coordinates
- Turbine Specifications
- Shadow Receptor Coordinates
- Monthly Sunshine Probabilities
- Joint Wind Speed and Direction Frequency Distribution
- USGS Digital Elevation Model (DEM)

A description of each input variable and how they affect the shadow flicker calculation are included below.

Turbine Coordinates: The location of a wind turbine in relation to a shadow receptor is one of the most important factors in determining shadow flicker impacts. A line-of-site is required for shadow flicker to occur. The intensity of the shadow flicker is dependent upon the distance from the wind turbine and weather conditions.

Turbine Specifications: A wind turbine's total height and rotor diameter will be included in the windPRO shadow flicker model. The taller the wind turbine, the more likely shadow flicker could have an impact on local shadow receptors as the ability to clear obstacles (such as hills or trees) is greater, although in this analysis, no credit is taken for any such blockage from trees. The larger the rotor diameter is, the wider the area where shadows will be cast. Also included with the turbine specifications are the cut-in and cut-out wind speeds within which the wind turbine is operational. If the wind speed is below the cut-in threshold or above the cut-out threshold, the turbine rotor will not be spinning and thus shadow flicker will not occur.

Shadow Receptor Coordinates: As with the wind turbine coordinates, the elevation, distance and orientation of a shadow receptor in relation to the wind turbines and the sun are the main factors in determining the impact of shadow flicker. Westwood developed the coordinates for all participating and non-participating occupied structures found to be located within 1 mile of the proposed repowered wind turbine locations.

Monthly Sunshine Probabilities: windPRO calculates sunrise and sunset times to determine the total annual hours of daylight for the modeled area. To further refine the shadow flicker calculations, the monthly probability of sunshine is included to account for cloud cover. The greater the probability of cloud cover, the less of an impact from shadow flicker. The monthly sunshine probabilities for many of the larger cities across the United States are available from the National Climatic Data Center (NCDC). For this study, 44 years worth of monthly sunshine probability data were retrieved for Williston, ND which was the closest, most representative station, to create the long-term representative monthly sunshine probabilities. Sunshine probability from the Winnipeg airport in Canada was also tested but resulted in lesser impacts, so Williston was chosen for the analysis.

The long-term representative monthly average sunshine probabilities are presented in table 5 below.

Table 5: Williston, ND Monthly Sunshine Probabilities

Williston, ND Monthly Sunshine Probabilities (1965-2009)												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sunshine %	51	57	61	59	63	68	77	75	67	56	43	47

retrieved from: <http://www1.ncdc.noaa.gov/pub/data/ccd-data/pctpos15.dat>

Joint Wind Speed and Direction Frequency Distribution: A set of long-term corrected wind distributions was provided by the Applicant to represent the annual wind speed and direction distribution for the project site. This data was used to estimate the probable number of operational hours for the wind turbines from each of the 12 wind direction sectors. During operation, the wind turbine rotors will always be assumed to face into the wind and automatically orient themselves as the wind direction changes. Shadow flicker can only occur when the blades are turning and the wind turbine rotor is between the sun and the receptor. Shadow flicker is most significant when the rotor is facing the sun.

USGS Digital Elevation Model (DEM): For this study, 1/3 arc-second USGS National Elevation Database (NED) DEM's were used for the windPRO shadow flicker model. The DEM grid information is important to the shadow flicker calculation since it allows the model to place the wind turbines and the shadow receptors at the correct elevations. The elevation model also allows the model to include the topography of the site when calculating the zones of visual influence surrounding the wind turbine and shadow receptor locations.

Wind Turbines from Adjacent Projects: There are no existing wind turbines outside the immediate vicinity of the Border Winds Project area. Only the shadow flicker generated from the 75 Border Winds turbines are included in the modeling results. A table of the proposed turbines can be found in Exhibit 1.

The actual calculation of potential shadow flicker at a given shadow receptor is carried out by simulating the environment near the wind turbines and the shadow receptors. The position of the sun relative to the turbine rotor disk and the resulting shadow is calculated in time steps of one minute throughout an entire year. If the shadow of the rotor disk (which in the calculation is assumed solid) at any time casts a shadow on a receptor window, then this step will be registered as one minute of shadow flicker. The calculation also requires that the sun must be at least 3.0° above the horizon in order to register shadow flicker. When the sun angle is less than 3.0° , the shadow quickly becomes too diffuse to be distinguishable since the amount of atmosphere that the light must pass through is 15 times greater than when the sun is directly overhead.

The sun's path with respect to each wind turbine location is calculated by the software to determine the paths of cast shadows for every minute of every day over a full year.

The turbine runtime and direction are calculated from the site's long-term wind speed and direction distribution. Finally, the effects of cloud cover are calculated using long-term reference data (monthly sunshine probability) to arrive at the projected annual flicker time at each receptor.

7.0 Results of Analysis – Shadow Flicker

The term “realistic” as used in this report means that turbine operational hours and direction as well as local sunshine probabilities have been factored in, but no blocking or shading effects due to trees or structures have been accounted for. This means that the realistic estimates are still inherently conservative values. Also, the realistic shadow flicker hours predicted by windPRO assumes an availability factor of 100% which is very unlikely to be the case. Actual availability factors will likely be in the range of 95-98%, however, with a conservative approach to estimating shadow flicker totals, the realistic estimates are not discounted accordingly.

A total of 36 participating and non-participating residential dwellings within 1 mile of a proposed repowered wind turbine were identified and analyzed. Fine resolution shadow flicker maps were also generated for the turbine array. The 36 shadow receptors were modeled as greenhouse-mode receptors in the shadow flicker calculation for the Border Winds 75 turbine array. All thirty six (36) receptors are expected to experience no more than 29 hours and 26 minutes of shadow flicker per year. All receptors are therefore within limits established generally as an industry best practice for projects that are not subject to a formal regulatory limit. Table 6 below depicts the distribution of shadow flicker hours modeled at the occupied structures. Please see Exhibit 3 for the full shadow flicker analysis results.

Table 6: Distribution of Realistic Shadow Flicker Hours Modeled at Occupied Structures

Realistic Shadow Flicker (hrs\year)	#Non-Participant Receivers	# Participant Receivers
0 to 1	8	0
1 to 5	8	3
5 to 10	5	4
10 to 15	0	3
15 to 20	1	0
20 to 25	1	1
25 to 30	1	1
30+	0	0

In addition to modeling the shadow flicker hours at sensitive receivers the shadow flicker expected at the town limits of St. John, ND was also calculated. The assessment determined that there are no instances where the expected hours / year of flicker exceeds 30 hours/year. the maximum shadow hours expected anywhere along the St. John perimeter is 21 hours per year.

8.0 Conclusions

The results of the noise assessment is that twenty-nine (29) of the 36 receptors are modeled at or below 45 dBA at 100 ft. away from the dwelling for any period of time and are therefore in compliance with North Dakota section 4 of Chapter 69-06-08-01 Energy conversion facility siting criteria. Of the seven (7) receptors modeled in excess of 45 dBA four (4) are located on project participant land, however, provisions that allow for exceedance of the noise limit has not been reviewed as part of this analysis. Additionally, no area 100 ft. away from the perimeter of the town of St. John, ND is modeled with noise levels in excess of 45 dBA.

Three (3) noise sensitive receptors are modeled at more than 45 dBA at 100 ft. away from the dwelling and are located on non-participant land.

The following assumptions were used during the noise assessment:

- Project turbine locations are Vestas V110-2.2, 95-meter hub height wind turbines.
- Effects from any external existing wind turbines were not applicable.
- All turbines were assumed to be operating simultaneously at maximum noise emission levels.
- All turbines were assumed to be downwind of all receptors.
- Atmospheric conditions were assumed to be most favorable for noise propagation.
- An additional 2 dBA was added to the noise emission levels.

The shadow flicker impact assessment for the identified receptors was calculated with reductions due to turbine operational direction and sunshine probabilities. Based on the provided turbine array, all 36 of the shadow receptor locations modeled for the Vestas V110 turbines on 95m towers are expected to experience no more than 29 hours and 25 minutes of shadow flickering per year; therefore, these receptors are in accordance with the generally-accepted industry-standard limit of 30 cumulative hours per year per residence. Additionally, no area along the perimeter of the town of St. John, ND is modeled with shadow flicker in excess of 30 hours per year.

The following assumptions were used during the shadow flicker assessment:

- Project turbine locations are Vestas V110-2.2, 95-meter hub height wind turbines.
- Effects from any external existing wind turbines were not applicable.
- No credit was taken for blocking effects of trees or structures during the initial shadow flicker model run.
- Receptors were greenhouse/worst-case scenarios rather than modeling specific facades of receptors.
- The assessment assumes 100% turbine availability.

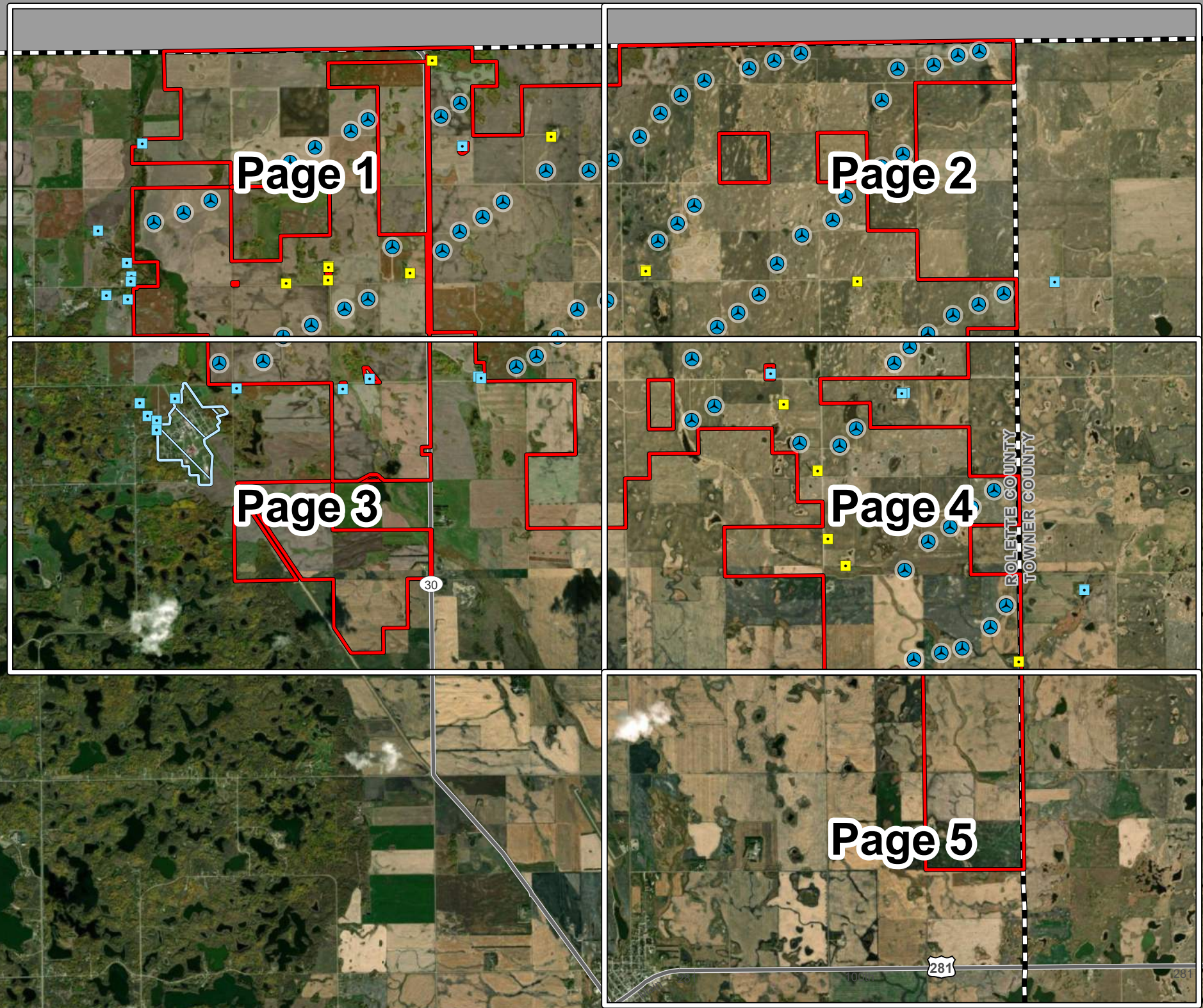
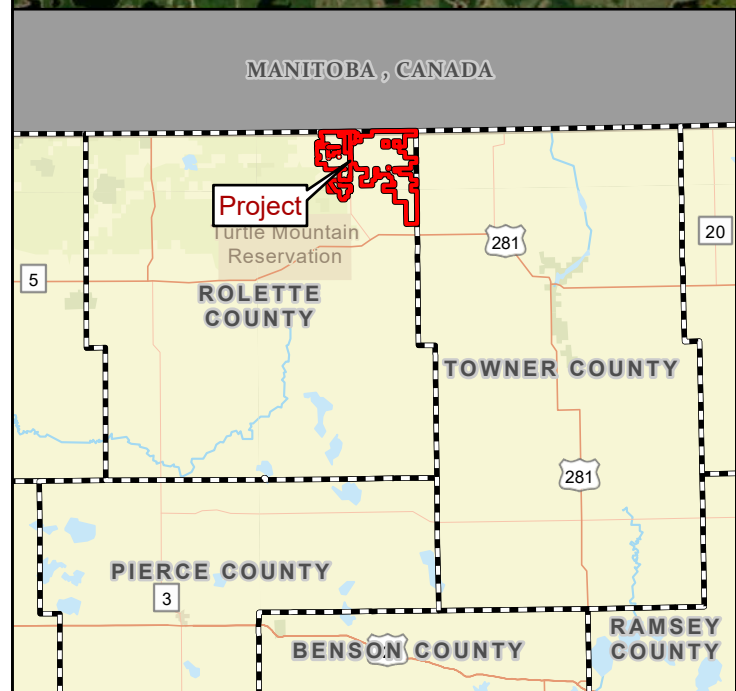
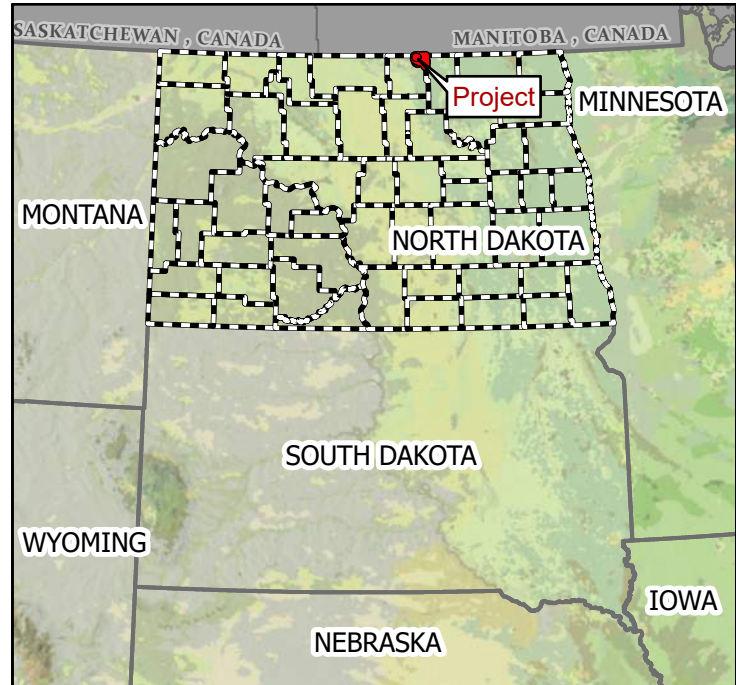
Due to the above conservative assumptions, the realistic noise and shadow flicker observed will likely be less than those predicted by this assessment.

Exhibit 1 – Project Turbine Locations

Proposed re-power turbine configuration
x75 Vestas V110-2.2 Mode 0, 95m Hub







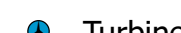



Turbine Layout - UTM Zone 14N, NAD 83, Meters				
WTG	Model	Easting (m)	Northing (m)	Elevation AMSL (m)
T01	Vestas V110-2.2	447437	5424821	578.3
T02	Vestas V110-2.2	447926	5424971	578.4
T03	Vestas V110-2.2	448372	5425158	571.9
T04	Vestas V110-2.2	448934	5425612	567.9
T05	Vestas V110-2.2	449682	5425760	570.0
T06	Vestas V110-2.2	450094	5425994	562.0
T07	Vestas V110-2.2	450685	5426251	560.3
T08	Vestas V110-2.2	450967	5426434	559.1
T09	Vestas V110-2.2	452163	5426461	558.7
T10	Vestas V110-2.2	452480	5426672	559.1
T11	Vestas V110-2.2	448458	5422497	582.0
T12	Vestas V110-2.2	449178	5422518	576.2
T13	Vestas V110-2.2	449512	5422906	573.9
T14	Vestas V110-2.2	449979	5423089	572.4
T15	Vestas V110-2.2	450523	5423345	570.3
T16	Vestas V110-2.2	450912	5423498	567.5
T17	Vestas V110-2.2	451327	5424341	563.5
T18	Vestas V110-2.2	452143	5424264	559.9
T19	Vestas V110-2.2	452431	5424572	560.7
T20	Vestas V110-2.2	452812	5424801	557.7
T21	Vestas V110-2.2	453148	5425041	560.1
T22	Vestas V110-2.2	453862	5425539	559.3
T23	Vestas V110-2.2	454563	5425529	555.5
T24	Vestas V110-2.2	454948	5425693	556.9
T25	Vestas V110-2.2	455404	5426064	554.4
T26	Vestas V110-2.2	455751	5426442	554.9
T27	Vestas V110-2.2	456090	5426732	553.7
T28	Vestas V110-2.2	456480	5426964	553.3
T29	Vestas V110-2.2	457215	5427150	551.6
T30	Vestas V110-2.2	457628	5427267	547.3
T31	Vestas V110-2.2	458064	5427376	544.3
T32	Vestas V110-2.2	453314	5422345	563.0
T33	Vestas V110-2.2	453647	5422510	565.0
T34	Vestas V110-2.2	454001	5422810	562.2
T35	Vestas V110-2.2	454330	5423259	561.1
T36	Vestas V110-2.2	454819	5423392	556.1
T37	Vestas V110-2.2	455670	5424356	554.7
T38	Vestas V110-2.2	455995	5424635	556.2
T39	Vestas V110-2.2	456276	5424924	557.9
T40	Vestas V110-2.2	456163	5421413	552.4
T41	Vestas V110-2.2	456540	5421638	555.0

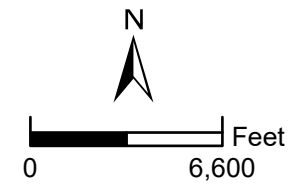
T42	Vestas V110-2.2	456187	5422414	556.1
T43	Vestas V110-2.2	456610	5422925	556.4
T44	Vestas V110-2.2	456955	5423153	556.1
T45	Vestas V110-2.2	457302	5423450	555.9
T46	Vestas V110-2.2	457608	5423946	553.5
T47	Vestas V110-2.2	458024	5424400	552.9
T48	Vestas V110-2.2	458532	5424641	548.2
T49	Vestas V110-2.2	458751	5425023	548.1
T50	Vestas V110-2.2	459348	5425498	543.3
T51	Vestas V110-2.2	459701	5425697	541.5
T52	Vestas V110-2.2	459375	5426586	541.5
T53	Vestas V110-2.2	459641	5427093	537.1
T54	Vestas V110-2.2	460235	5427144	534.1
T55	Vestas V110-2.2	460633	5427294	529.8
T56	Vestas V110-2.2	460984	5427353	528.3
T57	Vestas V110-2.2	457921	5421004	555.5
T58	Vestas V110-2.2	458575	5420951	553.2
T59	Vestas V110-2.2	458848	5421223	549.4
T60	Vestas V110-2.2	459494	5422283	550.8
T61	Vestas V110-2.2	459751	5422539	545.8
T62	Vestas V110-2.2	460055	5422752	545.1
T63	Vestas V110-2.2	460469	5423046	544.8
T64	Vestas V110-2.2	460891	5423213	539.1
T65	Vestas V110-2.2	461306	5423386	538.1
T66	Vestas V110-2.2	459597	5418893	550.9
T67	Vestas V110-2.2	459992	5419352	549.9
T68	Vestas V110-2.2	460355	5419584	547.5
T69	Vestas V110-2.2	460712	5419898	545.2
T70	Vestas V110-2.2	461084	5420170	542.6
T71	Vestas V110-2.2	459719	5417430	545.0
T72	Vestas V110-2.2	460169	5417528	546.8
T73	Vestas V110-2.2	460514	5417598	547.2
T74	Vestas V110-2.2	460981	5417933	547.1
T75	Vestas V110-2.2	461245	5418284	542.9



Data Source(s): Westwood (2021); ESRI WMS Imagery, National Geographic & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).

Legend

-  Project Area
-  Map Book Page
-  County Boundary
-  State Boundary
-  Canada
-  Major Road
-  Turbine
-  St. John Receptor Boundary
- Receptor Location**
-  Participating
-  Not Participating



Border Winds Project

Rolette County, North Dakota

Wind Noise & Shadow Flicker
Impacts Overview

EXHIBIT 1

Exhibit 2 – Noise Level Results and Maps

Border Winds - Predicted A-weighted noise level at receptors center points within 1 mile of proposed turbines
Receptors sorted by receptor ID

Predicted Noise at Receiver Center Point [dB(A)] - UTM Zone 14N, NAD 83, Meters					
Noise Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AMSL (m)	Noise Level dB(A)
R1	Participant	452037	5427371	558.5	40.6
R2	Non-Participant	447273	5426113	572.6	36.9
R3	Participant	453958	5426091	556.6	44.3
R4	Non-Participant	452504	5425967	558	44.4
R5	Non-Participant	446523	5424701	585.9	37.6
R6	Non-Participant	446982	5424161	584.9	39.2
R7	Non-Participant	450275	5424031	570.1	43.3
R8	Non-Participant	447051	5423941	584.8	37.9
R9	Participant	451607	5423903	565.2	45.8
R10	Participant	455463	5423866	555.5	45.2
R11	Non-Participant	447038	5423858	585.2	37.2
R12	Participant	450265	5423819	568	45.3
R13	Participant	449581	5423776	569.9	42.5
R14	Non-Participant	446637	5423641	591	34.3
R15	Participant	458916	5423625	550.3	41.4
R16	Non-Participant	446984	5423568	587.2	35.5
R17	Non-Participant	462143	5423557	534.3	38.8
R18	Non-Participant	452686	5422192	567.2	42.0
R19	Non-Participant	450912	5422188	567.5	38.7
R20	Non-Participant	452736	5422169	567.5	42.5
R21	Non-Participant	457472	5422144	555.6	41.8
R22	Non-Participant	448735	5422073	583.4	44.9
R23	Non-Participant	450472	5422032	567.9	38.9
R24	Non-Participant	447723	5421934	594.7	37.4
R25	Non-Participant	447146	5421869	600.6	33.2
R26	Non-Participant	459658	5421786	549	45.1
R27	Non-Participant	459608	5421785	550.4	45.2
R28	Non-Participant	447271	5421656	602.2	33.2
R29	Participant	457673	5421642	557.3	42.7
R30	Non-Participant	447421	5421579	601.1	33.6
R31	Non-Participant	447414	5421421	605.9	33.0
R32	Participant	458206	5420544	555.2	45.4
R33	Participant	458352	5419430	553	37.7
R34	Participant	458634	5418979	551.1	38.8
R35	Non-Participant	462530	5418513	533.2	35.6
R36	Participant	461435	5417361	537.3	42.0

Border Winds - Predicted A-weighted noise level at receptors center points within 1 mile of proposed turbines
 Receptors sorted by noise level

Predicted Noise at Receiver Center Point [dB(A)] - UTM Zone 14N, NAD 83, Meters					
Noise Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AMSL (m)	Noise Level dB(A)
R9	Participant	451607	5423903	565.2	45.8
R32	Participant	458206	5420544	555.2	45.4
R12	Participant	450265	5423819	568	45.3
R10	Participant	455463	5423866	555.5	45.2
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R26	Non-Participant	459658	5421786	549	45.1
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R14	Non-Participant	446637	5423641	591	34.3
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R25	Non-Participant	447146	5421869	600.6	33.2
R28	Non-Participant	447271	5421656	602.2	33.2
R31	Non-Participant	447414	5421421	605.9	33.0

Border Winds - Predicted A-weighted noise level at receptors center points within 1 mile of proposed turbines
 Receptors sorted by receptor ID

Predicted Noise at St. John Perimeter Points [dB(A)] - UTM Zone 14N, NAD 83, Meters					
Noise Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AMSL (m)	Noise Level dB(A)
St. John Boundary1	Non-Participant	448592	5421698	575.9	39.9
St. John Boundary2	Non-Participant	448584	5421719	575.1	40.1
St. John Boundary3	Non-Participant	448570	5421737	575.1	40.3
St. John Boundary4	Non-Participant	448555	5421755	575	40.5
St. John Boundary5	Non-Participant	448541	5421773	574.8	40.7
St. John Boundary6	Non-Participant	448526	5421790	574.6	40.9
St. John Boundary7	Non-Participant	448507	5421802	574.5	41.0
St. John Boundary8	Non-Participant	448484	5421804	574.7	40.9
St. John Boundary9	Non-Participant	448461	5421803	575.2	40.9
St. John Boundary10	Non-Participant	448438	5421803	576.3	40.8
St. John Boundary11	Non-Participant	448416	5421802	578	40.8
St. John Boundary12	Non-Participant	448393	5421802	579.6	40.7
St. John Boundary13	Non-Participant	448370	5421802	579.4	40.6
St. John Boundary14	Non-Participant	448347	5421801	578.5	40.5
St. John Boundary15	Non-Participant	448324	5421801	579.1	40.4
St. John Boundary16	Non-Participant	448301	5421800	579.4	40.3
St. John Boundary17	Non-Participant	448279	5421800	578.8	40.2
St. John Boundary18	Non-Participant	448256	5421800	578.6	40.1
St. John Boundary19	Non-Participant	448233	5421799	579	40.0
St. John Boundary20	Non-Participant	448210	5421799	579.5	39.8
St. John Boundary21	Non-Participant	448187	5421798	580.9	39.7
St. John Boundary22	Non-Participant	448171	5421811	581.9	39.7
St. John Boundary23	Non-Participant	448158	5421830	581.4	39.9
St. John Boundary24	Non-Participant	448146	5421849	580.4	40.0
St. John Boundary25	Non-Participant	448133	5421868	579.8	40.1
St. John Boundary26	Non-Participant	448120	5421887	579.9	40.3
St. John Boundary27	Non-Participant	448108	5421906	580.2	40.4
St. John Boundary28	Non-Participant	448095	5421925	579.5	40.5
St. John Boundary29	Non-Participant	448082	5421944	578.7	40.6
St. John Boundary30	Non-Participant	448070	5421963	578.7	40.7
St. John Boundary31	Non-Participant	448057	5421982	578.7	40.8
St. John Boundary32	Non-Participant	448044	5422001	578.7	40.9

St. John Boundary33	Non-Participant	448032	5422020	579.4	41.0
St. John Boundary34	Non-Participant	448019	5422039	577.3	41.0
St. John Boundary35	Non-Participant	448006	5422058	577.5	41.1
St. John Boundary36	Non-Participant	447994	5422077	578.1	41.1
St. John Boundary37	Non-Participant	447981	5422096	579	41.2
St. John Boundary38	Non-Participant	447969	5422115	577.7	41.2
St. John Boundary39	Non-Participant	447956	5422134	578.5	41.2
St. John Boundary40	Non-Participant	447943	5422153	580.3	41.2
St. John Boundary41	Non-Participant	447931	5422172	576.2	41.2
St. John Boundary42	Non-Participant	447916	5422190	575.9	41.1
St. John Boundary43	Non-Participant	447895	5422199	577.2	40.9
St. John Boundary44	Non-Participant	447873	5422198	578.6	40.6
St. John Boundary45	Non-Participant	447854	5422185	580.8	40.3
St. John Boundary46	Non-Participant	447843	5422165	583.5	40.0
St. John Boundary47	Non-Participant	447842	5422142	584.4	39.9
St. John Boundary48	Non-Participant	447843	5422120	587.5	39.7
St. John Boundary49	Non-Participant	447838	5422099	588.7	39.5
St. John Boundary50	Non-Participant	447823	5422082	589.7	39.3
St. John Boundary51	Non-Participant	447818	5422060	590.3	39.1
St. John Boundary52	Non-Participant	447818	5422037	590.9	38.9
St. John Boundary53	Non-Participant	447819	5422014	591.2	38.8
St. John Boundary54	Non-Participant	447819	5421991	591.4	38.6
St. John Boundary55	Non-Participant	447820	5421969	591.9	38.4
St. John Boundary56	Non-Participant	447820	5421946	592.2	38.3
St. John Boundary57	Non-Participant	447821	5421923	592.3	38.1
St. John Boundary58	Non-Participant	447822	5421900	592.7	38.0
St. John Boundary59	Non-Participant	447818	5421881	592.7	37.8
St. John Boundary60	Non-Participant	447795	5421882	592.6	37.6
St. John Boundary61	Non-Participant	447772	5421883	593	37.4
St. John Boundary62	Non-Participant	447749	5421884	593.3	37.3
St. John Boundary63	Non-Participant	447727	5421883	593.6	37.1
St. John Boundary64	Non-Participant	447706	5421873	593.6	36.9
St. John Boundary65	Non-Participant	447693	5421855	593.5	36.7
St. John Boundary66	Non-Participant	447691	5421832	594.1	36.5
St. John Boundary67	Non-Participant	447699	5421811	593.2	36.4
St. John Boundary68	Non-Participant	447696	5421793	592.5	36.3
St. John Boundary69	Non-Participant	447682	5421775	592.4	36.1

St. John Boundary70	Non-Participant	447667	5421758	592.8	35.9
St. John Boundary71	Non-Participant	447653	5421740	593	35.7
St. John Boundary72	Non-Participant	447639	5421722	593	35.5
St. John Boundary73	Non-Participant	447624	5421704	593.4	35.4
St. John Boundary74	Non-Participant	447611	5421686	593.8	35.2
St. John Boundary75	Non-Participant	447608	5421663	594	35.0
St. John Boundary76	Non-Participant	447615	5421642	593.7	35.0
St. John Boundary77	Non-Participant	447625	5421622	593.1	34.9
St. John Boundary78	Non-Participant	447623	5421599	593	34.8
St. John Boundary79	Non-Participant	447619	5421577	593	34.7
St. John Boundary80	Non-Participant	447616	5421554	593.4	34.5
St. John Boundary81	Non-Participant	447612	5421531	593.9	34.4
St. John Boundary82	Non-Participant	447591	5421530	594.6	34.3
St. John Boundary83	Non-Participant	447568	5421530	595.4	34.2
St. John Boundary84	Non-Participant	447545	5421530	596.2	34.0
St. John Boundary85	Non-Participant	447522	5421531	597.2	33.9
St. John Boundary86	Non-Participant	447500	5421531	598.1	33.8
St. John Boundary87	Non-Participant	447477	5421531	598.4	33.7
St. John Boundary88	Non-Participant	447454	5421530	599.2	33.6
St. John Boundary89	Non-Participant	447433	5421521	600.5	33.5
St. John Boundary90	Non-Participant	447420	5421503	602.4	33.3
St. John Boundary91	Non-Participant	447416	5421481	603.1	33.2
St. John Boundary92	Non-Participant	447415	5421458	604.3	33.1
St. John Boundary93	Non-Participant	447415	5421435	604.8	33.0
St. John Boundary94	Non-Participant	447415	5421412	606.2	32.9
St. John Boundary95	Non-Participant	447415	5421390	605	32.8
St. John Boundary96	Non-Participant	447414	5421367	604.3	32.7
St. John Boundary97	Non-Participant	447414	5421344	604.1	32.6
St. John Boundary98	Non-Participant	447414	5421321	603.5	32.6
St. John Boundary99	Non-Participant	447413	5421298	603.6	32.5
St. John Boundary100	Non-Participant	447413	5421275	603.6	32.4
St. John Boundary101	Non-Participant	447413	5421252	603.6	32.3
St. John Boundary102	Non-Participant	447413	5421230	603.6	32.2
St. John Boundary103	Non-Participant	447412	5421207	605.1	32.1
St. John Boundary104	Non-Participant	447412	5421184	606.3	32.0
St. John Boundary105	Non-Participant	447412	5421161	607.3	31.9
St. John Boundary106	Non-Participant	447411	5421138	608.9	31.8

St. John Boundary107	Non-Participant	447411	5421115	607.6	31.7
St. John Boundary108	Non-Participant	447411	5421093	606.8	31.7
St. John Boundary109	Non-Participant	447411	5421070	606.7	31.6
St. John Boundary110	Non-Participant	447410	5421047	606.9	31.5
St. John Boundary111	Non-Participant	447410	5421024	611.2	31.4
St. John Boundary112	Non-Participant	447410	5421001	612.7	31.3
St. John Boundary113	Non-Participant	447409	5420978	612.5	31.2
St. John Boundary114	Non-Participant	447409	5420955	610	31.1
St. John Boundary115	Non-Participant	447416	5420934	608.5	31.1
St. John Boundary116	Non-Participant	447433	5420918	608.4	31.1
St. John Boundary117	Non-Participant	447455	5420912	608.6	31.1
St. John Boundary118	Non-Participant	447477	5420912	609	31.2
St. John Boundary119	Non-Participant	447500	5420912	608.8	31.2
St. John Boundary120	Non-Participant	447523	5420912	608.4	31.3
St. John Boundary121	Non-Participant	447546	5420911	608.4	31.4
St. John Boundary122	Non-Participant	447569	5420911	609.2	31.4
St. John Boundary123	Non-Participant	447592	5420911	612.9	31.5
St. John Boundary124	Non-Participant	447614	5420911	614	31.6
St. John Boundary125	Non-Participant	447637	5420911	610.2	31.6
St. John Boundary126	Non-Participant	447660	5420910	607.1	31.7
St. John Boundary127	Non-Participant	447683	5420910	606.3	31.7
St. John Boundary128	Non-Participant	447706	5420910	605.8	31.8
St. John Boundary129	Non-Participant	447729	5420910	605.7	31.9
St. John Boundary130	Non-Participant	447752	5420909	605.6	31.9
St. John Boundary131	Non-Participant	447774	5420909	604.9	32.0
St. John Boundary132	Non-Participant	447797	5420909	603.4	32.1
St. John Boundary133	Non-Participant	447803	5420892	604.1	32.0
St. John Boundary134	Non-Participant	447804	5420869	605	31.9
St. John Boundary135	Non-Participant	447805	5420846	607	31.8
St. John Boundary136	Non-Participant	447813	5420825	607.5	31.7
St. John Boundary137	Non-Participant	447830	5420810	605.3	31.7
St. John Boundary138	Non-Participant	447851	5420804	605.6	31.7
St. John Boundary139	Non-Participant	447874	5420805	604.6	31.8
St. John Boundary140	Non-Participant	447897	5420805	603.2	31.8
St. John Boundary141	Non-Participant	447916	5420801	602	31.9
St. John Boundary142	Non-Participant	447917	5420778	602.8	31.8
St. John Boundary143	Non-Participant	447918	5420755	604	31.7

St. John Boundary144	Non-Participant	447918	5420733	604.4	31.6
St. John Boundary145	Non-Participant	447919	5420710	604.9	31.5
St. John Boundary146	Non-Participant	447922	5420687	605.4	31.4
St. John Boundary147	Non-Participant	447934	5420668	605.3	31.3
St. John Boundary148	Non-Participant	447954	5420657	604.1	31.3
St. John Boundary149	Non-Participant	447977	5420656	603.1	31.4
St. John Boundary150	Non-Participant	447999	5420657	602.6	31.4
St. John Boundary151	Non-Participant	448022	5420657	600.7	31.5
St. John Boundary152	Non-Participant	448045	5420657	598.8	31.5
St. John Boundary153	Non-Participant	448068	5420657	597.7	31.6
St. John Boundary154	Non-Participant	448068	5420634	598.2	31.5
St. John Boundary155	Non-Participant	448068	5420611	598.9	31.4
St. John Boundary156	Non-Participant	448069	5420589	599.8	31.3
St. John Boundary157	Non-Participant	448069	5420566	600.1	31.2
St. John Boundary158	Non-Participant	448069	5420543	601.1	31.1
St. John Boundary159	Non-Participant	448074	5420521	602.2	31.0
St. John Boundary160	Non-Participant	448089	5420504	602.1	31.0
St. John Boundary161	Non-Participant	448111	5420496	601.4	31.0
St. John Boundary162	Non-Participant	448133	5420496	599.9	31.0
St. John Boundary163	Non-Participant	448156	5420495	598.9	31.0
St. John Boundary164	Non-Participant	448179	5420495	598.2	31.1
St. John Boundary165	Non-Participant	448202	5420494	597.6	31.1
St. John Boundary166	Non-Participant	448225	5420494	597.1	31.2
St. John Boundary167	Non-Participant	448248	5420493	596.4	31.2
St. John Boundary168	Non-Participant	448271	5420493	596	31.2
St. John Boundary169	Non-Participant	448291	5420502	595.5	31.3
St. John Boundary170	Non-Participant	448306	5420520	594.8	31.4
St. John Boundary171	Non-Participant	448310	5420542	594.4	31.5
St. John Boundary172	Non-Participant	448310	5420565	593.4	31.6
St. John Boundary173	Non-Participant	448310	5420588	592.8	31.7
St. John Boundary174	Non-Participant	448310	5420611	592.9	31.8
St. John Boundary175	Non-Participant	448310	5420633	592.5	31.9
St. John Boundary176	Non-Participant	448311	5420656	592.3	32.0
St. John Boundary177	Non-Participant	448311	5420679	592.1	32.1
St. John Boundary178	Non-Participant	448311	5420702	592.4	32.2
St. John Boundary179	Non-Participant	448311	5420725	592.8	32.3
St. John Boundary180	Non-Participant	448313	5420748	592.6	32.4

St. John Boundary181	Non-Participant	448315	5420770	592.7	32.5
St. John Boundary182	Non-Participant	448317	5420793	593.3	32.6
St. John Boundary183	Non-Participant	448318	5420816	593.3	32.8
St. John Boundary184	Non-Participant	448320	5420839	593.1	32.9
St. John Boundary185	Non-Participant	448322	5420861	592.7	33.0
St. John Boundary186	Non-Participant	448324	5420884	591.6	33.1
St. John Boundary187	Non-Participant	448326	5420907	592.3	33.2
St. John Boundary188	Non-Participant	448328	5420930	592.1	33.4
St. John Boundary189	Non-Participant	448330	5420953	591.2	33.5
St. John Boundary190	Non-Participant	448332	5420975	590.9	33.6
St. John Boundary191	Non-Participant	448330	5420998	590.9	33.8
St. John Boundary192	Non-Participant	448318	5421017	590.1	33.9
St. John Boundary193	Non-Participant	448305	5421036	590.3	33.9
St. John Boundary194	Non-Participant	448293	5421055	591.1	34.0
St. John Boundary195	Non-Participant	448280	5421074	591.1	34.1
St. John Boundary196	Non-Participant	448267	5421093	591.1	34.2
St. John Boundary197	Non-Participant	448254	5421112	591.4	34.3
St. John Boundary198	Non-Participant	448242	5421131	591	34.4
St. John Boundary199	Non-Participant	448229	5421150	590.1	34.5
St. John Boundary200	Non-Participant	448216	5421169	589.9	34.5
St. John Boundary201	Non-Participant	448208	5421190	589.8	34.7
St. John Boundary202	Non-Participant	448205	5421213	589.9	34.8
St. John Boundary203	Non-Participant	448202	5421235	590.5	34.9
St. John Boundary204	Non-Participant	448212	5421252	591.2	35.1
St. John Boundary205	Non-Participant	448232	5421263	591.6	35.2
St. John Boundary206	Non-Participant	448251	5421275	591.6	35.3
St. John Boundary207	Non-Participant	448271	5421287	590.7	35.5
St. John Boundary208	Non-Participant	448290	5421298	590.6	35.6
St. John Boundary209	Non-Participant	448310	5421310	590.4	35.7
St. John Boundary210	Non-Participant	448330	5421322	590.2	35.9
St. John Boundary211	Non-Participant	448349	5421334	589.9	36.0
St. John Boundary212	Non-Participant	448369	5421345	589.3	36.2
St. John Boundary213	Non-Participant	448388	5421357	588.6	36.3
St. John Boundary214	Non-Participant	448408	5421369	588.2	36.4
St. John Boundary215	Non-Participant	448428	5421381	587.9	36.6
St. John Boundary216	Non-Participant	448444	5421396	587.3	36.7
St. John Boundary217	Non-Participant	448450	5421418	587	36.9

St. John Boundary218	Non-Participant	448446	5421440	587.3	37.1
St. John Boundary219	Non-Participant	448434	5421460	587.7	37.2
St. John Boundary220	Non-Participant	448422	5421479	587.9	37.4
St. John Boundary221	Non-Participant	448437	5421495	587.8	37.6
St. John Boundary222	Non-Participant	448454	5421510	587.7	37.7
St. John Boundary223	Non-Participant	448465	5421529	587.7	37.9
St. John Boundary224	Non-Participant	448465	5421552	586.8	38.2
St. John Boundary225	Non-Participant	448455	5421572	585.2	38.3
St. John Boundary226	Non-Participant	448441	5421590	584.1	38.5
St. John Boundary227	Non-Participant	448427	5421608	584.1	38.6
St. John Boundary228	Non-Participant	448441	5421617	582.9	38.7
St. John Boundary229	Non-Participant	448463	5421623	579	38.8
St. John Boundary230	Non-Participant	448485	5421629	576.9	39.0
St. John Boundary231	Non-Participant	448508	5421635	576.4	39.1
St. John Boundary232	Non-Participant	448530	5421641	576.5	39.2
St. John Boundary233	Non-Participant	448552	5421647	576.4	39.3
St. John Boundary234	Non-Participant	448573	5421655	576.4	39.4
St. John Boundary235	Non-Participant	448588	5421672	576.7	39.6
St. John Boundary236	Non-Participant	448593	5421694	576.2	39.8

Border Winds - Predicted A-weighted noise level at receptors center points within 1 mile of proposed turbines
 Receptors sorted by noise level

Predicted Noise at St. John Perimeter Points [dB(A)] - UTM Zone 14N, NAD 83, Meters					
Noise Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AMSL (m)	Noise Level dB(A)
St. John Boundary37	Non-Participant	447981	5422096	579	41.2
St. John Boundary38	Non-Participant	447969	5422115	577.7	41.2
St. John Boundary39	Non-Participant	447956	5422134	578.5	41.2
St. John Boundary40	Non-Participant	447943	5422153	580.3	41.2
St. John Boundary41	Non-Participant	447931	5422172	576.2	41.2
St. John Boundary35	Non-Participant	448006	5422058	577.5	41.1
St. John Boundary36	Non-Participant	447994	5422077	578.1	41.1
St. John Boundary42	Non-Participant	447916	5422190	575.9	41.1
St. John Boundary7	Non-Participant	448507	5421802	574.5	41.0
St. John Boundary33	Non-Participant	448032	5422020	579.4	41.0
St. John Boundary34	Non-Participant	448019	5422039	577.3	41.0
St. John Boundary6	Non-Participant	448526	5421790	574.6	40.9
St. John Boundary8	Non-Participant	448484	5421804	574.7	40.9
St. John Boundary9	Non-Participant	448461	5421803	575.2	40.9
St. John Boundary32	Non-Participant	448044	5422001	578.7	40.9
St. John Boundary43	Non-Participant	447895	5422199	577.2	40.9
St. John Boundary10	Non-Participant	448438	5421803	576.3	40.8
St. John Boundary11	Non-Participant	448416	5421802	578	40.8
St. John Boundary31	Non-Participant	448057	5421982	578.7	40.8
St. John Boundary5	Non-Participant	448541	5421773	574.8	40.7
St. John Boundary12	Non-Participant	448393	5421802	579.6	40.7
St. John Boundary30	Non-Participant	448070	5421963	578.7	40.7
St. John Boundary13	Non-Participant	448370	5421802	579.4	40.6
St. John Boundary29	Non-Participant	448082	5421944	578.7	40.6
St. John Boundary44	Non-Participant	447873	5422198	578.6	40.6
St. John Boundary4	Non-Participant	448555	5421755	575	40.5
St. John Boundary14	Non-Participant	448347	5421801	578.5	40.5
St. John Boundary28	Non-Participant	448095	5421925	579.5	40.5
St. John Boundary15	Non-Participant	448324	5421801	579.1	40.4
St. John Boundary27	Non-Participant	448108	5421906	580.2	40.4
St. John Boundary3	Non-Participant	448570	5421737	575.1	40.3
St. John Boundary16	Non-Participant	448301	5421800	579.4	40.3

St. John Boundary26	Non-Participant	448120	5421887	579.9	40.3
St. John Boundary45	Non-Participant	447854	5422185	580.8	40.3
St. John Boundary17	Non-Participant	448279	5421800	578.8	40.2
St. John Boundary2	Non-Participant	448584	5421719	575.1	40.1
St. John Boundary18	Non-Participant	448256	5421800	578.6	40.1
St. John Boundary25	Non-Participant	448133	5421868	579.8	40.1
St. John Boundary19	Non-Participant	448233	5421799	579	40.0
St. John Boundary24	Non-Participant	448146	5421849	580.4	40.0
St. John Boundary46	Non-Participant	447843	5422165	583.5	40.0
St. John Boundary1	Non-Participant	448592	5421698	575.9	39.9
St. John Boundary23	Non-Participant	448158	5421830	581.4	39.9
St. John Boundary47	Non-Participant	447842	5422142	584.4	39.9
St. John Boundary20	Non-Participant	448210	5421799	579.5	39.8
St. John Boundary236	Non-Participant	448593	5421694	576.2	39.8
St. John Boundary21	Non-Participant	448187	5421798	580.9	39.7
St. John Boundary22	Non-Participant	448171	5421811	581.9	39.7
St. John Boundary48	Non-Participant	447843	5422120	587.5	39.7
St. John Boundary235	Non-Participant	448588	5421672	576.7	39.6
St. John Boundary49	Non-Participant	447838	5422099	588.7	39.5
St. John Boundary234	Non-Participant	448573	5421655	576.4	39.4
St. John Boundary50	Non-Participant	447823	5422082	589.7	39.3
St. John Boundary233	Non-Participant	448552	5421647	576.4	39.3
St. John Boundary232	Non-Participant	448530	5421641	576.5	39.2
St. John Boundary51	Non-Participant	447818	5422060	590.3	39.1
St. John Boundary231	Non-Participant	448508	5421635	576.4	39.1
St. John Boundary230	Non-Participant	448485	5421629	576.9	39.0
St. John Boundary52	Non-Participant	447818	5422037	590.9	38.9
St. John Boundary53	Non-Participant	447819	5422014	591.2	38.8
St. John Boundary229	Non-Participant	448463	5421623	579	38.8
St. John Boundary228	Non-Participant	448441	5421617	582.9	38.7
St. John Boundary54	Non-Participant	447819	5421991	591.4	38.6
St. John Boundary227	Non-Participant	448427	5421608	584.1	38.6
St. John Boundary226	Non-Participant	448441	5421590	584.1	38.5
St. John Boundary55	Non-Participant	447820	5421969	591.9	38.4
St. John Boundary56	Non-Participant	447820	5421946	592.2	38.3
St. John Boundary225	Non-Participant	448455	5421572	585.2	38.3
St. John Boundary224	Non-Participant	448465	5421552	586.8	38.2

St. John Boundary57	Non-Participant	447821	5421923	592.3	38.1
St. John Boundary58	Non-Participant	447822	5421900	592.7	38.0
St. John Boundary223	Non-Participant	448465	5421529	587.7	37.9
St. John Boundary59	Non-Participant	447818	5421881	592.7	37.8
St. John Boundary222	Non-Participant	448454	5421510	587.7	37.7
St. John Boundary60	Non-Participant	447795	5421882	592.6	37.6
St. John Boundary221	Non-Participant	448437	5421495	587.8	37.6
St. John Boundary61	Non-Participant	447772	5421883	593	37.4
St. John Boundary220	Non-Participant	448422	5421479	587.9	37.4
St. John Boundary62	Non-Participant	447749	5421884	593.3	37.3
St. John Boundary219	Non-Participant	448434	5421460	587.7	37.2
St. John Boundary63	Non-Participant	447727	5421883	593.6	37.1
St. John Boundary218	Non-Participant	448446	5421440	587.3	37.1
St. John Boundary64	Non-Participant	447706	5421873	593.6	36.9
St. John Boundary217	Non-Participant	448450	5421418	587	36.9
St. John Boundary65	Non-Participant	447693	5421855	593.5	36.7
St. John Boundary216	Non-Participant	448444	5421396	587.3	36.7
St. John Boundary215	Non-Participant	448428	5421381	587.9	36.6
St. John Boundary66	Non-Participant	447691	5421832	594.1	36.5
St. John Boundary67	Non-Participant	447699	5421811	593.2	36.4
St. John Boundary214	Non-Participant	448408	5421369	588.2	36.4
St. John Boundary68	Non-Participant	447696	5421793	592.5	36.3
St. John Boundary213	Non-Participant	448388	5421357	588.6	36.3
St. John Boundary212	Non-Participant	448369	5421345	589.3	36.2
St. John Boundary69	Non-Participant	447682	5421775	592.4	36.1
St. John Boundary211	Non-Participant	448349	5421334	589.9	36.0
St. John Boundary70	Non-Participant	447667	5421758	592.8	35.9
St. John Boundary210	Non-Participant	448330	5421322	590.2	35.9
St. John Boundary71	Non-Participant	447653	5421740	593	35.7
St. John Boundary209	Non-Participant	448310	5421310	590.4	35.7
St. John Boundary208	Non-Participant	448290	5421298	590.6	35.6
St. John Boundary72	Non-Participant	447639	5421722	593	35.5
St. John Boundary207	Non-Participant	448271	5421287	590.7	35.5
St. John Boundary73	Non-Participant	447624	5421704	593.4	35.4
St. John Boundary206	Non-Participant	448251	5421275	591.6	35.3
St. John Boundary74	Non-Participant	447611	5421686	593.8	35.2
St. John Boundary205	Non-Participant	448232	5421263	591.6	35.2

St. John Boundary204	Non-Participant	448212	5421252	591.2	35.1
St. John Boundary75	Non-Participant	447608	5421663	594	35.0
St. John Boundary76	Non-Participant	447615	5421642	593.7	35.0
St. John Boundary77	Non-Participant	447625	5421622	593.1	34.9
St. John Boundary203	Non-Participant	448202	5421235	590.5	34.9
St. John Boundary78	Non-Participant	447623	5421599	593	34.8
St. John Boundary202	Non-Participant	448205	5421213	589.9	34.8
St. John Boundary79	Non-Participant	447619	5421577	593	34.7
St. John Boundary201	Non-Participant	448208	5421190	589.8	34.7
St. John Boundary80	Non-Participant	447616	5421554	593.4	34.5
St. John Boundary199	Non-Participant	448229	5421150	590.1	34.5
St. John Boundary200	Non-Participant	448216	5421169	589.9	34.5
St. John Boundary81	Non-Participant	447612	5421531	593.9	34.4
St. John Boundary198	Non-Participant	448242	5421131	591	34.4
St. John Boundary82	Non-Participant	447591	5421530	594.6	34.3
St. John Boundary197	Non-Participant	448254	5421112	591.4	34.3
St. John Boundary83	Non-Participant	447568	5421530	595.4	34.2
St. John Boundary196	Non-Participant	448267	5421093	591.1	34.2
St. John Boundary195	Non-Participant	448280	5421074	591.1	34.1
St. John Boundary84	Non-Participant	447545	5421530	596.2	34.0
St. John Boundary194	Non-Participant	448293	5421055	591.1	34.0
St. John Boundary85	Non-Participant	447522	5421531	597.2	33.9
St. John Boundary192	Non-Participant	448318	5421017	590.1	33.9
St. John Boundary193	Non-Participant	448305	5421036	590.3	33.9
St. John Boundary86	Non-Participant	447500	5421531	598.1	33.8
St. John Boundary191	Non-Participant	448330	5420998	590.9	33.8
St. John Boundary87	Non-Participant	447477	5421531	598.4	33.7
St. John Boundary88	Non-Participant	447454	5421530	599.2	33.6
St. John Boundary190	Non-Participant	448332	5420975	590.9	33.6
St. John Boundary89	Non-Participant	447433	5421521	600.5	33.5
St. John Boundary189	Non-Participant	448330	5420953	591.2	33.5
St. John Boundary188	Non-Participant	448328	5420930	592.1	33.4
St. John Boundary90	Non-Participant	447420	5421503	602.4	33.3
St. John Boundary91	Non-Participant	447416	5421481	603.1	33.2
St. John Boundary187	Non-Participant	448326	5420907	592.3	33.2
St. John Boundary92	Non-Participant	447415	5421458	604.3	33.1
St. John Boundary186	Non-Participant	448324	5420884	591.6	33.1

St. John Boundary93	Non-Participant	447415	5421435	604.8	33.0
St. John Boundary185	Non-Participant	448322	5420861	592.7	33.0
St. John Boundary94	Non-Participant	447415	5421412	606.2	32.9
St. John Boundary184	Non-Participant	448320	5420839	593.1	32.9
St. John Boundary95	Non-Participant	447415	5421390	605	32.8
St. John Boundary183	Non-Participant	448318	5420816	593.3	32.8
St. John Boundary96	Non-Participant	447414	5421367	604.3	32.7
St. John Boundary97	Non-Participant	447414	5421344	604.1	32.6
St. John Boundary98	Non-Participant	447414	5421321	603.5	32.6
St. John Boundary182	Non-Participant	448317	5420793	593.3	32.6
St. John Boundary99	Non-Participant	447413	5421298	603.6	32.5
St. John Boundary181	Non-Participant	448315	5420770	592.7	32.5
St. John Boundary100	Non-Participant	447413	5421275	603.6	32.4
St. John Boundary180	Non-Participant	448313	5420748	592.6	32.4
St. John Boundary101	Non-Participant	447413	5421252	603.6	32.3
St. John Boundary179	Non-Participant	448311	5420725	592.8	32.3
St. John Boundary102	Non-Participant	447413	5421230	603.6	32.2
St. John Boundary178	Non-Participant	448311	5420702	592.4	32.2
St. John Boundary103	Non-Participant	447412	5421207	605.1	32.1
St. John Boundary132	Non-Participant	447797	5420909	603.4	32.1
St. John Boundary177	Non-Participant	448311	5420679	592.1	32.1
St. John Boundary104	Non-Participant	447412	5421184	606.3	32.0
St. John Boundary131	Non-Participant	447774	5420909	604.9	32.0
St. John Boundary133	Non-Participant	447803	5420892	604.1	32.0
St. John Boundary176	Non-Participant	448311	5420656	592.3	32.0
St. John Boundary105	Non-Participant	447412	5421161	607.3	31.9
St. John Boundary129	Non-Participant	447729	5420910	605.7	31.9
St. John Boundary130	Non-Participant	447752	5420909	605.6	31.9
St. John Boundary134	Non-Participant	447804	5420869	605	31.9
St. John Boundary141	Non-Participant	447916	5420801	602	31.9
St. John Boundary175	Non-Participant	448310	5420633	592.5	31.9
St. John Boundary106	Non-Participant	447411	5421138	608.9	31.8
St. John Boundary128	Non-Participant	447706	5420910	605.8	31.8
St. John Boundary135	Non-Participant	447805	5420846	607	31.8
St. John Boundary139	Non-Participant	447874	5420805	604.6	31.8
St. John Boundary140	Non-Participant	447897	5420805	603.2	31.8
St. John Boundary142	Non-Participant	447917	5420778	602.8	31.8

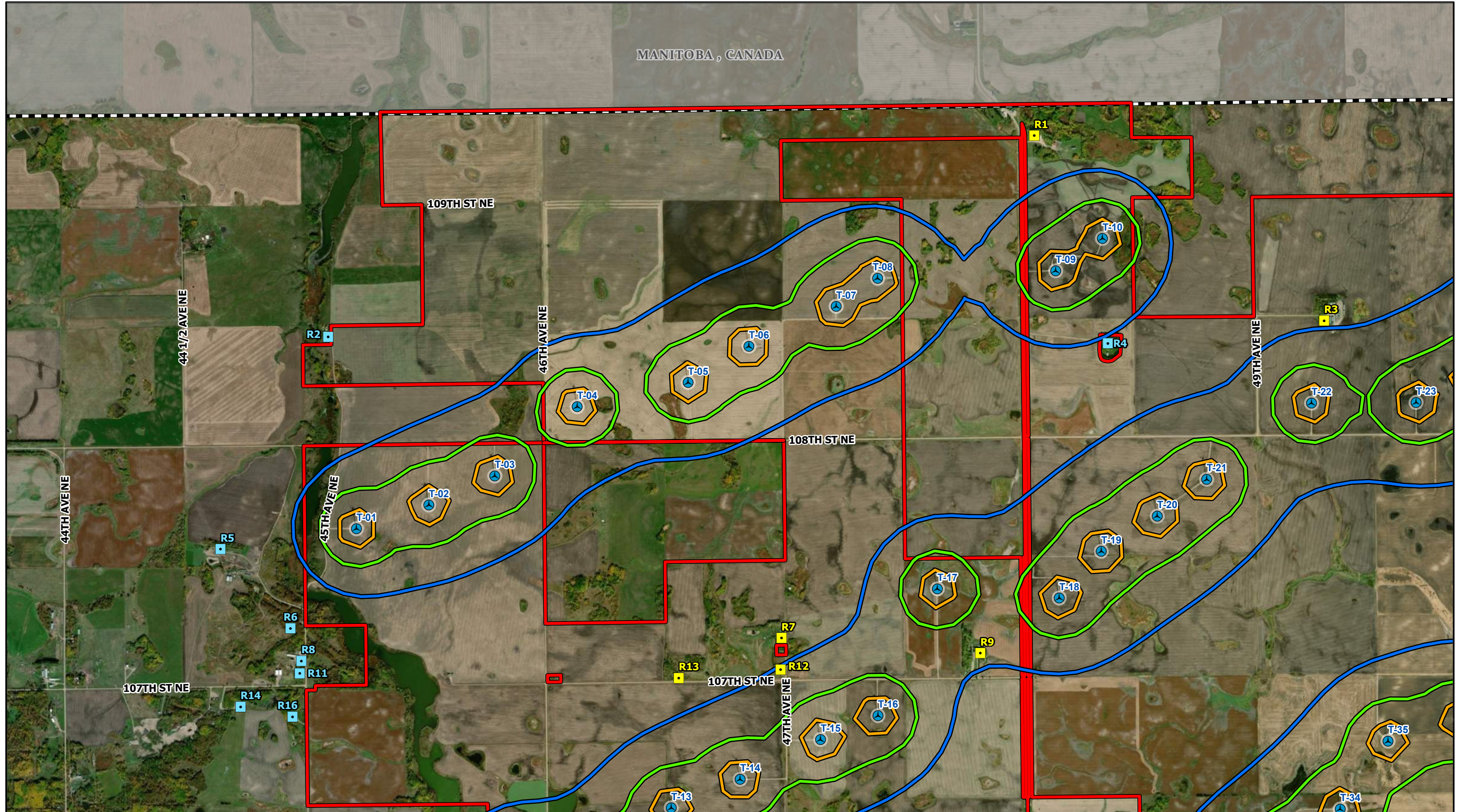
St. John Boundary174	Non-Participant	448310	5420611	592.9	31.8
St. John Boundary107	Non-Participant	447411	5421115	607.6	31.7
St. John Boundary108	Non-Participant	447411	5421093	606.8	31.7
St. John Boundary126	Non-Participant	447660	5420910	607.1	31.7
St. John Boundary127	Non-Participant	447683	5420910	606.3	31.7
St. John Boundary136	Non-Participant	447813	5420825	607.5	31.7
St. John Boundary137	Non-Participant	447830	5420810	605.3	31.7
St. John Boundary138	Non-Participant	447851	5420804	605.6	31.7
St. John Boundary143	Non-Participant	447918	5420755	604	31.7
St. John Boundary173	Non-Participant	448310	5420588	592.8	31.7
St. John Boundary109	Non-Participant	447411	5421070	606.7	31.6
St. John Boundary124	Non-Participant	447614	5420911	614	31.6
St. John Boundary125	Non-Participant	447637	5420911	610.2	31.6
St. John Boundary144	Non-Participant	447918	5420733	604.4	31.6
St. John Boundary153	Non-Participant	448068	5420657	597.7	31.6
St. John Boundary172	Non-Participant	448310	5420565	593.4	31.6
St. John Boundary110	Non-Participant	447410	5421047	606.9	31.5
St. John Boundary123	Non-Participant	447592	5420911	612.9	31.5
St. John Boundary145	Non-Participant	447919	5420710	604.9	31.5
St. John Boundary151	Non-Participant	448022	5420657	600.7	31.5
St. John Boundary152	Non-Participant	448045	5420657	598.8	31.5
St. John Boundary154	Non-Participant	448068	5420634	598.2	31.5
St. John Boundary171	Non-Participant	448310	5420542	594.4	31.5
St. John Boundary111	Non-Participant	447410	5421024	611.2	31.4
St. John Boundary121	Non-Participant	447546	5420911	608.4	31.4
St. John Boundary122	Non-Participant	447569	5420911	609.2	31.4
St. John Boundary146	Non-Participant	447922	5420687	605.4	31.4
St. John Boundary149	Non-Participant	447977	5420656	603.1	31.4
St. John Boundary150	Non-Participant	447999	5420657	602.6	31.4
St. John Boundary155	Non-Participant	448068	5420611	598.9	31.4
St. John Boundary170	Non-Participant	448306	5420520	594.8	31.4
St. John Boundary112	Non-Participant	447410	5421001	612.7	31.3
St. John Boundary120	Non-Participant	447523	5420912	608.4	31.3
St. John Boundary147	Non-Participant	447934	5420668	605.3	31.3
St. John Boundary148	Non-Participant	447954	5420657	604.1	31.3
St. John Boundary156	Non-Participant	448069	5420589	599.8	31.3
St. John Boundary169	Non-Participant	448291	5420502	595.5	31.3

St. John Boundary113	Non-Participant	447409	5420978	612.5	31.2
St. John Boundary118	Non-Participant	447477	5420912	609	31.2
St. John Boundary119	Non-Participant	447500	5420912	608.8	31.2
St. John Boundary157	Non-Participant	448069	5420566	600.1	31.2
St. John Boundary166	Non-Participant	448225	5420494	597.1	31.2
St. John Boundary167	Non-Participant	448248	5420493	596.4	31.2
St. John Boundary168	Non-Participant	448271	5420493	596	31.2
St. John Boundary114	Non-Participant	447409	5420955	610	31.1
St. John Boundary115	Non-Participant	447416	5420934	608.5	31.1
St. John Boundary116	Non-Participant	447433	5420918	608.4	31.1
St. John Boundary117	Non-Participant	447455	5420912	608.6	31.1
St. John Boundary158	Non-Participant	448069	5420543	601.1	31.1
St. John Boundary164	Non-Participant	448179	5420495	598.2	31.1
St. John Boundary165	Non-Participant	448202	5420494	597.6	31.1
St. John Boundary159	Non-Participant	448074	5420521	602.2	31.0
St. John Boundary160	Non-Participant	448089	5420504	602.1	31.0
St. John Boundary161	Non-Participant	448111	5420496	601.4	31.0
St. John Boundary162	Non-Participant	448133	5420496	599.9	31.0
St. John Boundary163	Non-Participant	448156	5420495	598.9	31.0

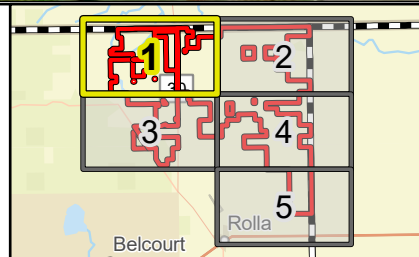
Border Winds - Predicted A-weighted noise level at test points 150 feet from receptor center

Noise Test Points 150 ft. from Receptor Center (Easting, Northing, Elevation(m)) - UTM Zone 14N, NAD 83, Meters													Receptor ID	
(452083,5427377,557.2)	(452074,5427398,556.9)	(452057,5427413,556.8)	(452035,5427417,556.8)	(452013,5427410,556.3)	(451998,5427393,556.4)	(451992,5427372,556.8)	(451997,5427350,556.7)	(451997,5427350,556.7)	(452013,5427333,557.9)	(452034,5427326,558.3)	(452056,5427330,558.4)	(452074,5427344,558.6)	(452083,5427365,558)	R1
(447270,5426068,571.9)	(447310,5426140,572.2)	(447319,5426119,572.3)	(447319,5426106,572.4)	(447310,5426086,572.5)	(447293,5426154,572.2)	(447292,5426071,572.6)	(447249,5426075,571.8)	(447234,5426135,571.2)	(447228,5426113,570.3)	(447233,5426092,570.9)	(447249,5426152,572.2)	(447271,5426159,572.5)	(447270,5426068,571.9)	R2
(454003,5426097,557.2)	(453994,5426064,557.8)	(453977,5426132,556.7)	(453955,5426046,556.2)	(453933,5426053,555.9)	(453918,5426070,555.8)	(453913,5426091,555.7)	(453918,5426113,555.6)	(453934,5426130,555.6)	(453955,5426137,556.2)	(453977,5426050,556.7)	(453995,5426118,557.1)	(454003,5426084,557.1)	(454003,5426097,557.2)	R3
(452550,5425973,557.4)	(452541,5425994,557.3)	(452524,5426013,557.2)	(452502,5426013,557.2)	(452479,5425929,557.2)	(452465,5425990,557.2)	(452465,5425996,557.4)	(452480,5425966,557.4)	(452501,5425922,557.2)	(452523,5425926,557.8)	(452541,5425940,557.6)	(452550,5425973,557.4)	(452550,5425973,557.4)	(452550,5425973,557.4)	R4
(446520,5424656,584.2)	(446560,5424673,585.1)	(446569,5424707,584.3)	(446569,5424694,584.4)	(446560,5424728,584.2)	(446543,5424742,584.4)	(446542,5424659,584.1)	(446499,5424663,584.5)	(446484,5424723,584.5)	(446478,5424701,584.5)	(446483,5424679,584.7)	(446499,5424740,584.1)	(446521,5424747,583.9)	(446520,5424656,584.2)	R5
(446979,5424207,581.8)	(447018,5424134,584.7)	(447027,5424167,581.9)	(447019,5424188,582.5)	(447019,5424155,582.5)	(447001,5424120,585)	(446958,5424203,582.1)	(446942,5424140,585.2)	(446936,5424162,583.9)	(446942,5424123,585.3)	(446979,5424134,584.7)	(446979,5424207,581.8)	(446979,5424207,581.8)	(446979,5424207,581.8)	R6
(450273,5424077,569.6)	(450312,5424004,568.8)	(450321,5424037,569)	(450321,5424025,568.8)	(450312,5424058,569.3)	(450295,5424073,569.8)	(450294,5423990,569.3)	(450251,5424070,568.6)	(450235,5424010,569.1)	(450230,5424032,568.7)	(450273,5424077,569.6)	(450273,5424077,569.6)	(450273,5424077,569.6)	(450273,5424077,569.6)	R7
(447047,5423896,583.9)	(447096,5423968,584.5)	(447096,5423947,584.3)	(447087,5423934,584.6)	(447087,5423914,584.4)	(447070,5423982,584.2)	(447069,5423990,583.9)	(447011,5423963,585.1)	(447011,5423963,585.1)	(447005,5423942,584.9)	(447047,5423896,583.9)	(447047,5423896,583.9)	(447047,5423896,583.9)	(447047,5423896,583.9)	R8
(451604,5423858,565.6)	(451644,5423930,564.7)	(451652,5423909,564.5)	(451652,5423896,564.2)	(451643,5423876,564.1)	(451626,5423944,564.7)	(451626,5423862,564.8)	(451583,5423942,564.4)	(451567,5423882,566.3)	(451561,5423904,565.5)	(451604,5423858,565.6)	(451604,5423858,565.6)	(451604,5423858,565.6)	(451604,5423858,565.6)	R9
(455508,5423872,555.2)	(455499,5423893,555.6)	(455482,5423908,554.6)	(455460,5423912,554)	(455438,5423905,553.7)	(455423,5423888,553.6)	(455417,5423867,554.1)	(455422,5423845,554.7)	(455438,5423828,554.8)	(455459,5423821,554.4)	(455508,5423872,555.2)	(455508,5423872,555.2)	(455508,5423872,555.2)	(455508,5423872,555.2)	R10
(447035,5423903,584)	(447075,5423884,584.3)	(447084,5423864,584.6)	(447083,5423851,584.7)	(447075,5423885,584.1)	(447058,5423899,583.9)	(447057,5423816,583.9)	(447014,5423896,584)	(446998,5423836,583.9)	(446993,5423858,585.1)	(447035,5423903,584)	(447035,5423903,584)	(447035,5423903,584)	(447035,5423903,584)	R11
(450261,5423774,567.3)	(450302,5423846,569.2)	(450310,5423825,568.1)	(450310,5423812,567.9)	(450301,5423792,568.3)	(450284,5423860,568.5)	(450284,5423777,567.2)	(450241,5423858,568)	(450225,5423797,567.6)	(450219,5423819,567.8)	(450261,5423774,567.3)	(450261,5423774,567.3)	(450261,5423774,567.3)	(450261,5423774,567.3)	R12
(449577,5423731,570.1)	(449618,5423803,568.3)	(449626,5423782,568.5)	(449626,5423769,568.9)	(449617,5423749,569.8)	(449600,5423817,568.3)	(449600,5423734,570)	(449557,5423815,568.8)	(449541,5423755,570.3)	(449535,5423776,570.1)	(449577,5423731,570.1)	(449577,5423731,570.1)	(449577,5423731,570.1)	(449577,5423731,570.1)	R13
(446633,5423596,592.4)	(446682,5423613,590.8)	(446682,5423647,587.7)	(446656,5423634,588.9)	(446656,5423668,587)	(446656,5423682,587.2)	(446655,5423599,591.9)	(446613,5423680,589.5)	(446597,5423619,591.1)	(446591,5423641,590.4)	(446633,5423596,592.4)	(446633,5423596,592.4)	(446633,5423596,592.4)	(446633,5423596,592.4)	R14
(458962,5423631,550.3)	(458953,5423598,549.5)	(458936,5423666,550.3)	(458913,5423580,549.8)	(458913,5423580,549.8)	(458891,5423587,549.2)	(458876,5423604,548.7)	(458876,5423647,549.4)	(458892,5423664,549.3)	(458913,5423671,549.9)	(458962,5423631,550.3)	(458962,5423631,550.3)	(458962,5423631,550.3)	(458962,5423631,550.3)	R15
(446982,5423613,583.4)	(447021,5423540,586.3)	(447030,5423574,586.2)	(447030,5423561,586.3)	(447021,5423595,585.7)	(447004,5423609,583.9)	(447003,5423526,587.9)	(446960,5423607,583.9)	(446945,5423590,585.7)	(446939,5423568,587)	(446982,5423613,583.4)	(446982,5423613,583.4)	(446982,5423613,583.4)	(446982,5423613,583.4)	R16
(462188,5423563,532)	(462180,5423584,532)	(462162,5423598,533.1)	(462140,5423602,533.2)	(462118,5423519,532.5)	(462103,5423535,532.5)	(462098,5423557,532.7)	(462103,5423579,533)	(462119,5423595,533.1)	(462140,5423511,532.6)	(462188,5423563,532)	(462188,5423563,532)	(462188,5423563,532)	(462188,5423563,532)	R17
(452705,5422234,565.8)	(452662,5422231,565.4)	(452646,5422214,565.2)	(452731,5422186,567.4)	(452722,5422165,567.5)	(452661,5422154,565.3)	(452682,5422147,565.6)	(452705,5422151,566.4)	(452646,5422171,565.4)	(452640,5422193,565.4)	(452705,5422234,565.8)	(452705,5422234,565.8)	(452705,5422234,565.8)	(452705,5422234,565.8)	R18
(450909,5422234,567.2)	(450948,5422161,567.3)	(450957,5422194,567.1)	(450957,5422182,567.2)	(450949,5422215,566.9)	(450931,5422147,567.3)	(450931,5422230,567)	(450888,5422227,567.3)	(450872,5422167,567.2)	(450866,5422189,567.3)	(450909,5422234,567.2)	(450909,5422234,567.2)	(450909,5422234,567.2)	(450909,5422234,567.2)	R19
(452773,5422196,565.3)	(452781,5422162,565.4)	(452733,5422214,566.9)	(452711,5422130,566.2)	(452711,5422130,566.2)	(452696,5422147,565.9)	(452691,5422169,566.6)	(452696,5422191,567.3)	(452712,5422207,567)	(452733,5422123,566)	(452773,5422196,565.3)	(452773,5422196,565.3)	(452773,5422196,565.3)	(452773,5422196,565.3)	R20
(457517,5422150,554.6)	(457509,5422171,555)	(457491,5422185,555)	(457469,5422189,555.3)	(457447,5422105,556.7)	(457432,5422122,556.4)	(457426,5422144,555.5)	(457432,5422166,555.6)	(457448,5422182,555.7)	(457468,5422098,556)	(457517,5422150,554.6)	(457517,5422150,554.6)	(457517,5422150,554.6)	(457517,5422150,554.6)	R21
(448732,5422118,582.3)	(448780,5422045,582.7)	(448780,5422079,582.7)	(448780,5422066,582.6)	(448772,5422100,582.6)	(448754,5422114,582.7)	(448754,5422031,582.4)	(448695,5422051,581.5)	(448689,5422073,583.1)	(448731,5422027,581.3)	(448732,5422118,582.3)	(448732,5422118,582.3)	(448732,5422118,582.3)	(448732,5422118,582.3)	R22
(450470,5422078,566.4)	(450509,5422005,567.3)	(450518,5422026,566.8)	(450518,5422026,566.8)	(450509,5422059,566.1)	(450492,5422074,565.9)	(450491,5421991,567.8)	(450448,5422071,566.8)	(450432,5422011,567.3)	(450427,5422033,567.5)	(450470,5422078,566.4)	(450470,5422078,566.4)	(450470,5422078,566.4)	(450470,5422078,566.4)	R23
(447719,5421889,593.6)	(447768,5421961,593.2)	(447768,5421907,593.2)	(447768,5421907,593.2)	(447759,5421907,593.3)	(447742,5421892,593.5)	(447742,5421975,593.5)	(447699,5421973,593.4)	(447683,5421913,593.9)	(447677,5421934,593.8)	(447719,5421889,593.6)	(447719,5421889,593.6)	(447719,5421889,593.6)	(447719,5421889,593.6)	R24
(447143,5421914,600.3)	(447182,5421841,599.2)	(447191,5421875,599.1)	(447191,5421862,598.9)	(447182,5421896,599.5)	(447165,5421910,600)	(447164,5421827,600.1)	(447121,5421831,603.2)	(447106,5421891,601)	(447100,5421869,601.7)	(447143,5421914,600.3)	(447143,5421914,600.3)	(447143,5421914,600.3)	(447143,5421914,600.3)	R25
(459704,5421792,548.1)	(459655,5421831,548.1)	(459618,5421808,549.8)	(459618,5421786,550.4)	(459634,5421824,548.9)	(459634,5421824,548.9)	(459634,5421824,548.9)	(459634,5421813,547.9)	(459634,5421813,547.9)	(459634,5421747,550.6)	(459704,5421792,548.1)	(459704,5421792,548.1)	(459704,5421792,548.1)	(459704,5421792,548.1)	R26
(459633,5421791,548.7)	(459644,5421812,548.6)	(459627,5421827,549)	(459605,5421831,548.8)	(459583,5421824,548.4)	(459568,5421808,548.4)	(459562,5421786,548.4)	(459562,5421764,549.1)	(459563,5421747,550.3)	(459604,5421740,550.4)	(459633,5421791,548.7)	(459633,5421791,548.7)	(459633,5421791,548.7)	(459633,5421791,548.7)	R27
(447268,5421701,602.3)	(447307,5421628,601.5)	(447316,5421628,601.5)	(447307,5421649,601.5)	(447307,5421683,600.9)	(447290,5421697,601.2)	(447289,5421614,601.4)	(447289,5421614,601.4)	(447225,5421678,603)	(447225,5421636,603.2)	(447268,5421701,602.3)	(447268,5421701,602.3)	(447268,5421701,602.3)	(447268,5421701,602.3)	R28
(457670,5421688,555.5)	(457710,5421615,555.4)	(457719,5421648,555.7)	(457718,5421636,555.6)	(457710,5421669,555.5)	(457693,5421684,555.1)	(457692,5421601,555.7)	(457649,5421681,556.3)	(457633,5421621,557.2)	(457628,5421643,556.8)	(457670,5421688,555.5)	(457670,5421688,555.5)	(457670,5421688,555.5)	(457670,5421688,555.5)	R29
(447466,5421585,597.9)	(447458,5421606,598.2)	(447448,5421620,598.8)	(447438,5421616,599.7)	(447397,5421617,600.2)	(447381,5421601,601.1)	(447375,5421579,602.6)	(447381,5421557,602.6)	(447399,5421541,602.9)	(447417,5421533,601.2)	(447466,5421585,597.9)	(447466,5421585,597.9)	(447466,5421585,597.9)	(447466,5421585,597.9)	R30
(447459,5421427,603)	(447450,5421448,603.4)	(447433,5421462,603.8)	(447411,5421466,604.1)	(447389,5421459,605.2)	(447374,5421443,605.6)	(447368,5421421,605.7)	(447373,5421399,605.2)	(447389,5421383,605)	(447410,5421375,604.4)	(447459,5421427,603)	(447459,5421427,603)	(447459,5421427,603)	(447459,5421427,603)	R31
(458203,5420590,554.1)	(458251,5420517,554.9)	(458242,5420538,554.6)	(458242,5420538,554.6)	(458242,5420538,554.6)	(458242,5420538,554.6)	(458242,5420538,554.6)	(458166,5420567,553.4)	(458166,5420567,553.4)	(458166,5420567,553.4)	(458203,5420590,554.1)	(458203,5420590,554.1)	(458203,5420590,554.1)	(458203,5420590,554.1)	R32
(458349,5419476,552.2)	(458388,5419403,551.9)	(458397,5419436,552.2)	(458397,5419424,552)	(458388,5419457,552.3)	(458371,5419472,552.1)	(458370,5419389,551.8)	(458327,5419392,551.2)	(458312,5419453,553.2)	(458306,5419431,553)	(458349,5419476,552.2)	(458349,5419476,552.2)	(458349,5419476,552.2)	(458349,5419476,552.2)	R33
(458631,5418934,549.7)	(458670,5418906,551.1)	(458670,5418955,551)	(458660,5418972,550.7)	(458671,5418952,549.8)	(458654,5419020,550.9)	(458653,5418937,550.1)	(458610,5418941,549.4)	(458594,5418957,549.4)	(458589,5418979,549.7)	(458631,5418934,549.7)	(458631,5418934,549.7)	(458631,5418934,549.7)	(458631,5418934,549.7)	R34

MANITOBA, CANADA



Data Source(s): Westwood (2021); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).

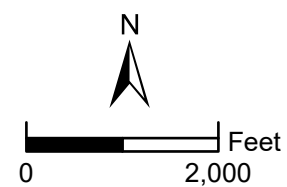


Legend

- Project Area
- County Boundary
- Canada
- Turbine
- St. John Receptor Boundary
- Receptor Location**
- Participating
- Not Participating

Noise Impact in Decibels

- 45 dB(A)
- 50 dB(A)
- 55 dB(A)



Border Winds Project

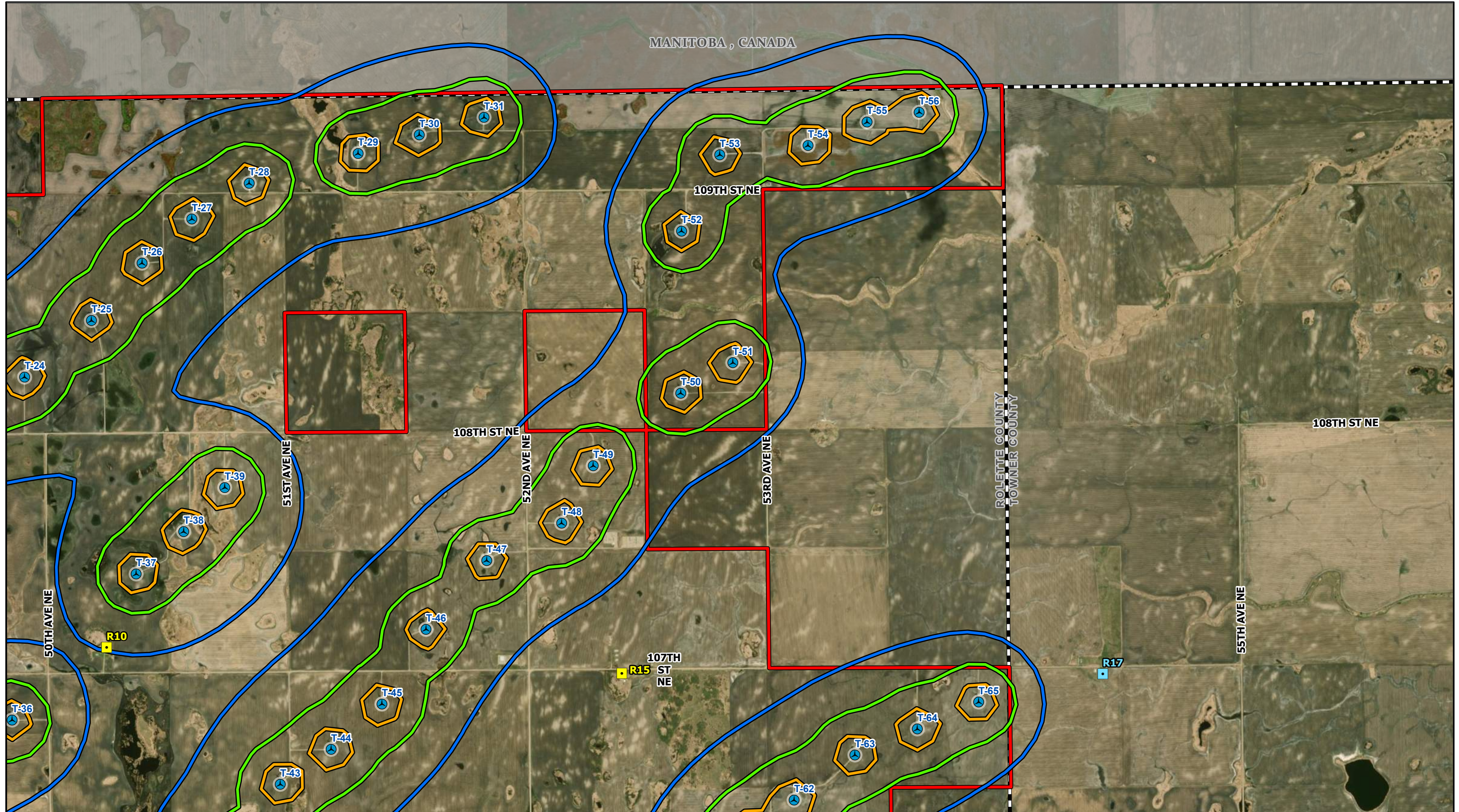
Rolette County, North Dakota

Wind Noise Impacts Map Book

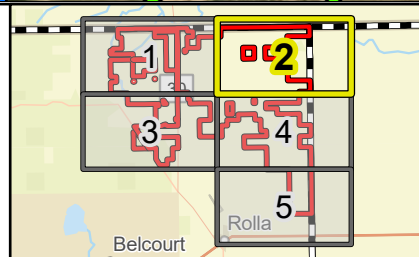
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Map Document: \\westwoodps.local\Global\Projects\0003319_01\1040_Environmental\Noise and Shadow\text\Bibis\210622_Update\DW_NoiseAndShadow_210622.aprx 8/19/2021 11:41 AM NGBryant



Data Source(s): Westwood (2021); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).



Legend

- Project Area
- County Boundary
- Canada
- Turbine

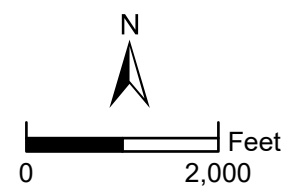
- St. John Receptor Boundary

Receptor Location

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Noise Impact in Decibels

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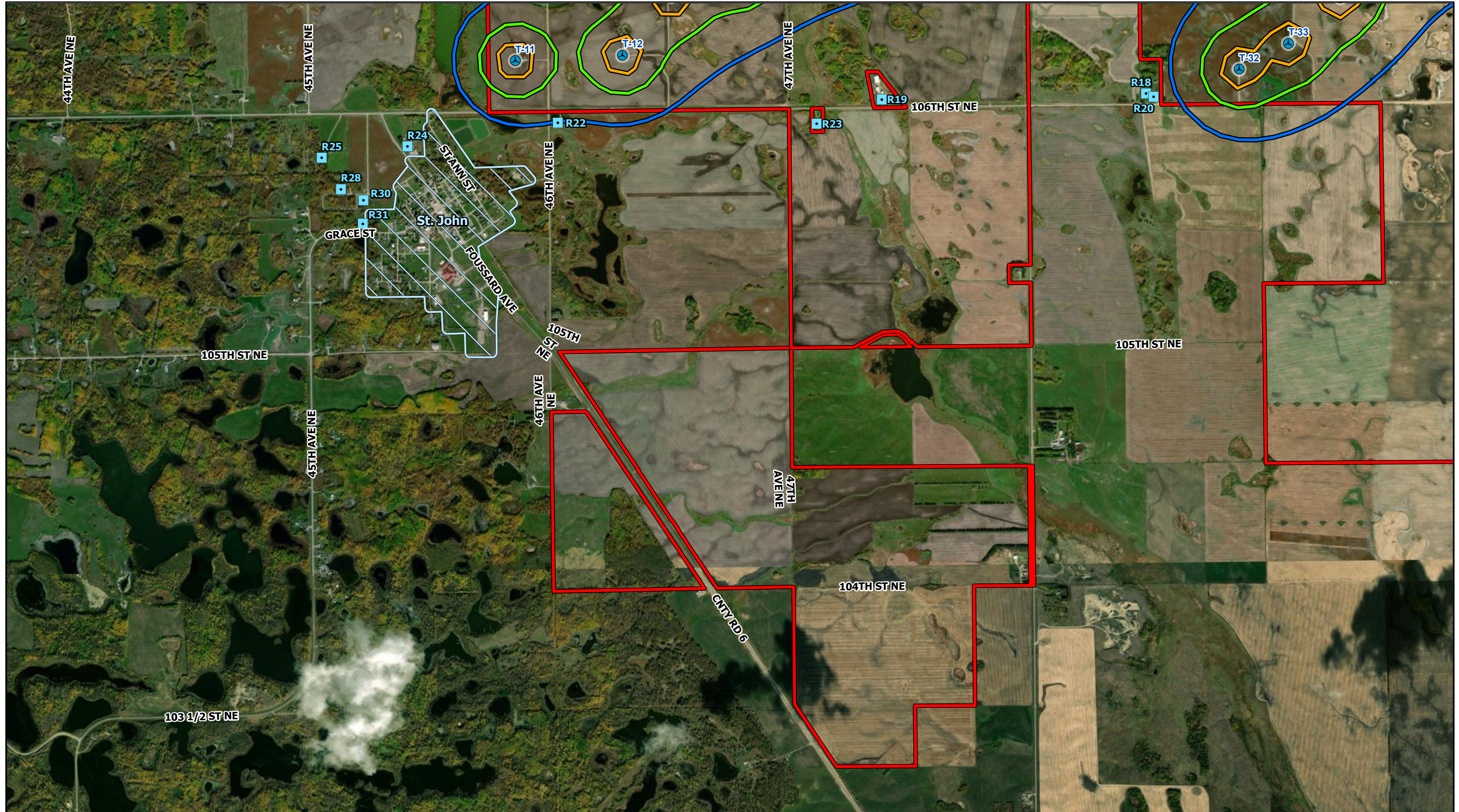


Border Winds Project

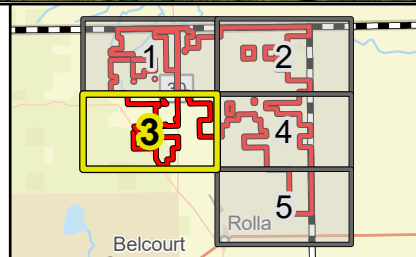
Rolette County, North Dakota

Wind Noise Impacts Map Book

Map Document: \\westwoodps.local\Global\Projects\0003319_01\1040_Environmental\Noise and Shadow\text\1040_0222_Update\DW_NoiseAndShadow_210622.aprx 8/19/2021 11:41 AM NGBryant



Data Source(s): Westwood (2021); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).



Legend

- Project Area
- County Boundary
- Canada
- Turbine

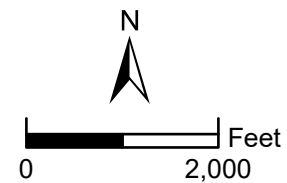
St. John Receptor Boundary

Receptor Location

- Participating
- Not Participating

Noise Impact in Decibels

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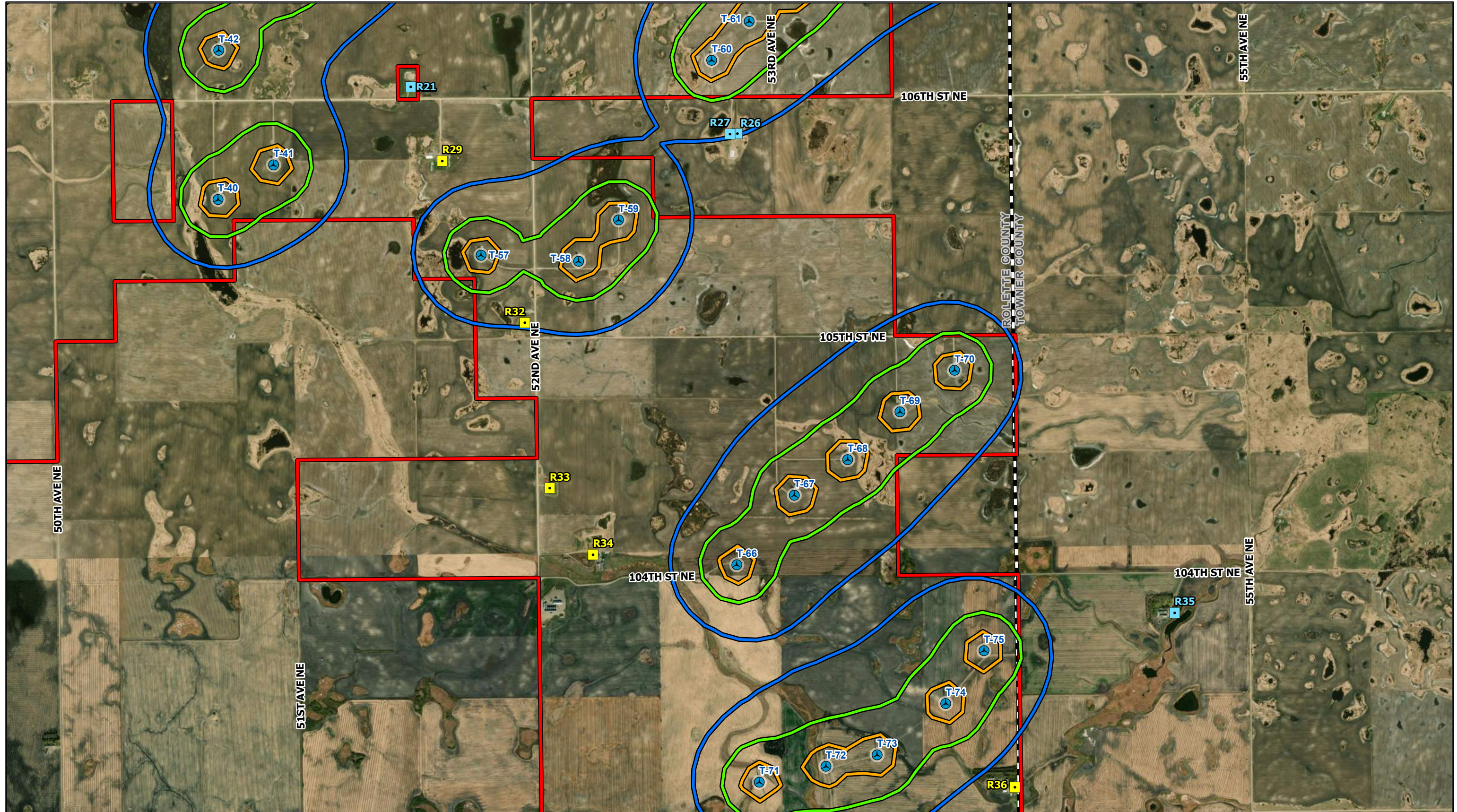


Border Winds Project

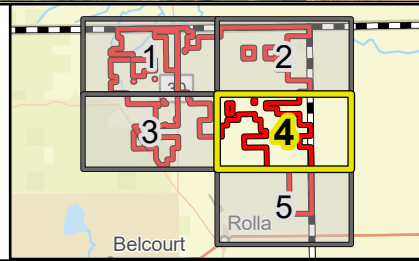
Rolette County, North Dakota

Wind Noise Impacts Map Book

Map Document: \\westwoodps.local\Global Projects\0003319_01\040_Environmental\Noise and Shadow\text\110622_Update\DW_NoiseAndShadow_210622.aprx 8/19/2021 11:41 AM NGBryant



Data Source(s): Westwood (2021); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).

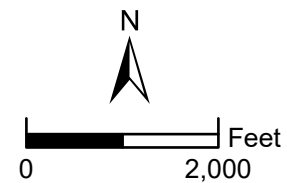


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Border Winds Project

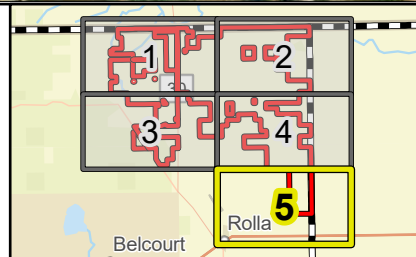
Rolette County, North Dakota

Wind Noise Impacts Map Book



Data Source(s): Westwood (2021); ESRI WMS Imagery & World Streets Basemaps (Accessed 2021); U.S. Census Bureau (2020).

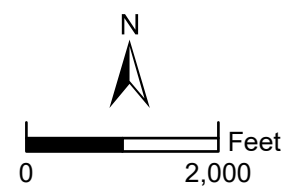
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Legend

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Border Winds Project

Rolette County, North Dakota

Wind Noise Impacts Map Book

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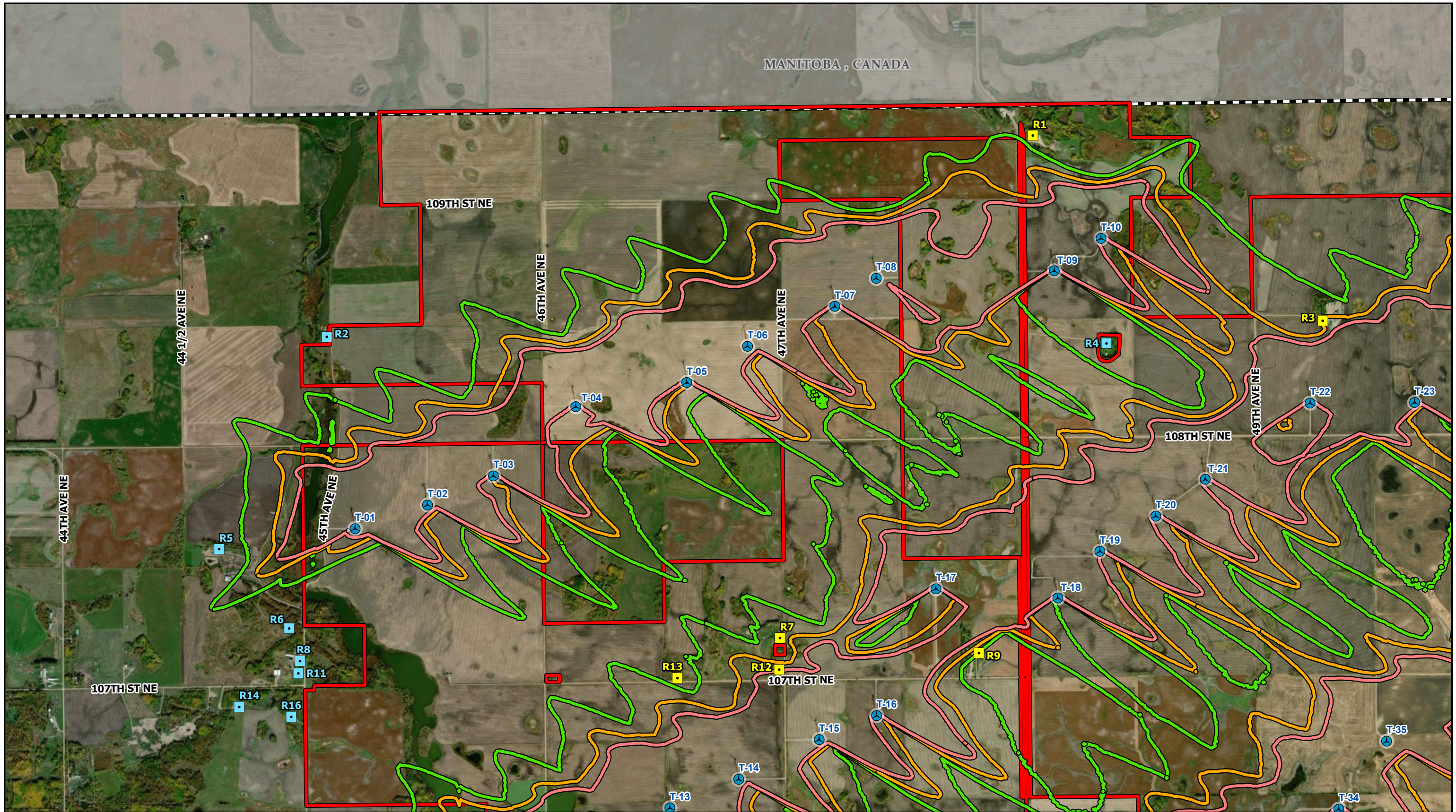
Exhibit 3 – Shadow Flicker Results and Maps

Border Winds - Real case shadow flicker hours at receptors within 1 mile of proposed turbines
 Receptors sorted by receptor ID

Predicted Shadow Flicker at Receiver - UTM Zone 14N, NAD 83, Meters					
Shadow Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AMSL (m)	Real Case Shadow HH:MM / Year
R1	Participant	452037	5427371	558.5	03:44
R2	Non-Participant	447273	5426113	572.6	04:18
R3	Participant	453958	5426091	556.6	21:02
R4	Non-Participant	452504	5425967	558	04:04
R5	Non-Participant	446523	5424701	585.9	06:07
R6	Non-Participant	446982	5424161	584.9	00:00
R7	Non-Participant	450275	5424031	570.1	15:30
R8	Non-Participant	447051	5423941	584.8	00:00
R9	Participant	451607	5423903	565.2	09:23
R10	Participant	455463	5423866	555.5	13:13
R11	Non-Participant	447038	5423858	585.2	01:05
R12	Participant	450265	5423819	568	29:25:00
R13	Participant	449581	5423776	569.9	06:38
R14	Non-Participant	446637	5423641	591	00:12
R15	Participant	458916	5423625	550.3	07:08
R16	Non-Participant	446984	5423568	587.2	00:51
R17	Non-Participant	462143	5423557	534.3	06:43
R18	Non-Participant	452686	5422192	567.2	20:39
R19	Non-Participant	450912	5422188	567.5	04:20
R20	Non-Participant	452736	5422169	567.5	26:22:00
R21	Non-Participant	457472	5422144	555.6	06:59
R22	Non-Participant	448735	5422073	583.4	00:00
R23	Non-Participant	450472	5422032	567.9	03:40
R24	Non-Participant	447723	5421934	594.7	01:28
R25	Non-Participant	447146	5421869	600.6	02:03
R26	Non-Participant	459658	5421786	549	05:52
R27	Non-Participant	459608	5421785	550.4	06:39
R28	Non-Participant	447271	5421656	602.2	00:06
R29	Participant	457673	5421642	557.3	12:49
R30	Non-Participant	447421	5421579	601.1	00:18
R31	Non-Participant	447414	5421421	605.9	00:21
R32	Participant	458206	5420544	555.2	01:56
R33	Participant	458352	5419430	553	03:13
R34	Participant	458634	5418979	551.1	08:11
R35	Non-Participant	462530	5418513	533.2	03:36
R36	Participant	461435	5417361	537.3	10:06
Max at St. John Boundary	Non-Participant	#	#	#	21:41

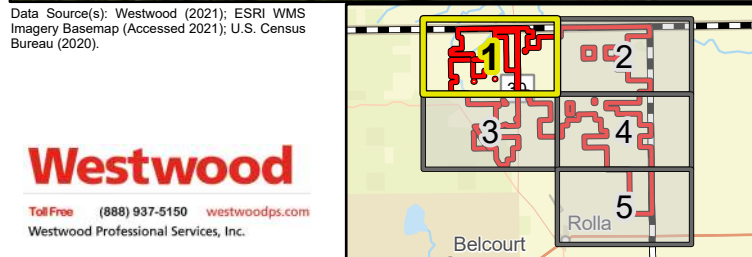
Border Winds - Real case shadow flicker hours at receptors within 1 mile of proposed turbines
 Receptors sorted by shadow hours / year

Predicted Shadow Flicker at Receiver - UTM Zone 14N, NAD 83, Meters					
Shadow Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AMSL (m)	Real Case Shadow HH:MM / Year
R12	Participant	450265	5423819	568	29:25:00
R20	Non-Participant	452736	5422169	567.5	26:22:00
Max at St. John Boundary	Non-Participant	#	#	#	21:41
R3	Participant	453958	5426091	556.6	21:02
R18	Non-Participant	452686	5422192	567.2	20:39
R7	Non-Participant	450275	5424031	570.1	15:30
R10	Participant	455463	5423866	555.5	13:13
R29	Participant	457673	5421642	557.3	12:49
R36	Participant	461435	5417361	537.3	10:06
R9	Participant	451607	5423903	565.2	09:23
R34	Participant	458634	5418979	551.1	08:11
R15	Participant	458916	5423625	550.3	07:08
R21	Non-Participant	457472	5422144	555.6	06:59
R17	Non-Participant	462143	5423557	534.3	06:43
R27	Non-Participant	459608	5421785	550.4	06:39
R13	Participant	449581	5423776	569.9	06:38
R5	Non-Participant	446523	5424701	585.9	06:07
R26	Non-Participant	459658	5421786	549	05:52
R19	Non-Participant	450912	5422188	567.5	04:20
R2	Non-Participant	447273	5426113	572.6	04:18
R4	Non-Participant	452504	5425967	558	04:04
R1	Participant	452037	5427371	558.5	03:44
R23	Non-Participant	450472	5422032	567.9	03:40
R35	Non-Participant	462530	5418513	533.2	03:36
R33	Participant	458352	5419430	553	03:13
R25	Non-Participant	447146	5421869	600.6	02:03
R32	Participant	458206	5420544	555.2	01:56
R24	Non-Participant	447723	5421934	594.7	01:28
R11	Non-Participant	447038	5423858	585.2	01:05
R16	Non-Participant	446984	5423568	587.2	00:51
R31	Non-Participant	447414	5421421	605.9	00:21
R30	Non-Participant	447421	5421579	601.1	00:18
R14	Non-Participant	446637	5423641	591	00:12
R28	Non-Participant	447271	5421656	602.2	00:06
R6	Non-Participant	446982	5424161	584.9	00:00
R8	Non-Participant	447051	5423941	584.8	00:00
R22	Non-Participant	448735	5422073	583.4	00:00



Data Source(s): Westwood (2021); ESRI WMS Imagery Basemap (Accessed 2021); U.S. Census Bureau (2020).

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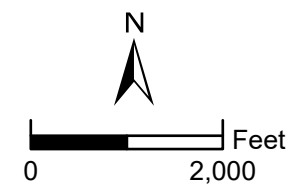
Legend

- Project Area
- County Boundary
- Canada
- Turbine
- St. John Receptor Boundary
- Participating Receptor Location
- Not Participating Receptor Location

Turbine Shadow Flicker in Hours Per Year

- 10 Hrs/Yr
- 20 Hrs/Yr
- 30 Hrs/Yr

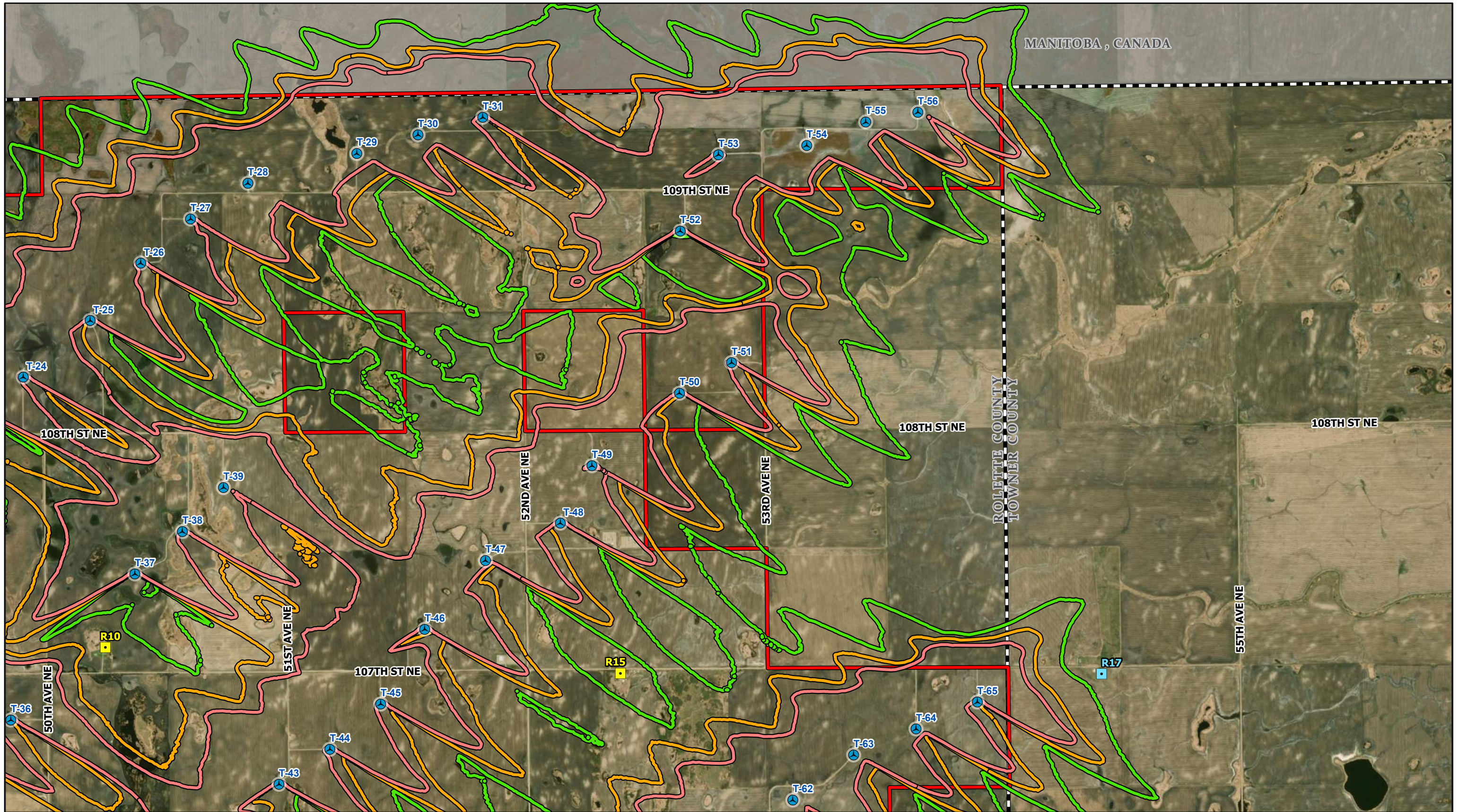
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Border Winds Project

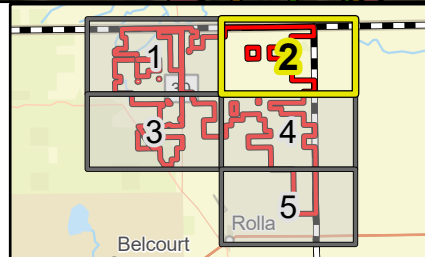
Rolette County, North Dakota

Turbine Shadow Impacts Map Book



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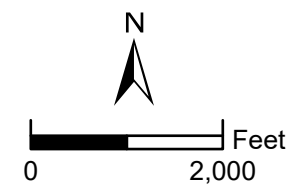


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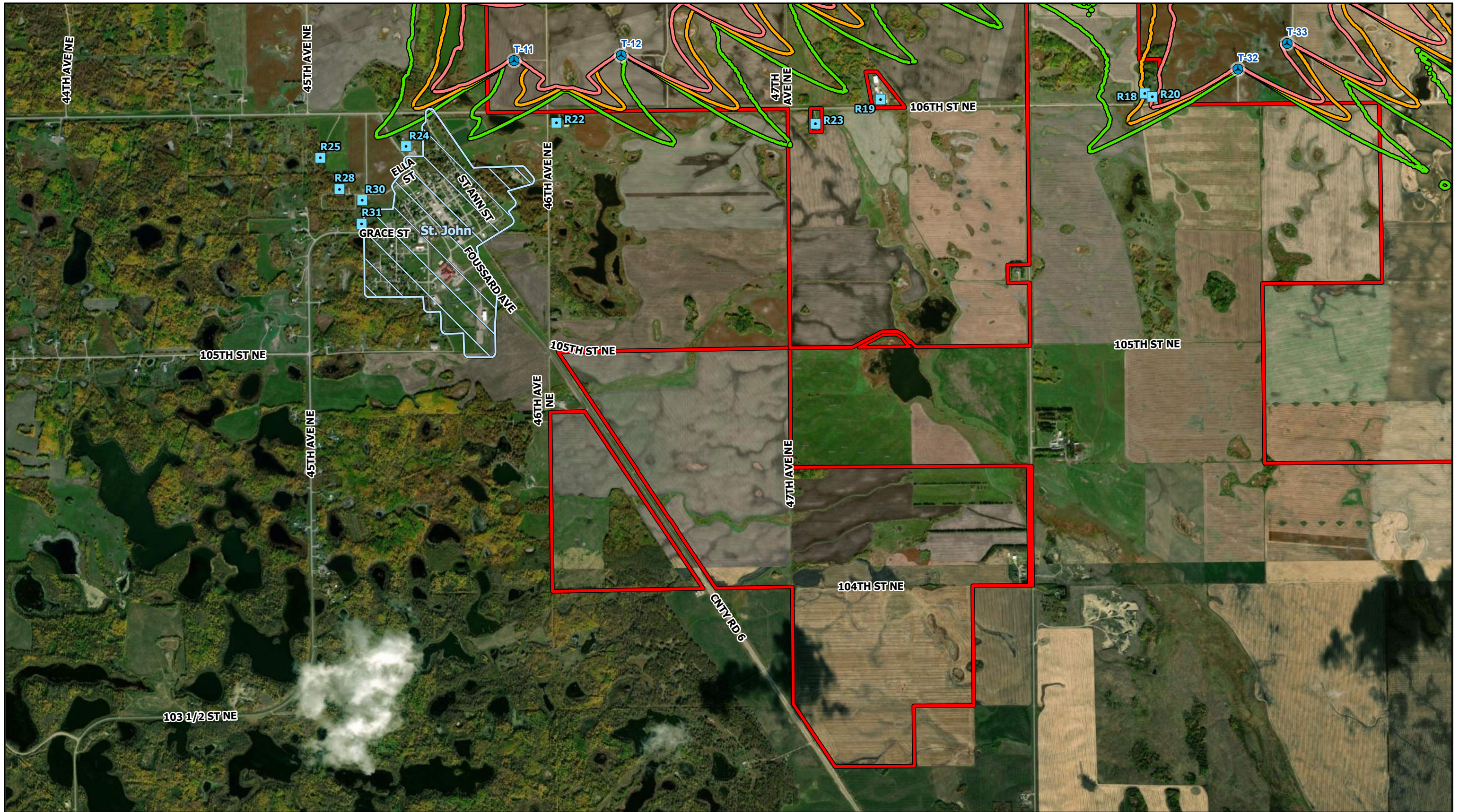


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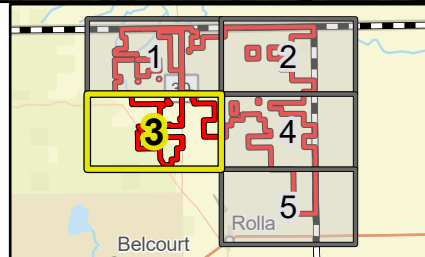
Rolette County, North Dakota

Turbine Shadow Impacts Map Book

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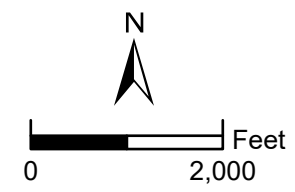


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- 30 Hrs/Yr

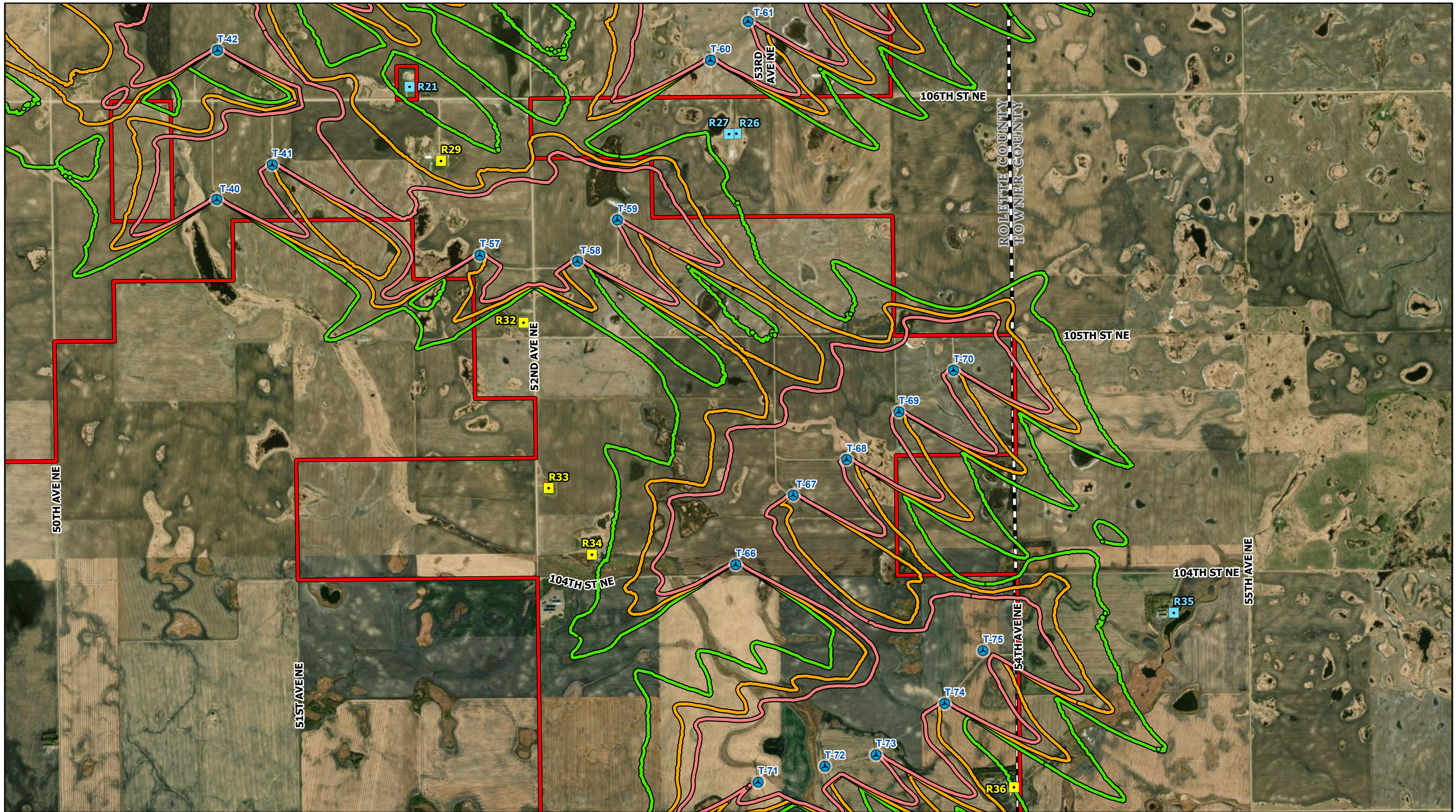


Border Winds Project

Rolette County, North Dakota

Turbine Shadow Impacts Map Book

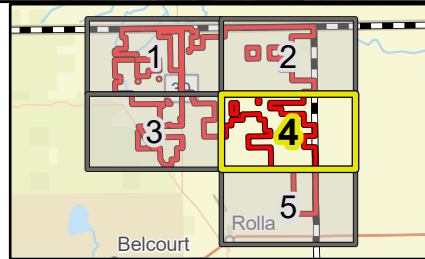
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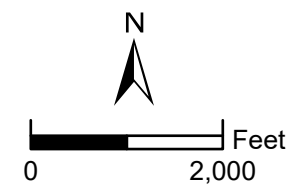


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- Not Participating

Turbine Shadow Flicker in Hours Per Year

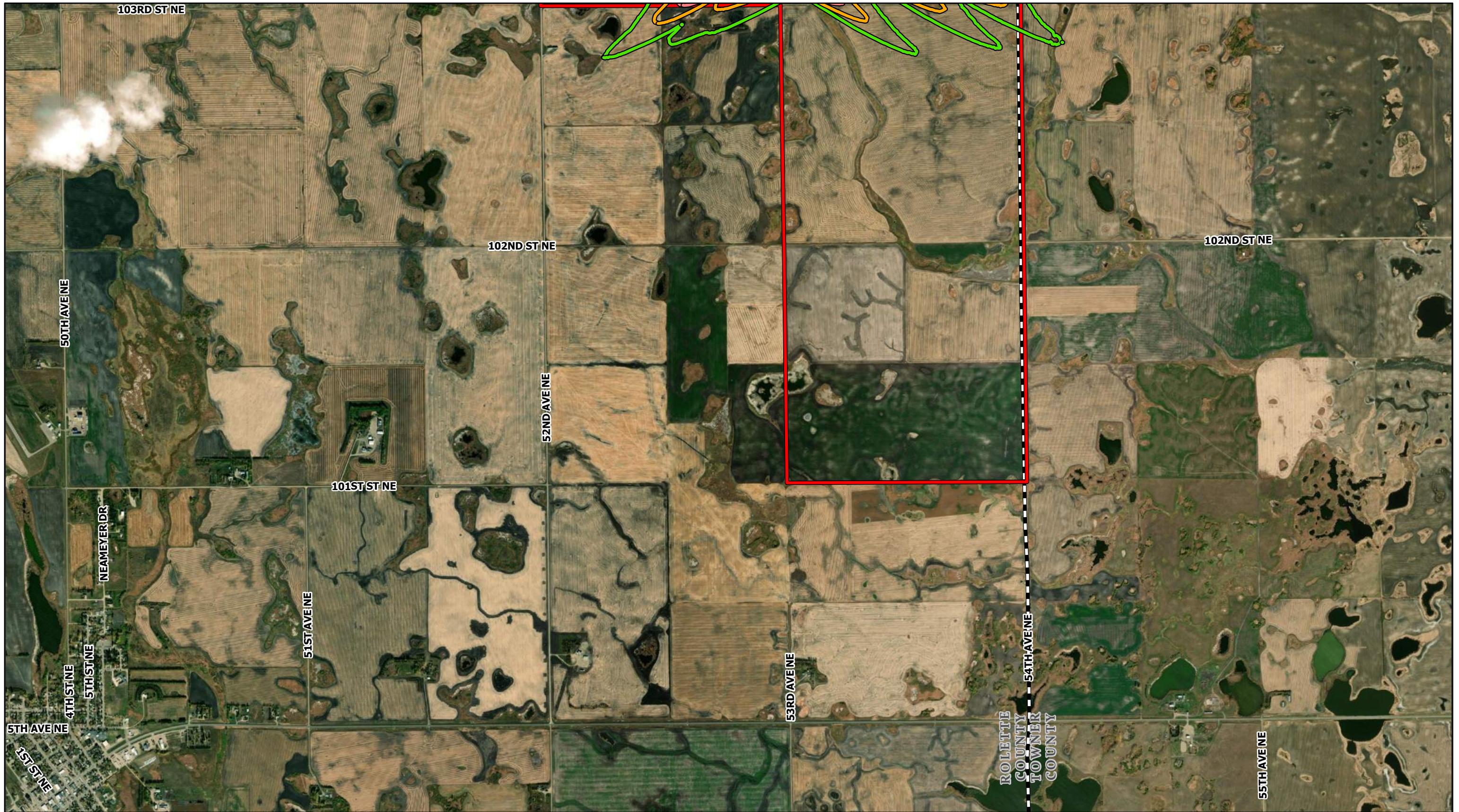
- 10 Hrs/Yr
- 20 Hrs/Yr
- 30 Hrs/Yr



Border Winds Project

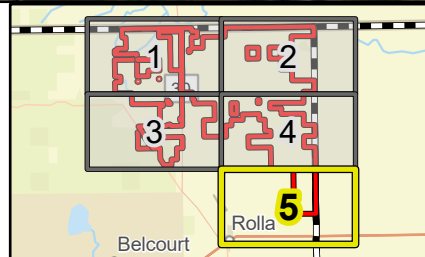
Rolette County, North Dakota

Turbine Shadow Impacts Map Book



Data Source(s): Westwood (2021); ESRI WMS Imagery Basemap (Accessed 2021); U.S. Census Bureau (2020).

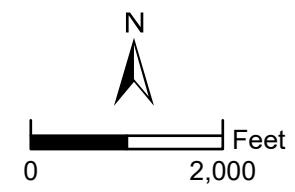
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Border Winds Project

Rolette County, North Dakota

Turbine Shadow Impacts Map Book

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Appendix B
Obstruction Evaluation & Airspace Analysis Report
Microwave Beam Path Analysis Report

Borders Wind Project

Xcel Energy

Rolette County, North Dakota

Obstruction Evaluation & Airspace Analysis

June 24, 2020



Capitol Airspace Group

capitolairspace.com

(703) 256 - 2485



Summary

Capitol Airspace conducted an obstruction evaluation and airspace analysis for the Borders wind project in Rolette County, North Dakota. The purpose for this analysis was to identify obstacle clearance surfaces established by the Federal Aviation Administration (FAA) that could limit increasing existing wind turbine heights from 481 feet above ground level (AGL) to 493 or 509 feet AGL. This analysis assessed height constraints overlying 75 existing wind turbine locations (black points, [Figure 1](#)), as well as an approximately 44-square-mile study area (black outline, [Figure 1](#)).

14 CFR Part 77.9 requires that that all structures exceeding 200 feet AGL be submitted to the FAA so that an aeronautical study can be conducted. The FAA's objective in conducting aeronautical studies is to ensure that proposed structures do not affect the safety of air navigation or the efficient utilization of navigable airspace by aircraft. The result of an aeronautical study is the issuance of a determination of 'hazard' or 'no hazard' that can be used by the proponent to obtain necessary local construction permits. It should be noted that the FAA has no control over land use in the United States and cannot enforce the findings of its studies.

The lowest obstacle clearance surfaces overlying the Borders wind project range from 2,260 to 2,772 feet above mean sea level (AMSL) and are associated with instrument departure procedures, instrument approach procedures, and minimum instrument flight rules (IFR) altitude sectors. Proposed structures that exceed these surfaces would require an increase to instrument departure procedure minimum climb gradients, instrument approach procedure minimum altitudes, and minimum IFR altitudes. If the FAA determines that any of these impacts would affect as few as one operation per week, it could result in determinations of hazard.

United States Geological Survey (USGS) elevation data indicates that these surfaces could limit increasing wind turbine heights to 493 and 509 feet AGL in the western and southeastern sections of the study area. However, none of the existing locations are in these areas.

This study did not consider electromagnetic interference on FAA communication systems.

Capitol Airspace applies FAA defined rules and regulations applicable to obstacle evaluation, instrument procedures assessment and visual flight rules (VFR) operations to the best of its ability and with the intent to provide the most accurate representation of limiting airspace surfaces as possible. Capitol Airspace maintains datasets obtained from the FAA which are updated on a 56-day cycle. The results of this analysis are based on the most recent data available as of the date of this report. Limiting airspace surfaces depicted in this report are subject to change due to FAA rule changes and regular procedure amendments. Therefore, it is of the utmost importance to obtain FAA determinations of no hazard prior to making substantial financial investments in this project.



Methodology

Capitol Airspace studied the proposed project based upon location information provided by Xcel Energy. Using this information, Capitol Airspace generated graphical overlays to determine proximity to airports (**Figure 1**), published instrument procedures, enroute airways, FAA minimum vectoring altitude and minimum instrument flight rules (IFR) altitude charts, as well as military airspace and training routes.

Capitol Airspace evaluated all 14 CFR Part 77 imaginary surfaces, published instrument approach and departure procedures, visual flight rules operations, FAA minimum vectoring altitudes, minimum IFR altitudes, and enroute operations. All formulas, headings, altitudes, bearings and coordinates used during this study were derived from the following documents and data sources:

- 14 CFR Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace
- FAA Order 7400.2M Procedures for Handling Airspace Matters
- FAA Order 8260.3D United States Standard for Terminal Instrument Procedures
- FAA Order 8260.58A United States Standard for Performance Based Navigational (PBN) Instrument Procedure Design
- Technical Operations Evaluation Desk Guide for Obstruction Evaluation/Airport Airspace Analysis (1.5.1)
- United States Government Flight Information Publication, US Terminal Procedures
- National Airspace System Resource Aeronautical Data

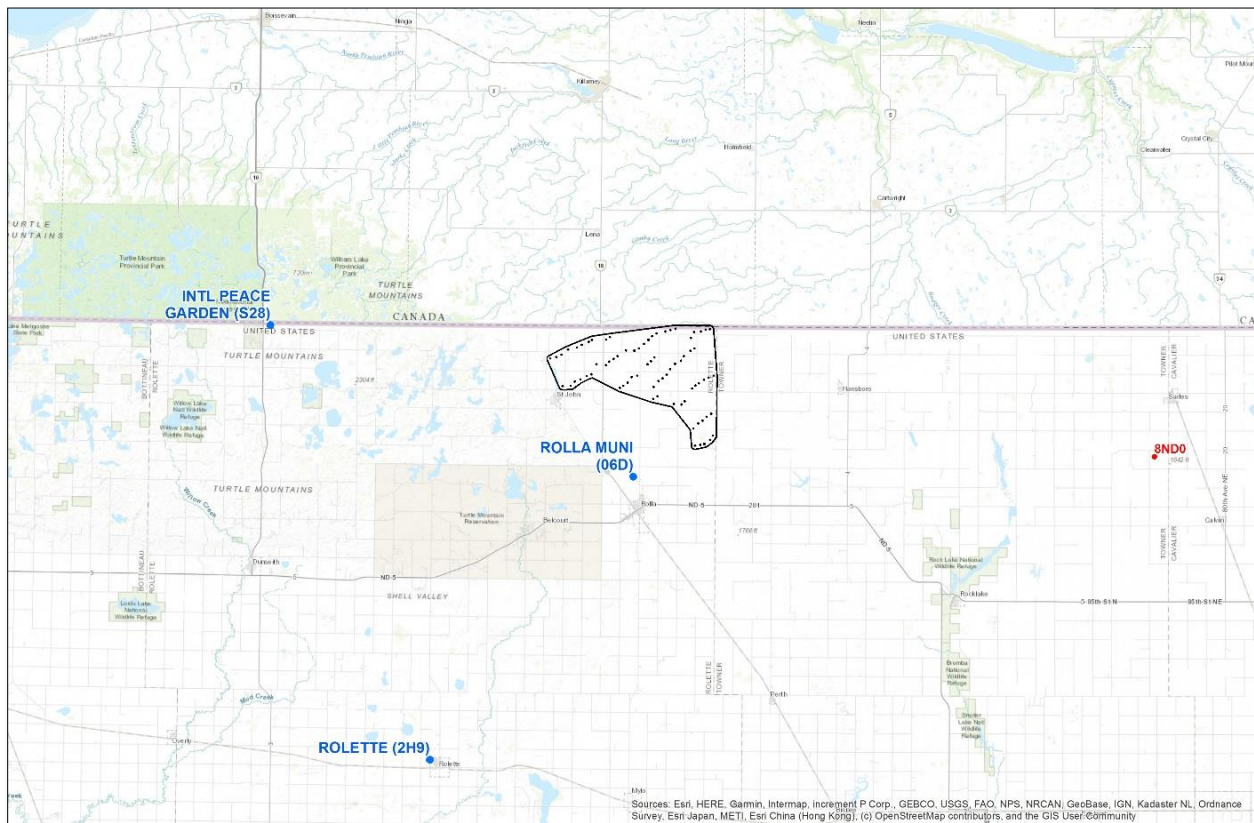


Figure 1: Public-use (blue) and private-use (red) airports in proximity to the Borders wind project



Study Findings

14 CFR Part 77.17(a)(2) Obstruction Standard and 77.19/21/23 Imaginary Surfaces

The FAA uses level and sloping imaginary surfaces to determine if a proposed structure is an obstruction to air navigation. Structures that are identified as obstructions are then subject to a full aeronautical study and increased scrutiny. However, exceeding a Part 77 imaginary surface does not automatically result in the issuance of a determination of hazard. Proposed structures must have airspace impacts that constitute a substantial adverse effect in order to warrant the issuance of determinations of hazard.

14 CFR Part 77.17(a)(2) obstruction standards (**Figure 2**) overlying the Borders wind project:

Rolla Municipal (06D)¹

77.17(a)(2) : 2,024 to 2,397 feet AMSL

At 493 and 509 feet AGL, 48 existing locations in the southern section of the study area (orange and yellow areas, **Figure 2**) will exceed this surface and will be identified as obstructions. Additionally, at 509 feet AMSL, wind turbines will exceed 77.17(a)(1) – a height of 499 feet AGL at the site of the object – and will be identified as obstructions regardless of location.

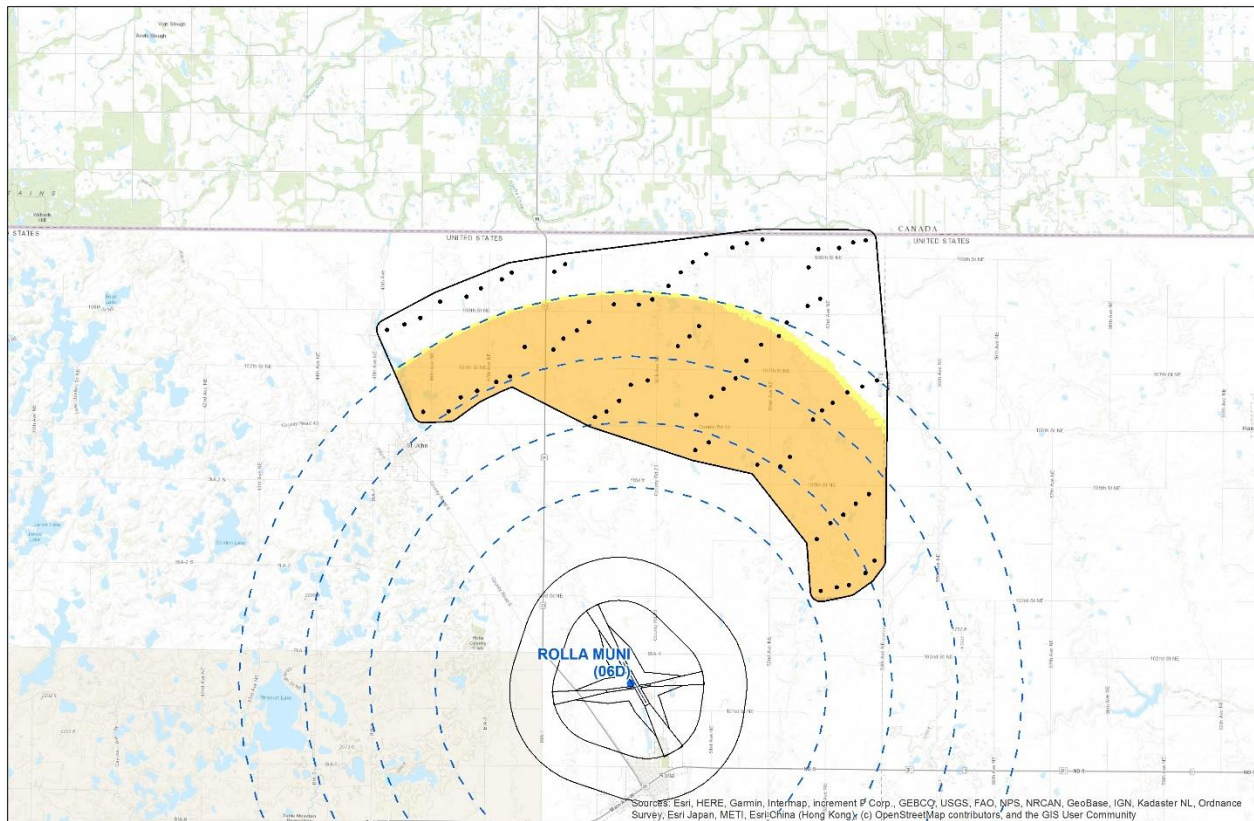


Figure 2: 77.17(a)(2) obstruction standard (dashed blue) and 77.19 imaginary surfaces (solid black)

¹Rolla Municipal (06D) has a “plan on file” with the FAA to extend Runway 14/32 to the northwest and Runway 07/25 to the west. As a result, Capitol Airspace assessed the Part 77.17(a)(2) obstruction standard for both the existing and planned airport reference points (ARP).



Visual Flight Rules (VFR) Traffic Pattern Airspace

VFR traffic pattern airspace is used by pilots operating during visual meteorological conditions. The airspace dimensions are based upon the category of aircraft which, in turn, is based upon the approach speed of the aircraft. 14 CFR Part 77.17(a)(2) and 77.19 (as applied to a *visual* runway) imaginary surfaces establish the obstacle clearance surface heights within VFR traffic pattern airspace.

Rolla Municipal (06D) VFR traffic pattern airspace overlies the Borders wind project. While the FAA may initially protect for up to Category D VFR traffic pattern airspace (shaded grey, **Figure 3**), not all airports are likely to support a significant volume of Category D operations. As a result, the FAA will apply VFR traffic pattern airspace considering the airport’s likely operations and runway physical characteristics (**Table 1**). The likely VFR traffic pattern airspace (purple outline, **Figure 3**) does not overlie the Borders wind project. As a result, this segment of airspace should not limit increasing wind turbine heights to 493 or 509 feet AGL at any of the existing locations.

Table 1: Runway physical characteristics and likely VFR traffic pattern application

Status	Dimensions (Feet)	Weight Bearing Capacity (Pounds)	Surface Type	Potential VFR Traffic Pattern Category	Likely VFR Traffic Pattern Category
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Rolla Municipal (06D)²

Runway 07/25	Existing	2,200 x 75	N/A - Turf	Turf	-	B
Runway 07/25	Proposed	4,083 x 75	Unknown	Unknown	-	B
Runway 14/32	Existing	4,300 x 75	12,500	Asphalt	C	B
Runway 14/32	Proposed	5,000 x 75	Unknown	Unknown	-	C

² Rolla Municipal (06D) has a “plan on file” with the FAA to extend Runway 14/32 to the northwest and Runway 07/25 to the west. As a result, Capitol Airspace assessed VFR traffic pattern airspace for both the existing and planned runway end locations. It is likely that the extended Runway 07/25 would still serve as a secondary runway and only support Category B or lower aircraft.

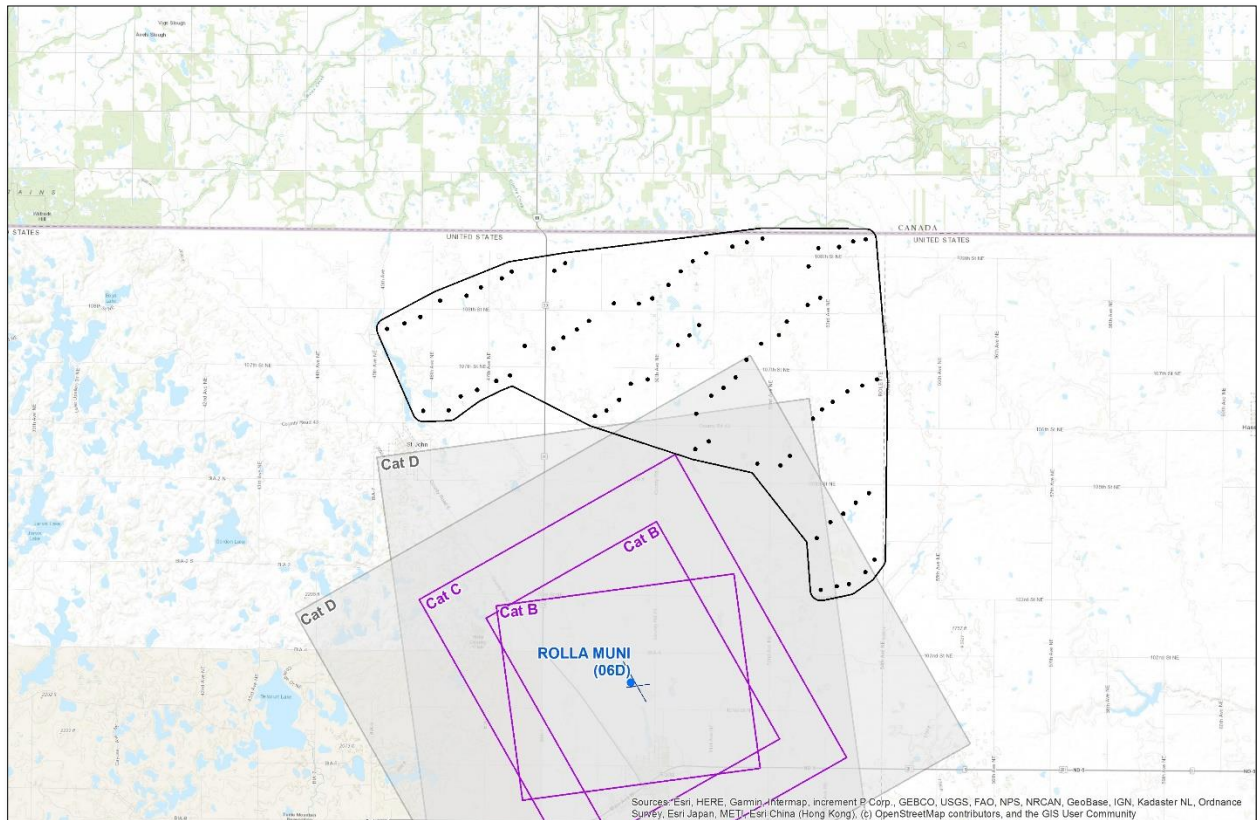


Figure 3: Rolla Municipal (06D) VFR traffic pattern airspace



Visual Flight Rules (VFR) Routes

During periods of marginal visual meteorological conditions— low cloud ceilings and one statute mile visibility – pilots often operate below the floor of controlled airspace. Operating under these weather conditions requires pilots to remain within one statute mile of recognizable landmarks such as roads, rivers, and railroad tracks. The FAA protects for known and regularly used VFR routes by limiting structure heights within two statute miles of these routes to no greater than 14 CFR Part 77.17(a)(1) – a height of 499 feet AGL at the site of the object.

The Borders wind project is located in proximity to highways and transmission lines that may be used as VFR routes (**Figure 4**). There is no dataset that identifies VFR routes or their utilization. However, a traffic flow analysis can be conducted to assess historical radar flight track data and identify regularly used low-level routes.³ If the FAA determines that VFR routes are flown regularly (as few as once per day), they could limit wind development in excess of 499 feet AGL and within two statute miles of these landmarks (hatched orange, **Figure 4**).

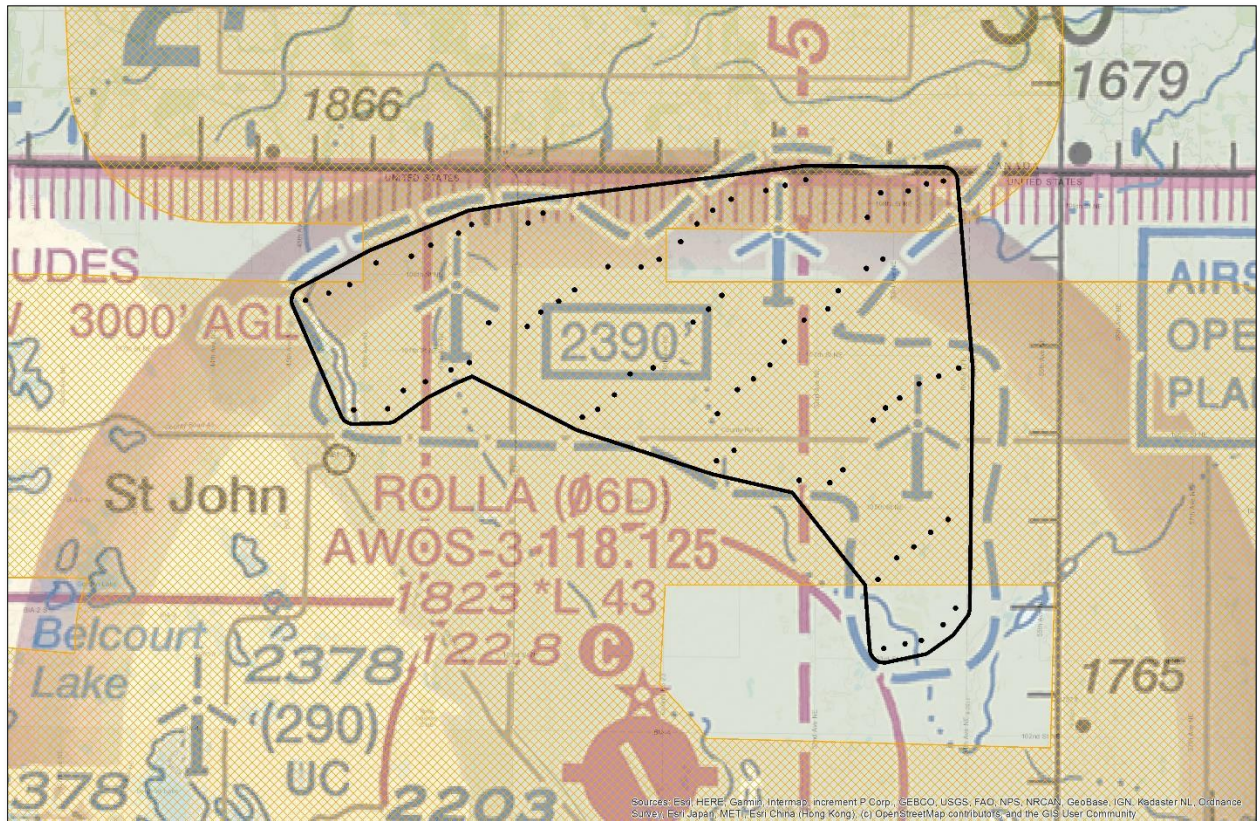


Figure 4: Potential VFR routes in proximity to the Borders wind project

³ Radar coverage must be adequate to detect low level VFR flights.



Instrument Departures

In order to ensure that aircraft departing during marginal weather conditions do not fly into terrain or obstacles, the FAA publishes instrument departure procedures that provide obstacle clearance to pilots as they transition between the terminal and enroute environments. These procedures contain specific routing and minimum climb gradients to ensure clearance from terrain and obstacles.

Proposed structures that exceed instrument departure procedure obstacle clearance surfaces would require an increase to instrument departure procedure minimum climb gradients. If the FAA determines that this impact would affect as few as one instrument departure per week, it could be used as the basis for determinations of hazard.

Rolla Municipal (06D)⁴

Obstacle Departure Procedure

Obstacle clearance surfaces (contours, [Figure 5](#)) range from 2,336 to 3,072 feet AMSL and are some of the lowest height constraints overlying the western and central sections of the study area. USGS elevation data indicates that these surfaces could limit increasing wind turbine heights to 493 or 509 feet AGL along the southern edge of the study area (red and orange areas, [Figure 5](#)). However, none of the existing locations are in this area.

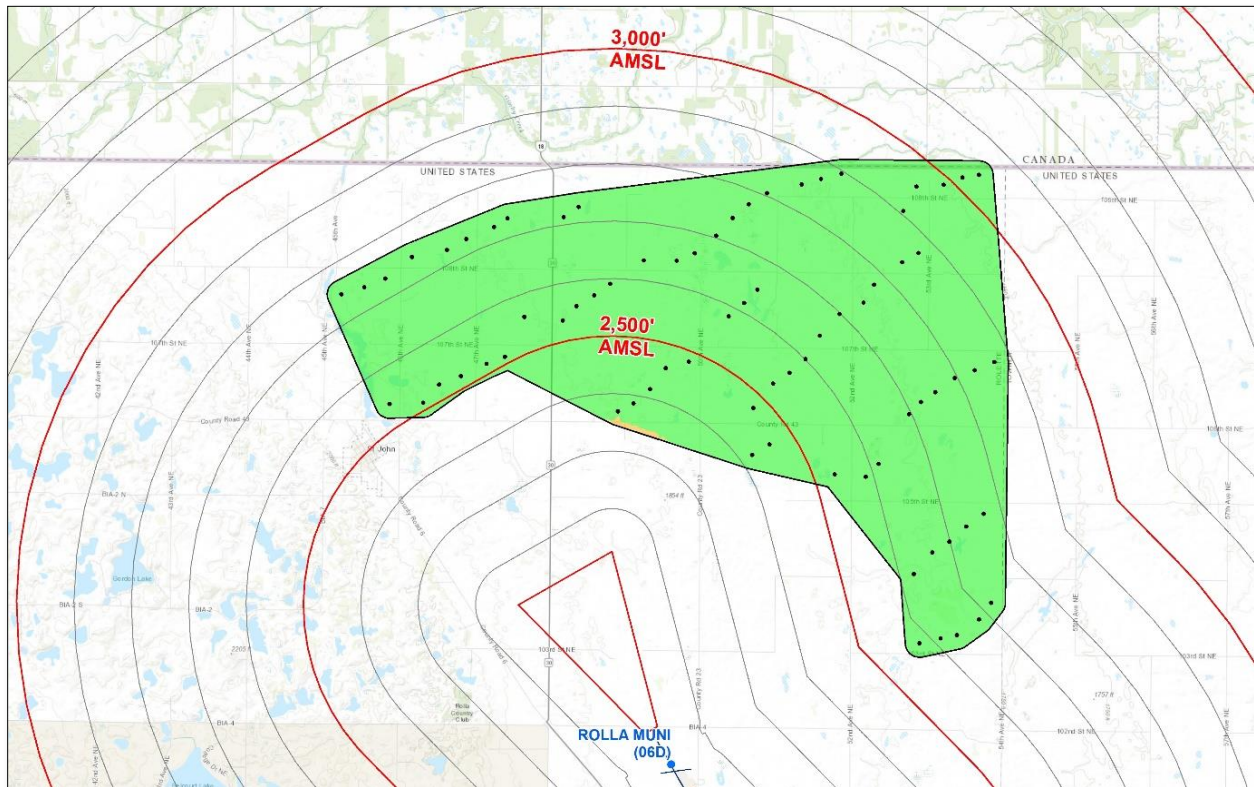


Figure 5: Rolla Municipal (06D) diverse departure assessment

⁴ Rolla Municipal (06D) has a “plan on file” with the FAA to extend Runway 14/32 to the northeast and Runway 07/25 to the west. There is no plan to add instrument procedures to Runway 07/25. As a result, Capitol Airspace assessed instrument departure procedures from both the existing and planned Runway 14/32.



Instrument Approaches

Pilots operating during periods of reduced visibility and low cloud ceilings rely on terrestrial and satellite based navigational aids (NAVAIDS) in order to navigate from one point to another and to locate runways. The FAA publishes instrument approach procedures that provide course guidance to on-board avionics that aid the pilot in locating the runway. Capitol Airspace assessed a total of four published instrument approach procedures at three public-use airports in proximity to the Borders wind project:⁵

Rolla Municipal (06D)

RNAV (GPS) Approach to Runway 32

Bottineau Municipal (D09)

RNAV (GPS) Approach to Runway 31

Cando Municipal (9D7)

RNAV (GPS) Approach to Runway 16

RNAV (GPS) Approach to Runway 34

Proposed wind turbines that exceed instrument approach procedure obstacle clearance surfaces would require an increase to their minimum altitudes. Increases to these altitudes, especially critical *decision altitudes (DA)* and *minimum descent altitudes (MDA)*, can directly impact the efficiency of instrument approach procedures. If the FAA determines this impact would affect as few as one operation per week, it could be used as the basis for determinations of hazard.

⁵ Capitol Airspace assessed instrument approach procedures within 30 nautical miles (NM) of the study area. Although approach surfaces – including Terminal Arrival Areas (TAA), feeder segments, and initial segments – from airports further than 30 NM may overlie the study area, the obstacle clearance surfaces present a lower risk to projects than the surfaces identified in this report. Therefore, height constraints associated with instrument approach surfaces for airports beyond 30 NM were not considered and are not included in the Composite Map ([Figure 11](#)).



Rolla Municipal (06D) ⁶

Circling Approach Areas

The Category C and Category D circling approach areas (dashed red outline, [Figure 6](#)) overlie the southern section of the Borders wind project. The Category C and Category D circling MDA (CMDA) are 2,560 and 2,700 feet AMSL, respectively. The obstacle clearance surfaces are 2,260 and 2,400 feet AMSL, respectively, and are some of the lowest height constraints overlying the southern section of the study area. USGS elevation data indicates that the Category C obstacle clearance surface could limit increasing wind turbine heights to 493 and 509 feet AGL in the southeastern corner of the study area (red area, [Figure 6](#)). However, none of the existing locations are in this area.

RNAV (GPS) Approach to Runway 14 (proposed)

Rolla Municipal has is proposing to add instrument procedures to Runway 14. Since development of these procedures has not yet begun, the FAA will assess wind turbines for impact on anticipated MDA. Capitol Airspace used industry best practice to develop and assess an optimal RNAV (GPS) Approach to Runway 14 with LNAV minimums ([Figure 6](#)).

The LNAV final segment obstacle clearance surfaces (including Paragraph 2-9-10 OIS) (solid red outline, [Figure 6](#)) range from 2,278 to 3,250 feet AMSL where they overlie the wind project and are some of the lowest height constraints overlying a small southwestern section of the study area. If the FAA protects for this procedure, USGS elevation data indicates that these surfaces could limit increasing wind turbine heights to 493 and 509 feet AGL in the western section of the study area (red and orange areas, [Figure 6](#)). However, none of the existing locations are in these areas.

⁶ Rolla Municipal (06D) has a “plan on file” with the FAA to extend Runway 14/32 to the northwest and Runway 07/25 to the west. There is no plan to add instrument procedures to Runway 07/25. Capitol Airspace assessed instrument approach procedure obstacle clearance surfaces for both the existing and planned Runway 14/32 locations. Circling approach areas were assessed based on both the existing and planned Runway 14/32 and Runway 07/25 locations.

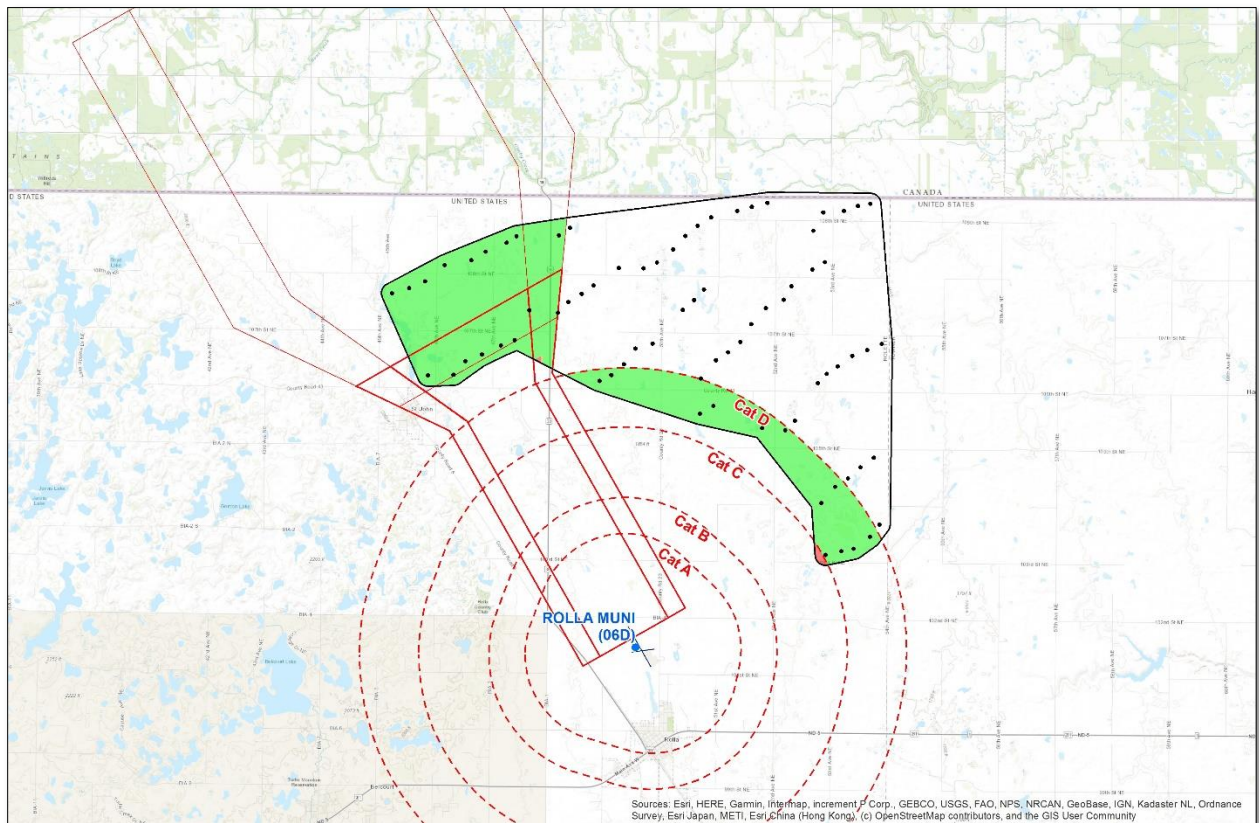


Figure 6: Rolla Municipal (06D) hypothetical RNAV (GPS) Approach to Runway 14



Enroute Airways

Enroute airways provide pilots a means of navigation when flying from airport to airport and are defined by radials between VHF omni-directional ranges (VORs). The FAA publishes minimum altitudes for airways to ensure clearance from obstacles and terrain. The FAA requires that each airway have a minimum obstacle clearance of 1,000 feet in non-mountainous areas and normally 2,000 feet in mountainous areas.

Proposed structures that exceed enroute airway obstacle clearance surfaces would require an increase to their minimum obstruction clearance altitudes (MOCA) and/or minimum enroute altitudes (MEA). If the FAA determines that this impact would affect as few as one enroute airway operation per week, it could be used as the basis for determinations of hazard.

Low altitude enroute airway obstacle clearance surfaces (e.g., *Figure 7*) do not overlie the Borders wind project and should not limit increasing wind turbine heights to 493 or 509 feet AGL at any of the existing locations.

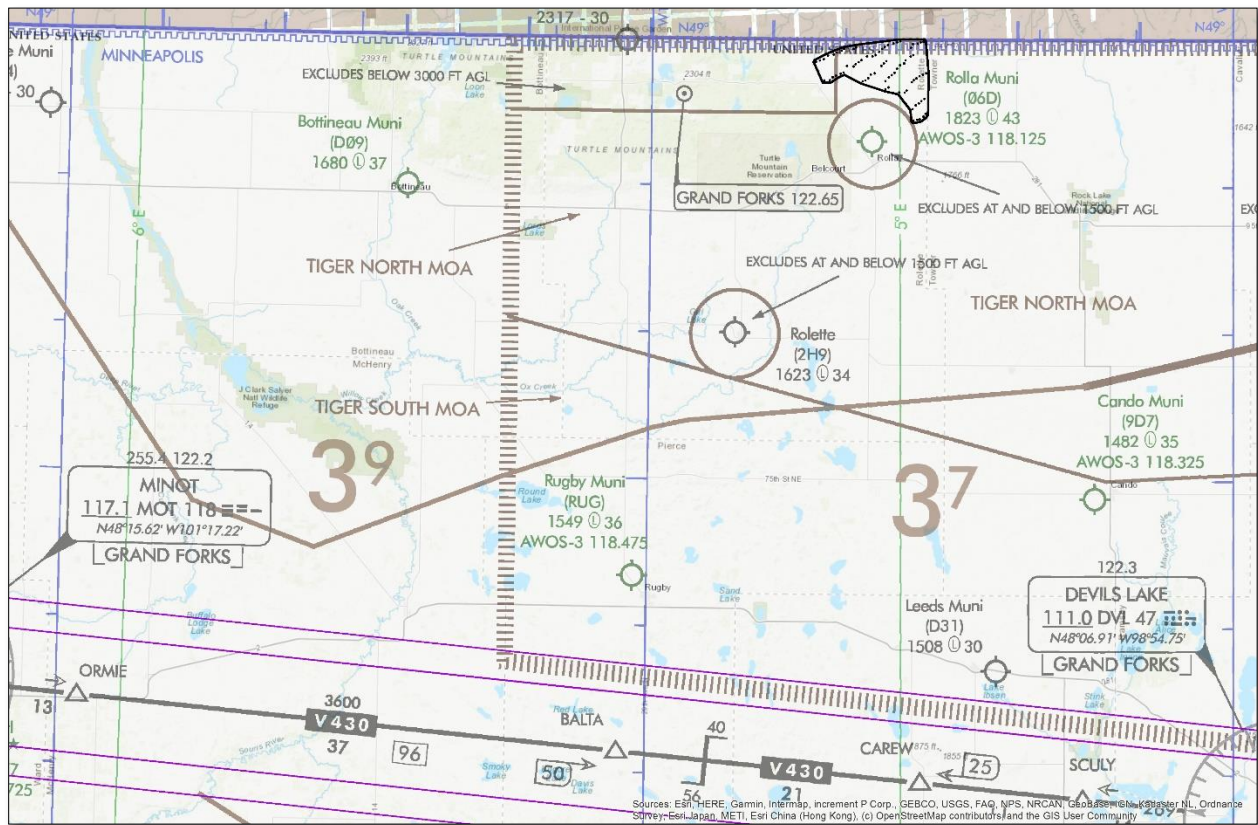


Figure 7: Low altitude enroute chart L-14 with V430 obstacle evaluation areas (purple)



Minimum Vectoring/IFR Altitudes

The FAA publishes minimum vectoring altitude (MVA) and minimum instrument flight rules (IFR) altitude (MIA) charts that define sectors with the lowest altitudes at which air traffic controllers can issue radar vectors to aircraft based on obstacle clearance. The FAA requires that sectors have a minimum obstacle clearance of 1,000 feet in non-mountainous areas and normally 2,000 feet in mountainous areas.

Proposed structures that exceed MVA/MIA sector obstacle clearance surfaces would require an increase to the altitudes usable by air traffic control for vectoring aircraft. If the FAA determines that this impact would affect as few as one radar vectoring operation per week, it could result in determinations of hazard.

Minneapolis (ZMP) Air Route Traffic Control Center (ARTCC)

Sector PDVL01 (ZMP_TAV_2018)

The MIA is 3,500 feet AMSL. The obstacle clearance surface (hatched blue, **Figure 8**) is 2,549 feet AMSL and is the lowest height constraint overlying the northern and northeastern sections of the study area. However, USGS elevation data indicates that this surface should not limit increasing wind turbine heights to 493 or 509 feet AGL at any of the existing locations (green area, **Figure 8**).

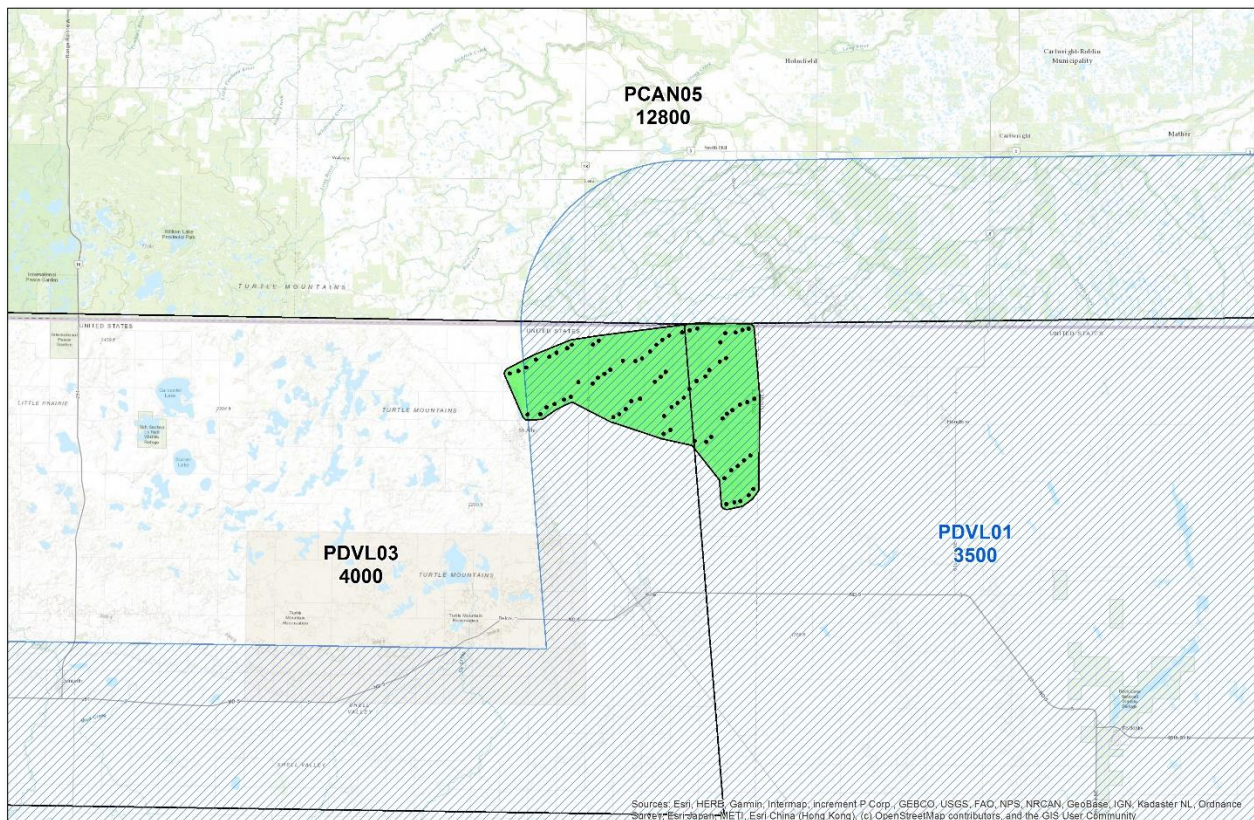


Figure 8: Minneapolis (ZMP) ARTCC MIA sectors (black) with Sector PDVL01 obstacle evaluation area (hatched blue)



Terminal and Enroute Navigational Aids

The FAA has established protection areas in order to identify proposed structures that may have a physical and/or electromagnetic effect on navigational aids (NAVAIDs). The protection area dimensions vary based on the proposed structure type as well as the NAVAID type. Proposed structures located within these areas may interfere with NAVAID services and will require further review by FAA Technical Operations. If further review determines that proposed structures would have a significant physical and/or electromagnetic effect on NAVAIDs, it could result in determinations of hazard.

NAVAID protection areas do not overlie the Borders wind project (**Figure 9**). As a result, it is unlikely that the proposed height increase to existing wind turbine would have a physical or electromagnetic effect on terminal or enroute NAVAIDs.

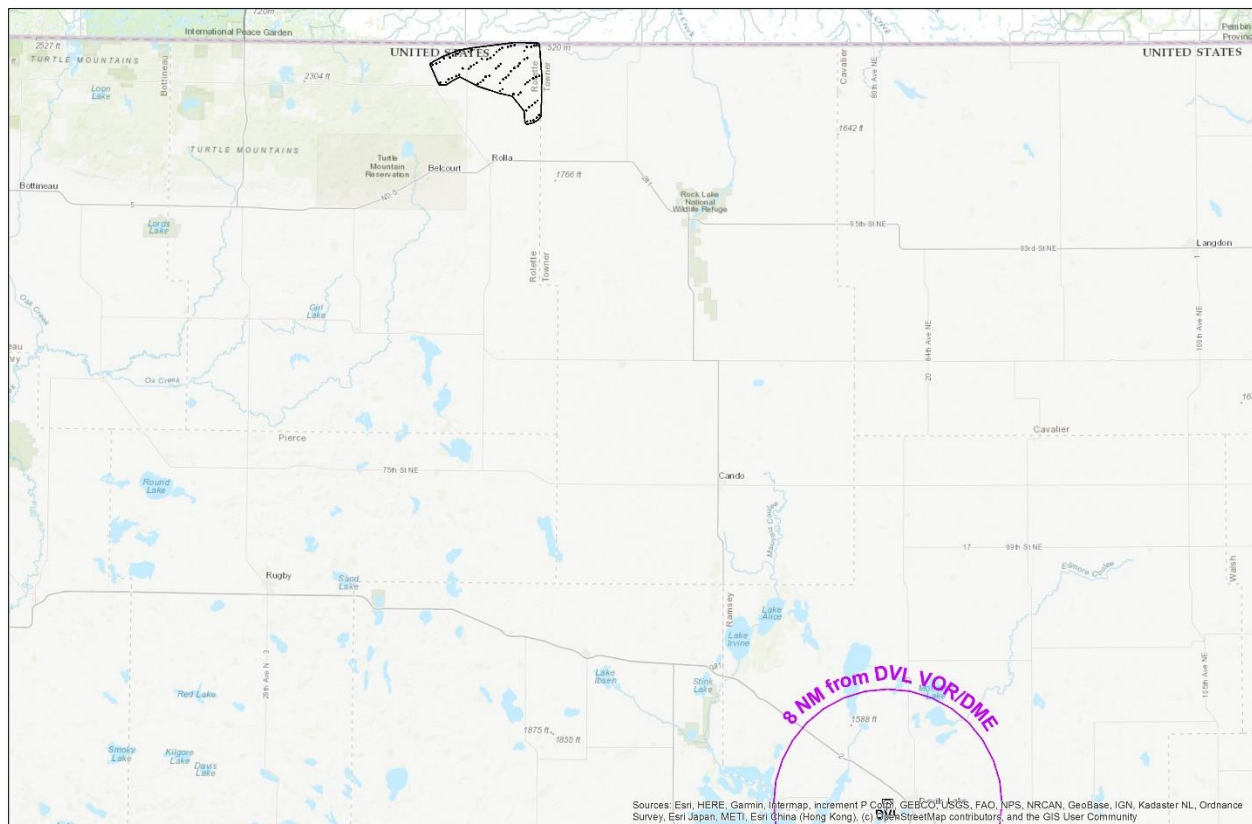


Figure 9: NAVAID screening surfaces in proximity to the Borders wind project



Military Airspace and Training Routes

Although the FAA does not consider impact on military airspace or training routes, they will notify the military of proposed structures located within these segments of airspace. Impact on these segments of airspace can result in military objections to the proposed development. If the planned development area is located on federal land, impact on military airspace or training routes may result in the denial of permits by the Bureau of Land Management.

Military operation areas overlying the Borders wind project (**Figure 10**):

United States Air Force (USAF) 119th Operations Support Squadron

Route/Airspace	Minimum Altitude
Tiger North MOA	300 feet AGL

Due to the low altitude associated with this MOA, increasing existing wind turbine heights could have an impact on their operations. If this segment of airspace is used frequently by USAF 119th Operations Support Squadron or other nearby units, they may object to proposed wind development within the routes' boundaries. Under the provisions of the 2018 National Defense Authorization Act (NDAA), the Military Aviation and Installation Assurance Siting Clearinghouse (Clearinghouse) may issue a Notice of Presumed Risk to National Security (NPR) letter to initiate mitigation discussions. These discussions are facilitated through the Clearinghouse and with the affected bases or organizations with operational interests. Per the legislative directive, NPR letters are provided to the Governor of the State(s). The Clearinghouse typically attempts to notify developers shortly before the issuance of an NPR letter.

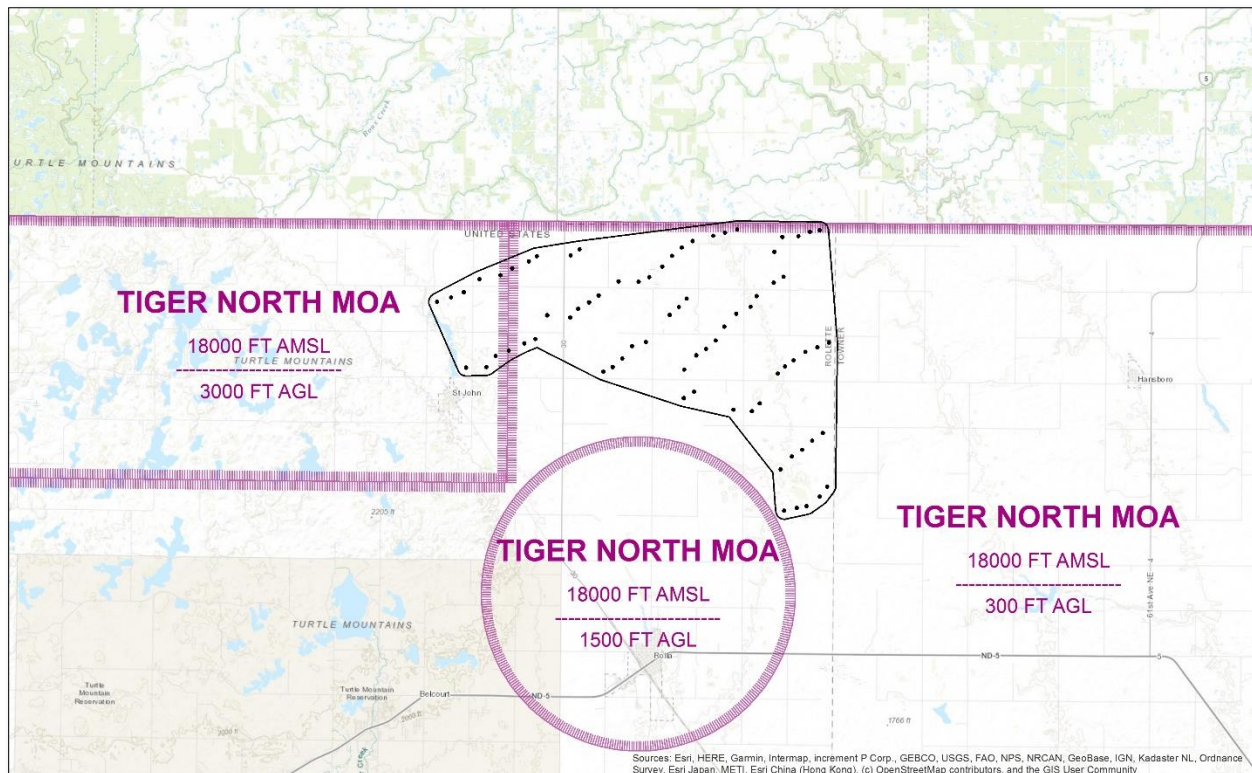


Figure 10: Military airspace overlying the Borders wind project



Surveillance Radar Systems

Various radar systems support air traffic control operations and weather detection and forecasting. Proposed wind turbines that are within radar line of sight (RLOS) are “visible” to radars and could both create unwanted primary returns (clutter) and cause a decrease in radar sensitivity due to dropped primary targets. If the FAA determines that these radar effects would impact air traffic control operations, the FAA may conduct further review to identify potential safety hazards and the associated risks to the National Airspace System. The additional analysis may extend the FAA’s timeline for review of proposed wind turbines and could ultimately result in determinations of hazard.

The preliminary RLOS analysis results indicate that 481 and 590-foot AGL wind turbines within the Borders wind project study area will not be visible to or interfere with any air traffic control, air defense, homeland security, or weather radar sites ([Table 2](#)).

Table 2: Radar systems assessed and preliminary RLOS results

Surveillance Radars	Visible at 481’ AGL	Visible at 590’ AGL
Cavalier Air Force Station Perimeter Acquisition Radar Attack Characterization System (PARCS)	No	No
Weather Radars		
Minot Air Force Base Weather Surveillance Radar Model 1988 Doppler (WSR-88D) ⁷	No	No

⁷ The National Oceanic and Atmospheric Administration (NOAA) has developed a screening tool to identify whether wind turbines within RLOS of WSR-88D radars pose a risk to weather detection and forecasting. The results from this tool indicate that the project area falls within “green” areas established by the NOAA Radar Operations Center. A green area, or “No Impact Zone”, indicates that impacts are not likely to WSR-88D operations.



Conclusion

At 493 and 509 feet AGL, 48 wind turbines in the southern section of the study area will exceed the Rolla Municipal (06D) 14 CFR Part 77.17(a)(2) obstruction standard (**Figure 2**) and will be identified as obstructions. Additionally, increasing existing wind turbine heights to 509 feet AGL will exceed 14 CFR Part 77.17(a)(1) – a height of 499 feet above ground level at the site of the object – and will be identified as obstructions regardless of location. However, heights in excess of these surfaces are feasible provided proposed wind turbines do not exceed FAA obstacle clearance surfaces.

The lowest obstacle clearance surfaces overlying the Borders wind project range from 2,260 to 2,772 feet AMSL (**Figure 11**) and are associated with instrument departure procedures, instrument approach procedures, and MIA sectors. USGS elevation data indicates that these surfaces could limit increasing wind turbine heights to 493 and 509 feet AGL in the western and southeastern sections of the study area (red and orange areas, **Figure 12**). However, these surfaces should not limit increasing wind turbine heights to 493 or 509 feet AGL at any of the existing locations (green area, **Figure 12**).

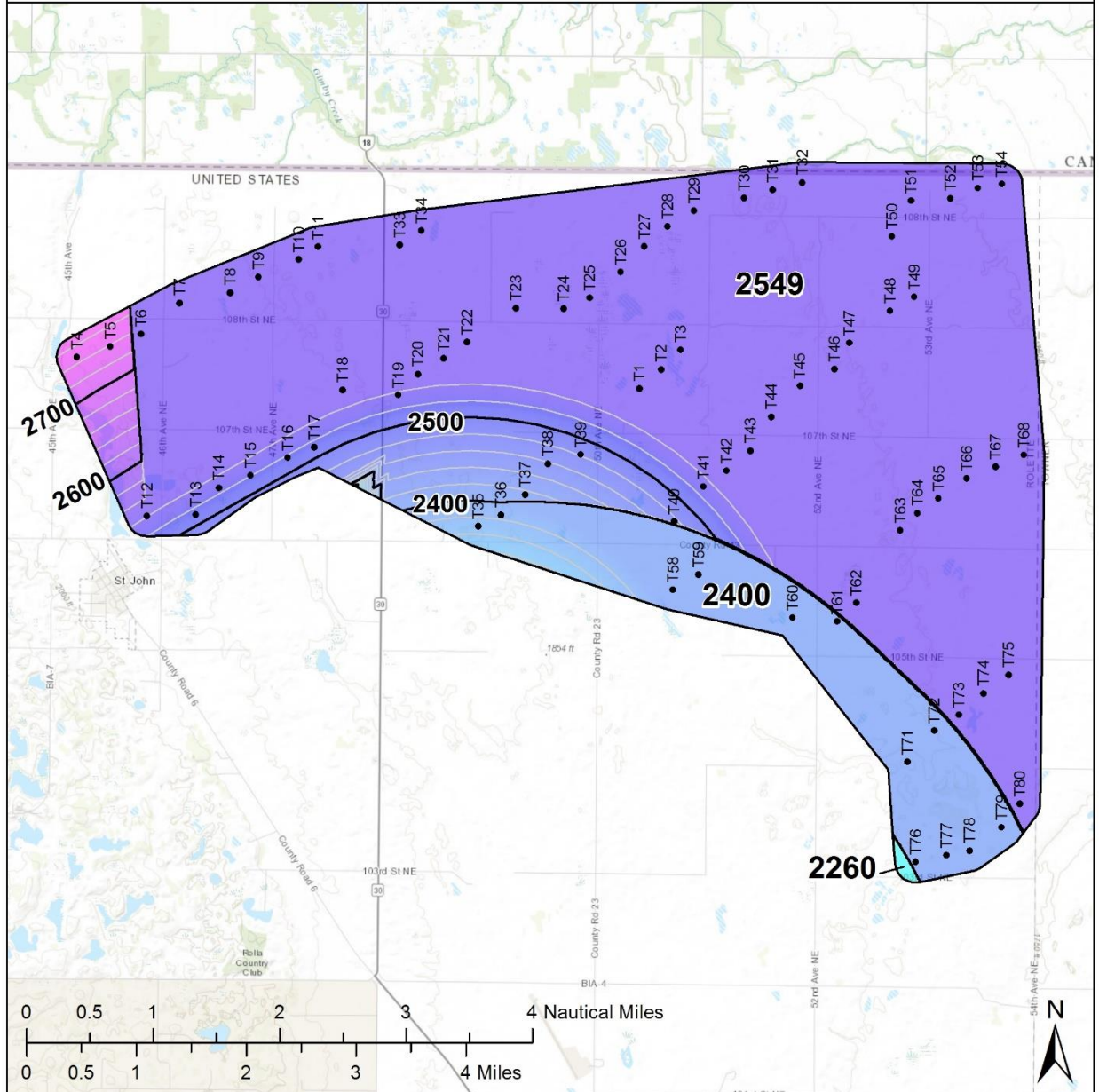
Military airspace overlies most of the study area (**Figure 10**). Impact on this segment of airspace could result in military objections to increasing existing wind turbine heights.

The AGL Clearance Map (**Figure 12**) is based on USGS National Elevation Dataset (NED) 1/3 Arc Second data which has a vertical accuracy of 1.89 meters root-mean-square error (RMSE). Therefore, the AGL Clearance Map should only be used for general planning purposes and not exact structure siting. In order to avoid the possibility of determinations of hazard, proposed structure heights should adhere to the height constraints depicted in the Composite Map (**Figure 11**).

If you have any questions regarding the findings of this study, please contact **James Scott** or **Candace Childress** at (703) 256-2485.



Proposed structures that exceed 14 CFR Part 77.17(a)(1) - a height of 499 feet AGL at the site of the object - will be identified as obstructions regardless of location.



Obstacle Clearance Surface

Height - AMSL Feet

High : 2,772

Low : 2,260

• Existing Wind Turbine

— 20-Foot Contour

— 100-Foot Contour

Borders Wind Project
Composite Height Constraint Map

Plot Date:
22 June 2020

Figure 11

Coordinate System:
NAD 1983 UTM Zone 14N

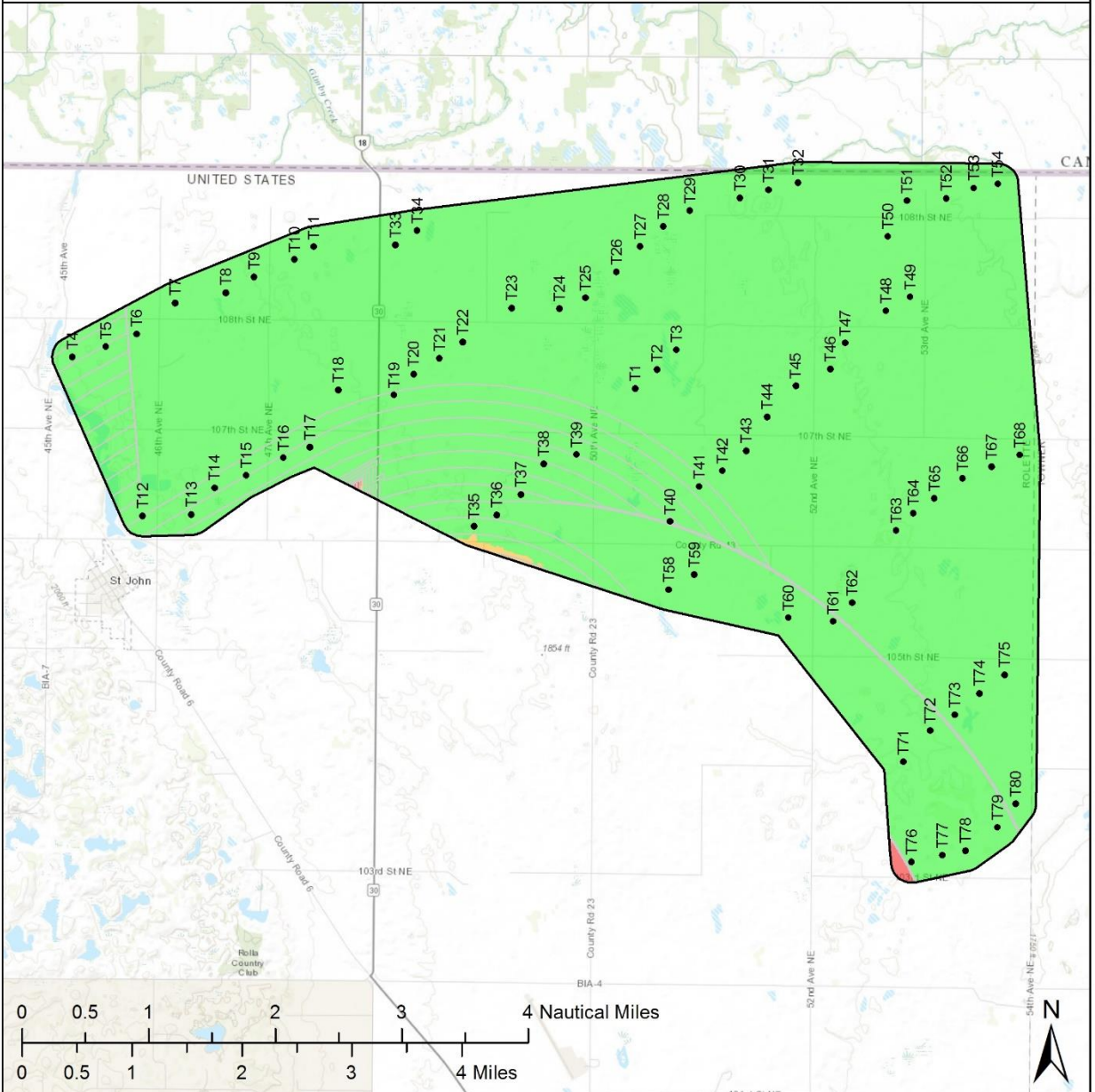


Candace Childress

All heights above mean sea level (AMSL)



The USGS 1/3 Arc Second Digital Elevation Model (DEM) data used to create this map has a vertical accuracy of 1.89 meters RMSE. This map should only be used for general planning purposes and not exact structure siting.



Clearance	
Height - AGL Feet	
	< 493
	≥ 493 < 509
	≥ 509
	Existing Wind Turbine

Borders Wind Project Above Ground Level (AGL) Clearance Map	
Plot Date: 22 June 2020	Figure 12
Coordinate System: NAD 1983 UTM Zone 14N	
Candace Childress	Capitol Airspace Group

Borders Wind Project

Xcel Energy

Rolette County, North Dakota

Microwave Path Analysis

June 22, 2020



Capitol Airspace Group

capitolairspace.com

(703) 256 - 2485



Summary

Capitol Airspace conducted a microwave path analysis for the Borders wind project in Rolette County, North Dakota. The purpose for this analysis was to identify licensed and applied coordinated non-federal microwave paths that could limit increasing the rotor diameter of existing 95-meter hub height wind turbines from 100 to a maximum of 120 meters. At the time of this analysis, 75 wind turbine locations (black points, **Figure 1**) had been identified for repowering. This analysis assessed each location (including its rotor-swept volume) to determine if it could obstruct Fresnel zones associated with microwave paths in proximity to the Borders wind project.

Point-to-point microwave transmission is a critical component of the national communications infrastructure. Microwave paths enable broadband data transmission that supports telephone, cellular, and personal communication service (PCS) networks, wireless internet providers, audio and video transmission from television studios to transmitter sites, as well as many other industry and utility applications. In order to ensure signal reliability, these paths are sited to avoid any line-of-sight obstructions. Proposed structures that create a line-of-sight obstruction can degrade signal reliability and could require revisions to the microwave system.

Licensed and applied coordinated non-federal microwave paths do not overlie the Borders wind project (**Figure 1**). As a result, increasing the rotor diameter of existing wind turbines should not impact any applied or licensed non-federal microwave links.

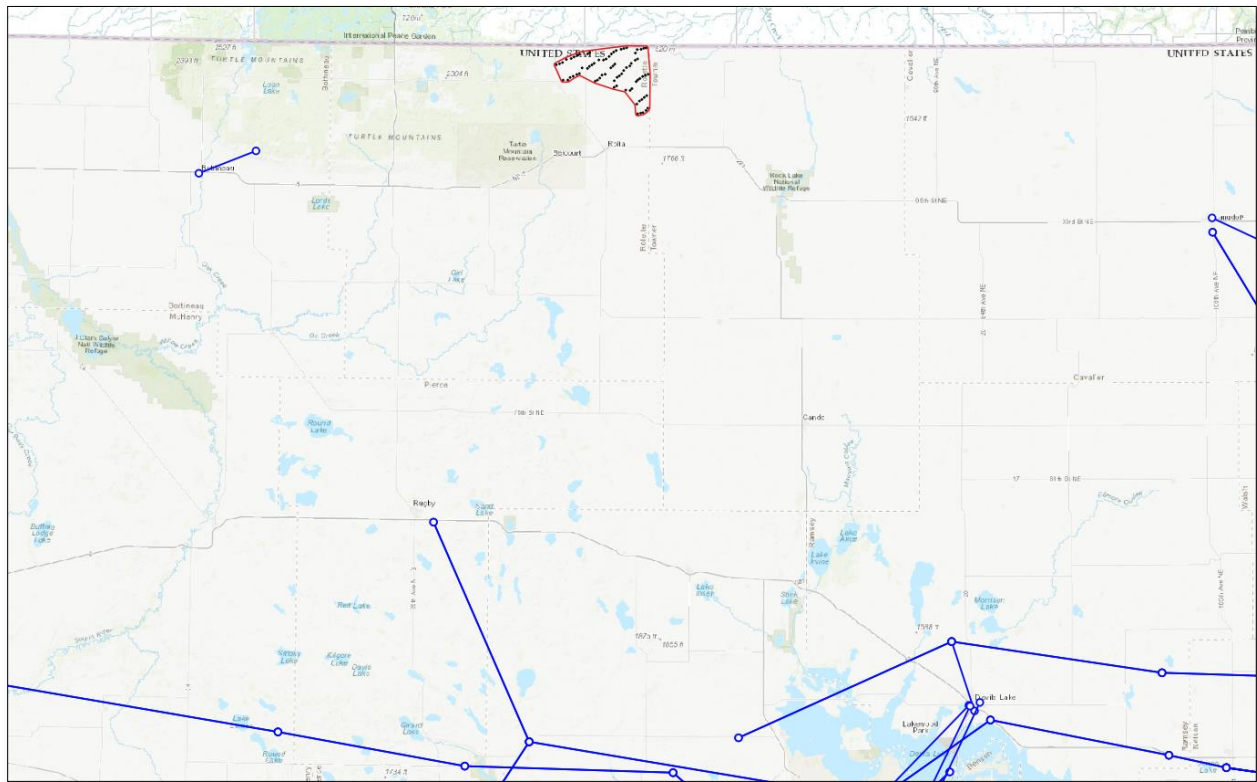


Figure 1: Licensed (blue) microwave paths in proximity to the Borders wind project

Capitol Airspace maintains a database obtained from the FCC which is updated on a daily basis. The results of this analysis are based on FCC data available as of the date of this report.



Methodology

Capitol Airspace studied the proposed project based upon location information provided by Xcel Energy. Using this information, Capitol Airspace used a Geographic Information System (GIS) to determine proximity to both licensed and applied coordinated non-federal microwave paths contained in the Federal Communication Commission (FCC) Universal Licensing System (ULS) database.

This analysis considers impact on microwave paths resulting from the physical blockage of the first Fresnel zone (*Figure 2*). The first Fresnel zone is a three-dimensional volume whose radius at a given point is calculated using the path frequency and distance from the transmitting and receiving antennas. The Fresnel zone radius is largest at the path midpoint (where $d_1 = d_2$). Lower frequencies result in larger Fresnel zone radii for a given path and are typically associated with longer paths. Higher frequencies result in smaller Fresnel zone radii for a given path and are typically associated with shorter paths.

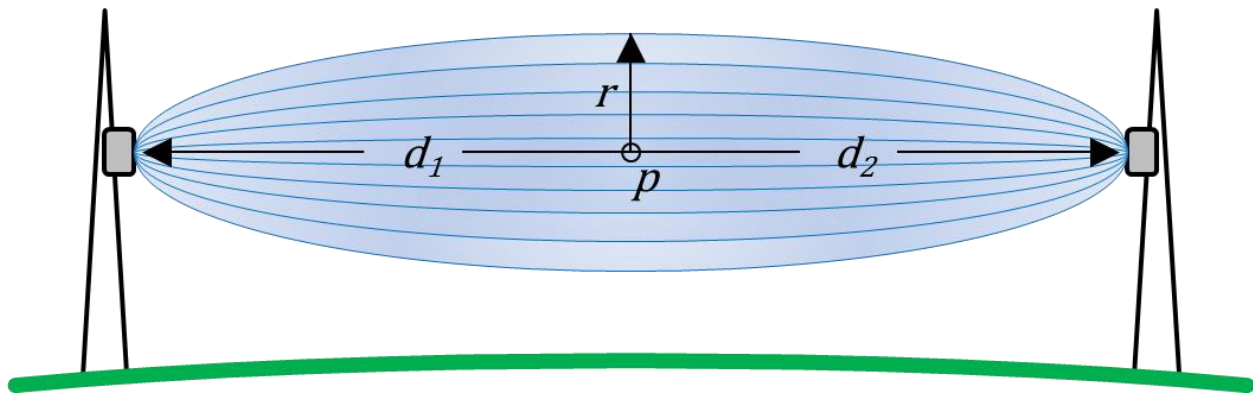


Figure 2: Fresnel zone example

In many cases, ULS database microwave transmitter and receiver antenna locations are inaccurate (e.g. *Figure 3*). Available satellite and aerial imagery were used to improve the coordinates for locations associated with microwave paths in proximity to the defined study area.



Figure 3: Example of using aerial imagery to correct erroneous ULS database antenna location



Findings

No microwave links overlie the Borders wind project (**Table 1**).

Licensee	Call Sign	Path	Status	Transmitter	Receiver	Frequency (MHz) ¹
-	-	-	-	-	-	-

Table 1: Microwave paths with Fresnel zones overlying the Borders wind project

Conclusion

The results of this analysis indicate that microwave path Fresnel zones do not overlie the Borders wind project. As a result, increasing the rotor diameter of existing 95-meter hub height wind turbines to 120 meters should not obstruct Fresnel zones associated with applied or licensed coordinated non-federal microwave paths.

If you have any questions regarding the findings of this study, please contact **James Scott** or **Candace Childress** at (703) 256-2485.

¹ Microwave paths may be licensed to operate using more than one frequency. For the purposes of calculating Fresnel zone radii, the lowest frequency was used to create the largest Fresnel zone.



March 31, 2022

Shannon Whiton
Xcel Energy
414 Nicollet Mall
Floor 2
Minneapolis, MN 55401

RE: Border Repower Wind Project

Dear Ms. Whiton,

Based on the June 24, 2020 Obstruction Evaluation Report, the Borders Repower Wind project is within the lateral boundaries of the United States Air Force (USAF) 119th Operations Support Squadron's Tiger North Military Operations Area (MOA). The lowest altitude of the MOA is 300 feet above ground level (AGL).

Due to the low altitude associated with this MOA, constructing wind turbines within the airspace could have an impact on their operations. If this segment of airspace is used frequently by USAF 119th Operations Support Squadron or other nearby units, they may object to proposed wind development within the routes' boundaries.

Having addressed the potential concern, military aircraft are required to overfly existing obstacles by at least 500 feet. Military pilots round structures and obstacle heights up to the next 100 feet, and overfly that height by 500 feet. Currently, the existing Borders wind turbines stand at 481 feet AGL. This height would be rounded up to 500 feet, resulting in military pilots overflying these structures at 1000 feet AGL. Repowering wind turbines from 481 to no taller than 499 feet AGL should not result in any additional impact to military operations. This is because military pilots would still be rounding 499 to 500 and overflying the project at 1,000 feet.

Any questions should be directed to me. I can be reached at 571-303-1124 or via email at James.Scott@capitolairspace.com.

Sincerely,

James R. Scott
Project Manager
Capitol Airspace Group

Appendix C
Cultural Resource Reports and
Correspondence
(PUBLIC VERSION)

12701 Whitewater Drive, Suite 300
Minnetonka, MN 55343

Main (952) 937-5150
Fax (952) 937-5822

westwoodps.com
(888) 937-5150

Westwood

February 3, 2022

State Historical Society of North Dakota
Archeology and Historic Preservation
612 East Boulevard Ave
Bismarck, ND 58505

Re: Class I Cultural Resource Literature Review Border Winds Energy Project
File R003319.01

Greetings,

The Border Winds Wind Energy Project was initially developed in 2008. The Project complied with North Dakota Public Service Commission (PSC) siting and Rolette County zoning requirements. A Class I Cultural Resources Literature Review, a Class III Cultural Resources Survey, and consultation with the ND State Historic Preservation Office (SHPO) was performed during that process to comply with PSC and SHPO requirements.

The Project is now being planned for a repower. The repower will consist of replacing turbine blades, gear assemblies, and selected nacelles on the existing 75 2.0 -MW Vestas turbines. Turbine towers and pedestals will not be changed. At this time, no new ground disturbing activities are anticipated in the Project Area. A Class I Cultural Resources Literature Review has been completed for the repower to ascertain if any newly discovered resources or changes to the Project could potentially impact cultural resources. It is our understanding that all development for the repower Project will take place in the previously surveyed corridors and no additional survey is recommended. Should Project design at any point be revised outside of previously surveyed corridors, we then recommend additional cultural resources survey and additional consultation with SHPO.

We would appreciate your review of the attached Class I Report as well as comments on the Project.

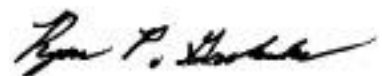
Please contact us if you have any questions.

Sincerely,

WESTWOOD PROFESSIONAL SERVICES



Rigden Glaab
Senior Archaeological Principal Investigator



Ryan P. Grohnke
Cultural Resources Manager

CLASS I CULTURAL RESOURCE LITERATURE REVIEW

Border Winds Energy Project

Rolette County, North Dakota

AUGUST 18, 2021

PREPARED FOR:



PREPARED BY:

Westwood

Westwood

Class I Cultural Resource Literature Review

Border Winds Energy Project

Rolette County, North Dakota

Prepared For:

Xcel Energy
414 Nicollet Mall, (GO 6)
Minneapolis, MN 55401

Prepared By:

Rigden Glaab, MA, RPA- Principal Investigator
Ryan P. Grohnke, and Dean Sather
Westwood Professional Services
12701 Whitewater Drive, Suite 300
Minnetonka, MN 55343
(952) 937-5150

Project Number: R003319.01

Date: August 18, 2021

Abstract

Westwood Professional Services (Westwood) was contracted by Xcel Energy, to perform a Class I Literature Review for the proposed Border Winds Energy Project in Rolette County, North Dakota (Project). This investigation is being conducted in compliance with a North Dakota Public Service Commission permit of the Project for the repower of the existing facility. The turbine towers and pedestals will not be modified, and previous existing infrastructure is planned to be utilized. An earlier Class I Literature Review identified 11 archaeological sites and nine architectural sites that had been previously recorded in the project area and a one-mile buffer (Grohnke and Sather 2008). A subsequent Class III Intensive Cultural Resources Survey was conducted by Westwood in 2009 and 2013 utilizing pedestrian surface survey and/or shovel testing to locate previously unrecorded archaeological deposits (Grohnke 2013; Mieras, Grohnke, and Sather 2010). Seven pre-contact archaeological isolated finds were located and three historic archaeological sites were identified and documented. None of the historic or pre-contact archaeological sites identified during the Class III survey were considered eligible for listing on the National Register of Historic Places (NRHP). No further work was recommended for these resources. Westwood archaeologists recommended avoiding Site 32RO67, which is a previously recorded lithic scatter *unevaluated* for the NRHP.

The current repowering project for Border Winds will involve the replacement of wind turbine components (blades, gear assemblies, nacelles) on the existing turbine structures. This proposed component replacement is anticipated to be conducted within the existing, certified Project Area that includes 75 wind turbines, 14 thermal resistivity test locations, two substations, 50 miles of collector lines, and 25 miles of proposed access roads. This comprises the area of potential effect (APE) for the Project. An updated Class I Literature Review was performed by Westwood Principal Investigator Rigden Glaab at the Historical Preservation Division (HPD) of the State Historical Society of North Dakota (SHSND) on May 19, 2021. The updated file search area encompasses the limits of the 2008 study and currently surrounds the proposed APE. The Study Area for this review include the APE and a one-mile buffer.

A total of 11 isolated finds, three architectural sites, and 19 sites/site leads were identified in the 2021 Class I Literature Review Study Area. Of these 33 resources, there is one North Dakota state historic site (32ROx43) and one property (32RO51) listed on the NRHP. A total of 18 previous cultural resource surveys have been conducted in the study area including the inventory by Westwood (see Mieras, Grohnke, and Sather 2010). Ten of the identified previously recorded resources were also from the Westwood survey.

There are six resources that intersect with the APE that include a site lead for the Boundary Post Office (32ROx57), a pre-contact isolated lithic flake (32ROx104), a pre-contact lithic scatter (32RO67), and three historic cultural material scatters (32RO69, 32RO70, and 32RO71). The Boundary Post Office (32ROx57) and Site 32RO67 are *unevaluated* for the NRHP. The remaining four resources in the Project area are *not eligible* for the NRHP and Westwood recommends no further work at these locations.

Avoidance is recommended for Site 32RO67 as this lithic scatter may contain subsurface deposits and additional artifacts. If avoidance is not possible during the current repowering project, Westwood recommends a Phase II Evaluation of Site 32RO67 to determine any potential impacts to the subsurface integrity or distribution of the lithic scatter. A final recommendation for the NRHP would follow this proposed fieldwork. A Class III Intensive Cultural Resources Survey is not recommended should all proposed repower project efforts be conducted within current project corridors/locations or are located within areas previously

surveyed for cultural resources as is currently planned. Should any proposed Project design be located outside of previously constructed or previously surveyed areas, that aspect of the design should first be surveyed for unrecorded cultural resources.

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- Exhibit 2 (Set): 1:24,000 Scale Topographic Project Maps

1.0 Introduction

Westwood Professional Services (Westwood) was contracted by Xcel Energy (Xcel), of Minneapolis, Minnesota to conduct a Class I Cultural Resources Literature Search for the proposed Border Winds Energy Project (Project) in Rolette County, North Dakota. Xcel is proposing to repower the existing wind energy generation facility near the town of Rolla in the Townships of Fairview, Mount Pleasant and Baxter, Rolette County, and the Townships of Picton and Mount View in Towner County, North Dakota (**Exhibit 1 and 2**).

The Border Winds Wind Energy Project was initially developed in 2008. The Project was sited to comply with North Dakota Public Service Commission (PSC) siting and Rolette County zoning requirements. The repower will consist of replacing turbine blades, gear assemblies, and selected nacelles on the existing 75 2.0 -MW Vestas turbines. Turbine towers and pedestals will not be changed. At this time, no new ground disturbing activities are anticipated in the Project Area. This Class I Cultural Resources Literature Review is being conducted to support compliance with PSC Certification for the proposed repower.

Westwood was contracted to facilitate the collection of information regarding the cultural resources identified within the defined project boundary and the one-mile buffer. This one-mile buffer is a standard applied for the collection of corroborating data regarding regional distribution of cultural resources. The data collected are then used to identify the types of cultural properties that might be encountered as well as landforms and regions that might have a high potential for containing significant cultural resources. A listing of townships and sections included in either the defined project boundary or the surrounding buffer are summarized in **Table 1** below.

Table 1 – Sections Included In Project Area and One Mile Buffer

County	Township (T)	Range (R)	Project Sections	Buffer Sections
Towner	161N	68W		6
Rolette	161N	69W		1-6
Rolette	161N	70W		1
Towner	162N	68W	3-10, 15-22	2, 11, 14, 23, 26-31
Rolette	162N	69W	1-36	
Rolette	162N	70W		1, 2, 12, 13, 24, 25, 36
Towner	163N	68W	7-10, 15-22, 27-34	2-6,11, 14, 23, 26, 35
Rolette	163N	69W	1-36	
Rolette	163N	70W	1, 12, 13, 24, 25, 36	2, 11, 14, 23, 26, 35
Towner	164N	68W		30, 31
Rolette	164N	69W	25-36	
Rolette	164N	70W	25, 36	26, 35

Key: County = project area county of interest; Township = north/south coordinate of township; Range = east/west coordinate of township; Project Sections = sections within the township included in the defined project area; Buffer Sections = sections included in the one-mile buffer surrounding the defined project boundaries.

A catalog of previously identified and recorded cultural resources for the area was compiled from the records maintained at the Historical Preservation Division (HPD) of the State

Historical Society of North Dakota (SHSND), and the ND State Archives and Librarian Bismarck, North Dakota. The data collected from these sources includes the state archaeological site files, historic property files, the North Dakota National Register inventory, and archival collections of published and unpublished reports of previous cultural resource investigations. Westwood staff also consulted historic documents in order to identify potential cultural features relating to the proto-historic to early historic periods that may exist in the project area. The Project area has been previously examined by Westwood during a Class I Literature Review and subsequent Class III Intensive Cultural Resources Survey (Grohnke and Sather 2008; Mieras, Grohnke, and Sather 2010). A total of 33 resources were identified in the 2021 Class I Literature Review consisting of 11 isolated finds, three architectural sites, and 19 sites/site leads. Further recommendations regarding these resources are discussed below.

2.0 Environmental Setting

Environmental Background

The project area is located within the Northern Black Glaciated Plains (NBGP) portion of the Northern Great Plains (DesLauriers and Lambert 1997). A majority of the land within the NBGP is utilized in agricultural production with over 80% dedicated to dry-farmed cropland. The elevation of the region varies from 300 meters (ca. 980 feet) to 700 meters (2300 feet) exhibiting a general increase in elevation from east to west. The ground surface of the region is level to slightly undulating till plains, which includes a number of kettle holes, kames and moraines. The average annual temperature is 3-4° Celsius (37-40° Fahrenheit). The region receives an annual average precipitation of 375-450 millimeters (15-18 inches). The region is freeze-free between 100 and 120 days per year. Generally, the precipitation per year is insufficient for maximum agricultural production. The few sources of surface water in the region are too small, too distant from need, or only seasonally available to be applied to agricultural needs. Water from underground sources is most effectively obtained in areas covered in glacial drift.

Soils in the region are dominated by Borolls and Aquolls. The soils are generally deep and well drained to poorly drained. On the well-drained level surfaces located on till plains, the soils are classified as Haploborolls. In undulating, poorly drained areas the soils are classified as Argiaquolls with Argialbolls in wetlands.

Natural vegetation in the region was dominated historically by prairie vegetation. Native vegetation species common on the till plains included western wheatgrass, needle-and-thread, green needlegrass, and blue grama. Species commonly in association with the wetlands included prairie cordgrass, northern cordgrass, big bluestem, and slim sledge. The majority of the land is currently cultivated and being used for agricultural purposes, primarily small grains.

Wildlife species occupying the project area have changed somewhat since historic times, mostly as a result of habitat changes associated with mechanized agriculture. Historically, avian species listed as occurring in the greater geographic region include the piping plover, least tern, chimney swift, eastern phoebe, purple martin, eastern bluebird, black-and-white warbler, ovenbird, indigo bunting, rose-breasted grosbeak, orchard oriole, and field and swamp sparrows. Mammals on the historic list for the region include white-tailed deer, mule deer, pronghorn, bobcat, white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. The black-footed ferret and bison were also historically associated with the area. Herpetofauna historically inhabiting the region include the snapping turtle, spiny softshell

turtle, smooth green snake, and the prairie rattlesnake. Since European settlement, many of these species have become either extirpated from the area or considerably less abundant.

Mammals observed during a June 2008 field visit of the project area, white-tailed deer (*Odocoileus virginianus*), beaver (*Castor canadensis*), prairie dog (*Cynomys ludovicianus*), coyote (*Canis latrans*), and badger (*Taxidea taxus*). Avian species frequently observed during a spring migration survey (2009) include red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), great-horned owl (*Bubo virginianus*), American kestrel (*Falco sparverius*), northern harrier (*Circus cyaneus*), killdeer (*Charadrius vociferous*), and several species of waterfowl, shorebirds, and songbirds.

The project area occurs within portions of two major migration flyways. The Central and Mississippi Flyways are used by millions of birds as they migrate from northern Canada south through the Great Plains to the Gulf of Mexico and beyond. Based on historical field research and observations, it is known that waterfowl, shorebirds, and songbirds migrate through the North Dakota region of these flyways each spring and fall.

3.0 Cultural Setting

The Historic Preservation Division (HPD) of the SHSND has developed several historic contexts for the state of North Dakota. These contexts examine North Dakota's recent (Historic) and distant (Pre-Contact) past and are based on decades of archaeological and historical research. They are designed to help generally describe and interpret the history of the state and give basic insight into the prevailing theories pertaining to the Historic and Pre-Contact communities existing in specific locations and at discrete points of time. The project area falls within the Northern Red River Study unit (SHSND 2008).

The cultural histories focusing solely on American Indian communities are divided into several major traditions: Paleo-Indian, Plains Archaic, Plains Woodland, Plains Village, and Equestrian/Nomadic. These traditions are defined on the basis of significant changes in how American Indian communities lived and what resources, local or exotic, they utilized.

The final cultural history is the Historic Period. This context ranges from the first contact between Europeans and American Indians during European exploration in the region, through Euro-American settlement of traditionally American Indian lands.

Paleo-Indian Tradition (9,500 to 5,500 B.C.)

The Paleo-Indian Tradition refers to the period of time at the close of the Pleistocene era and into the Holocene era, when American Indian communities were small, mobile, and focused on hunting. This period is marked by the retreat of glacial ice, the decline of the megafauna (e.g., woolly mammoth, mastodons, and camels), and the growth of modern vegetation. The small number of artifacts found at Paleo-Indian sites indicates that these communities hunted a limited number of large animals in a variety of environmental settings. As the Pleistocene era ended and the Holocene era began, the megafauna gradually died out. This caused the Paleo-Indian people to shift their focus from hunting animals such as the mammoth to the largest remaining species, bison. In addition to bison, it is likely that gathering wild plant foods and hunting smaller animals also contributed significantly to the diet of the Paleo-Indian people (SHSND 2008).

Plains Archaic Tradition (5,500 to 400 B.C.)

The Plains Archaic Tradition is divided into Early, Middle, and Late periods. The people of the Plains Archaic Tradition remained hunters and gatherers as their Paleo-Indian forbearers. However, shifts in diet and settlement patterns define the transition to the Archaic Tradition. It seems that native people were adapting to environmental changes by using more diverse plant and animal resources.

During this period, Plains Archaic people began developing regional differences within their material culture, interaction between different populations became less common, and the quality of craftsmanship exhibited by their lithic tools diminished. As with Paleo-Indian sites, Archaic sites are relatively small and ephemeral. Similarly, with Paleo-Indian sites, it is believed that Archaic sites are likely deeply buried in the floodplains.

Plains Woodland Tradition (400 B.C to A.D. 1850)

Throughout the Midwest, the Woodland Tradition is generally divided into three periods: Early, Middle, and Late. The transition to the Woodland Tradition occurred when American Indians began manufacturing ceramic vessels, using bows and arrows, constructing earthen burial mounds, cultivating various plant species, and harvesting select plant species. Notwithstanding these developments, life for communities during the Woodland Tradition in many ways remained similar to that of the Archaic period.

Despite some similarities between Initial Woodland and Archaic period community size, populations began to grow during the Late or Terminal Woodland period. One possible reason is that American Indians became increasingly efficient in how they acquired food toward the end of the Woodland period. Site types assigned to the Woodland Tradition throughout the region range from cemeteries and small limited use sites to extensive village and habitation sites. Woodland period communities were situated in locations that ranged from focusing on a specific resource to general environments capable of sustaining a large community for a long time.

Plains Village (A.D. 1000 to 1850)

Significant changes in subsistence and settlement patterns characterize the shift to the Plains Village Tradition. Ceramic vessels differ from previous types in form as well as decoration, and settlement patterns shift to larger, more permanent villages typically located in riverine settings. The subsistence strategies of these populations appear to incorporate hunting and gathering with limited agriculture focusing on specific plants. The Plains Village primary adaptation was "...the production of a dependable storable surplus food supply primarily in the form of dried corn" (SHSND 2008). Evidence indicates that the Plains Village complex relied heavily on bison hunting and intensive corn horticulture.

Equestrian Nomadic Tradition (mid 1700s to 1851)

The introduction of the horse is the primary characteristic of the Equestrian Nomadic Tradition. This period is also referred to as protohistoric, a time when the indigenous people were coming into contact with and being influenced by European culture. This contact was not always direct interaction between Native and Euro-American peoples, but sometimes through contact with items of Euro-American cultural material being traded throughout the area.

Historic Period

The Historic Period refers to the time when the Euro-American presence and influence became unavoidable. During the Historic Period, Euro-Americans pushed westward and increasingly settled in the Dakotas. Although North and South Dakota were initially within the Missouri Territory, the Dakota Territory was eventually established in 1861 and encompassed North Dakota, South Dakota, and much of Montana and Wyoming. Dakota Territory was opened to homesteaders in 1862. Following the opening of the Dakota Territory several railroads that served the territory, including the Dakota Southern and Manitoba (known later as the Great Northern) Railways, were built, and the Gold Rush of 1876 began. These events led to massive Euro-American settlement of the Dakota Territory between 1872 and 1887. This period is known as the Great Dakota Boom. A severe drought brought the Boom to an end between 1886 and 1887.

In 1889 North and South Dakota were admitted to the Union as the 39th and 40th states, in no particular order. The states were the leading producers of wheat until the drought and Great Depression in the 1930s, and railroads continued to expand and run until the collapse of the farming industry in the 1980s. Significant events witnessed by residents of North and South Dakota throughout the 20th century include discovering oil in 1927 and 1951, enduring record blizzards, creating numerous military bases and nuclear missile silos, and constructing dams.

4.0 Literature Review

Westwood Principal Investigator Rigden Glaab performed a literature review search for the current Project area at the HPD of the SHSND on May 19, 2021. The updated file search area encompasses the limits of the 2008 study which surrounds the proposed 2021 APE (see Grohnke and Sather 2008; **Exhibit 1 and Exhibit 2 [set]**). The Study Area for this review includes the APE and a one-mile buffer.

Previous Investigations

A total of 18 previous archaeological surveys have been conducted in the study area. Table 2 summarizes the previous cultural resources investigations that have occurred in the Study Area. Of particular note are MS 11981, Class III Intensive Cultural Resources Inventory of the Border Winds Energy Project by Kevin J. Mieras, Ryan P. Grohnke and Dean T. Sather; and MS14625, Class III Intensive Cultural Resources Inventory: Supplemental 2013 Investigations For the Border Winds Energy Project by Ryan P. Grohnke. These surveys investigated the entirety of the Border Winds Energy Project APE.

Table 2 – Previous Cultural Resources Reports

Year	Manuscript	Title	Author (s)
1985	MS 3649	A Class III Cultural Resource Inventory of the Turtle Mountain Road Improvement Project, Turtle Mountain Indian Reservation, Rolette County, North Dakota (UW#821)	Blikre, L.R. et al
1995	MS 6449	North Dakota Department of Transportation Safety Project Cultural Resource Review 1992-1994	Christensen, R. C. et al.

PUBLIC DOCUMENT - NONPUBLIC DATA HAS BEEN EXCISED

Year	Manuscript	Title	Author (s)
1999	MS 7533	Project Walking Shield: A Cultural Resources Inventory of 25 Proposed Tribal Homesites on Turtle Mountain Chippewa Trust Lands in Rolette Co., ND	Ferris, Kade M.
1999	MS 7376	Hansboro Bridge Replacement, Bridge Number 101-06.0: A Class III Cultural Resource Inventory, Towner County, ND	Morrison, J. G.
2000	MS 7660	Addendum To: Ottertail Company's 230 kV Harvey/Rolla Transmission Line Cultural Resources Inventory, Wells, Pierce, and Rolette Counties, ND	Olson, Byron L.
2000	MS 7560	Results of a Class II/Class III Cultural Resource Inventory for the All Seasons Water Project: System IV, Phase II, Rolette and Towner Co., ND	Larson, T. K.
2000	MS 7554	DeMers Gravel Pit: A Class III Cultural Resource Inventory, Rolette Co., ND	Bluemle, William, J.
2007	MS 10472	Evaluation of Buildings and Structures at the Land Ports of Entry in North Dakota, Rolette, Divide, Bottineau, Cavalier, Towner, Pembina, Burke and Renville Counties	Belfast, J. et al.
2007	MS 10463	Archaeological Survey of the St. John (SJO) Land Port of Entry, Rolette Co., ND	Greiser, T. W. et al.
2007	MS 10015	Wakopa Trail Survey: A Class III Cultural Resources Inventory in Rolette Co., ND	Bluemle, William J.
2008	MS 10779	County Route 43: A Class III Cultural Resource Inventory in Rolette Co., ND	France, E.L.
2009	MS 11412	106th St NE/County Road 43: A Class III Cultural Resource Inventory in Towner Co., ND	Engel, D.
2009	MS 10858	North Dakota Department of Transportation: A Class III Cultural Resource Inventory of North Dakota State Highway 30 From Rolla to the Canadian Border in Rolette Co., ND	Strait, J.D.
2010	MS 17694	Building Preservation Plan U. S. Land Port of Entry - St. John GSA Building #ND0531AN, St. John, North Dakota (32RO50)	USGSA
2010	MS 11981	Class III Intensive Cultural Resources Inventory Border Winds Energy Project Rolette Co., ND	Mieras, K.J. et al.
2013	MS 14625	Class III Intensive Cultural Resources Inventory: Supplemental 2013 Investigations for the Proposed Border Winds Energy Project, Rolette County, North Dakota	Grohnke, R.P.

Year	Manuscript	Title	Author (s)
2018	MS 17969	A Class III Cultural Resource Inventory of the IHS Housing Service Lines in Rolette County, North Dakota	Neumiller, A. and Brooks, B.
2019	MS 18541	A Class III Intensive Cultural Resource Inventory for the St. John to NDSH 30 Shoulder Widening Project in Rolette County, North Dakota	Reich, A.Y.

Previously Recorded Cultural Resources

The results of the 2021 Class I Literature Review identified a total of 33 cultural resources that include 11 isolated finds, three architectural sites, and 19 sites/site leads in the Project APE or one mile literature review buffer. Among these resources are one North Dakota state historic site (32ROx43) and one property (32RO51) listed on the NRHP. Ten of the identified previously recorded resources were also from the Westwood survey. Table 3 provides an inventory of previously recorded archaeological sites and architectural resources identified in the 2021 Class I Literature Review.

Table 3 – Previously Identified Archaeological and Architectural Resources

Site Number	Resource Type	Cultural Period	Project Area/Buffer	NRHP
32RO12	Architecture (Structure)	Historic	Buffer	Not Eligible
32RO32	Architecture (Fortunate & Cedulie Martineau House)	Historic	Buffer	Eligible
32RO50	St. John Border Inspection Station	Historic	Buffer	Eligible
32RO51	Coghlan House/Coghlan Castle	Historic	Buffer	Eligible
32RO65	Burlington Northern Railroad Bed	Historic	Buffer	Unevaluated
32RO67	Pre-Contact CMS	Pre-Contact	Project	Unevaluated
32RO68	St. John The Baptist Catholic Church	Historic	Buffer	Unevaluated
32RO69	Historic CMS	Historic	Project	Not Eligible
32RO70	Historic CMS	Historic	Project	Not Eligible
32RO71	Historic CMS	Historic	Project	Not Eligible
32RO409	Architecture (School)	Historic	Buffer	Unevaluated
32ROx42	Lithic Flake	Pre-Contact	Buffer	Not Eligible
32ROx43	St. Claude Historic (District?, Cemetery?)	Historic	Buffer	Unevaluated
32ROx44	St. Claude Mission	Historic	Buffer	Unevaluated
32ROx45	Grave	Historic	Buffer	Unevaluated
32ROx46	St. John Post Office	Historic	Buffer	Unevaluated
32ROx57	Boundary Post Office	Historic	Project	Unevaluated
32ROx61	Uniface	Pre-Contact	Buffer	Not Eligible
32ROx72	St. John Café	Historic	Buffer	Unevaluated
32ROx73	Square Deal Store	Historic	Buffer	Unevaluated

Site Number	Resource Type	Cultural Period	Project Area/Buffer	NRHP
32ROx74	Fire Station	Historic	Buffer	Unevaluated
32ROx75	Architectural (House)	Historic	Buffer	Unevaluated
32ROx80	Lithic Flake	Pre-Contact	Buffer	Not Eligible
32ROx83	Lithic Flake	Pre-Contact	Buffer	Not Eligible
32ROx103	Lithic Flake	Pre-Contact	Buffer	Not Eligible
32ROx104	Test Cobble	Pre-Contact	Project	Not Eligible
32ROx105	Lithic Flake	Pre-Contact	Buffer	Not Eligible
32ROx106	Projectile Point	Pre-Contact	Buffer	Not Eligible
32ROx107	Lithic Knife	Pre-Contact	Buffer	Not Eligible
32ROx108	Lithic Flake	Pre-Contact	Buffer	Not Eligible
32ROx109	Projectile Point and Biface Fragment	Pre-Contact	Buffer	Not Eligible
32TO8	Bridge over Hidden Island Coulee	Historic	Buffer	Not Eligible
32TOx48	Picton Post Office.	Historic	Buffer	Unevaluated

Cultural Resources in the APE

A total of six resources are identified in the APE comprised of a site lead for the Boundary Post Office (32ROx57), a pre-contact isolated lithic flake (32ROx104), a pre-contact lithic scatter (32RO67), and three historic cultural material scatters (32RO69, 32RO70, and 32RO71). The content of these sites is discussed in greater detail below along with the respective eligibility information for the NRHP.

[NONPUBLIC DATA HAS BEEN EXCISED... Site Lead 32ROx57 (Boundary Post Office)

Site Lead 32ROx57 identifies the suspected area where the Boundary Post Office was once located as recorded by Benson (1980) citing an unknown source (Reap 1978?). There is little information available on the form. [REDACTED]

[REDACTED]. The APE was previously surveyed by Westwood in 2010. Should the existing infrastructure be used as planned or should alterations occur in the previously surveyed area, no additional investigations are recommended.

Isolated Find 32ROx104 (Lithic Flake)

Isolated find 32ROx104 consists of a single tested cobble of Swan River chert recorded by Westwood (Mieras, Grohnke, and Sather 2010). [REDACTED]

[REDACTED]. 32ROx104 was located during pedestrian survey of a proposed access road and will be directly impacted by construction. This isolated find is located on top of a small hill approximately 60 meters from a seasonal marsh, in an agricultural field with 95% ground surface visibility. The Project APE passes approximately 10 feet north of the isolate. Westwood previously recommended this resource *not eligible* for the NRHP. No further work is recommended at this location.

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[NONPUBLIC DATA HAS BEEN EXCISED...]

Site 32RO67 (Lithic Scatter)

Site 32RO67, a low density lithic scatter, was previously located within the APE of the Project, but the proposed location for the access road to Turbine [REDACTED] was revised to avoid 32RO67 (Mieras, Grohnke, and Sather 2010). [REDACTED]

[REDACTED]. Metcalf Archaeological Consulting (2008), which identified 32RO67, reported that the site has low to moderate potential for significant amounts of cultural materials and features, but that further work was necessary to determine the sites NRHP eligibility. Westwood initially recommended that the proposed turbine access road be realigned to avoid 32RO67. The proposed location of the access road to Turbine [REDACTED] was revised as of 2010.

It is recommended that the Project avoid Site 32RO67 by remaining on currently developed infrastructure as this lithic scatter may contain subsurface deposits and additional artifacts (see also Mieras, Grohnke, and Sather 2010). If avoidance is not possible, Westwood recommends a Phase II Evaluation of Site 32RO67 to determine any potential impacts to the subsurface integrity or distribution of the lithic scatter. A final recommendation for the NRHP would follow this proposed fieldwork.

Site 32RO69 (Historic CMS)

Site 32RO69 is located on a hilltop within a cultivated field with 90% GSV (Mieras, Grohnke, and Sather 2010). [REDACTED]

[REDACTED]. This site consists of a scatter of historic period artifacts including glass, pottery, and miscellaneous metal fragments. The scatter covers approximately 1,200 square meters of area. Upon locating Site 32RO69, the immediate area was subjected to an intensive pedestrian survey consisting of one-meter intervals. The total number of artifacts observed is estimated to be at least 500. No artifacts were collected. This site was recommended not eligible for the NRHP with no additional work proposed due to a lack of integrity. The 2021 route passes through the western boundary of the site.

Site 32RO70 (Historic CMS)

Site 32RO70 consists of historic period artifacts including window and bottle glass, pottery, and miscellaneous metal (Mieras, Grohnke, and Sather 2010). [REDACTED]

[REDACTED]. Upon locating Site 32RO70, the immediate area was subjected to an intensive pedestrian survey consisting of one-meter intervals. The total number of artifacts observed is estimated to be at least 300. No artifacts were collected. Mieras et al. (2010) recommended Site 32RO70 *not eligible* for the NRHP with no additional work proposed due to a lack of integrity. The 2021 route passes through or near the northwestern boundary of the site.

Site 32RO71 (Historic CMS)

Site 32RO71 consists of historic period artifacts including glass, pottery, and miscellaneous metal (Mieras, Grohnke, and Sather 2010). [REDACTED]

[REDACTED]. Upon locating Site 32RO71, the immediate area was subjected to an intensive pedestrian survey consisting of one-meter intervals. The total number of artifacts observed is estimated to be at least 300. No artifacts were collected. Site 32RO71 was recommended *not eligible* for the NRHP due to a lack

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of integrity in 2010 by Westwood with no additional work planned at the time. The 2021 route passes through or near the southeastern boundary of the site.

5.0 Conclusions and Recommendations

Westwood was retained by Xcel to conduct a Class I Literature Review in compliance with the PSC Certification for the Border Winds Energy Project in Rolette County, North Dakota. Westwood previously performed a Class I Literature Review, and later a Class III Intensive Cultural Resources Survey of the Border Winds Project that inventoried the APE as of 2013 (Grohnke and Sather 2008; Mieras, Grohnke, and Sather 2010; Grohnke 2013). The 2021 Project layout consists of 75 wind turbines, 14 thermal resistivity test locations, two substations, 50 miles of collector lines, and 25 miles of proposed access roads (i.e., Project APE). Westwood Principal Investigator Rigden Glaab performed a Class I Literature Review at the HPD of the SHSND on May 19, 2021. The 2021 file search area includes the 2008 study limits that surround the proposed APE.

There were 33 resources identified in 2021 Class I Literature Review. These include 11 isolated finds, three architectural sites, and 19 sites/site leads. There is one North Dakota state historic site (32ROx43) and one property (32RO51) listed on the NRHP, both of which are outside of the APE. There have been 18 previous cultural resource surveys in the study area (see also Mieras, Grohnke, and Sather 2010). Ten of the identified previously recorded resources are from the 2010 the Westwood survey.

The Class I Literature Review identified six resources in the current APE which are the site lead for the Boundary Post Office (32ROx57), a pre-contact isolated lithic flake (32ROx104), a pre-contact lithic scatter (32RO67), and three historic cultural material scatters (32RO69, 32RO70, and 32RO71). Site 32RO67 and the Boundary Post Office (32ROx57) and are *unevaluated* for the NRHP. The other four sites in the APE are *not eligible* for the NRHP.

Westwood recommends that Site 32RO67 be avoided. This lithic scatter may contain subsurface deposits (e.g., features) and additional artifacts (e.g., tools, faunal remains). If Project design follows the existing infrastructure, no additional work will be necessary. However, should Project design be altered and the site may be impacted, Westwood recommends a Phase II Evaluation of Site 32RO67 to identify impacts to the subsurface integrity of the lithic scatter. A final recommendation for the NRHP would be provided after the archaeological assessment of the site.

A Class III Intensive Cultural Resources Survey is not recommended should all project design remain in currently constructed corridors/locations or are located within areas previously surveyed for cultural resources. Should any proposed Project design be located outside of previously constructed or previously surveyed areas, that aspect of the design should first be surveyed for unrecorded cultural resources. The results of the 2021 Class I Literature Review and previous Westwood studies indicate that both pre-contact and post-contact period resources may be present in the Project. If the assemblages follow the local pattern, artifacts present will include projectile points, utilized flakes, and evidence of tool production reflecting ephemeral occupation episodes. The literature review suggests that post-contact resources may include linear, unimproved road segments, and recent farm/ranch deposits.

6.0 Reference Cited

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Grohnke, R.P.

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Grohnke, R., and D. Sather

2008 *Class I Literature Search for the Proposed Border Winds Project, Rolette and Towner Counties, North Dakota*. Document is on file at the North Dakota State Historic Preservation Office (ND SHPO), Bismarck, North Dakota.

Mieras, K. J., R. Grohnke, and D. Sather

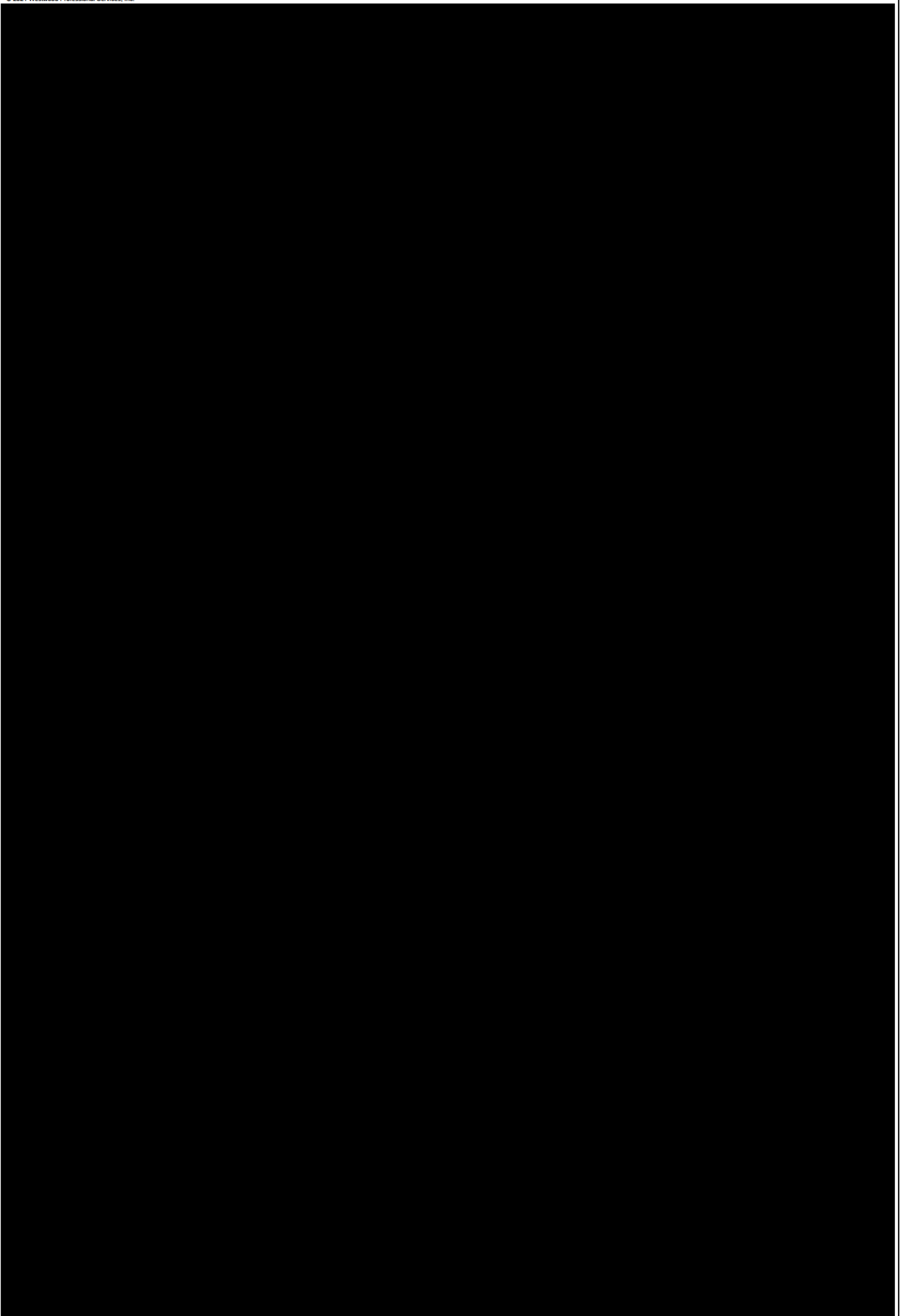
2010 *Class III Intensive Cultural Resources Inventory for the Proposed Border Winds Energy Project, Rolette County, North Dakota*. Document is on file at the North Dakota State Historic Preservation Office (ND SHPO), Bismarck, North Dakota.

SHSND

2008 Northern Red River Study Unit. Electronic document, https://www.history.nd.gov/hp/PDFinfo/9_Northern_Red_River_Study_Unit.pdf, accessed July 30, 2021.

Exhibits:
Project Overview
Map (Exhibit 1)
and
1:24,000 Scale
Topographic Project
Maps (Exhibit 2)

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- Turbine Location
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- Map Index
- Counties
- One Mile Study Buffer
- Westwood Inventoried APE as of 2014



Border Winds Project
Rolette and Towner Counties, North Dakota

Project Overview

EXHIBIT 1

NOTE: Archaeological sites are sensitive and confidential. This map and the information it contains should not be publicly disseminated.

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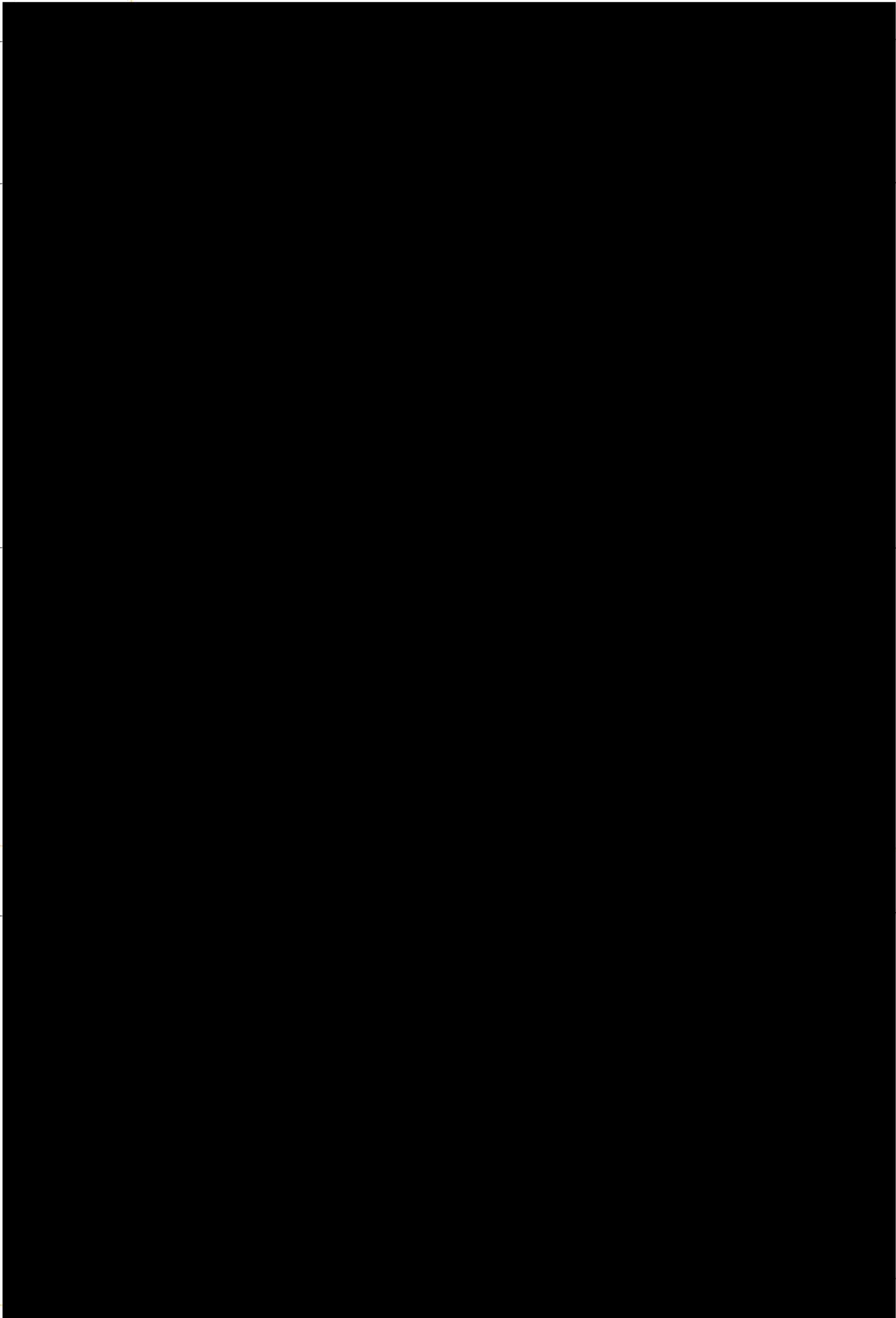
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Border Winds Project
Rolette and Towner Counties, North Dakota

Project Location (1:24,000)

EXHIBIT 2 (MAPS 1-17)

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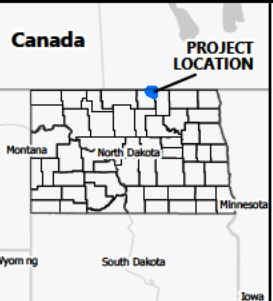


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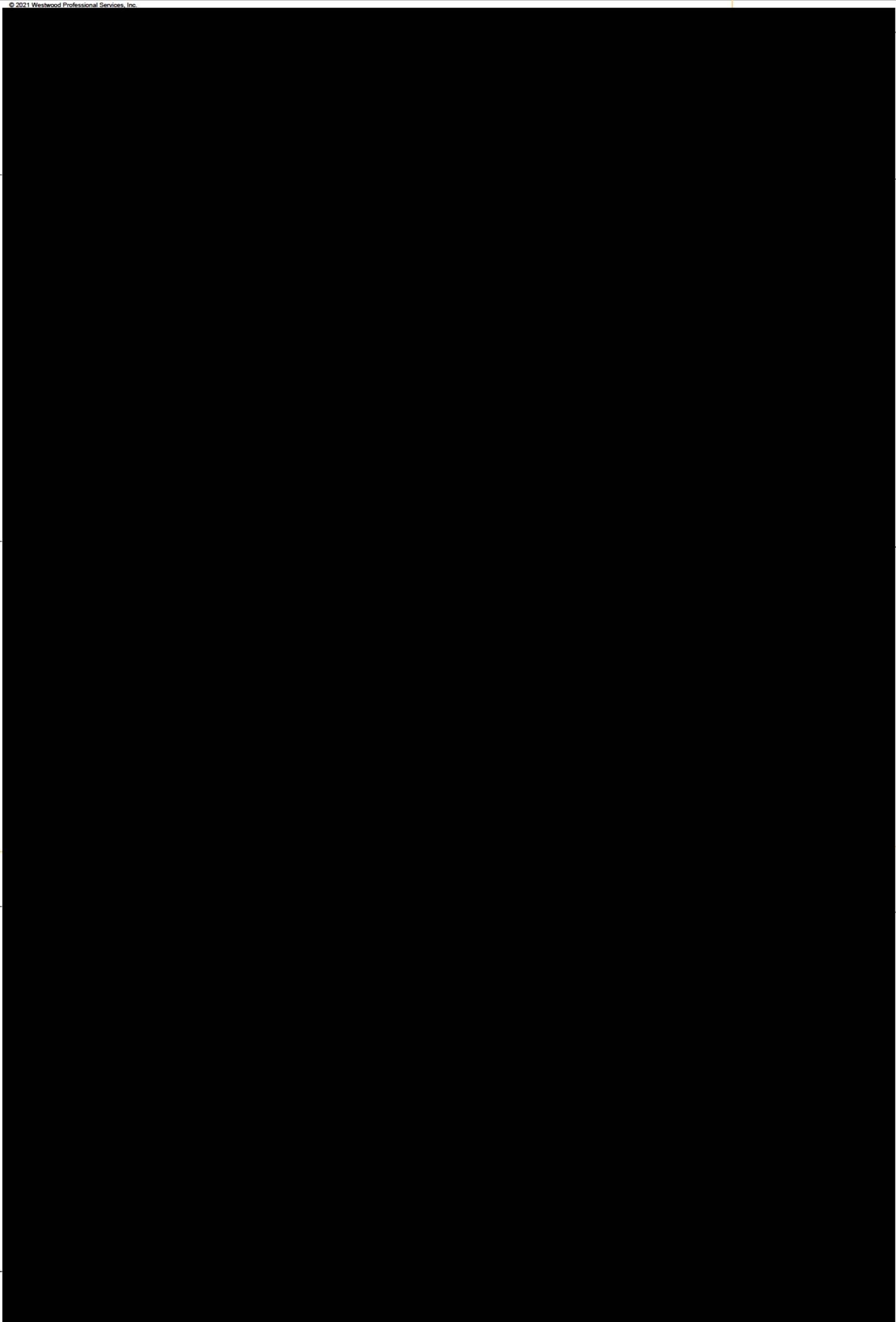
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Border Winds Project
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Project Location (1:24,000)

EXHIBIT 2 (MAPS 1-17)

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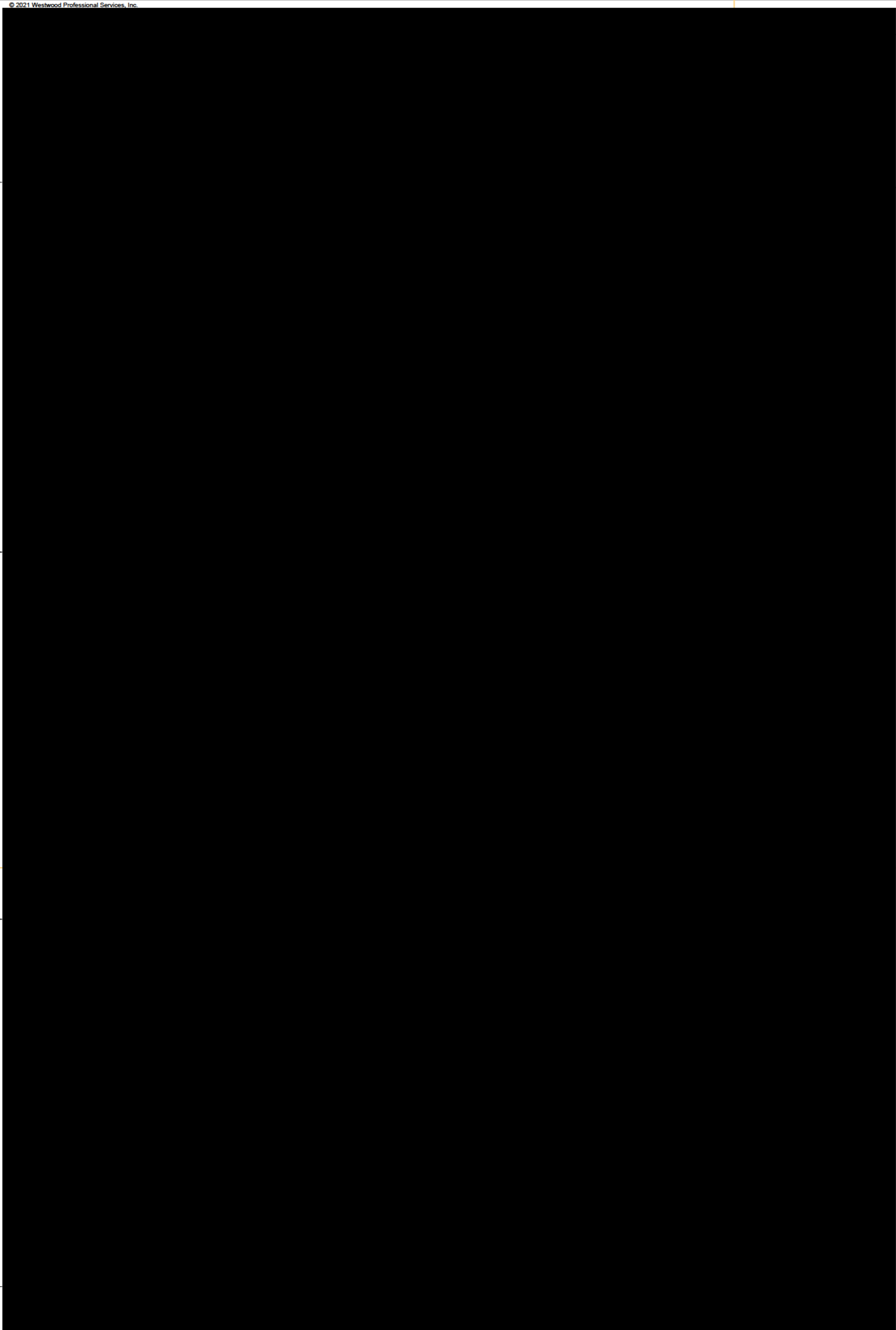
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Border Winds Project
Rolette and Towner Counties, North Dakota

Project Location (1:24,000)

EXHIBIT 2 (MAPS 1-17)

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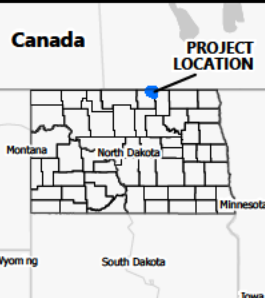


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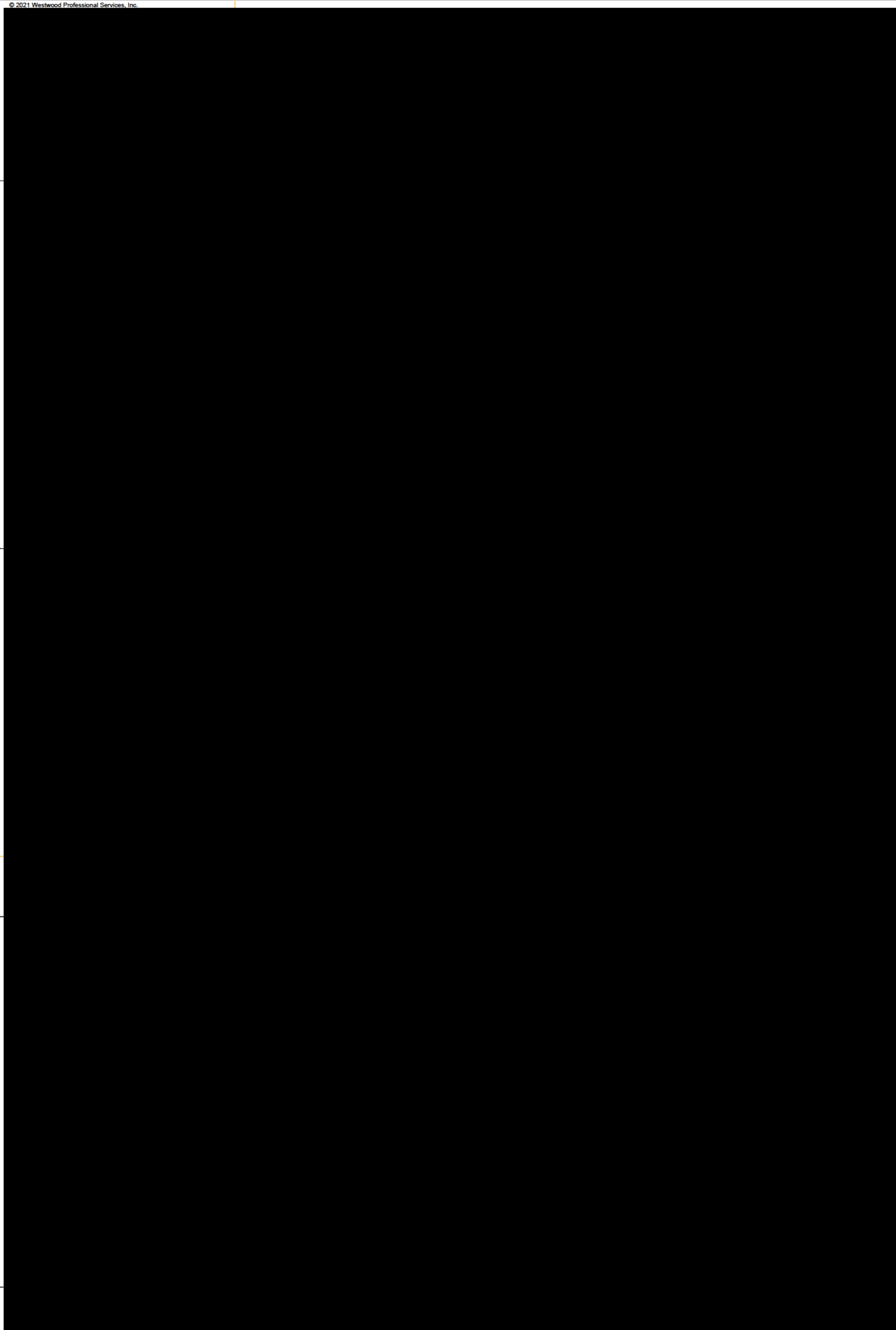
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Border Winds Project
Rolette and Towner Counties, North Dakota

Project Location (1:24,000)

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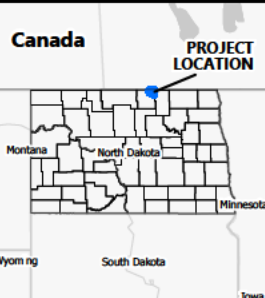


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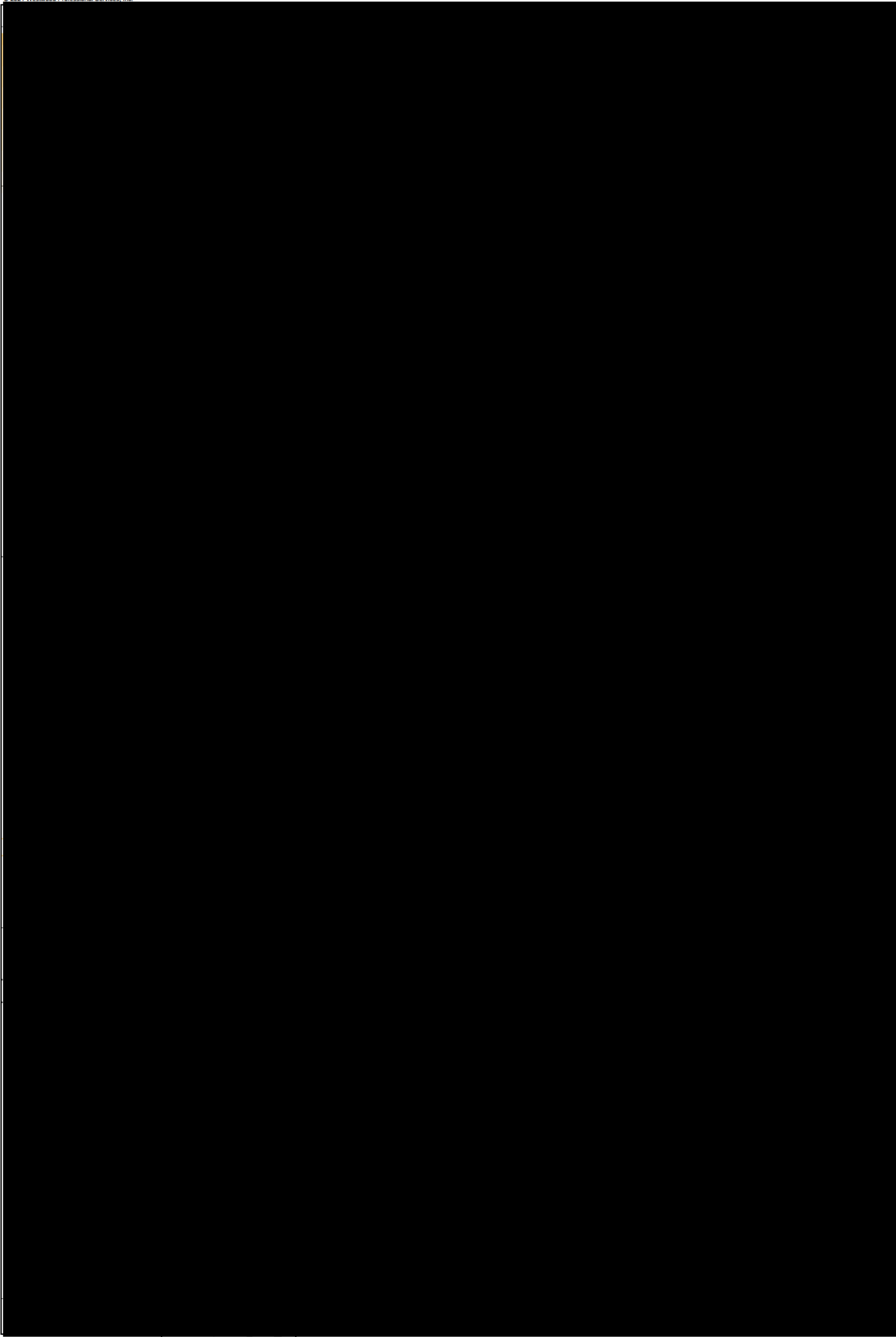
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Border Winds Project
Rolette and Towner Counties, North Dakota

Project Location (1:24,000)

EXHIBIT 2 (MAPS 1-17)

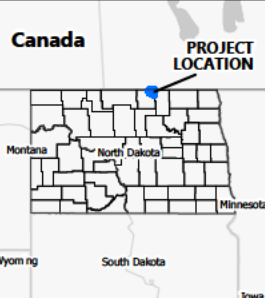
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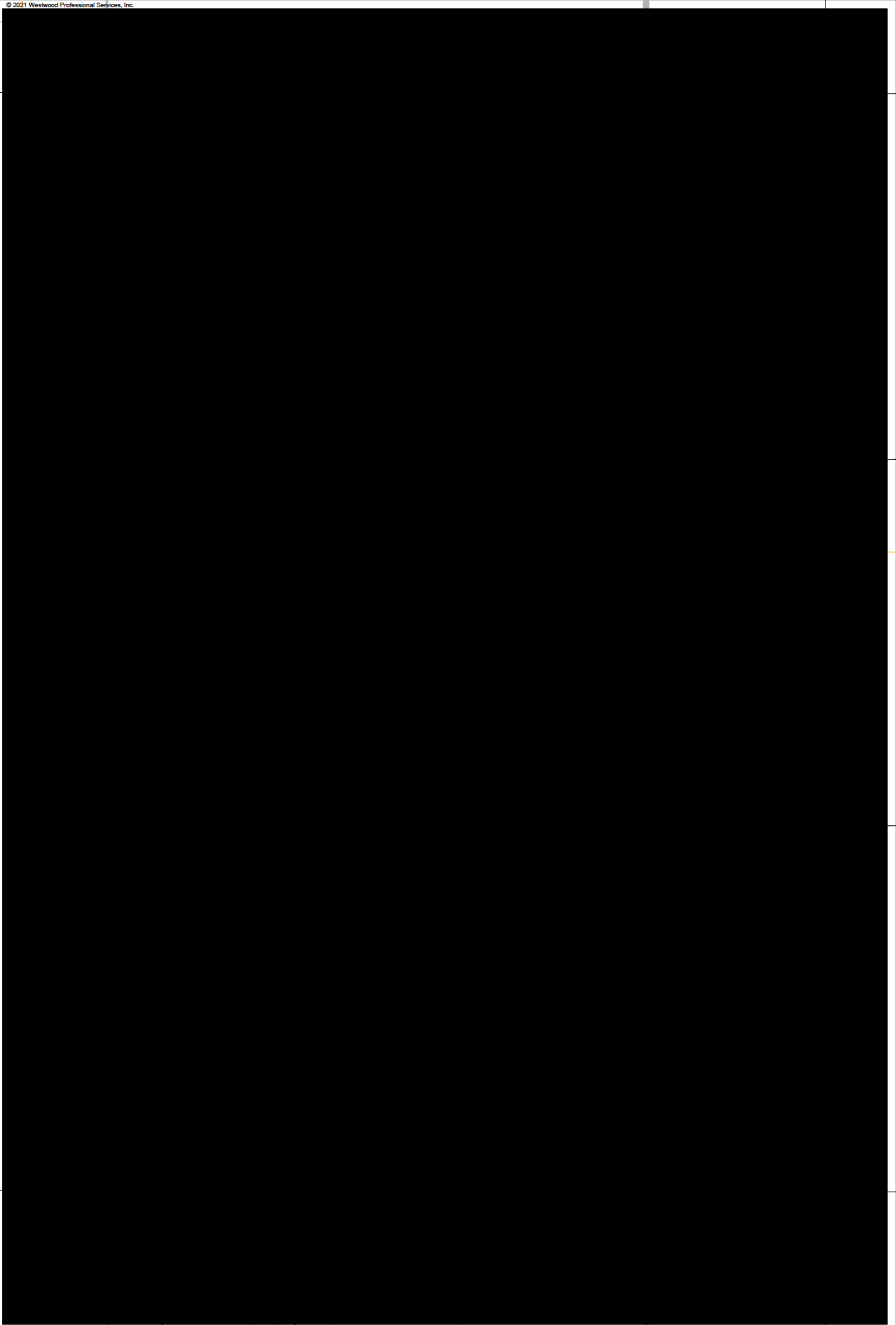
Border Winds Project
Rolette and Towner Counties, North Dakota

Project Location (1:24,000)

EXHIBIT 2 (MAPS 1-17)

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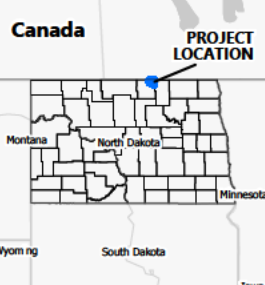
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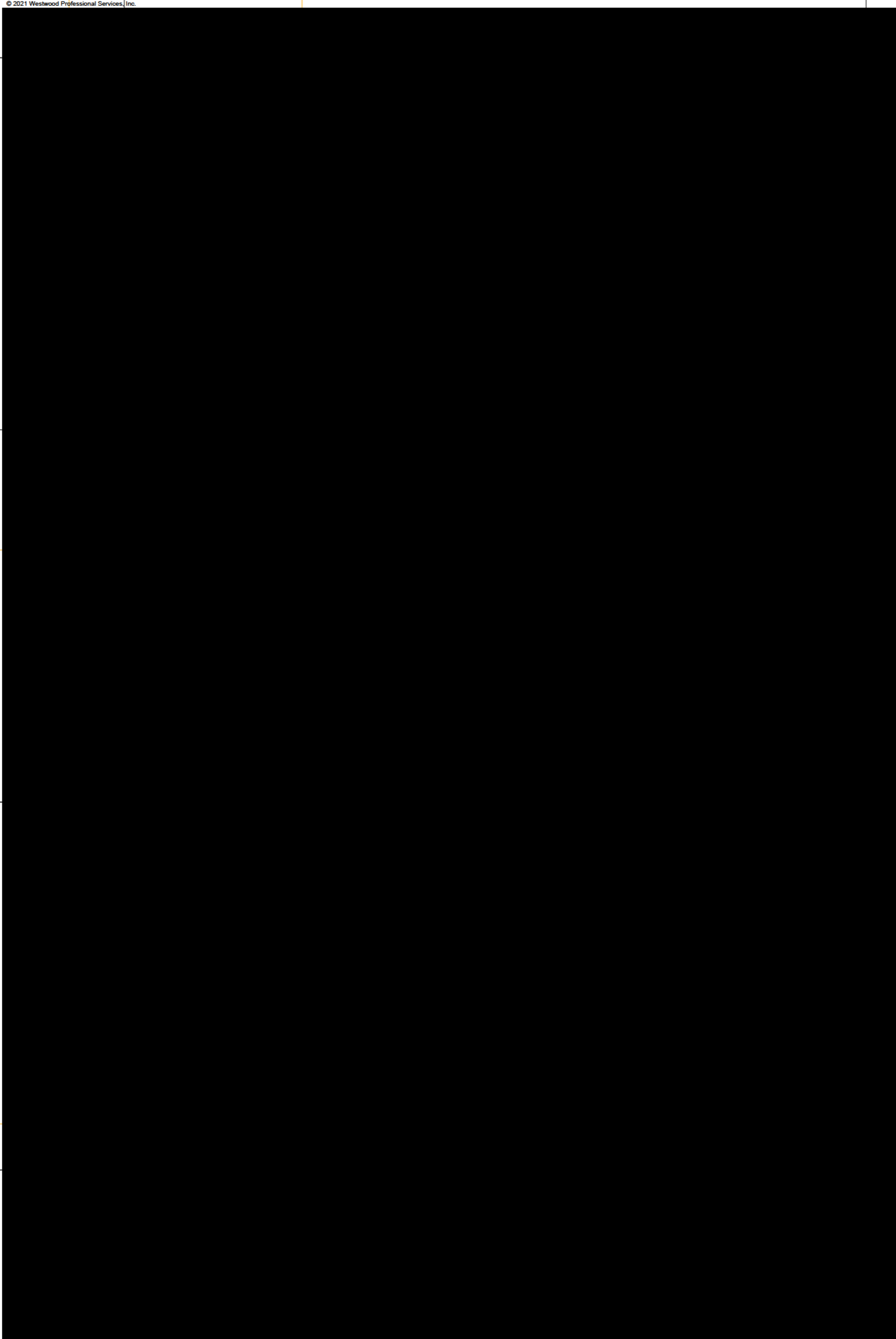
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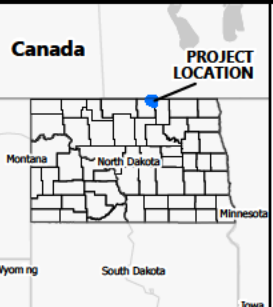


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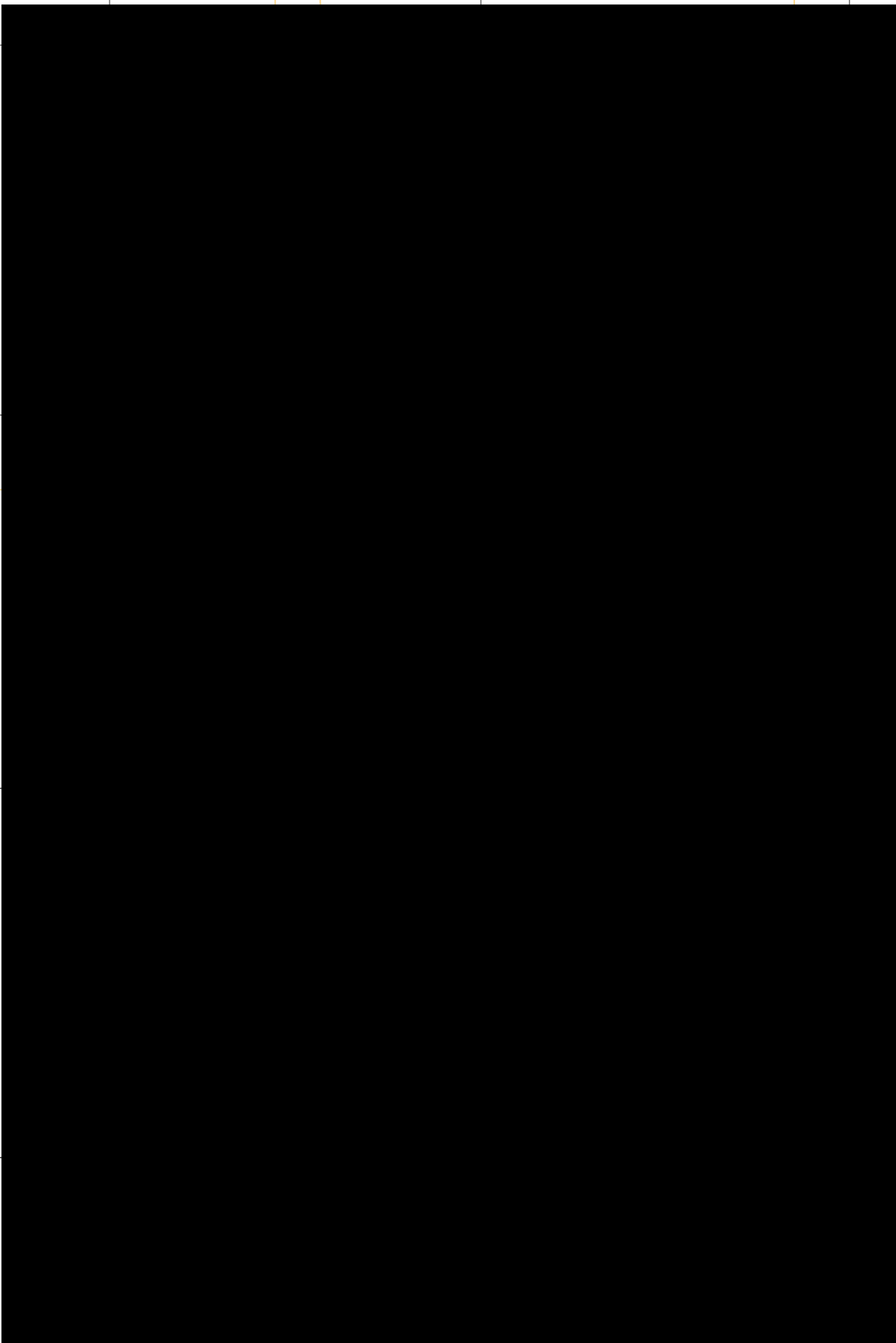
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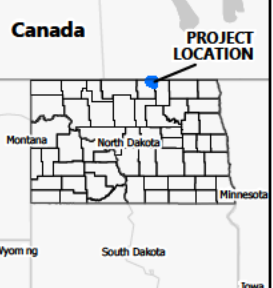


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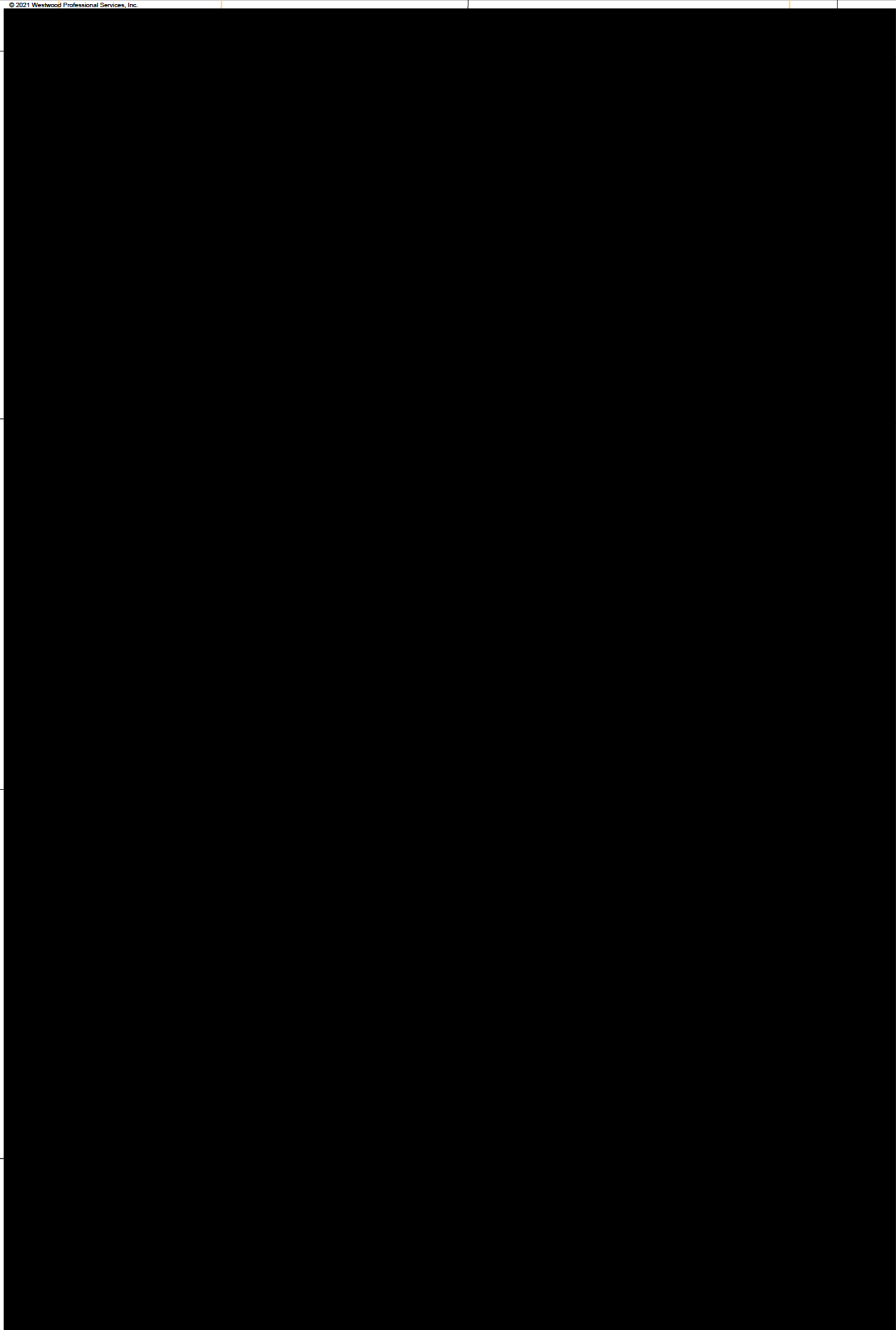
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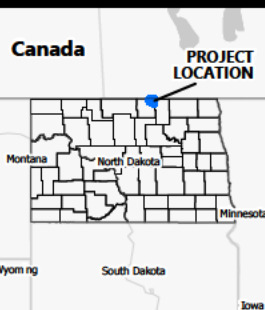


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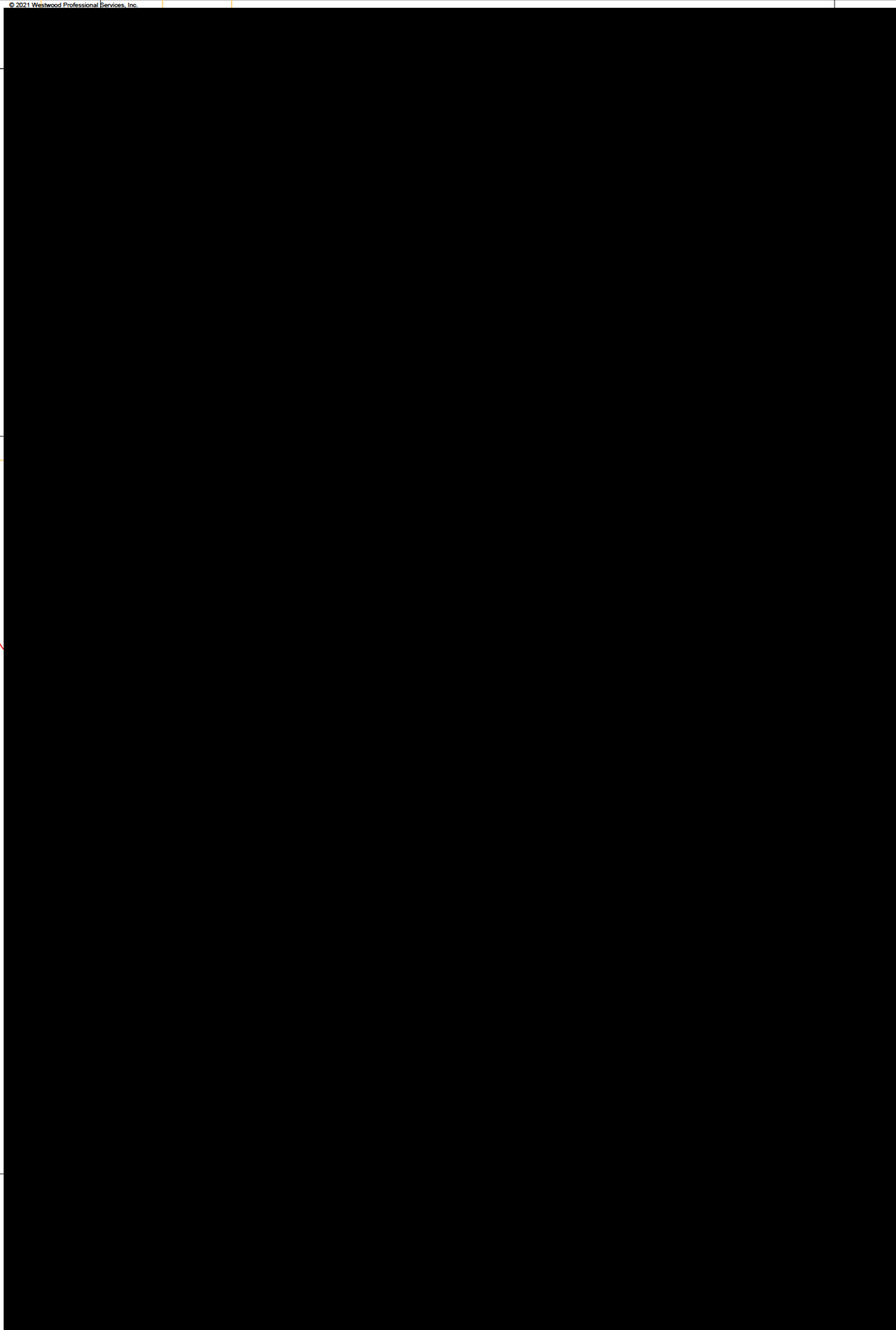
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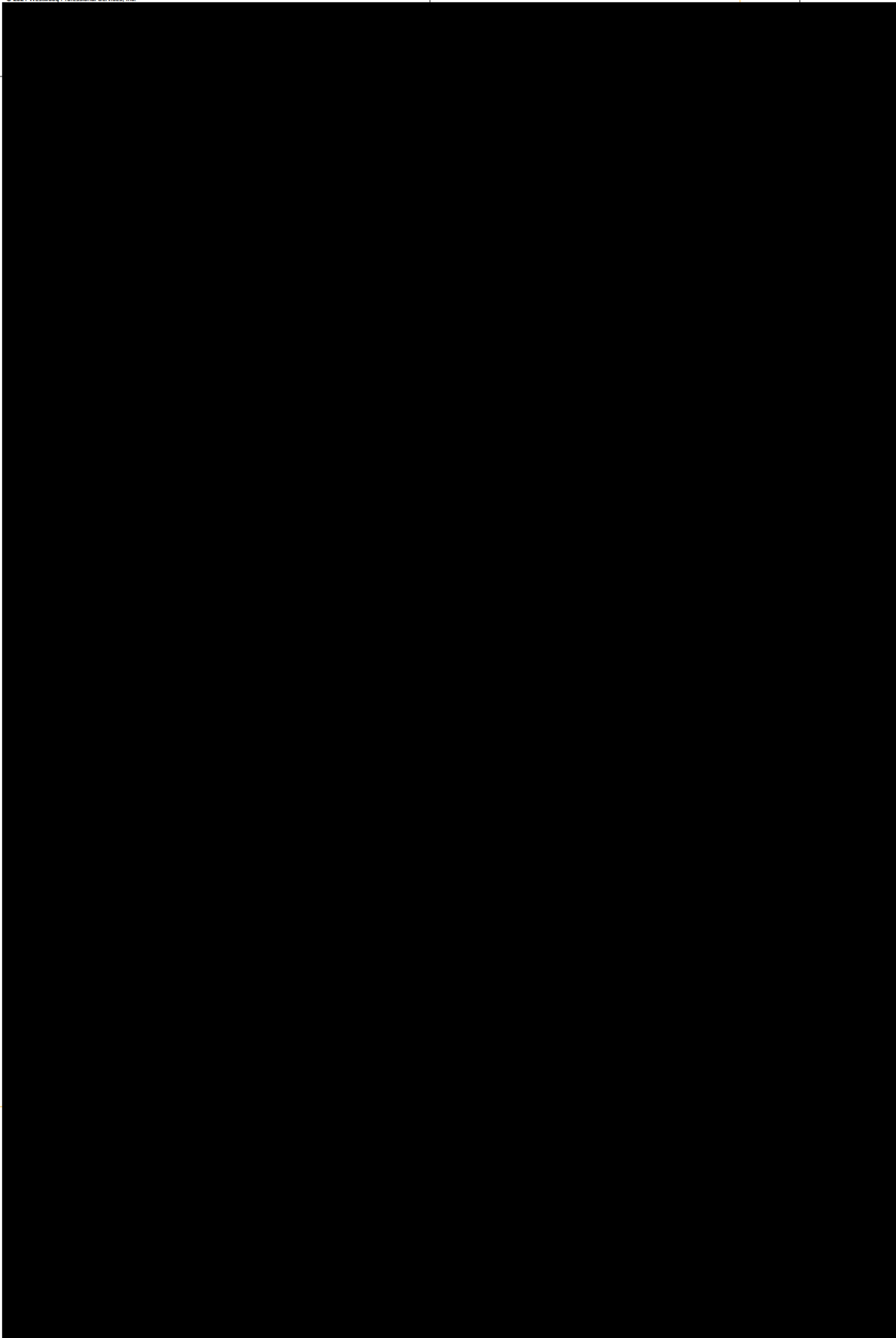
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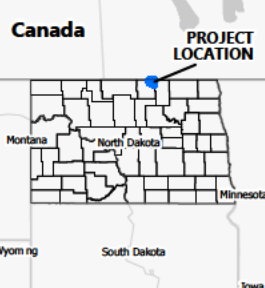
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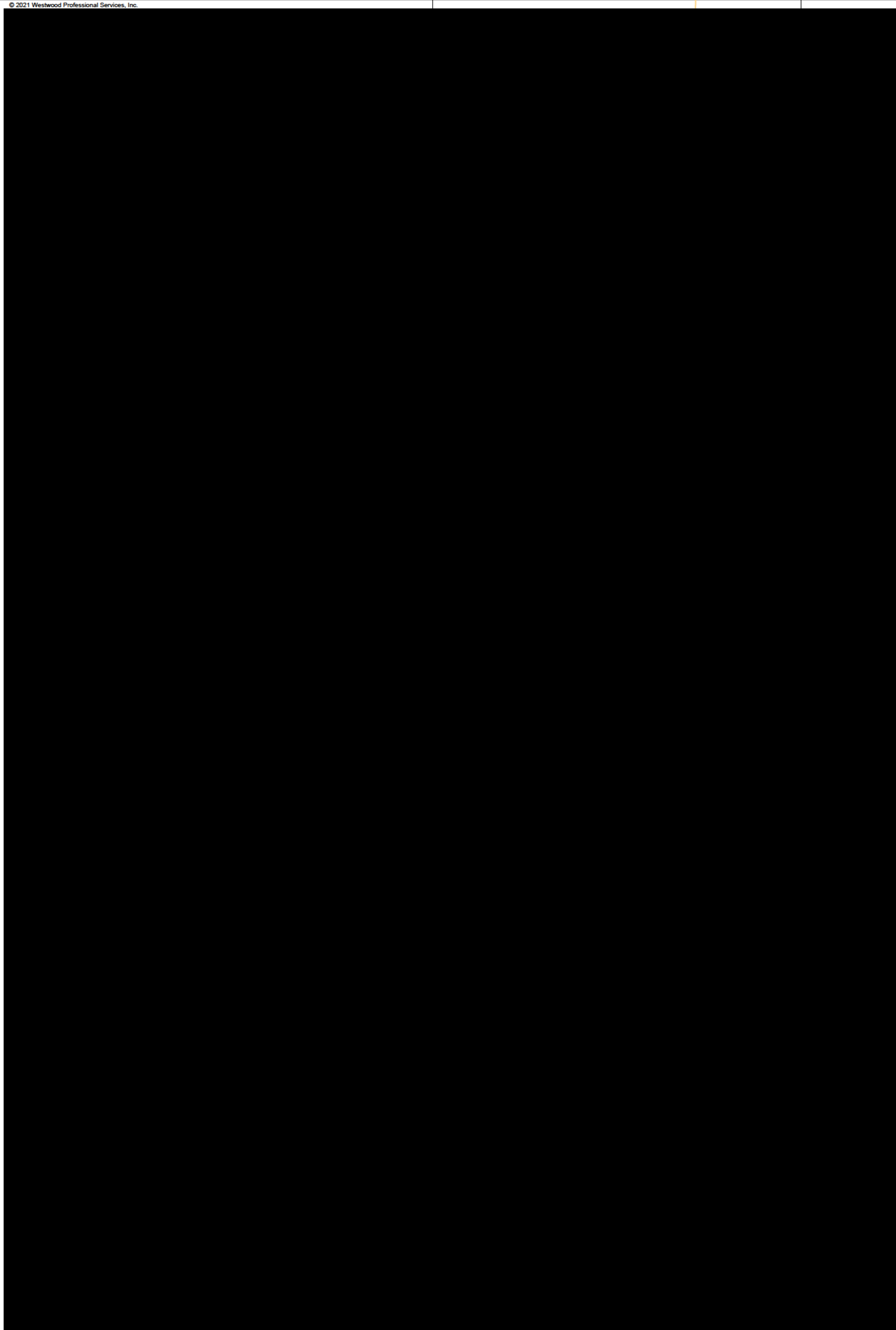
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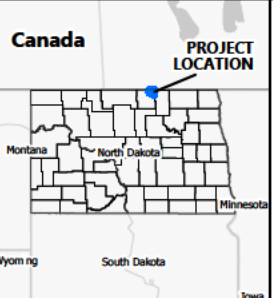
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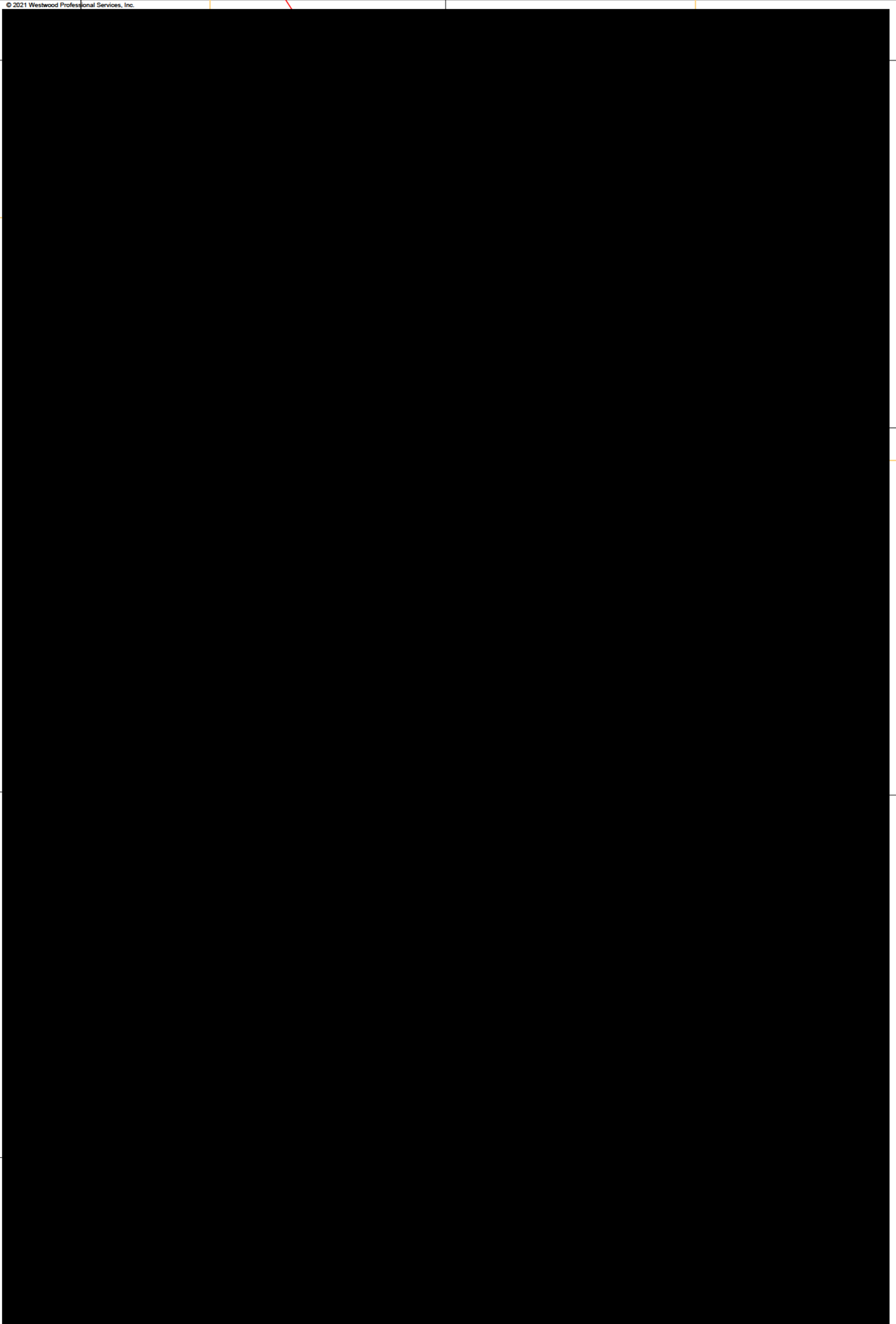
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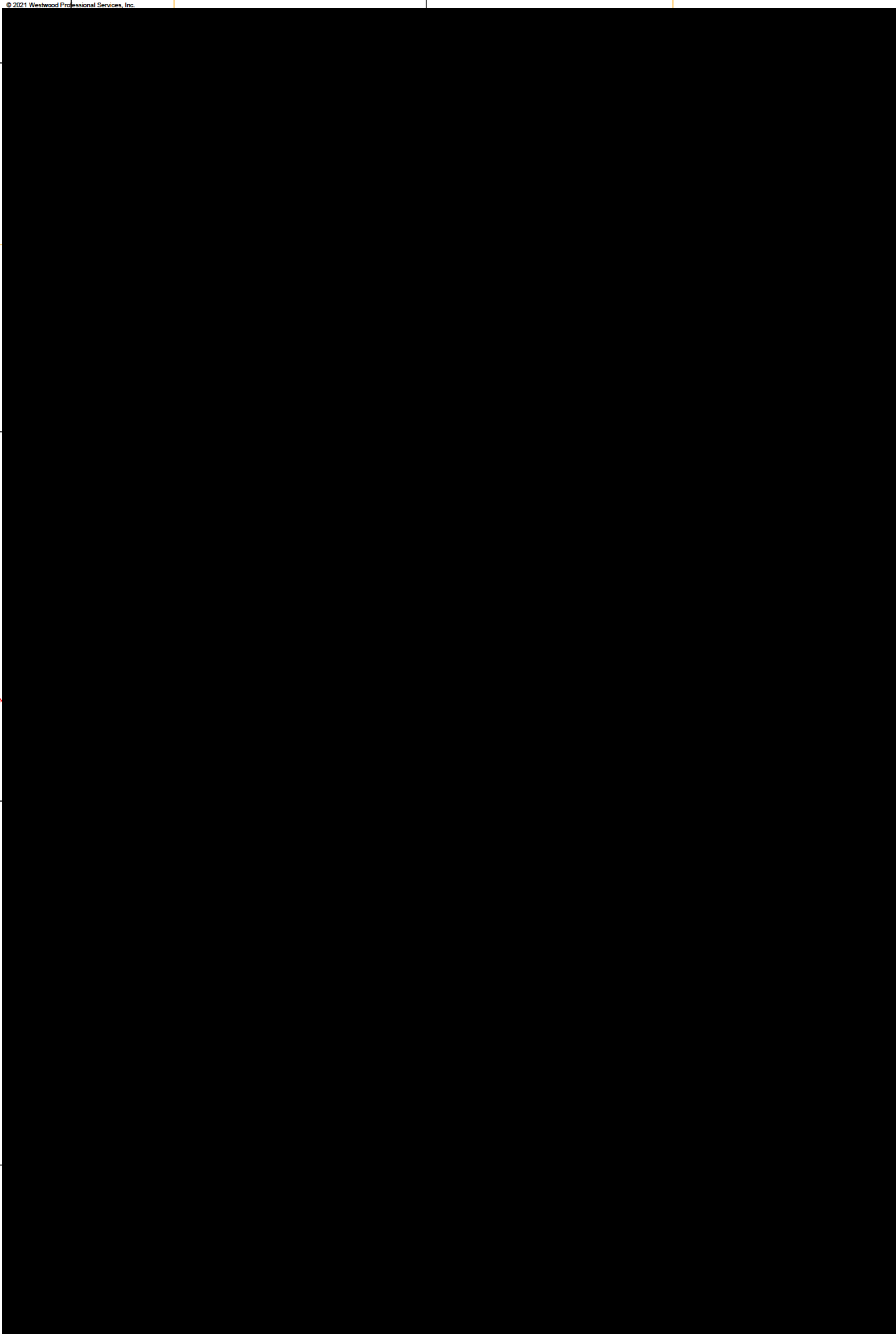
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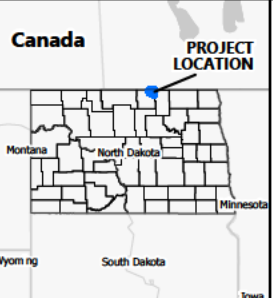
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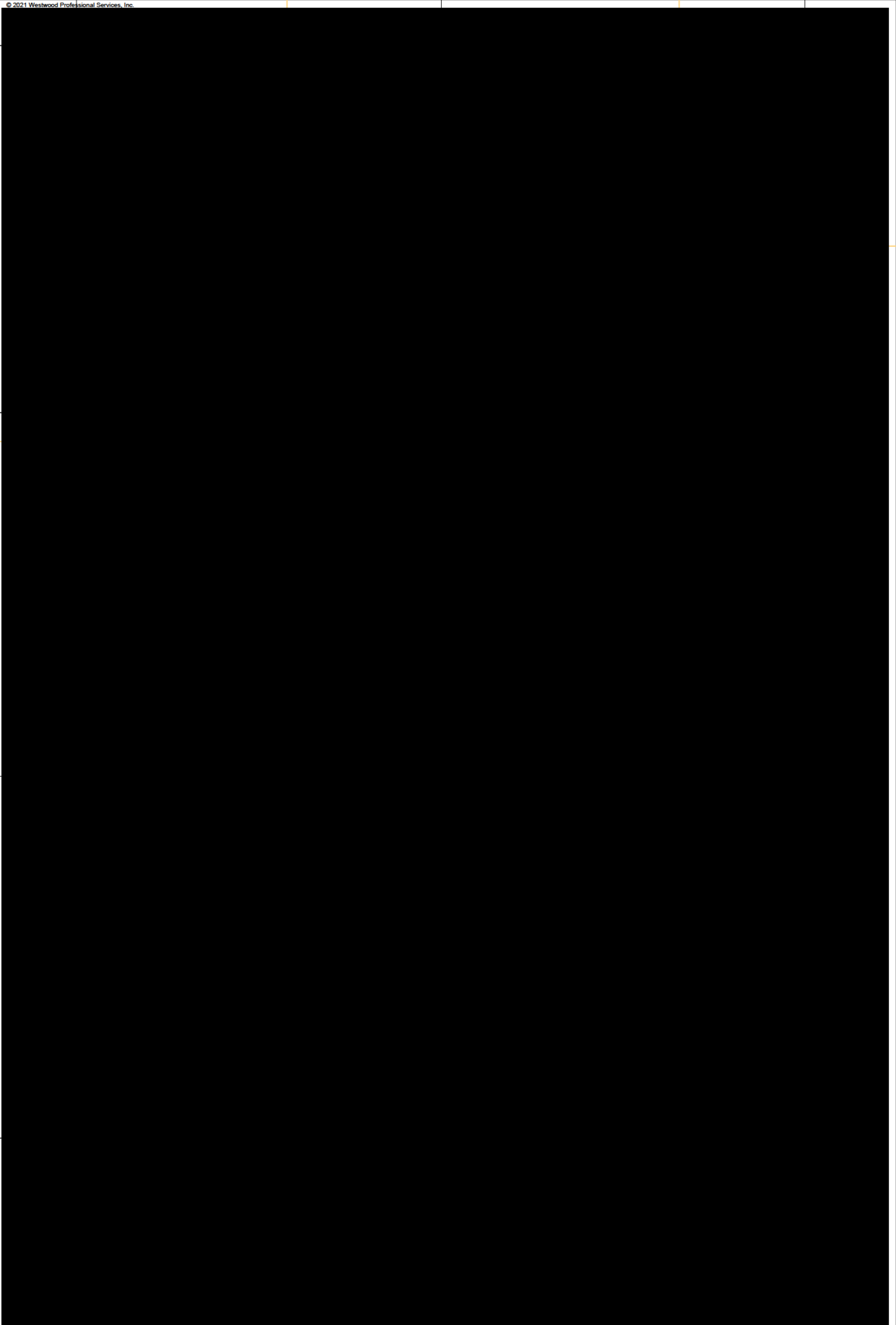
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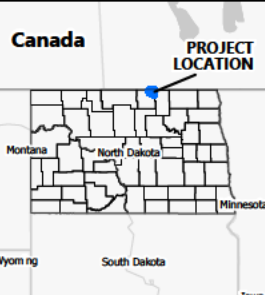
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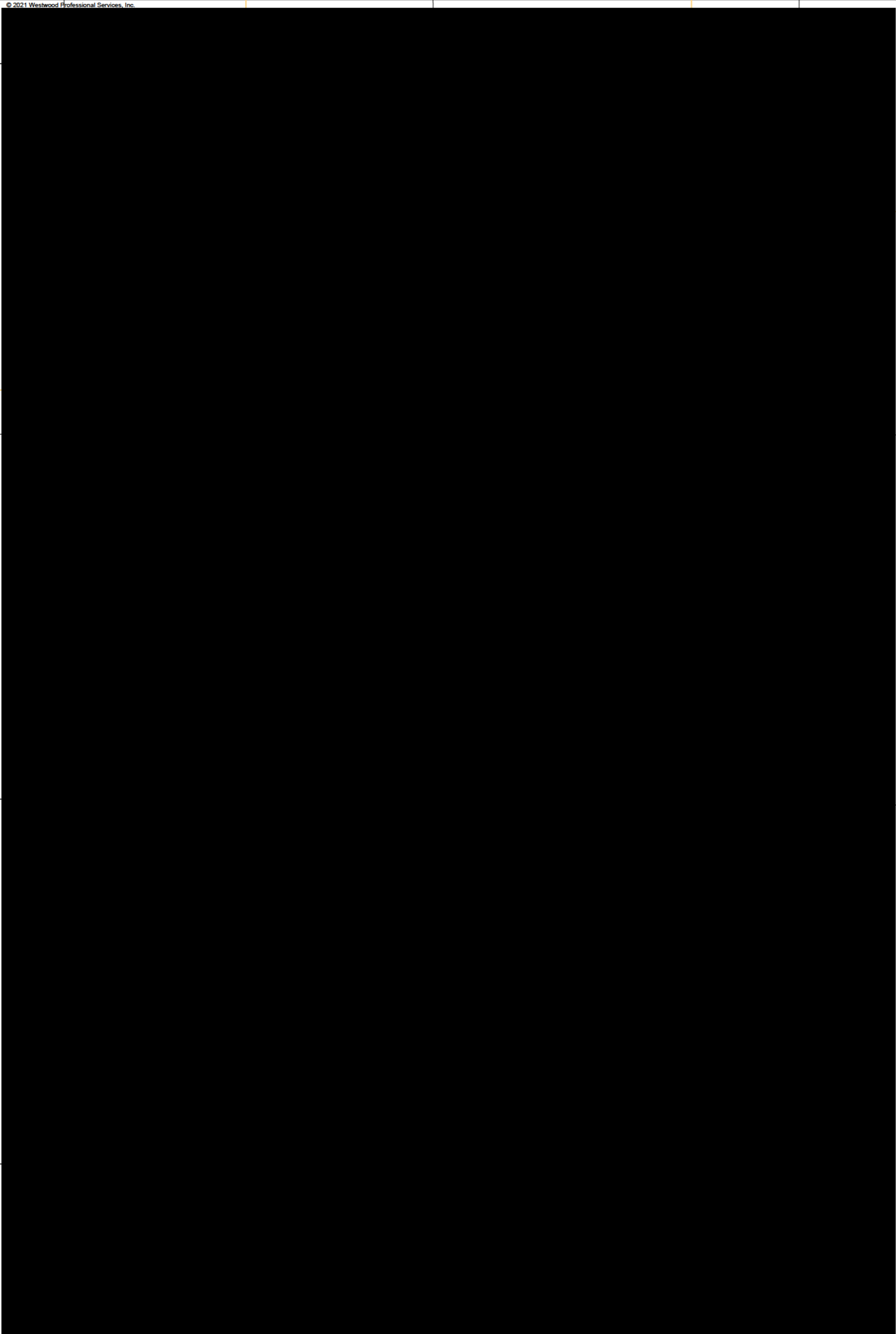
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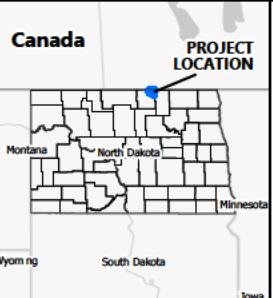
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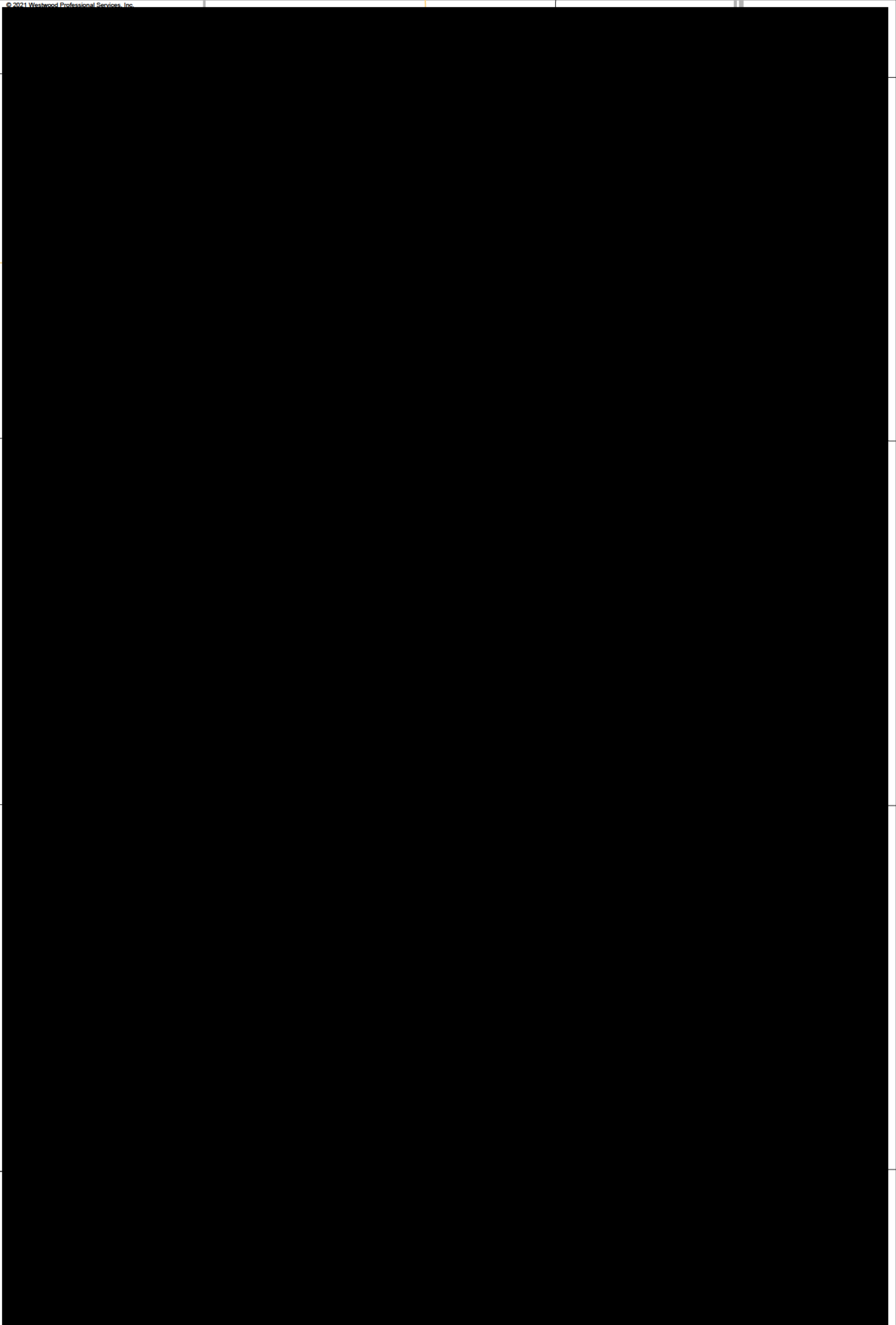
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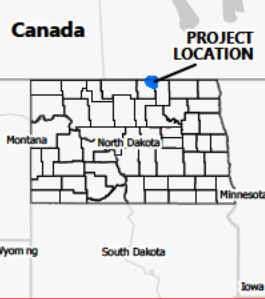


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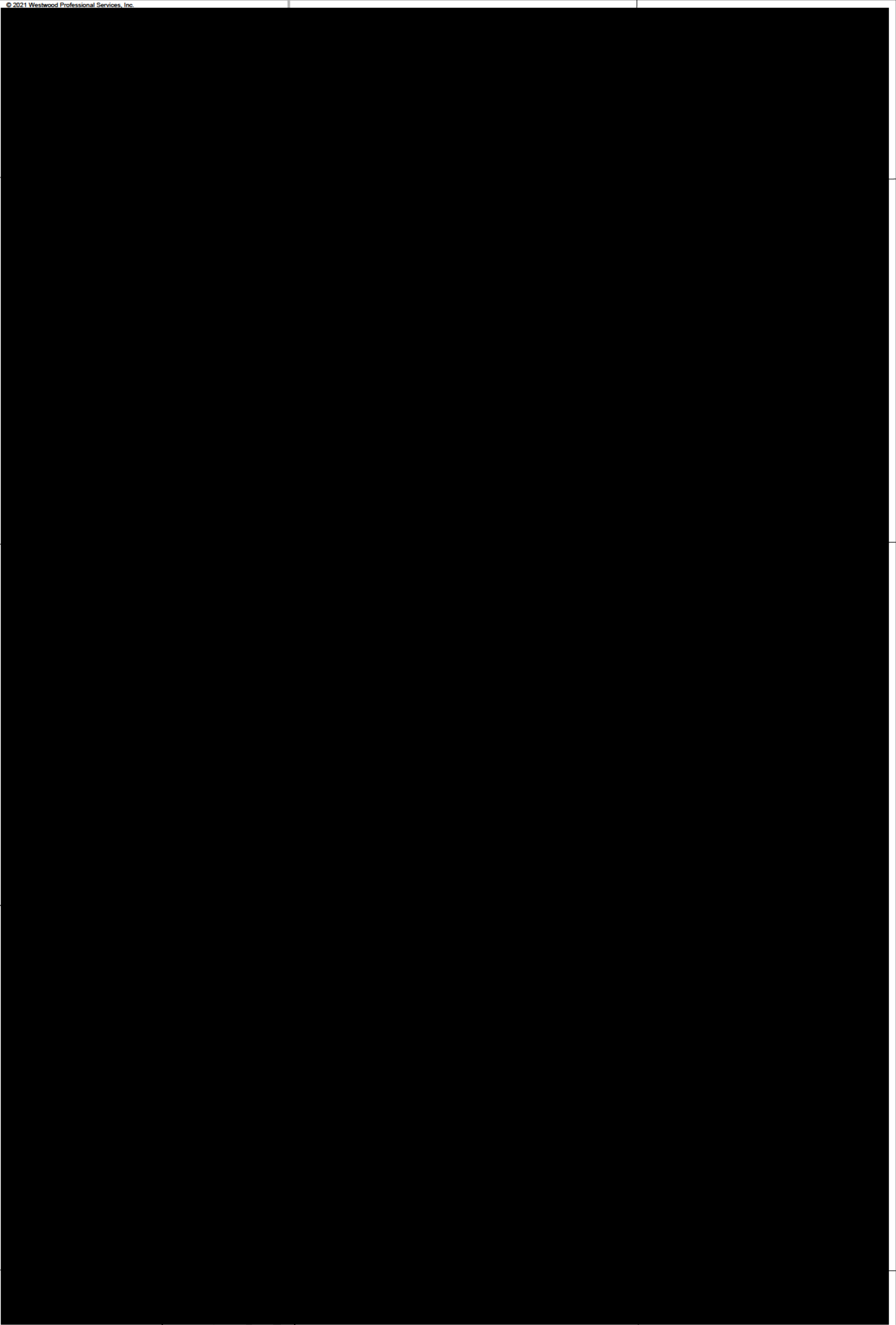
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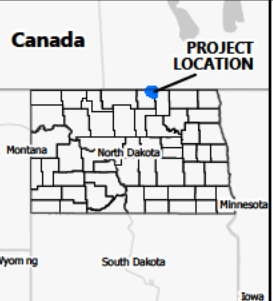


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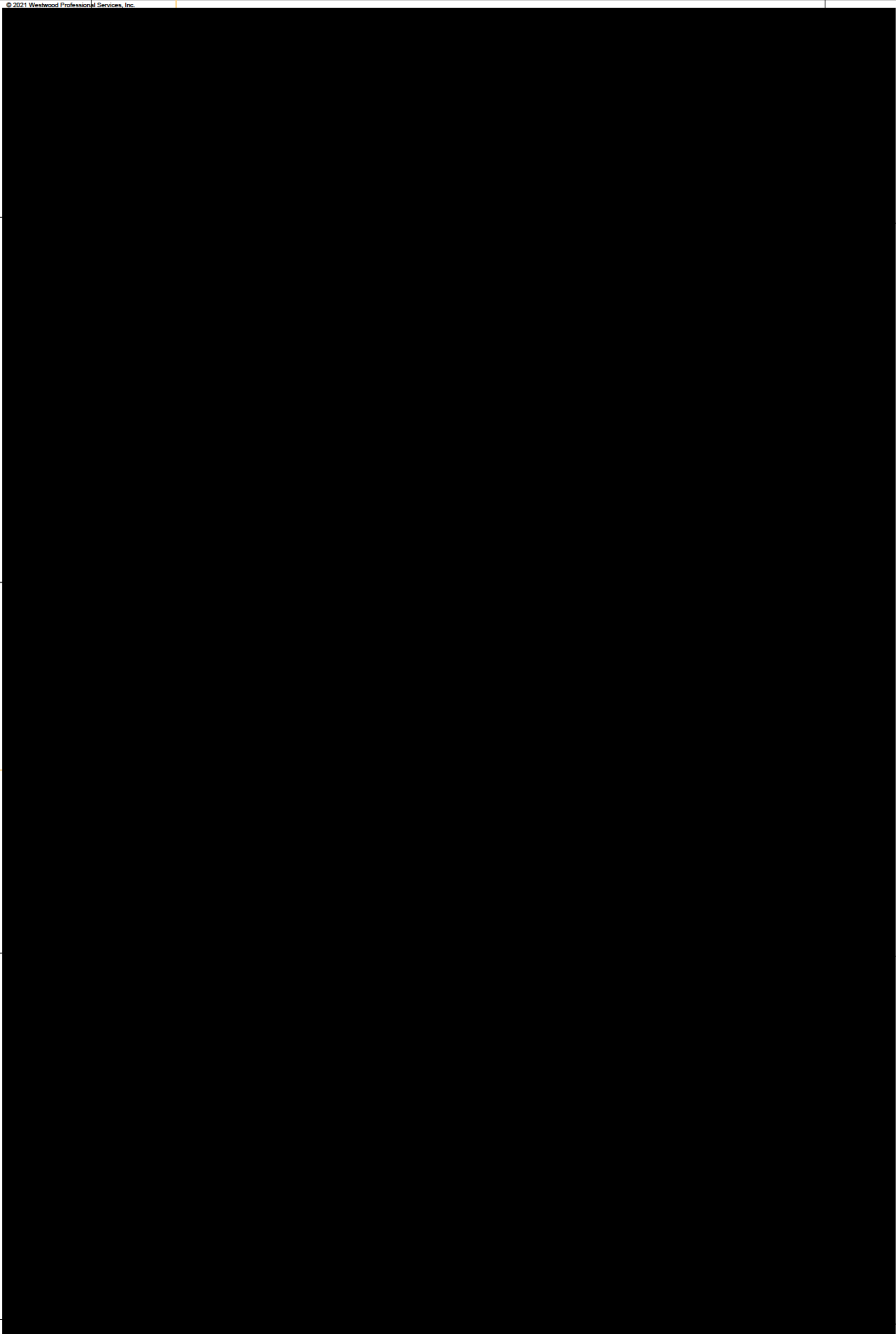
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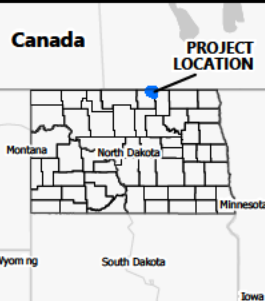


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EXHIBIT 2 (MAPS 1-17)



CLASS III INTENSIVE CULTURAL RESOURCES INVENTORY:
SUPPLEMENTAL 2013 INVESTIGATIONS

Border Winds Energy Project

Rolette County, North Dakota
November 21, 2013



Prepared For:

Border Winds Energy, LLC
11101 West 120th Avenue, Suite 400
Broomfield, CO 80021

Prepared By:



Westwood

Class III Intensive Cultural Resources Inventory: Supplemental 2013 Investigations For the Border Winds Energy Project

Rolette County, North Dakota

Prepared for:

Border Winds Energy, LLC
11101 West 120th Avenue, Suite 400
Broomfield, CO 80021

Prepared by:

Ryan P. Grohnke

Principal Investigator:

Amanda M. Gronhovd, MS, RPA

Westwood Professional Services, Inc.

7699 Anagram Drive
Eden Prairie, MN 55344
(952) 937-5150

Project Number: R0002071.01

November 21, 2013

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MANAGEMENT SUMMARY

Westwood Professional Services, Inc. (Westwood) was contracted by Border Winds Energy, LLC (BWE) to conduct additional survey for proposed reroutes and alterations to the original project layout of the proposed Border Winds Energy Project. The project had been originally surveyed in 2010 during the Class III Intensive Cultural Resources Inventory for the Border Winds Wind Energy Project. Although archaeological sites and historic structures were identified during the 2010 literature review and field survey, it was recommended that the project would have no adverse effect upon any National Register of Historic Places eligible or listed properties. Cultural resources investigations were originally recommended for the project area as part of the site permit application process defined by the North Dakota Public Service Commission. The current investigation was conducted to determine if previously undocumented cultural resource sites were located within reroutes of the original Border Winds Energy Project design.

Amanda Gronhovd of 10,000 Lakes Archaeology, Inc. served as Principal Investigator. The project field crew consisted of Field Director Ryan Grohnke and Cultural Resource Scientist Grady Larimer. The Class I Literature Review was updated on September 16, 2013. Field work was conducted October 21-25, and November 12, 2013.

No previously unrecorded archaeological sites or historic structures were identified in the Areas of Potential Effect for the current project. It is recommended that the project may proceed and that no further work is necessary.

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Appendix

Appendix 1: Unanticipated Discovery Plan for Cultural Resources or Human Remains

1.0 INTRODUCTION

In 2013, Westwood was contracted by BWE to conduct additional survey for proposed reroutes and alterations to the original project layout of the proposed Border Winds Energy Project. Amanda M. Gronhovd, Senior Cultural Resource Specialist, served as Principal Investigator for the supplemental survey. Ms. Gronhovd meets the Secretary of the Interior’s standards in archaeology as stipulated in 36 CFR Part 61 and is permitted to serve as Principal Investigator for archaeology in North Dakota. This report details the results of the supplemental Class III investigations of the Border Winds Energy Project which were conducted during October 21, 2013 through October 25, and November 12, 2013. The project field crew consisted of Ryan P. Grohnke and Grady Larimer. Mr. Grohnke is permitted to serve as Field Supervisor in North Dakota.

The current project addresses reroutes and alterations to the original design of the Border Winds Energy Project. In 2010, Westwood conducted a Class III Intensive Cultural Resources Inventory for the proposed Border Winds Energy Project (ND SHPO Ref.:08-1046) in Rolette County, ND on behalf of Sequoia Energy, Inc. The project was submitted to SHPO in a report by Kevin J. Mieras, Ryan P. Grohnke, and Dean T. Sather. Dean T. Sather served as principal investigator for the 2010 investigations. The project was recommended for archaeological survey by the North Dakota Public Service Commission. Minor changes to the design have occurred since the 2010 survey.

The project area is located in Rolette County in north-central North Dakota and is immediately east of the Turtle Mountains. The proposed project will include construction of up to 75 wind turbines, associated access roads, transmission cables, crane paths, construction laydown yard/operations and maintenance facility, and a substation. The project area is located in Section 1 of Township 162N, Range 69W; Sections 1-26 and 36 of Township 163N, Range 69W; Sections 1-3, 10-14 and 23-25 of Township 163N, Range 70W; Sections 25-36 of Township 164N, Range 69W; and Sections 25-27 and 34-36 of Township 164N, Range 70W (Exhibit 1).

2.0 SCOPE OF WORK

The Class III Intensive Cultural Resources Survey was conducted to determine if previously undocumented archaeological sites or historic resources are present within the proposed project’s Area of Potential Effect (APE) and to assess the potential of any such discovered resources to be considered eligible for listing on the National Register of Historic Places (NRHP). The project APE was considered all locations that would potentially have direct physical disturbance or indirect visual impact as a result of proposed construction activities in areas that had not been previously surveyed during the 2010 Class III Intensive Cultural Resource Inventory. Areas of direct physical impact include reroutes and alterations to turbine locations, access roads, transmission cables, crane paths, and a substation (Exhibit 2). Areas of potential indirect visual impact include areas within a one-mile radius of each turbine location that were outside of areas investigated during the 2010 Class III Intensive Cultural Resource Inventory.

3.0 METHODOLOGY

The project area was examined using background research, a literature review, pedestrian survey and limited shovel testing. The environmental background and historic contexts were examined to assess the probability of sites within the project area, identify locations with high potential for site occurrence, and propose which types of sites are likely to be found in the region.

The Class I Literature Search was updated at the North Dakota Heritage Center in Bismarck, North Dakota. The North Dakota Cultural Resources Survey database was examined to obtain a list of known archaeological (historic and prehistoric) and architectural sites within the APE, along with a listing of previous surveys conducted in the project area. County and township histories and historic maps and atlases were examined at the North Dakota State Library and Archives.

Field investigations executed during a Class III Intensive Cultural Resources Survey provide a means of determining if cultural resources exist within the project area and to assess the vertical and horizontal boundaries of any discovered deposits. Investigative techniques for archaeology for this Class III survey included visual inspection of the APE through pedestrian survey.

Pedestrian survey consisted of controlled visual inspection of the ground surface. Most effective visual inspection was conducted on ground surfaces exhibiting exposed soils such as cultivated fields. Field personnel conducting pedestrian surveys were spaced 10 meters apart and traversed the field in parallel transects inspecting the exposed surface for evidence of cultural deposits. Positive findings consist of historic or prehistoric artifacts and/or evidence of larger, intact cultural features such as structural remains or earthworks. Survey was not conducted in wetlands, areas that had been previously surveyed, or on areas on significant slopes.

A preliminary inventory of standing buildings and structures within the project area was conducted by Westwood Cultural Resource Scientists to ascertain possible indirect visual impact. The APE for this investigation examined those areas within one-mile of proposed turbine locations which had not been previously surveyed in 2010. No additional structures were identified in the Area of Potential Effect for this study.

4.0 RESULTS OF INVESTIGATION

4.1 Environmental Background

The project area is located within the Northern Black Glaciated Plains (NBGP) portion of the Northern Great Plains (DesLauriers and Lambert 1997). A majority of the land within the NBGP is utilized for agricultural production with over 80% dedicated to dry-farmed cropland. The elevation of the region varies from 300 meters (ca. 980 feet) to 700 meters (2,300 feet) exhibiting a general increase in elevation from east to west. The ground surface of the region is level to slightly undulating till plains, which includes a number of kettle holes, kames and moraines. The average annual temperature is 3-4° Celsius (37-40° Fahrenheit). The region receives an annual average precipitation of 375-450 millimeters (15-18 inches). The region is freeze-free between 100 and 120 days per year. Generally, the precipitation per year is insufficient for maximum agricultural production. The few

sources of surface water in the region are too small, too distant from need, or only seasonally available to be applied to agricultural needs. Water from underground sources is most effectively obtained in areas covered in glacial drift.

Soils in the region are dominated by Borolls and Aquolls, and are generally deep and well drained to poorly drained. On the well drained level surfaces located on till plains, the soils are classified as Haploborolls. In undulating, poorly drained areas the soils are classified as Argiaquolls with Argialbolls in wetlands.

Natural vegetation in the region was dominated historically by prairie vegetation. Native vegetation species common on the till plains included western wheatgrass, needle-and-thread, green needlegrass, and blue grama. Species commonly in association with the wetlands included prairie cordgrass, northern cordgrass, big bluestem, and slim sledge. The majority of the land is currently cultivated and being used for agricultural purposes, primarily small grains.

Wildlife species occupying the project area have changed somewhat since historic times, mostly as a result of habitat changes associated with mechanized agriculture. Historically, avian species listed as occurring in the greater geographic region include the piping plover, least tern, chimney swift, eastern phoebe, purple martin, eastern bluebird, black-and-white warbler, ovenbird, indigo bunting, rose-breasted grosbeak, orchard oriole, and field and swamp sparrows. Mammals on the historic list for the region include white-tailed deer, mule deer, pronghorn, bobcat, white-tailed jackrabbit, white-tailed prairie dog, and black-tailed prairie dog. The black-footed ferret and bison were also historically associated with the area. Herpetofauna historically inhabiting the region include the snapping turtle, spiny softshell turtle, smooth green snake, and the prairie rattlesnake. Since European settlement, many of these species have become either extirpated from the area or are considerably less abundant.

Mammals observed during a June 2008 field visit of the project area include: white-tailed deer (*Odocoileus virginianus*), beaver (*Castor canadensis*), prairie dog (*Cynomys ludovicianus*), coyote (*Canis latrans*), and badger (*Taxidea taxus*). Avian species frequently observed during a spring migration survey (2009) include red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), great-horned owl (*Bubo virginianus*), American kestrel (*Falco sparverius*), northern harrier (*Circus cyaneus*), killdeer (*Charadrius vociferous*), and several species of waterfowl, shorebirds, and songbirds.

The project area occurs within portions of two major migration flyways. The Central and Mississippi Flyways are used by millions of birds as they migrate from northern Canada south through the Great Plains to the Gulf of Mexico and beyond. Based on historical field research and observations, it is known that waterfowl, shorebirds, and songbirds migrate through the North Dakota region of these flyways each spring and fall.

4.2 Cultural History

The Historic Preservation Division (HPD) of the SHSND has developed several historic contexts for the state of North Dakota. These contexts examine North Dakota's recent (Historic) and distant (Pre-Contact) past, and are based on decades of archaeological and historical research. They are designed to help generally describe and interpret the history of the state, and give basic insight into the prevailing theories pertaining to the Historic and Pre-Contact communities existing in specific locations and at discrete points of time. The project area falls within the Northern Red River Study unit (SHSND 2008).

The cultural histories focusing solely on American Indian communities are divided into several major traditions: Paleo-Indian, Plains Archaic, Plains Woodland, Plains Village, and Equestrian/Nomadic. These traditions are defined on the basis of significant changes in how American Indian communities lived and what resources, local or exotic, they utilized.

The final cultural history is the Historic Period. This context ranges from the first contact between Europeans and American Indians during European exploration in the region, through Euro-American settlement of traditionally American Indian lands.

4.2.1 Paleo-Indian Tradition (9,500 to 5,500 B.C.)

The Paleo-Indian Tradition refers to the period of time at the close of the Pleistocene era and into the Holocene era, when American Indian communities were small, mobile and focused on hunting. This period is marked by the retreat of glacial ice, the decline of the megafauna (e.g. woolly mammoth, mastodons, and camels), and the growth of modern vegetation. The small number of artifacts found at Paleo-Indian sites indicates that these communities hunted a limited number of large animals in a variety of environmental settings. As the Pleistocene era ended and the Holocene era began, the megafauna gradually died out. This caused the Paleo-Indian people to shift their focus from hunting animals such as the mammoth to the largest remaining species, bison. In addition to bison, it is likely that gathering wild plant foods and hunting smaller animals also contributed significantly to the diet of the Paleo-Indian people (SHSND 2008).

4.2.2 Plains Archaic Tradition (5,500 to 400 B.C.)

The Plains Archaic Tradition is divided into Early, Middle, and Late periods. The people of the Plains Archaic Tradition remained hunters and gatherers as their Paleo-Indian forbearers. However, shifts in diet and settlement patterns define the transition to the Archaic Tradition. It seems that native people were adapting to environmental changes by using more diverse plant and animal resources.

During this period, Plains Archaic people began developing regional differences within their material culture, interaction between different populations became less common, and the quality of craftsmanship exhibited by their lithic tools diminished. As with Paleo-Indian sites, Archaic sites are relatively small and ephemeral. Similarly, with Paleo-Indian sites, it is believed that Archaic sites are likely deeply buried in the floodplains.

4.2.3 Plains Woodland Tradition (400 B.C to A.D. 1850)

Throughout the Midwest, the Woodland Tradition is generally divided into three periods: Early, Middle, and Late. The transition to the Woodland Tradition occurred when American Indians began manufacturing ceramic vessels, using bows and arrows, constructing earthen burial mounds, cultivating various plant species, and harvesting select plant species. Notwithstanding these developments, life for communities during the Woodland Tradition in many ways remained similar to that of the Archaic period.

Despite some similarities between Initial Woodland and Archaic period community size, populations began to grow during the Late or Terminal Woodland period. One possible reason is that American Indians became increasingly efficient in how they acquired food toward the end of the Woodland period. Site types assigned to the Woodland Tradition throughout the region range from cemeteries and small limited use sites to extensive village and habitation sites. Woodland period communities were situated in locations that ranged from focusing on a specific resource to general environments capable of sustaining a large community for a long time.

4.2.4 Plains Village (A.D. 1000 to 1850)

Significant changes in subsistence and settlement patterns characterize the shift to the Plains Village Tradition. Ceramic vessels differ from previous types in form as well as decoration, and settlement patterns shift to larger, more permanent villages typically located in riverine settings. The subsistence strategies of these populations appear to incorporate hunting and gathering with limited agriculture focusing on specific plants. The Plains Village primary adaptation was "...the production of a dependable storable surplus food supply primarily in the form of dried corn" (SHSND 2008). Evidence indicates that the Plains Village complex relied heavily on bison hunting and intensive corn horticulture.

4.2.5 Equestrian Nomadic Tradition (mid 1700s to 1851)

The introduction of the horse is the primary characteristic of the Equestrian Nomadic Tradition. This period is also referred to as protohistoric, a time when the indigenous people were coming into contact with and being influenced by European culture. This contact was not always direct interaction between Native and Euro-American peoples, but sometimes through contact with items of Euro-American cultural material being traded throughout the area.

4.2.6 Historic Period

The Historic Period refers to the time when the Euro-American presence and influence became unavoidable. During the Historic Period, Euro-Americans pushed westward and increasingly settled in the Dakotas. Although North and South Dakota were initially within the Missouri Territory, the Dakota Territory was eventually established in 1861 and encompassed North Dakota, South Dakota, and much of Montana and Wyoming. Dakota Territory was opened to homesteaders in 1862. Following the opening of the Dakota Territory several railroads that served the territory, including the Dakota Southern and Manitoba (known later as the Great

Northern) Railways, were built, and the Gold Rush of 1876 began. These events led to massive Euro-American settlement of the Dakota Territory between 1872 and 1887. This period is known as the Great Dakota Boom. A severe drought brought the Boom to an end between 1886 and 1887.

In 1889 North and South Dakota were admitted to the Union as the 39th and 40th states, in no particular order. The states were the leading producers of wheat until the drought and Great Depression in the 1930s, and railroads continued to expand and run until the collapse of the farming industry in the 1980s. Significant events witnessed by residents of North and South Dakota throughout the 20th century include discovering oil in 1927 and 1951, enduring record blizzards, creating numerous military bases and nuclear missile silos, and constructing dams.

5.0 CULTURAL RESOURCES REPORTS AND SITES

On September 16, 2013, Westwood Cultural Resource Specialist Ryan P. Grohnke conducted a background literature search at the State Historical Society of North Dakota (SHSND) located at the North Dakota Heritage Center in Bismarck, North Dakota. The North Dakota Cultural Resources Survey database was examined to obtain a list of known archaeological (historic and prehistoric) and architectural sites within the APE, along with a listing of previous surveys conducted in the project area. County and township histories and historic maps and atlases were examined at the North Dakota State Library and Archives. The original Government Land Office (GLO) survey records were investigated online. This research was completed to update research conducted on April 14, 2008, by Ryan P. Grohnke, July 13, 2009, by Ryan P. Grohnke and Dean T. Sather, and again on May 20, 2010, by Ryan P. Grohnke to include information that may have been recently added to the archives.

Westwood staff inventoried previously executed cultural resource investigations for the townships included in the Border Winds Energy Project area. Table 5-1 lists cultural resource project reports submitted to and maintained at the Historic Preservation Division of the SHSND. The inventory indentified 10 previously submitted reports documenting cultural resource investigations within the defined project boundaries. A majority of the identified reports relate the findings from location specific investigations involving limited or small parcels which do not encompass significant portions of the current proposed project area.

Table 5-1: Previous Cultural Resources Reports			
Year	Manuscript	Title	Author(s)
1965	2011	Historic Sites Under the Authority of the State Historical Society of North Dakota as Established by the Thirty-ninth Legislative Assembly	Blikre, L.
1995	6449	North Dakota Department of Transportation Safety Project Cultural Resource Review 1992-1994	Borchert, J

Year	Manuscript	Title	Author(s)
1999	7533	Project Walking Shield: A Cultural Resources Inventory of 25 Proposed Tribal Homesites on Turtle Mountain Chippewa Trust Lands in Rolette Co., ND	Ferris, K
2000	7554	DeMers Gravel Pit: A Class III Cultural Resource Inventory, Rolette Co., ND	Bluemle, W.
2000	7660	Addendum To: Ottertail Company’s 230 kV Harvey/Rolla Transmission Line Cultural Resources Inventory, Wells, Pierce, and Rolette Counties, ND	Olson, B.
2007	10015	Wakopa Trail Survey: A Class III Cultural Resources Inventory in Rolette Co., ND	Bluemle, W
2007	10463	Archaeological Survey of the St. John (SJO) Land Port of Entry, Rolette Co., ND	Greiser, T. et al.
2007	10472	Evaluation of Buildings and Structures at the Land Ports of Entry in North Dakota, Rolette, Divide, Bottineau, Cavalier, Towner, Pembina, Burke and Renville Counties	Belfast, J. et al.
2008	10779	County Route 43: A Class III Cultural Resource Inventory in Rolette Co., ND	France, E.
2009	10858	North Dakota Department of Transportation: A Class III Cultural Resource Inventory of North Dakota State Highway 30 From Rolla to the Canadian Border in Rolette Co., ND	Strait, J.

Key: Year = year of report publication or submission; Manuscript = archival number applied to project report; Title = Project Report Title; Author = principal author of report.

5.1 Archaeological Properties

Previously conducted cultural resource investigations within the project area and the proscribed one-mile buffer documented 22 archaeological sites; this includes the sites identified during the initial Class III survey of the Border Winds Energy Project in 2010. Besides the sites that were identified during the 2010 Class III survey, only one site was not originally reported in the previous Border Winds investigations. This is site 32RO68, a grave found at St. John the Baptist Catholic Church in St. John. This site is not within the APE of the project area. None of the sites have been evaluated for listing on the National Register of Historic Places (NRHP). The list of recorded archaeological properties is summarized in Table 5-2.

Site Number	Site Type	Cultural Period	Project Area / Buffer	NRHP Eligibility
32RO65	Burlington Northern Railroad Bed	Historic	Project	Unevaluated
32RO67	Cultural Material Scatter	Prehistoric	Project	Unevaluated

Site Number	Site Type	Cultural Period	Project Area / Buffer	NRHP Eligibility
32RO68	Grave	Historic	Buffer	Unevaluated
32RO69	Cultural Material Scatter	Historic	Project	Unevaluated
32RO70	Cultural Material Scatter	Historic	Project	Unevaluated
32RO71	Cultural Material Scatter	Historic	Project	Unevaluated
32ROX42	Isolated Find	Prehistoric	Project	Unevaluated
32ROX43	Historic Site	Historic	Project	Unevaluated
32ROX44	St. Claude Mission	Historic	Project	Unevaluated
32ROX45	Grave	Unknown	Buffer	Unevaluated
32ROX46	Trail	Historic	Buffer	Unevaluated
32ROX57	Boundary Post Office	Historic	Project	Unevaluated
32ROX61	Isolated Find	Prehistoric	Project	Unevaluated
32ROX80	Isolated Find	Prehistoric	Project	Unevaluated
32ROX83	Isolated Find	Prehistoric	Project	Unevaluated
32ROX103	Isolated Find	Prehistoric	Project	Unevaluated
32ROX104	Isolated Find	Prehistoric	Project	Unevaluated
32ROX105	Isolated Find	Prehistoric	Project	Unevaluated
32ROX106	Isolated Find	Prehistoric	Project	Unevaluated
32ROX107	Isolated Find	Prehistoric	Project	Unevaluated
32ROX108	Isolated Find	Prehistoric	Project	Unevaluated
32ROX109	Isolated Find	Prehistoric	Project	Unevaluated

Key: Site Number = site designation applied by State Archaeologist; Site Type = defined site use type; Cultural Period = reported culture historic period affiliation; Project Area / Buffer = denotes if listed site is within the defined project area or within the one-mile buffer. NRHP Eligibility = status of site pertaining to NRHP.

5.2 Architectural Properties

Westwood reviewed the History/Architecture Inventory Files at the HPD of the SHSND to identify historic properties recorded within the project area and the proscribed one-mile buffer (Table 5-3). Previous architectural surveys of the area identified two properties within the project area and seven within the one-mile buffer (Table 5-3). The majority of these properties were inventoried, but were not evaluated for NRHP eligibility. One of the properties within the overall project area is listed on the NRHP (The Coghlan House, 32RO51) and one has been nominated (St. John Inspection Station, 32RO50). No new architectural properties have been inventoried since the 2010 Class III survey of the Border Winds Energy Project.

[NONPUBLIC DATA HAS BEEN EXCISED...]

Table 5-3: Previously Recorded Architectural Resources				
Site Number	Description	Location	Project Area / Buffer	NRHP Eligibility
32RO12	Unnamed	██████████	Buffer	Unevaluated
32RO32	Fortunate & Cedulae Martineau House	██████████	Buffer	Unevaluated
32RO50	St. John Inspection Station	██████████	Project	Nominated
32RO51	Coghlan House	██████████	Project	Listed
32ROx72	St. John Café	██████████	Buffer	Unevaluated
32ROx73	Square Deal	██████████	Buffer	Unevaluated
32ROx74	Fire Station	██████████	Buffer	Unevaluated
32ROx75	Unnamed	██████████	Buffer	Unevaluated
32TO8	Bridge 48-101-060	██████████	Buffer	Unevaluated

Key: Site Number = reference number for recorded property; Description = name of historic structure or description of type of structure; Location = amended legal description of recorded property; Project/Buffer = relative location of recorded structure; NRHP Eligibility = status of site pertaining to NRHP.

...NONPUBLIC DATA HAS BEEN EXCISED]

6.0 FIELD INVESTIGATIONS

Field investigations were conducted October 21-25, and November 12, 2013. The project field crew consisted of Field Director Ryan P. Grohnke and Cultural Resource Scientist Grady Larimer. The vast majority of the survey occurred in cultivated agricultural fields shortly after harvest. Field conditions at these times were conducive to pedestrian survey with an estimated ground surface visibility average of 85%. Survey transects were conducted at 10-15 m intervals over the new locations. All reroutes/changes to the original 2010 layout were examined (Exhibit 2). No archaeological sites were identified during the survey.

Areas within a one-mile radius of proposed turbine locations were inspected for architectural resources. No historic structures were located in the current Area of Potential Effect in locations outside of the areas inspected during the 2010 Class III survey.

7.0 SUMMARY AND RECOMMENDATIONS

In October of 2013, a field review of reroutes and alterations to the project design of the Border Winds Energy Project was undertaken to supplement the original Class III Intensive Cultural Resources Survey of 2010. No previously unrecorded archaeological sites or historic structures were identified in the new Area of Potential Effect. It is recommended that the project may proceed as planned.

Westwood stresses that if construction plans are altered to include areas that were not previously surveyed, these locations should be examined for cultural resources. Further, if human remains are encountered during construction activities, all ground disturbing activity must cease and local law enforcement must be notified. *North Dakota Century Code §23-06-27 prohibits the*

intentional disturbance of human burials. Details on procedures to be followed should an unanticipated discovery of cultural resources or human remains occur are attached in Appendix A.

8.0 REFERENCES CITED

DesLauriers, L.L. and R.E. Lambert

1997 Soil Survey of Rolette County, North Dakota. United States Department of Agriculture, Soil Conservation Service. U.S. Government Printing Office.

Mieras, Kevin J., Ryan P. Grohnke and Dean T. Sather

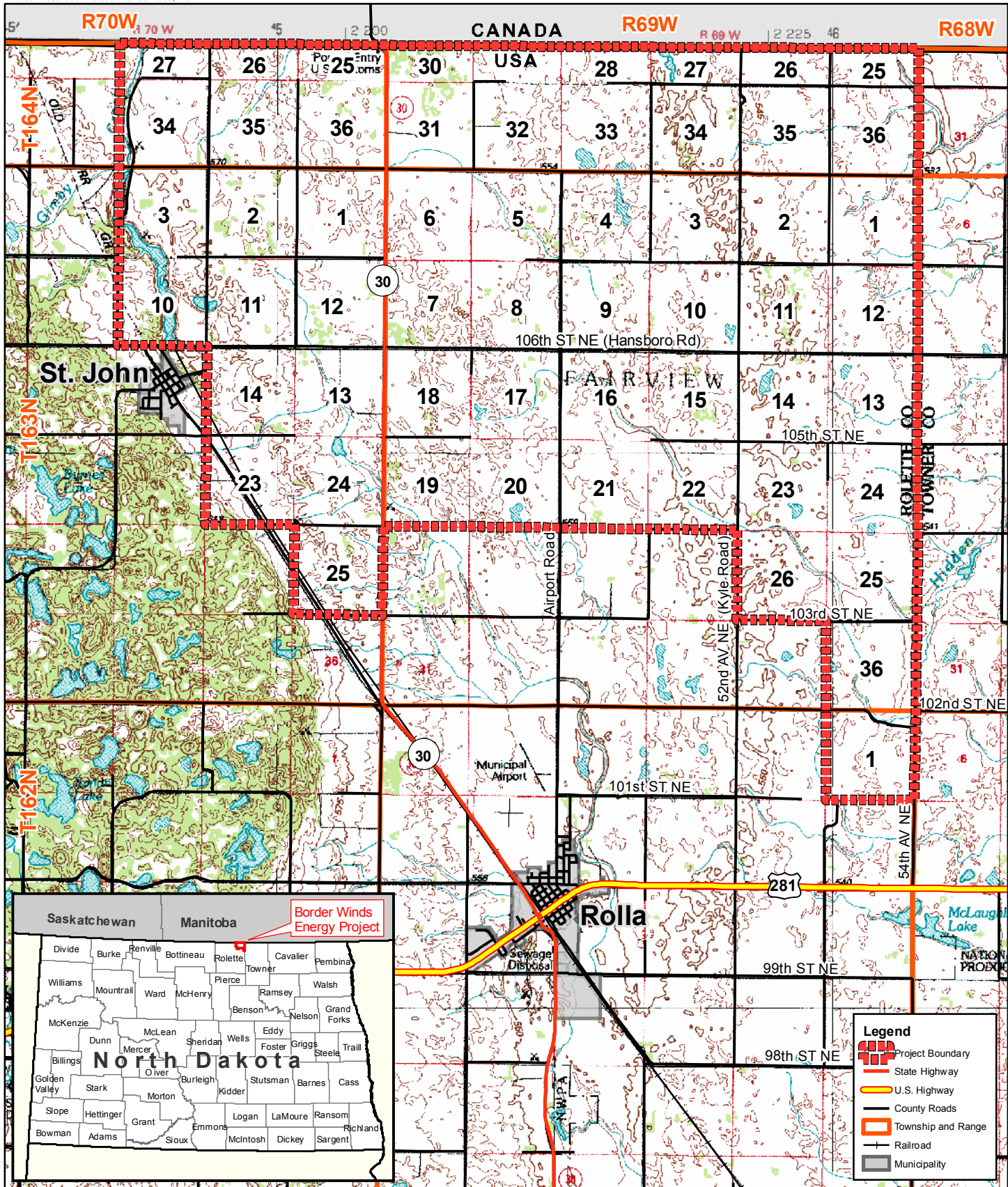
2010 Class III Cultural Resources Inventory for the Proposed Border Winds Energy Project, Rolette County, North Dakota. Westwood Professional Services, Eden Prairie, MN. Submitted to Sequoia Energy.

SHSND (State Historical Society of North Dakota)

2008 The North Dakota Comprehensive Plan for Historic Preservation: Archaeological Component. State Historical Society of North Dakota, Bismarck, North Dakota.

EXHIBITS

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Border Winds Energy Project

Rolette County, North Dakota

Project Location

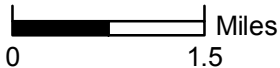
EXHIBIT 1



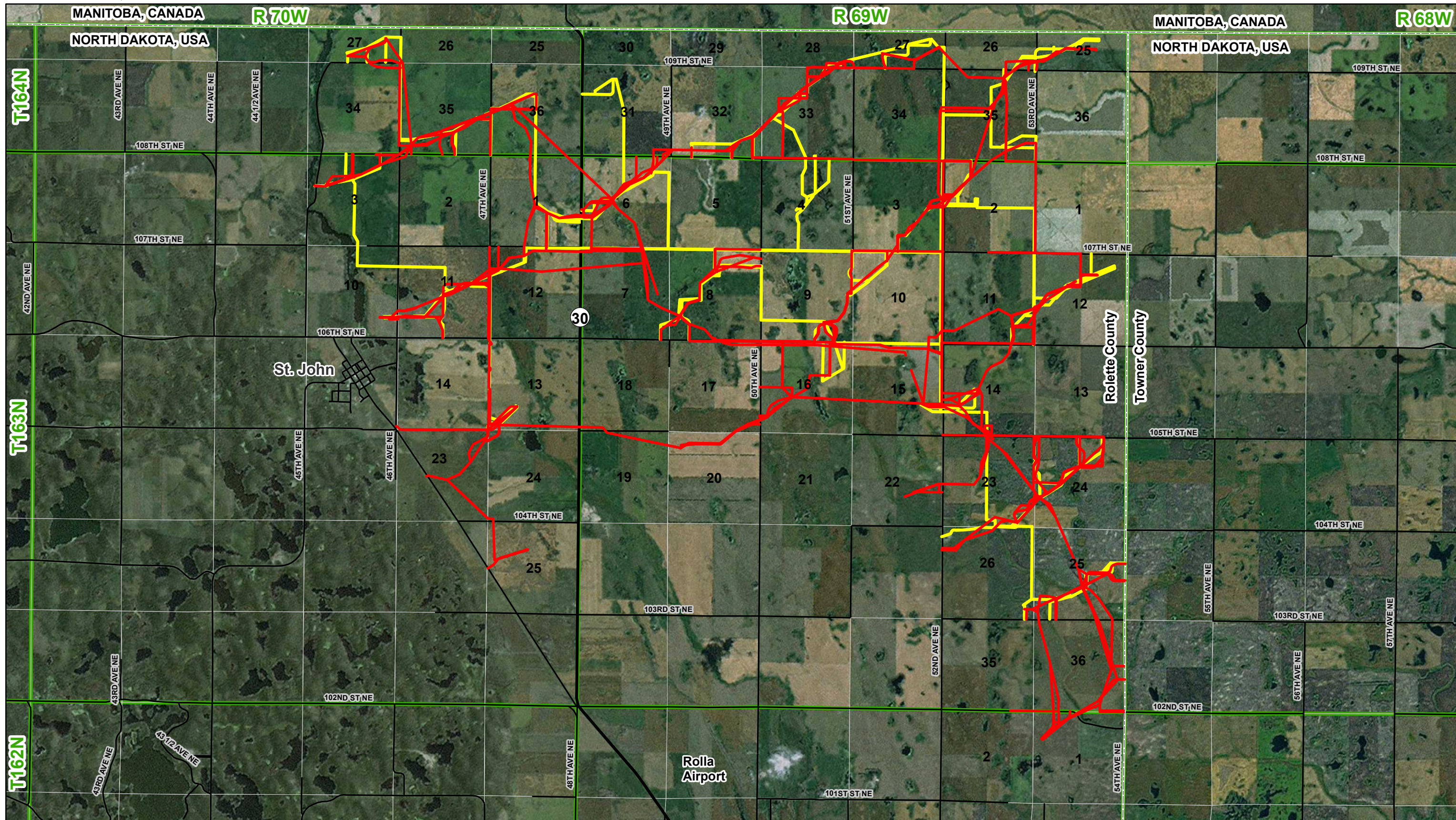
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TOLL FREE 1-888-937-5150

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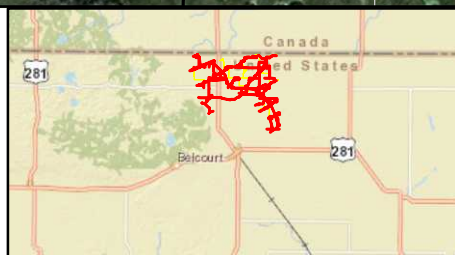
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Data Source(s): Westwood (2013); ESRI WMS Imagery Basemap Aerial and Streets (accessed 2013); Province Boundaries, ESRI Data (2005-2008); Muni Boundaries, NDDOT (2008); North Dakota Geographic Survey US PLS System (1994); Roads, NDDOT (2008); County Boundaries, North Dakota State Water Commission (2002).



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Legend

- 2010 APE (Previously Surveyed)
- 2013 APE (Supplemental Survey)
- County Boundary
- PLS Township Boundary
- PLS Section Boundary
- Road

Border Winds Energy Project

Rollette County, North Dakota

Project Area of Potential Effect



Map Document: P:\0002071\00GIS\BWL_CRM_EX2_131111B.mxd 12/9/2013 11:19:15 AM

APPENDIX

**Unanticipated Discovery Plan
for Cultural Resources or Human Remains
Border Winds Wind Energy Project
Rolette County, North Dakota**

Prepared for:

Border Winds Energy, LLC
11101 West 120th Avenue, Suite 400
Broomfield, CO 80021

Prepared by:

Westwood Professional Services
7699 Anagram Drive
Eden Prairie, MN 55344
(952) 937-5150

Project Number: R0002071.01

October 31, 2013

1.0 INTRODUCTION

Border Winds Energy, LLC (BWE) intends to construct the Border Winds Energy Project in Rolette County, North Dakota. At the request of the State Historical Society of North Dakota (SHSND)/North Dakota State Historic Preservation Office (NDSHPO), this plan was developed to establish procedures to be followed if unrecorded archaeological resources or human remains are discovered during construction of the proposed project.

2.0 PROCEDURES FOR UNANTICIPATED DISCOVERIES

If any employee of the Border Winds construction contractor or a subcontractor believes they have found an archaeological resource or human remains in the course of their work, all work in that vicinity (that segment of the project or a 200 foot radius) will cease. The employee will notify the construction superintendent. The construction superintendent will comply with the following procedures. The area will be secured by moving all equipment away from the discovery, asking all employees to vacate the area, and having one supervisory employee remain nearby to observe that no further disturbance occurs. Additional procedures differ in regards to archaeological resources and human remains.

2.1 Archaeological Resources

The construction superintendent will contact the Cultural Resource Specialists at Westwood Professional Services (Westwood). One of the Cultural Resource Specialists will notify BWE of the discovery. A Cultural Resource Specialist will travel to the site as soon as feasible, generally within 24 hours. He will determine the significance and integrity of the discovery. If the discovery is not considered significant, work will be allowed to continue and a letter detailing the findings will be submitted to BWE and the ND SHPO within three business days. Should the site be considered significant, a Cultural Resource Specialist will consult with the SHSND/NDSHPO and BWE regarding appropriate management of the cultural resources.

Cultural Resource Specialists

Amanda Gronhovd MS, RPA
Principal Investigator
10,000 Lakes Archaeology, Inc.
Mobile: (612) 670-6431

and Ryan P. Grohnke
Field Director, Cultural Resources
Westwood Professional Services, Inc.
Direct: (952) 906-7403
Mobile: (612) 209-3352

2.2 Human Remains

If human remains are discovered, North Dakota Century Code 23-06-27 “Protection of human burial sites, human remains and burial goods” must be followed. The construction superintendent must immediately contact local law enforcement at the number given below. If possible, the remains should be covered with a tarp for protection and to prevent photographs. Human remains will be treated with respect at all times.

After notifying local law enforcement, the construction superintendent will contact the Cultural Resource Specialists at Westwood. A Cultural Resource Specialist will contact and coordinate with BWE and the SHSND/NDSHPO. A Cultural Resource Specialist will travel to the site as soon as feasible, generally within 24 hours, to assist in evaluating the extent of the burial site and any affiliated cultural resources.

If the remains are determined or assumed to be Native American, the SHSND/NDSHPO will be consulted to determine how the remains will be managed. At the request of the SHSND/NDSHPO, appropriate Native American Tribal representatives may be contacted.

Rolette County Sheriff's Department

Telephone: (701) 477-5623

Appendix D
Delineated Wetlands Review and Maps

MEMORANDUM

Date: February 8, 2022

**Re: Delineated Resources Review
Border Winds Repower Project, Rolette County, North Dakota**

Westwood File 0003319.00

To: Ellen Heine, Borders Winds Energy, LLC

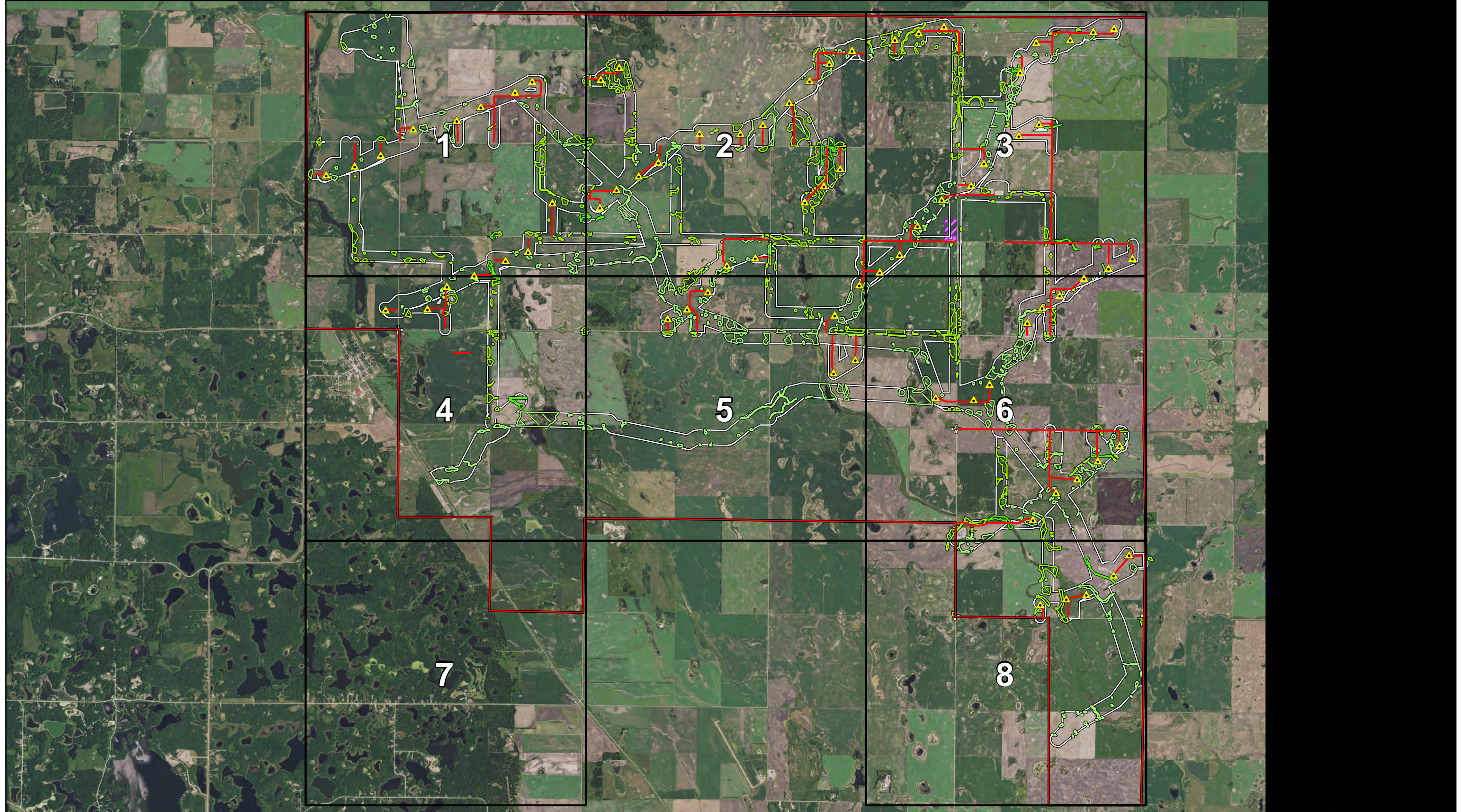
From: Robert Cress

Westwood Professional Services, Inc. (Westwood) performed wetland delineations for the original Border Winds Wind Project at the request of Sequoia Energy in 2009. Border Winds Energy, LLC (BWE) contracted Westwood to update the 2009 delineation and conduct delineations in other areas of the Project during Fall 2013. Subsequent delineations were conducted for locations of project infrastructure outside of the original project footprint in May 2014 which included the O&M facility and access roads. A wetland permit application was submitted to the U.S. Army Corp of Engineers (USACE) on December 30, 2013, and authorization for the wetland impacts associated for the Project was granted by the USACE on February 24, 2014. The impacts for the project were authorized under Nationwide Permit 12 (Utility Lines).

Westwood has been tasked with compiling the wetland delineation data from prior delineation efforts to aid in the repower of the project. Westwood compiled the prior field delineation data which is included in **Exhibits 1-1 to 1-8**. Westwood understands that the plan for the repower is to access all turbines via existing public roads and turbine access roads. In addition it is understood that all staging and work limits will be located within previously surveyed corridors. Based on this information Westwood understands that wetland impacts will be avoided and does not recommend any additional field delineations. If at a future date it is decided that crane paths will be located outside of previously delineated corridors, additional field delineations will be necessary to accurately map the potential extent of water resources within the Project Area.

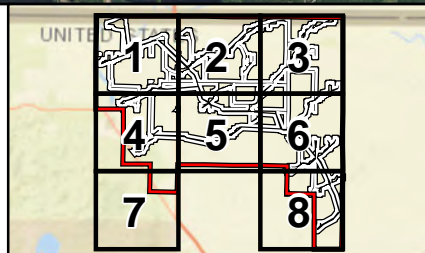
Exhibits

Border Winds Repower Project
Rolette County, North Dakota



Data Source(s): Westwood (2021);

Map Document: N:\0003319_01\CIS\MXD\BW_DelineatedWetlands_Overview.mxd 8/23/2021 1:45:47 PM PJC/ess



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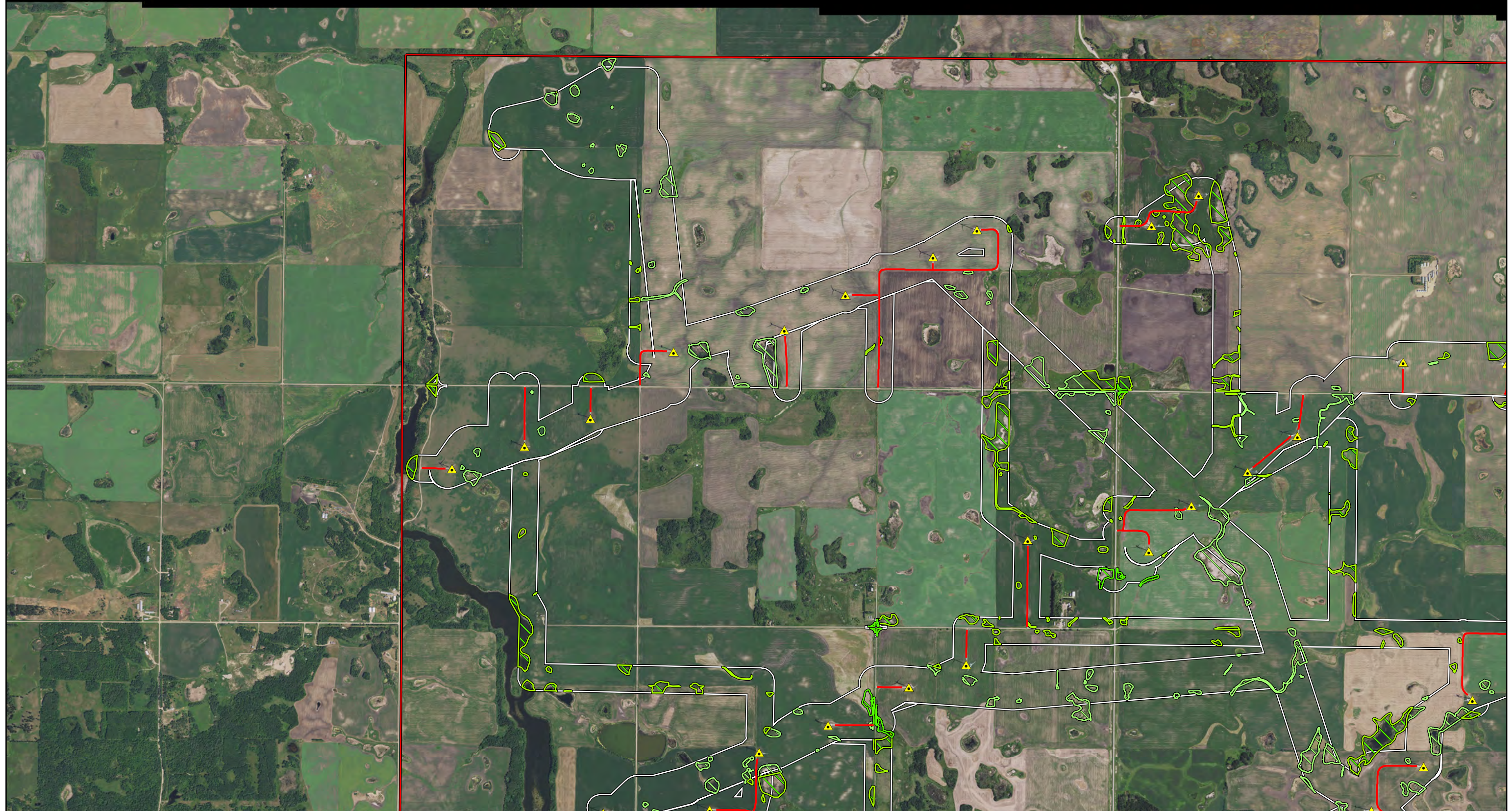
- Project Boundary
- Delineated Area
- Delineated Wetland
- Turbine Location
- Access Road Location
- Mapbook Grid
- O&M Facility



Border Winds Repower Project

Rolette County, North Dakota

Delineated Wetland Corridors Overview

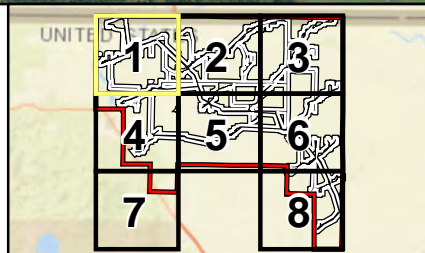


Data Source(s): Westwood (2021);

Map Document: N:\0003319_01\CIS_MXD\BW_DelineatedWetlands_Mapbook.mxd 8/24/2021 8:41:26 AM RJC/ess

Westwood

Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.



Legend

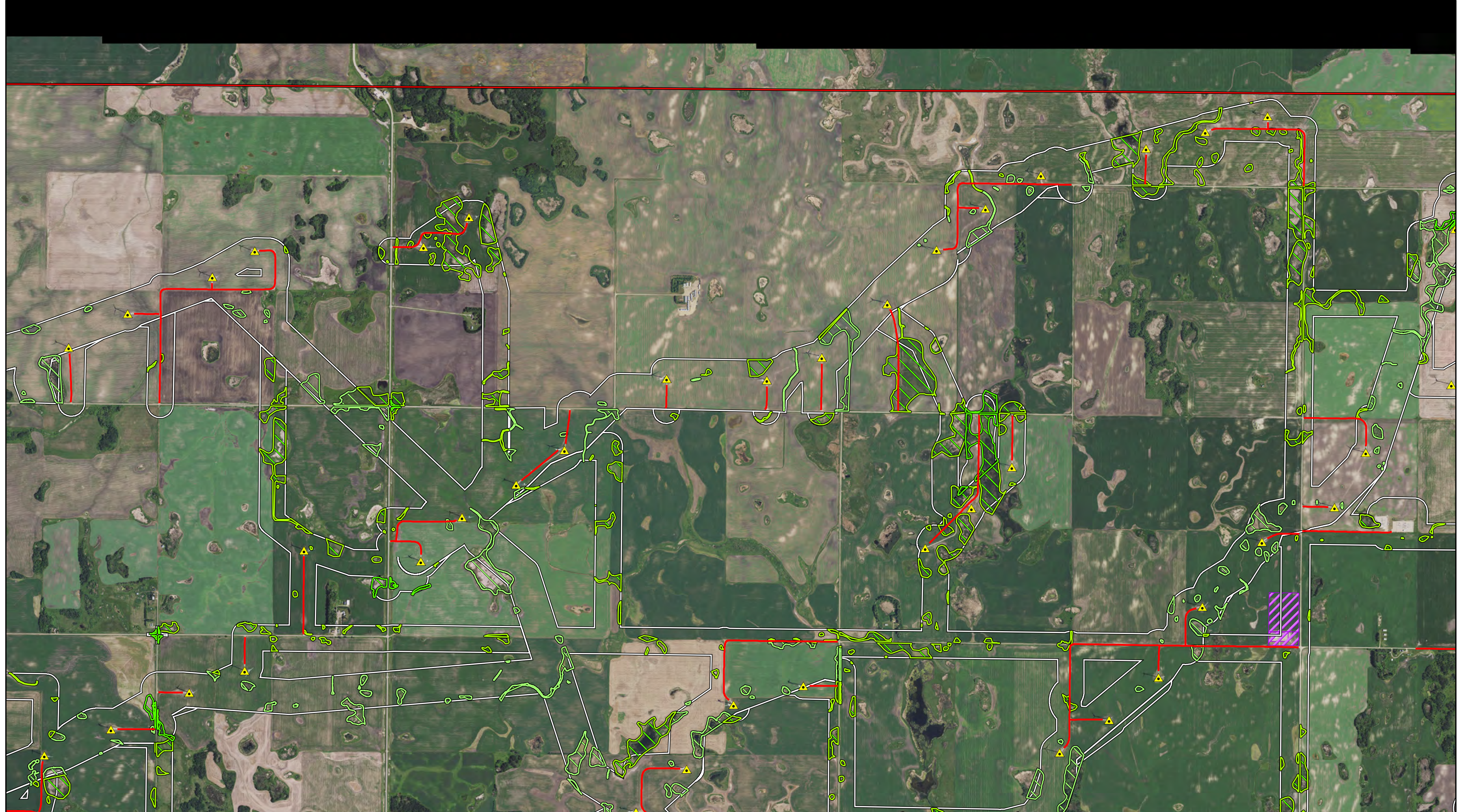
-  Project Boundary
-  Delineated Area
-  Delineated Wetland
-  Turbine Location
-  Access Road Location
-  Mapbook Grid
-  O&M Facility



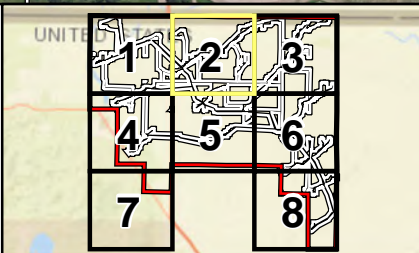
Border Winds Repower Project

Rolette County, North Dakota

Delineated Wetland Corridors Mapbook



Data Source(s): Westwood (2021);



- Legend**
- Project Boundary
 - Delineated Area
 - Delineated Wetland
 - Turbine Location
 - Access Road Location
 - Mapbook Grid
 - O&M Facility

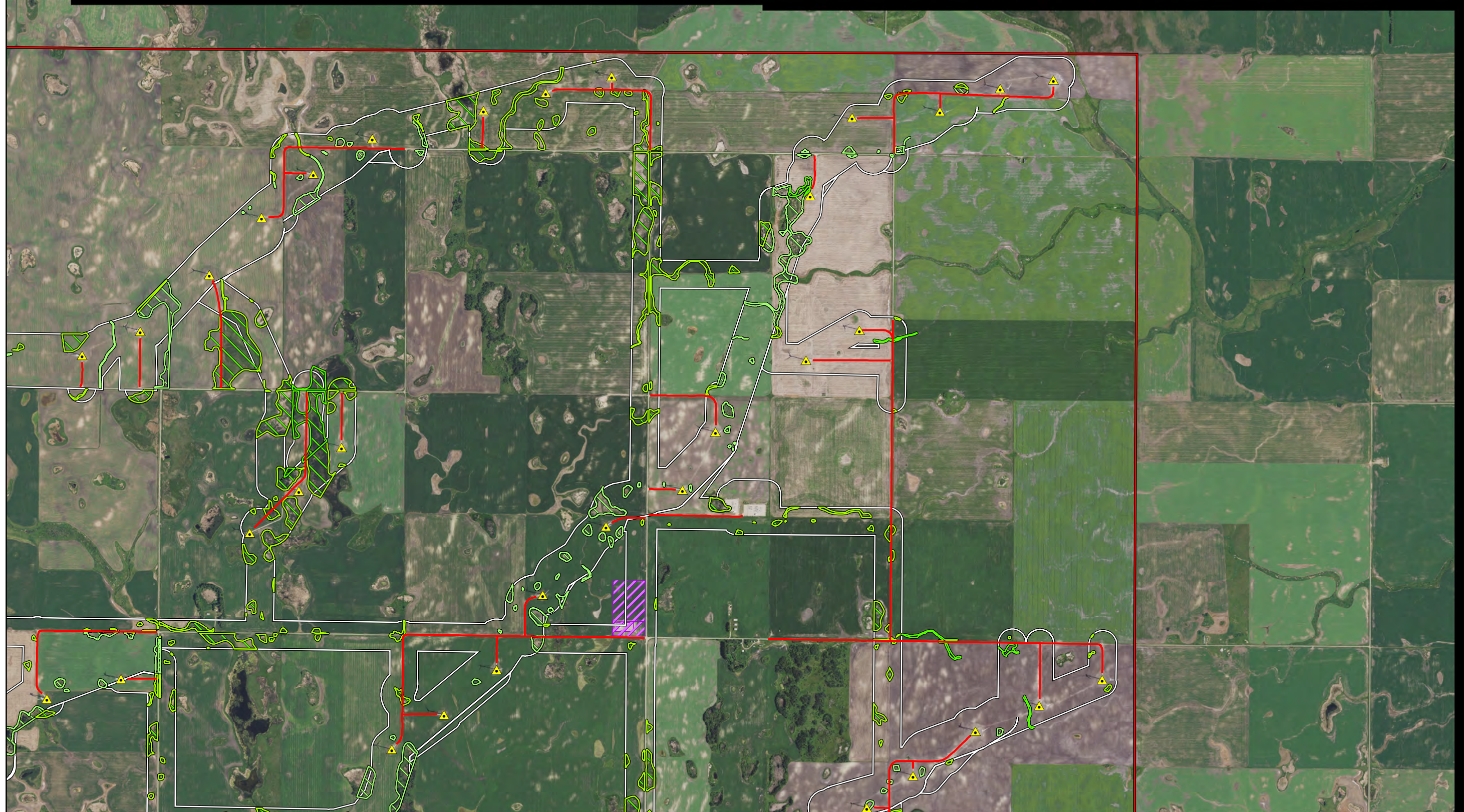


Border Winds Repower Project

Rolette County, North Dakota

Delineated Wetland Corridors Mapbook

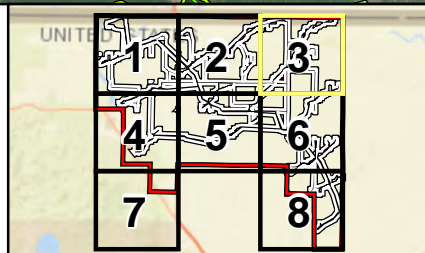
Westwood
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Data Source(s): Westwood (2021);

Map Document: N:\0003319_01\CIS_MXD\BW_DelineatedWetlands_Mapbook.mxd 8/24/2021 8:41:45 AM RJC/ess

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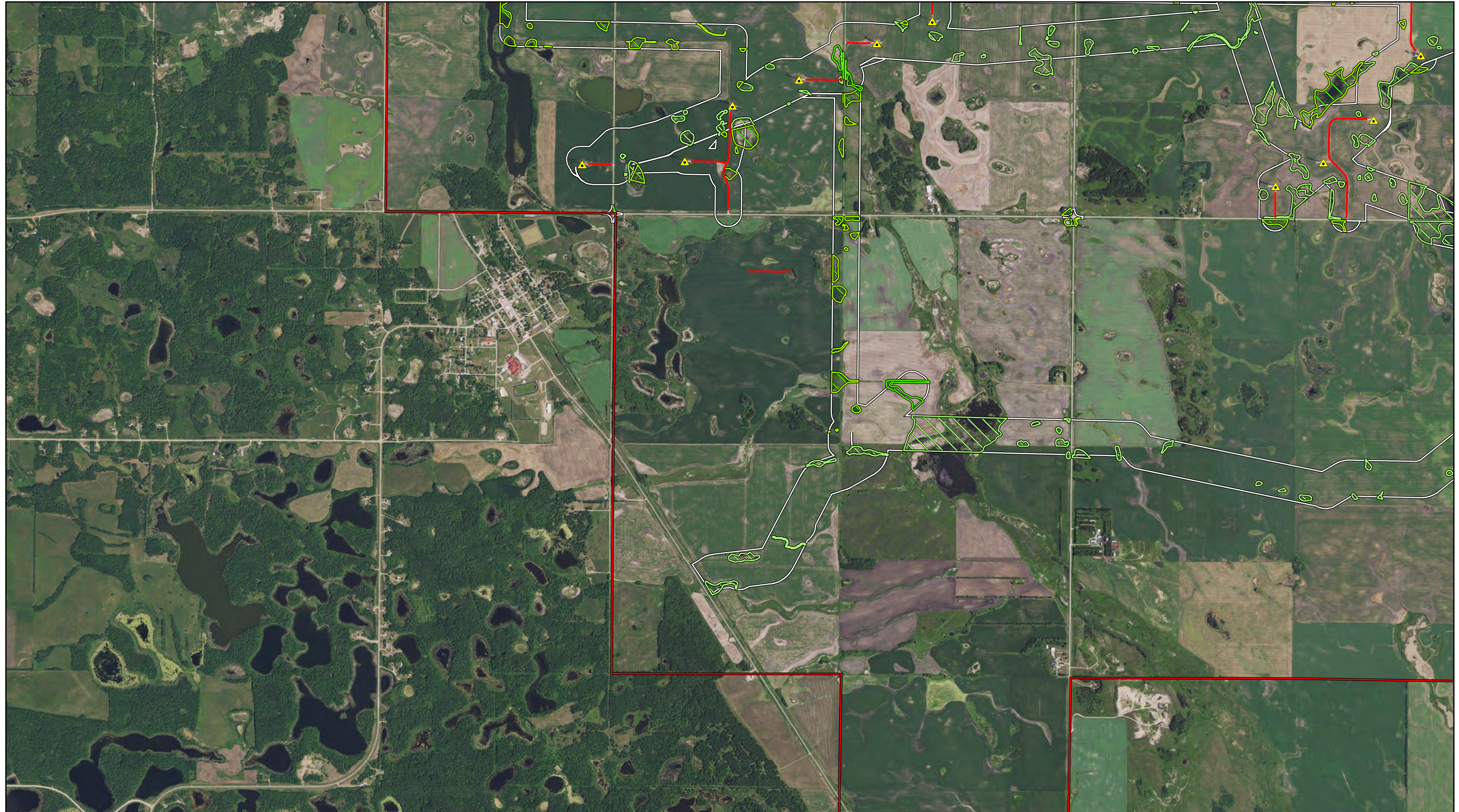
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 - O&M Facility



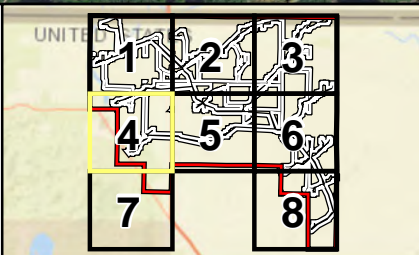
Border Winds Repower Project

Rolette County, North Dakota

Delineated Wetland Corridors Mapbook



Data Source(s): Westwood (2021);



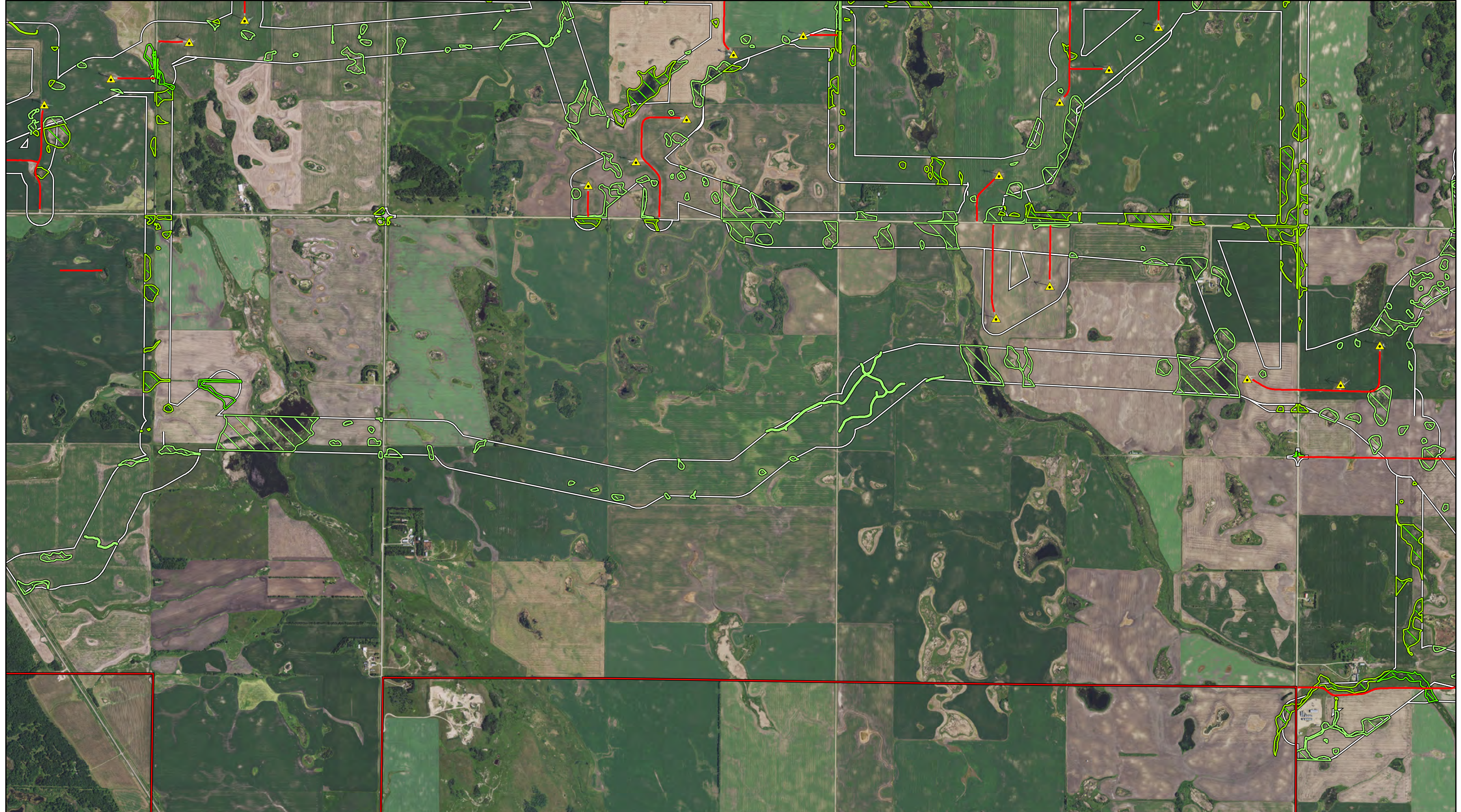
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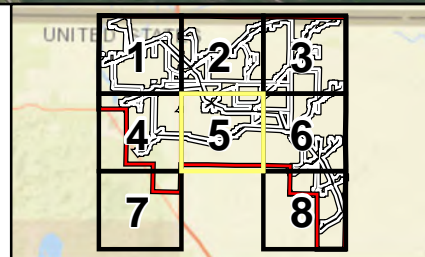
Border Winds Repower Project

Rolette County, North Dakota

Delineated Wetland Corridors Mapbook



Data Source(s): Westwood (2021);



Legend

Project Boundary	Access Road Location
Delineated Area	Mapbook Grid
Delineated Wetland	O&M Facility
Turbine Location	

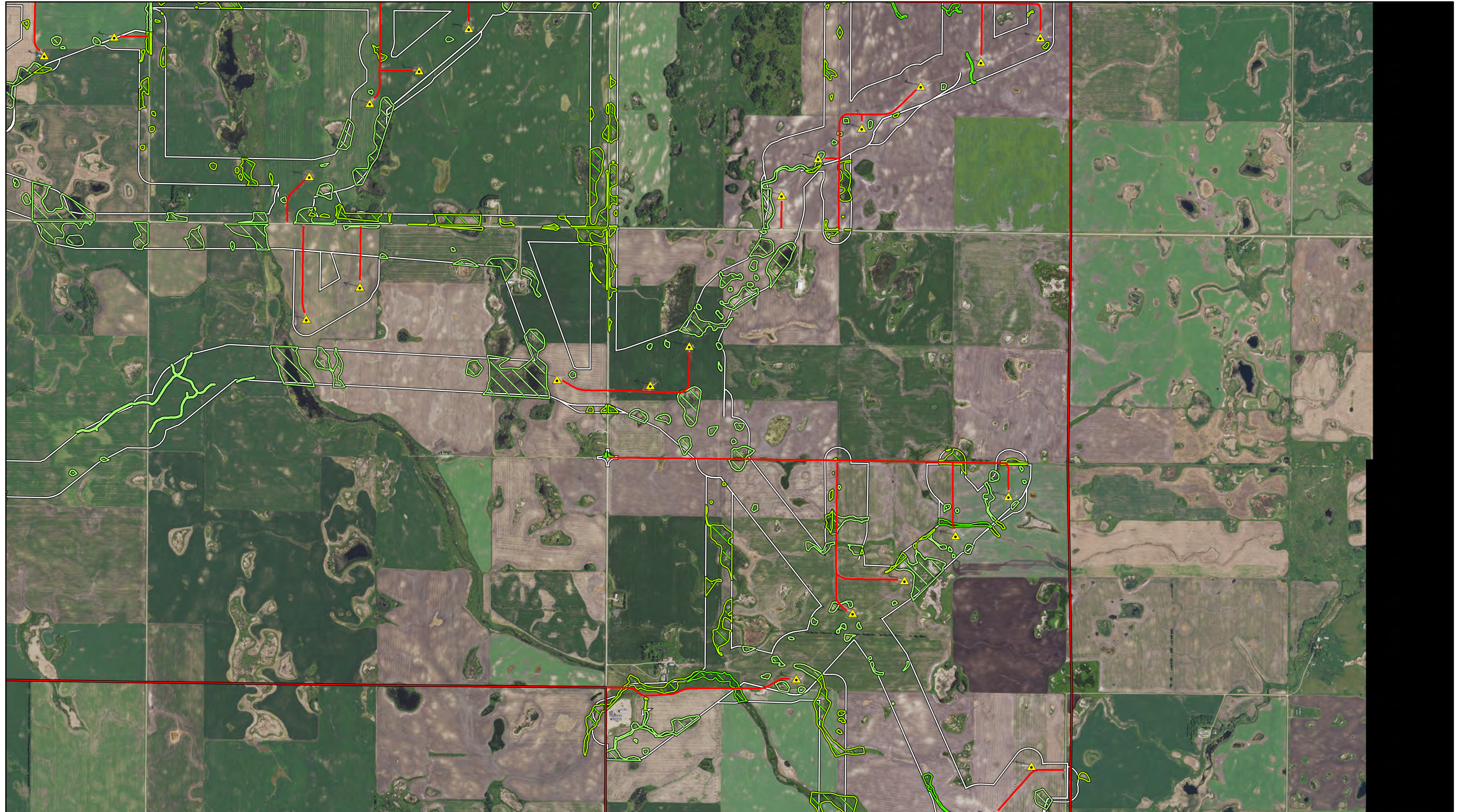


Border Winds Repower Project

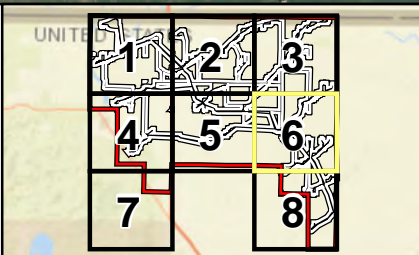
Rolette County, North Dakota

Delineated Wetland Corridors Mapbook

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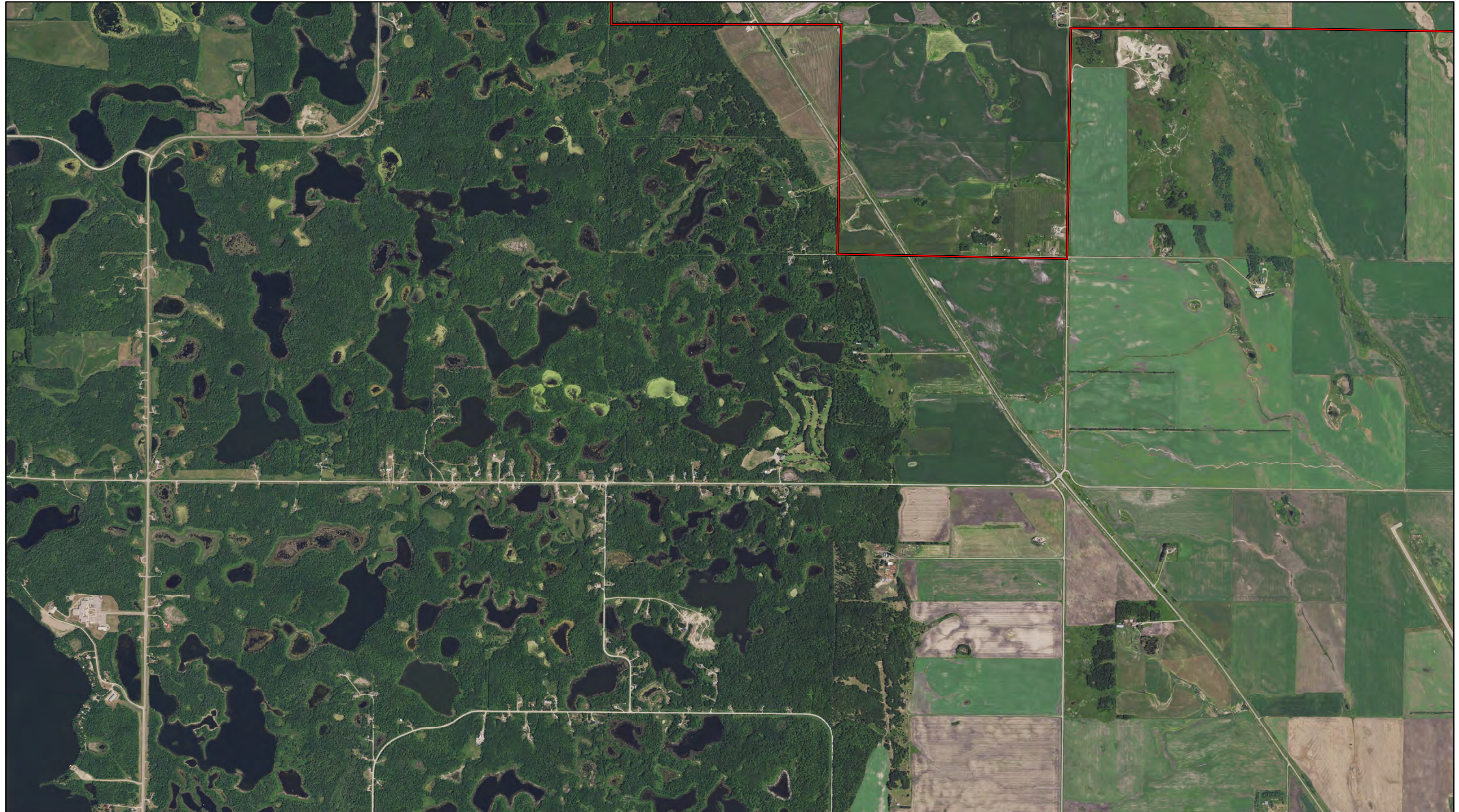
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- Project Boundary
 - Delineated Area
 - Delineated Wetland
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 - Access Road Location
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 - O&M Facility



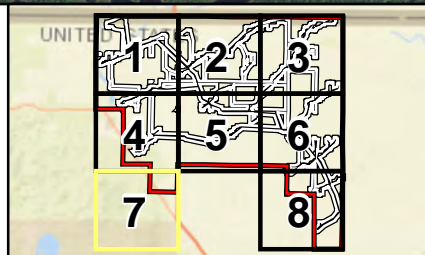
Border Winds Repower Project

Rolette County, North Dakota

Delineated Wetland Corridors Mapbook



Data Source(s): Westwood (2021);



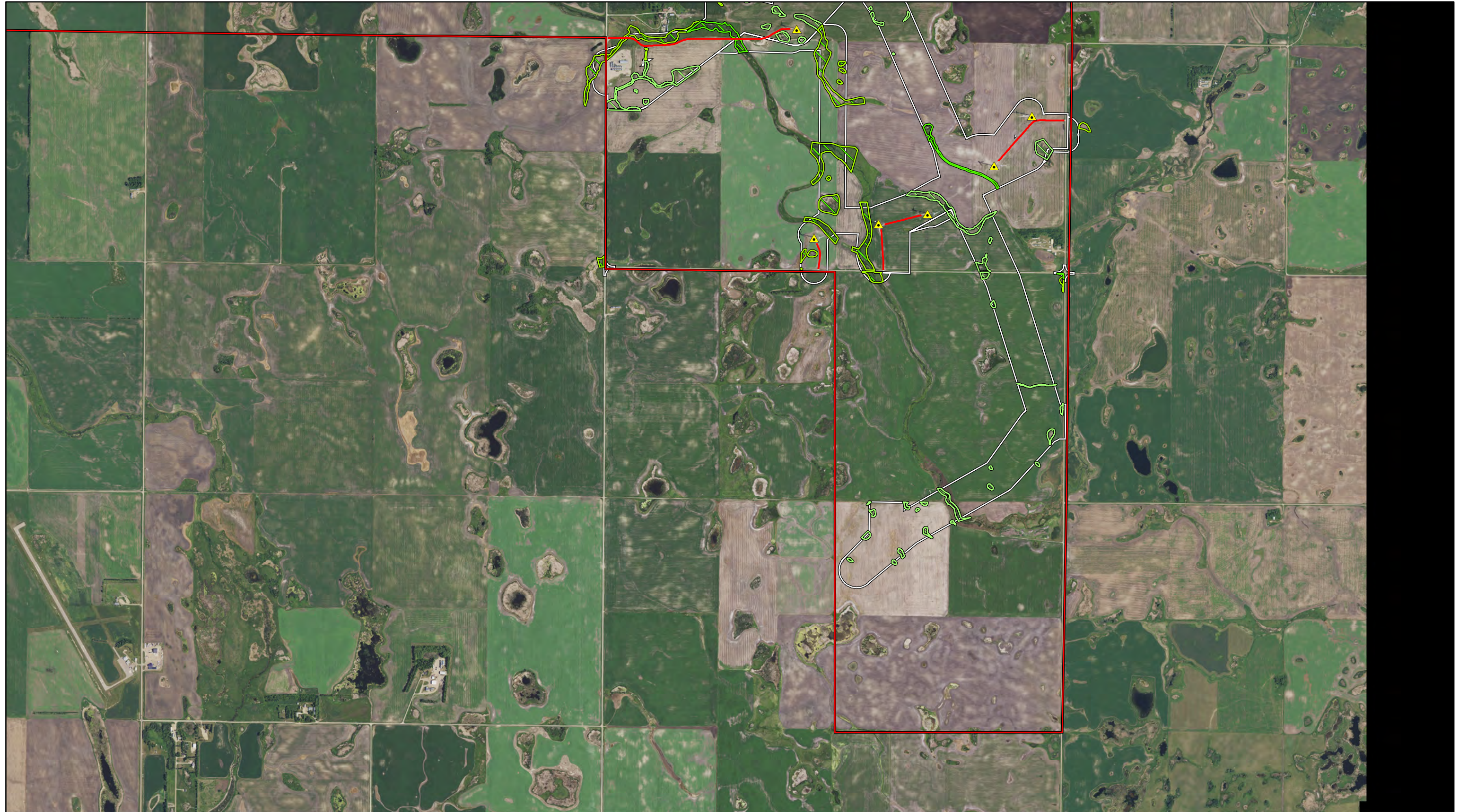
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- Project Boundary
 - Access Road Location
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 - Turbine Location



Border Winds Repower Project

Rolette County, North Dakota

Delineated Wetland Corridors Mapbook

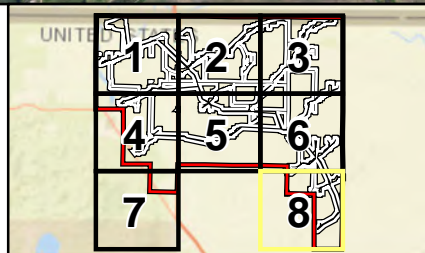


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Legend

-  Project Boundary
-  Access Road Location
-  Delineated Area
-  Mapbook Grid
-  Delineated Wetland
-  O&M Facility
-  Turbine Location



Border Winds Repower Project

Rolette County, North Dakota

Delineated Wetland Corridors Mapbook

Appendix E
Natural Resources Impacts Memo

Westwood

March 10, 2022

Re: Natural Resources Impacts for Repower of Border Winds Wind Farm, Rolette County, ND

On behalf of Northern States Power Company (NSP), Westwood Professional Services is writing to summarize impacts to natural resources regarding the Applicant's plans to repower the Border Winds Wind Farm. NSP is submitting a Certificate of Site Compatibility (CSC) to the North Dakota Public Service Commission (NDPSC) to repower the Border Winds Wind Farm in Rolette County, North Dakota in March of 2022. The repowered project will have the same number of turbines but will be more efficient in its wind energy conversion. This memo summarizes desktop and field studies that have been conducted to date for the Border Winds Wind Farm Project ("Project"), and to address migratory wildlife risks ahead of the proposed project repower. Some of the studies have been on-going since the Project's initial operation in December 2011. Based on studies to date, and results of post-construction monitoring efforts described in this memo, repowering the Project is not anticipated to have any measurable change in impact on migrating birds and bats. Impacts are expected to be similar to other operating wind projects in the area.

The location of the Project's original 75 turbines, access roads, collection lines, and other supporting infrastructure will not be altered during the repowering process. In order to repower the Project turbines, a crane will be used to install the new rotors, nacelles, and blades, which will utilize already disturbed areas. Public roadways and intersections were already retrofitted for these vehicles and equipment; therefore no upgrades should be required to allow for delivery of the rotor, nacelle, and blades to each turbine location. A temporary laydown yard will setup on in an already constructed area, therefore, no new disturbances will occur for this portion of the Project. NSP anticipates beginning repowering the Project during the third quarter of 2024, and construction is anticipated to take several months to complete.

Natural resources impact assessment:

The Project Area is located on the eastern side of Rolette County, within the Northern Black Glaciated Plains (NBGP) portion of the Northern Great Plains (DesLauriers and Lambert 1997). A majority of the land within this ecoregion is used for agricultural production with over 80% dedicated to dry-farmed cropland. Elevation of the region varies from 300 meters (ca. 980 feet) to 700 meters (2300 feet) exhibiting a general uphill gain from east to west. Ground surfaces of the region are mostly level to slightly undulating till plains, which includes a number of kettle holes, kames and moraines. Annual temperature average is 3-4° Celsius (37-40° Fahrenheit), and annual average precipitation ranges between 375-450 millimeters (15-18 inches). There are usually 100 and 120 days per year that are freeze free.

Within the Project area, most of the land use is comprised of row crop agriculture, specifically small grain crops (USDA NASS 2021). Westwood biologists requested an updated Information for Planning and Consultation (IPaC) review from the U.S. Fish and Wildlife Service (USFWS) for the Project (Attachment A). The IPaC indicated that the following species may occur in, within, or near the Project Area, 1) federally threatened northern long-eared bat (*Myotis septentrionalis*); 2) the candidate species monarch butterfly (*Danaus plexippus*).

Although the Project is located within the known range of the NLEB, summer risk to NLEBs is not expected due to the lack of woodlands within proximity to turbines and the tendency for NLEB to forage within 1,000 feet of woodlands.

The Dakota skipper is a rare butterfly that is a candidate for the federal endangered species list and is known to occur in Rolette County. The only known population of Dakota skippers in Rolette County is associated with the Holywater Spring site, which is located approximately 13 miles southeast of the Project Area. Because the Dakota skipper requires high quality native prairie, it is unlikely to be present in the Project Area.

Other wildlife likely to occur in the area include mammals like American badger (*Taxidea taxus*), American beaver (*Castor canadensis*), American mink (*Neogale vison*), American red squirrel (*Tamiasciurus hudsonicus*), big brown bat (*Eptesicus fuscus*), bobcat (*Lynx rufus*), common raccoon (*Procyon lotor*), coyote (*Canis latrans*), deer mouse (*Peromyscus maniculatus*), eastern cottontail (*Sylvilagus floridanus*), groundhog (*Marmota monax*), long-tailed weasel (*Neogale frenata*), meadow vole (*Microtus pennsylvanicus*), muskrat (*Ondatra zibethicus*), North American porcupine (*Erethizon dorsatum*), northern short-tailed shrew (*Blarina brevicauda*), red fox (*Vulpes vulpes*), snowshoe hare (*Lepus americanus*), striped skunk (*Mephitis mephitis*), and white-tailed deer (*Odocoileus virginianus*). Bird species likely to occur in the project area include American Redstart (*Setophaga ruticilla*), American Robin (*Turdus migratorius*), Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Black-billed Magpie (*Pica hudsonia*), Bobolink (*Dolichonyx oryzivorus*), Chestnut-sided Warbler (*Setophaga pensylvanica*), Clay-colored Sparrow (*Spizella pallida*), Eastern Towhee (*Pipilo erythrophthalmus*), Gray Catbird (*Dumetella carolinensis*), Least Flycatcher (*Empidonax minimus*), Nelson's Sparrow (*Ammodramus nelsoni*), Northern Waterthrush (*Parkesia noveboracensis*), Red-bellied Woodpecker (*Melanerpes carolinus*), Western Meadowlark (*Sturnella neglecta*), and Yellow Warbler (*Setophaga petechia*). Amphibians that might occur in the project area include the barred tiger salamander (*Ambystoma mavortium*), northern leopard frog (*Lithobates pipiens*), and the wood frog (*Lithobates sylvaticus*) (iNaturalist 2022). Any of the wildlife living around the Project area should already be accustomed to the turbines. Repowering turbines will likely not disturb wildlife for prolonged periods; therefore, the populations should not be affected.

It is Westwood's conclusion, based on NSP's plans to repower the project without new disturbances to the area, that there should be no new impacts to nearby habitats or wildlife. The increased traffic during the turbine replacement phase should also have no direct impact on wildlife as vehicles will be moving slow, which should allow time for animals to move out of the road.

Sincerely,

WESTWOOD PROFESSIONAL SERVICES



David Kuhlmann
Senior Wildlife Biologist

References

DesLauriers, L.L. and R.E. Lambert
1997 Soil Survey of Rolette County, North Dakota. United States Department of
Agriculture, Soil Conservation Service. U.S. Government Printing Office.

iNaturalist 2022. Rolette County, North Dakota. Accessed March 7, 2022
<https://www.inaturalist.org/places/rolette-county#page=1&taxon=3>.

USDA NASS 2021. <https://nassgeodata.gmu.edu/CropScape/>.

12701 Whitewater Drive, Suite 300
Minnetonka, MN 55343

Main (952) 937-5150
Fax (952) 937-5822

westwoodps.com
(888) 937-5150

Westwood

June 24, 2021

Brian Kietzman
North Dakota Game and Fish
Jamestown Office
3320 East Lakeside Road
Jamestown, North Dakota 58401

Re: Border Winds Wind Farm, Rolette County, North Dakota
File: 0003319.01

Dear Mr. Kietzman:

On behalf of Xcel Energy (Xcel), Westwood Professional Services is writing to request comments regarding the Applicant's plans to acquire a Certificate of Site Compatibility (CSC) from the North Dakota Public Service Commission (NDPSC) to repower the Border Winds Wind Farm in Rolette County, North Dakota (**Exhibit 1**). Xcel anticipates submitting a CSC to repower the 150 megawatt (MW) nameplate capacity wind energy facility to the NDPSC in October 2021. The repowered project will have the same nameplate capacity (150 MW) but will be more efficient in its wind energy conversion.

The Project Area is located within the Northern Black Prairie region of the Northern Glaciated Plains ecoregion of North Dakota. Most of the land use within the Project Area is comprised of row crop agriculture, specifically small grain crops (**Exhibit 2**).

The location of the Project's original 75 turbines, access roads, collection lines, and other supporting infrastructure will not be altered during the repowering process. However, in order to repower the Project turbines, a crane will be used to install the new rotors, nacelles, and blades, which will require a temporary crane path. Some minor upgrading of public roadways and intersections may be required to allow for delivery of the towers, rotors, and nacelles to each turbine location. A temporary laydown yard will likely be constructed within agricultural lands to stage the turbine repower components prior to installation. A temporary crane path will also be required for installing the new rotors and nacelles, the temporary crane path will be restored to pre-construction conditions following construction completion. Xcel anticipates to begin repowering the Project during the third quarter of 2024, and construction is anticipated to take several months to complete.

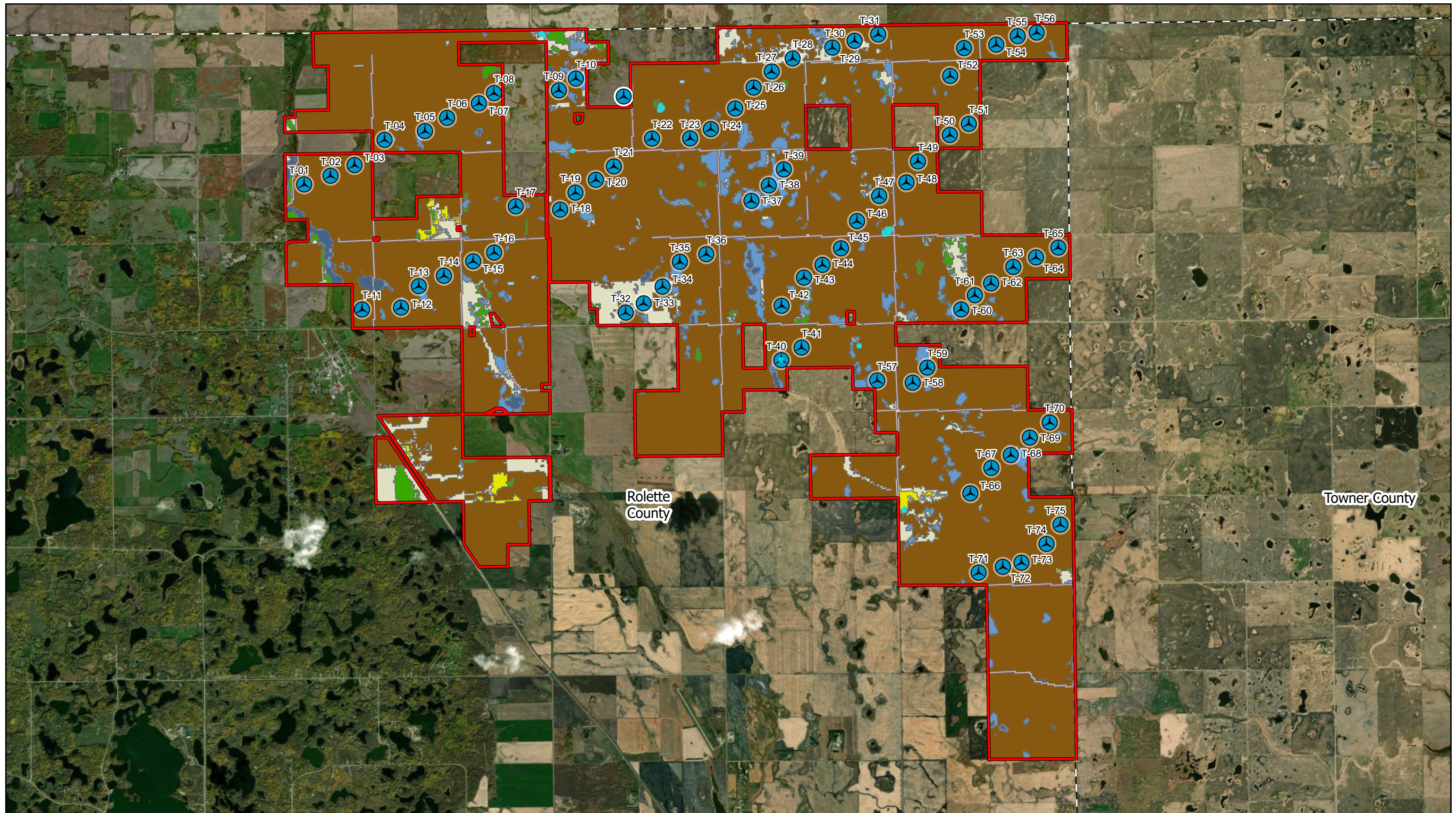
We would appreciate hearing any comments you may have regarding the proposed repowering project; comments received will be incorporated into the NDPSC review process. Please respond as soon as possible or within 30 days of the date of this letter. If you have questions, I can be reached at (952) 697-5773 or via email at lucas.wandrie@westwoodps.com.

Sincerely,

WESTWOOD PROFESSIONAL SERVICES

A handwritten signature in black ink, appearing to read 'L. Wandrie', with a long horizontal flourish extending to the right.

Lucas J. Wandrie, Ph.D. (ABD)
Wildlife and Permitting Specialist



Data Source(s): Westwood (2021).

Legend

- Project Area
- County Boundary
- ⊙ Existing Turbines

NLCD

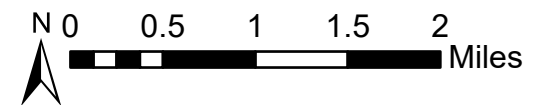
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- Developed, Open Space (2.5%)
- Developed, Low Intensity (0.1%)
- Developed, Medium Intensity (<0.1%)

- Developed, High Intensity (<0.1%)
- Hay/Pasture (0.5%)
- Herbaceous (<0.1%)
- Shrub/Scrub (<0.1%)
- Mixed Forest (0.2%)

- Deciduous Forest (1.1%)
- Woody Wetlands (<0.1%)
- Emergent Herbaceous Wetlands (4.2%)
- Open Water (0.7%)
- Barren Land (<0.1%)

Borderwinds Windfarm Repower Project

Rolette County, North Dakota



NLCD Landcover Types

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Westwood Professional Services, Inc.

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Minnetonka, MN 55343

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Fax (952) 937-5822

westwoodps.com
(888) 937-5150

Westwood

June 24, 2021

Jerry Reinisch
U.S. Fish and Wildlife Service
North Dakota Ecological Services Field Office
3425 Miriam Avenue
Bismarck, North Dakota 58501-7926

Re: Border Winds Wind Farm, Rolette County, North Dakota
File: 0003319.01

Dear Mr. Reinisch:

On behalf of Xcel Energy (Xcel), Westwood Professional Services is writing to request comments regarding the Applicant's plans to acquire a Certificate of Site Compatibility (CSC) from the North Dakota Public Service Commission (NDPSC) to repower the Border Winds Wind Farm in Rolette County, North Dakota (**Exhibit 1**). Xcel anticipates submitting a CSC to repower the 150 megawatt (MW) nameplate capacity wind energy facility to the NDPSC in October 2021. The repowered project will have the same nameplate capacity (150 MW) but will be more efficient in its wind energy conversion.

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The location of the Project's original 75 turbines, access roads, collection lines, and other supporting infrastructure will not be altered during the repowering process. However, in order to repower the Project turbines, a crane will be used to install the new rotors, nacelles, and blades, which will require a temporary crane path. Some minor upgrading of public roadways and intersections may be required to allow for delivery of the towers, rotors, and nacelles to each turbine location. A temporary laydown yard will likely be constructed within agricultural lands to stage the turbine repower components prior to installation. A temporary crane path will also be required for installing the new rotors and nacelles, the temporary crane path will be restored to pre-construction conditions following construction completion. Xcel anticipates to begin repowering the Project during the third quarter of 2024, and construction is anticipated to take several months to complete.

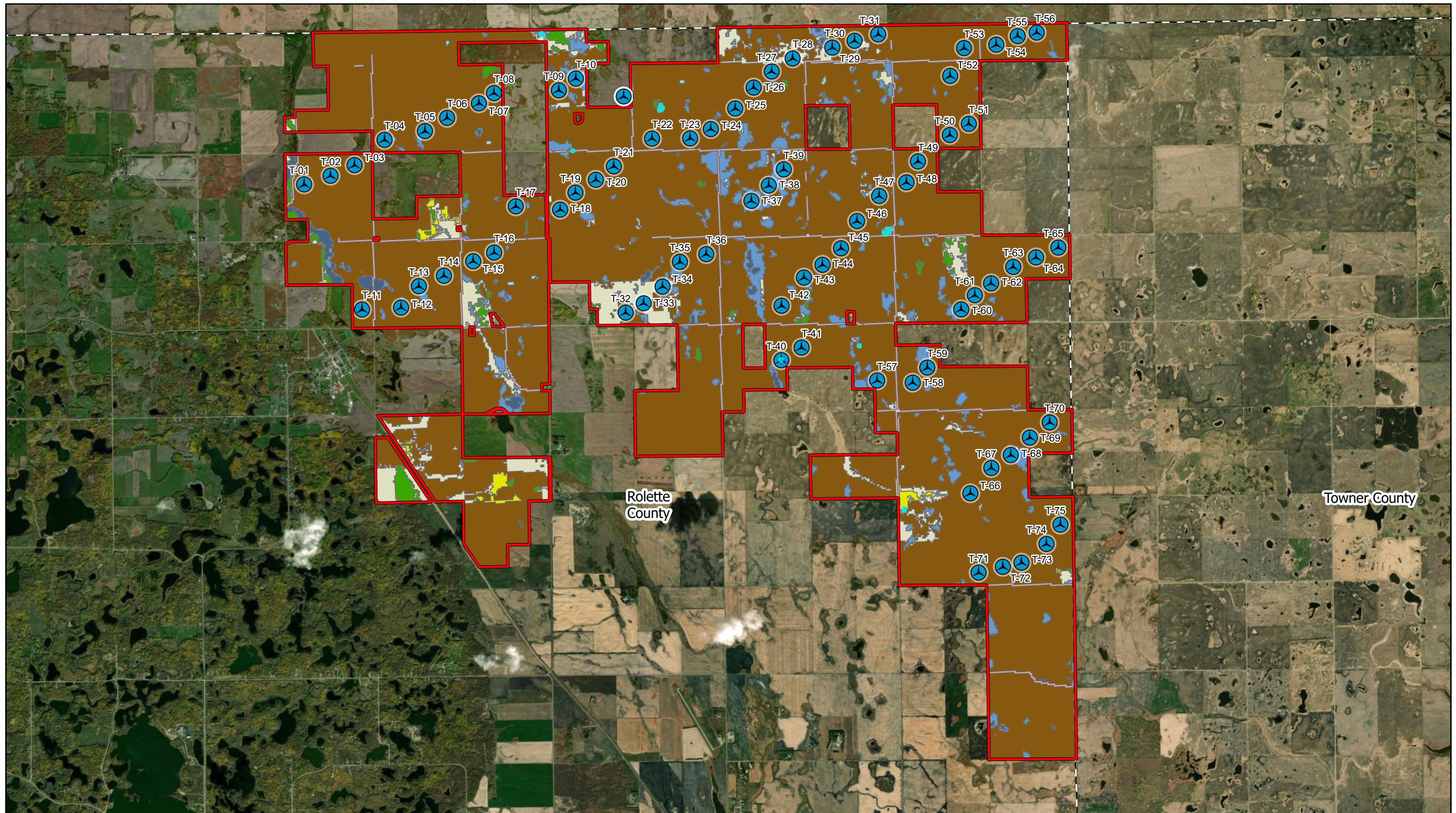
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Sincerely,

WESTWOOD PROFESSIONAL SERVICES

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Lucas J. Wandrie, Ph.D. (ABD)
Wildlife and Permitting Specialist



Data Source(s): Westwood (2021).

Legend

- Project Area
- County Boundary
- ⊕ Existing Turbines

NLCD

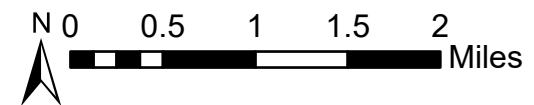
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- Developed, Low Intensity (0.1%)
- Developed, Medium Intensity (<0.1%)

- Developed, High Intensity (<0.1%)
- Hay/Pasture (0.5%)
- Herbaceous (<0.1%)
- Shrub/Scrub (<0.1%)
- Mixed Forest (0.2%)

- Deciduous Forest (1.1%)
- Woody Wetlands (<0.1%)
- Emergent Herbaceous Wetlands (4.2%)
- Open Water (0.7%)
- Barren Land (<0.1%)

Borderwinds Windfarm Repower Project

Rolette County, North Dakota



NLCD Landcover Types

Westwood

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2.2 turbines will reuse the 75 existing 95 meter (311.7 feet) structural steel towers and, as a result, turbine locations will not change. NSP plans to use the existing turbine foundations (with reinforcement, if needed), collection and communications systems, permanent access roads, and Project substation (with upgrades to accommodate the repower technology, as needed). Other associated facilities will remain unchanged.

5. During installation of the repowering technology, existing access roads will be temporarily widened to accommodate delivery and staging of components and equipment. Temporary crane paths may also be needed to facilitate equipment removal and installation. A temporary laydown yard located near the existing O&M building will also be used during installation. These areas have been evaluated and conform with exclusion area criteria.

6. Repowering the Project will not affect its layout, which will remain as depicted in the as-built maps NSP filed with the Commission on December 21, 2017 (Case No. PU-14-31).

7. The repowering activities are wholly within the site designated by the Commission for the Project and are to improve the same type of facility for which a Certificate of Site Compatibility was issued. *See* N.D.C.C. §§ 49-22-03(3)(a)(1), (3) and (4)(b).

8. NSP has conducted an environmental and regulatory compliance analysis for the repowered Project, and an associated report prepared by its environmental consultant, Westwood, is provided as **Exhibit A**. As set forth in **Exhibit A**:

a. All areas that will be affected by repower activities have been field surveyed for cultural resources and wetlands. No cultural resources will be affected by repowering the Project, and no permanent wetland impacts will occur as a result of repower activities.

b. Westwood, at the direction of NSP, completed an updated sound analysis for the Project with the proposed repower technology. At the time the Project was permitted, the Commission did not have a sound standard for wind energy facilities. Finding of Fact No. 34 in the Commission's 2011 Order states that "average noise levels at [occupied] residences should not exceed a generally accepted 45 dBA standard." The updated sound analysis conducted for the repowered Project demonstrates that sound levels are not anticipated to exceed 45 dBA at any occupied residence, or within 100 feet of any occupied residence or community building.

c. Westwood, at the direction of NSP, completed a shadow flicker assessment for the Project with the proposed repower technology. The Commission does not have a shadow flicker standard, and shadow flicker was not addressed in the Commission's 2011 Order. The shadow flicker assessment conducted for the repowered Project demonstrates that shadow flicker levels are not anticipated to exceed 30 hours per year at any occupied residence.

d. NSP has analyzed the repowered Project's compliance with the Commission's current exclusion area and avoidance area criteria. The repowered Project will comply with all current exclusion area and avoidance area criteria, with the requested variance, and construction activities associated with repowering will not affect any known exclusion or avoidance areas within the designated Project site. *See* N.D.C.C. §§ 49-22-03(3)(a)(2) and (4)(a).

e. The repowered Project will continue to comply with all requirements set forth in the Commission's Orders regarding the Project, including applicable laws and rules designating the site. *See* N.D.C.C. §§ 49-22-03(3)(a)(1) and (4)(c).

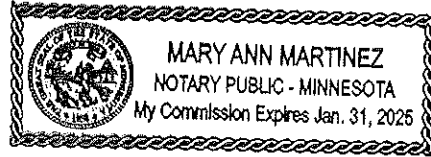
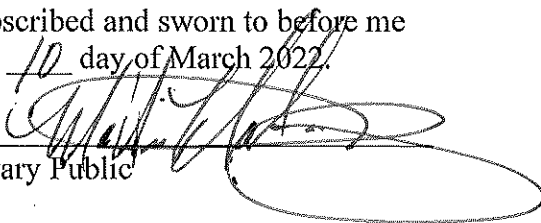
FURTHER AFFIANT SAYETH NOT.



Christopher Clark

Subscribed and sworn to before me
this 10 day of March 2022.

Notary Public



75449659 v1

Exhibit A

Environmental and Regulatory Compliance Memorandum Border Winds Energy Project Repower Case Nos. PU-08-797, PU-14-31, and PU-17-362

Introduction

Northern States Power Company (“NSP”) has retained Westwood to prepare this memorandum to support NSP’s certification of compliance with N.D.C.C. § 49-22-03(a) in connection with repowering activities for the Border Winds Energy Project (“Repower Project”). NSP, with assistance from Westwood, analyzed the Repower Project with respect to environmental, cultural, and natural resources, as well as sound and shadow flicker. The following sections and referenced figures and appendices summarize the results of the analysis.

Description of the Project

The Repower Project involves replacing the current turbine technology (Vestas V100-2.0 megawatt (“MW”) turbines) with new technology (V110-2.2 MW turbines). More specifically, the Repower Project will consist of removing and replacing the existing Vestas V100-2.0 blades, hub, gearbox, pad mount transformer, and generator with a new repower package of Vestas V110-2.2 blades, hub, gearbox, pad mount transformer, and generator. Replacing these mechanisms may require full nacelle replacement. All 75 of the Vestas V110-2.2 turbines will reuse the existing 95 meter (311.7 feet) structural steel towers and, as a result, turbine locations will not change. NSP plans to use the existing turbine foundations (with reinforcement, if needed), collection/communications systems, permanent access roads, and Project substation (with upgrades to accommodate the repower technology, as needed). Other associated facilities will remain unchanged.

During installation of the repowering technology, existing access roads will be temporarily widened to accommodate delivery and staging of components and equipment. Temporary crane paths may also be needed to facilitate equipment removal and installation. A temporary laydown yard will be utilized during the Repower Project. NSP is working with a landowner adjacent to the existing Border Winds O&M building for use of that land as a laydown site. This site was previously used during initial project construction and meets exclusion and avoidance area criteria. NSP currently plans to begin repowering activities in 2024 or 2025.

Figure 1 depicts the Repower Project Area and layout. Figure 2 depicts the proposed turbine technology (V110-2.2 MW turbines).

Compliance with Exclusion and Avoidance Areas

Exclusion Areas

Per N.D.A.C. §§ 69-06-08-01(1) and (2), the geographical areas listed in Table 1 shall be excluded in the consideration of a site for an energy conversion facility. Based on the Commission’s approach in prior repower dockets, NSP confirmed the Repower Project’s compliance with the Commission’s current exclusion area criteria, which are consistent with the exclusion area criteria

at the time of project construction in 2013. With the exception of one turbine that is within the non-participating property line exclusion area, the Repower Project complies with all exclusion areas. NSP has learned that the owner of the property at issue recently passed away and is in the process of locating contact information for the heirs of the non-participating landowner near the turbine in question to obtain a waiver. NSP requests that the Commission grant a variance upon submission of the waiver. If the new landowner/s are not willing to grant a waiver NSP will not repower that turbine. Additional Exclusion Areas based on the change in turbine height for the Repower Project are mapped in Figure 3.

Table 1: Summary of Exclusion Areas

General Exclusion Area	Present Within Project Area?	Description
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.	None	United States Fish and Wildlife Service (“USFWS”) administered Waterfowl Production Areas (“WPA”) are located near the Repower Project Area. Based on prior consultation with the USFWS, a minimum 0.25-mile buffer was and continues to be maintained from each WPA.
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.	None	N/A
County parks and recreational areas; municipal parks; parks owned or administered by other governmental subdivisions; hardwood draws; and enrolled woodlands.	None	N/A
Areas critical to the life stages of threatened or endangered animal or plant species.	None	N/A
Areas where animal or plant species that are unique or rare to this state would be irreversibly damaged.	Present	One rare plant community (calcareous fen) is present within the Project boundary. The calcareous fen will not be impacted by the Repower Project.
Areas within 1,200 feet of the geographic center of an intercontinental ballistic missile (ICBM) launch or launch control facility.	None	N/A

Table 1: Summary of Exclusion Areas

General Exclusion Area	Present Within Project Area?	Description
Areas within thirty feet [9.14 meters] on either side of a direct line between an intercontinental ballistic missile (ICBM) 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.	None	N/A
Additional Exclusion Areas for Wind Energy Conversion Facilities – Areas within:	Present Within Project Area?	Description
1.1x the turbine height from the nearest edge of an interstate or state roadway right-of-way (ROW).	Present	No turbines will be located within these exclusion areas
1.1x the turbine height plus 75 feet from the centerline of any county or maintained township roadway.	Present	No turbines will be located within these exclusion areas
1.1x the turbine height from the nearest edge of railroad ROW.	Present	No turbines will be located within these exclusion areas
1.1x the turbine height from the neared edge of a 115 kV or higher transmission line ROW.	Present	No turbines will be located within these exclusion areas
1.1x the turbine height from the property line of a non-participating landowner and 3x the height of the turbine from an inhabited rural residence of a non-participating 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 NDCC Chapter 17-04.	Present	One turbine is within the setback distance from a non-participating property line. NSP will coordinate with that landowner to obtain a waiver to support issuance of a variance.

Avoidance Areas

Per N.D.A.C. §§ 69-06-08-01(3) and (4), the geographical areas listed in Table 2 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 or (in the case of the sound limit) a waiver has been obtained. Based on the Commission’s approach in prior repower dockets, NSP confirmed the Repower Project’s compliance with the Commission’s current avoidance area criteria.

Table 2: Summary of Avoidance Areas		
Avoidance Area	Present Within Project Area?	Description
Historical resources which are not designated as exclusion areas.	Present	All areas impacted by the Repower Project have been surveyed for cultural resources and no impacts are anticipated.
Areas within the city limits of a city or the boundaries of a military installation.	None	N/A
Areas within known floodplains as defined by the geographical boundaries of the hundred-year flood.	None	N/A
Areas that are geologically unstable.	None	N/A
Woodlands and wetlands.	Present	The Repower Project will not impact woodlands or wetlands.
Areas of recreational significance which are not designated as exclusion areas.	None	N/A
A geographic area where, due to the operation of the facility, the sound levels within one hundred feet on an inhabited residence or 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.	Present	Westwood completed a sound assessment for the Repower Project using the Vestas V110-2.2 MW turbines at all 75 turbine locations. Sound levels do not exceed 45 dBA within 100 feet of inhabited residences or community buildings.

Setback Compliance

In addition to compliance with the setbacks set forth above, the Repower Project continues to comply with the setback commitments listed in Table 3, which were made at the time a Certificate of Site Compatibility was issued for the Project. These setbacks comply with Rolette County’s zoning ordinance requirements.

Setback Type	Distance
Occupied Residence	1,640 feet
USFWS WPA	0.25 miles

Socioeconomics

The Repower Project will have positive impacts on socioeconomics by extending the life of the project, which, in turn, extends the time period for which landowners will receive easement payments. In addition, the Repower Project will create temporary construction jobs, with associated opportunities for increased local spending.

Land Use

The Repower Project will be constructed entirely within the previously designated site, and turbine and other permanent infrastructure locations will remain the same. As a result, land use will also remain unchanged. The Repower Project will result in temporary disturbances, including temporary widening of access roads to accommodate transportation of components and equipment, a temporary laydown yard, and temporary crane paths (as needed). Temporarily impacted areas will be restored in compliance with applicable provisions of the Commission’s Findings of Fact, Conclusions of Law and Order, dated May 5, 2011 (Case No. PU-08-797) (“May 2011 Order”).

Public Services

The Repower Project will result in a temporary increase in traffic in and near the Repower Project Area but is not anticipated to interfere with local road use. NSP will coordinate with Rolette County regarding local road use, will obtain all necessary road use permits, and will restore roads impacted by the Repower Project in accordance with the requirements of the Commission’s May 2011 Order and as required by Rolette County.

Sound, Shadow Flicker, and Human Health and Safety

As noted above, the Repower Project continues to maintain a turbine setback of 1,640 feet from occupied residences, and modeled sound levels for the Repower Project do not exceed 45 dBA within 100 feet of any occupied residence or community building. Initial analysis determined that six occupied residences had noise levels exceeding 45 dBA with standard edge blades. To address this issue serrated trailing edge (STE) blades were added to 10 turbines. Further modeling with

the STE blades on 10 turbines was conducted, which confirmed no exceedances of the 45 dBA limit. Noise modeling reports are included in Appendix A.

At the time the Project was permitted, the Commission did not specifically address shadow flicker. However, Westwood conducted a shadow flicker assessment for the Repower Project utilizing realistic modeling inputs. Based on the assessment, shadow flicker levels from the Repower Project will not exceed 30 hours per year at any occupied residences. The shadow flicker analysis is also included in Appendix A.

Capitol Airspace Group completed an obstruction evaluation and airspace analysis for the Repower Project. Based on its analysis, Capitol Airspace Group anticipates that the Repower Project will not affect the safety of air navigation or, at the proposed turbine tip height of less than 500 feet, result in military objections (see March 31, 2022 Capitol Airspace Group letter at the end of Appendix B). Xcel Energy will submit Form 7460-1 to the FAA for each turbine to confirm the increased tip height will not impact navigable airspace or communications technology used in aviation operations. The Obstruction Evaluation & Airspace Analysis report is included in Appendix B.

The Repower Project will continue to comply with all safety-related and other conditions of the Commission's May 2011 Order.

Cultural Resources

The Repower Project activities will occur within areas previously surveyed for cultural resources, and the Repower Project will not impact cultural resources. A Class III Intensive Cultural Resources Inventory Report, dated September 29, 2009, and a Class III Intensive Cultural Resources Inventory Report, dated August 10, 2010, were previously filed with the Commission on November 16, 2009 (Hearing Exhibit 6) and January 27, 2011 (Hearing Exhibit 19), respectively (see Docket Item #33 and 77 in Case No. PU-08-797). An additional 2013 Supplemental Class III Intensive Cultural Resources Inventory Report, dated November 21, 2013, was completed and is included in Appendix C. An updated Class I Cultural Resource Literature Review was completed in 2021 to confirm no newly discovered resources are present within the project area. A copy of that report is included in Appendix C.

Should any proposed Repower Project design be located outside of previously constructed or previously surveyed areas, that aspect of the design will be surveyed, and the results submitted to the SHSND for review. The report and SHSND's concurrence would be submitted to the Commission prior to initiating construction in newly surveyed areas.

Additionally, Border Winds has prepared an Unanticipated Discoveries Plan, which outlines measures in the event previously unknown potential cultural resources or human remains are identified during construction of the Repower Project and is included in Appendix C.

Recreational Resources

The Repower Project will not impact any recreational resources. The Repower Project continues to maintain a setback of more than 0.25 miles from nearby WPAs.

Land-Based Economics

The Repower Project will not result in any additional long-term land impact; as a result, the Repower Project will also not result in any long-term impacts to agricultural use or production. NSP will compensate landowners for any temporary impacts to cropland in accordance with the terms of its wind lease agreements.

Soils

The Repower Project will likely result in minor short-term impacts to soils during construction. No additional impacts are expected from continued operation of the facility. Within work areas, topsoil will be separated from subsoils, protected from erosion and runoff using mulch, and then re-spread over disturbed areas once work is completed. Erosion control measures will also be implemented during construction to avoid or minimize soil erosion and off-site deposition. Erosion and sedimentation will be reduced by implementation of best management practices (BMPs) such as mulching, hydroseeding, wildlife-friendly erosion control blankets, silt fence installation, jute matting, and revegetation. After repowering is completed, soils will be planted with crops or revegetated in accordance with Natural Resources Conservation Service requirements (unless otherwise specified by the landowner and approved by the Commission) to stabilize them long term. Based on the implementation of these recommended and required mitigation measures, no adverse impacts to soil resources are expected as a result of the Repower Project.

Geologic and Groundwater Resources

The Repower Project is not expected to disturb any geologic or groundwater resources.

Waterbodies, Wetlands, and Floodplain Resources

Wetland delineations were completed for the original Border Winds Wind Project and all wetland impacts were permitted through the US Army Corps of Engineers. Access to turbine sites for the Repower Project will utilize existing roads and access roads and will not impact wetlands.

There are no lakes, perennial streams, 100-year or 500-year floodplains located within the Repower Project boundary.

Vegetation

The Repower Project will not affect the calcareous fen present within the previously designated site boundary. The Repower Project will utilize previously disturbed areas and will not require removal of trees or shrubs during construction. NSP will comply with the site restoration and reseeded conditions in the Commission's May 2011 Order and all other applicable permitting requirements.

Wildlife

The Repower Project is not anticipated to result in significant impacts to wildlife or wildlife habitats in the area because construction impacts will be confined to previously disturbed locations. Increased traffic during the turbine replacement phase should also have no direct impact on wildlife as vehicles will be moving slowly, which should allow time for animals to move out of the road.

Based on studies to date, and results of post-construction monitoring efforts following initial construction of the project, the Repower Project is not anticipated to have any measurable change in impact on migrating birds or bats. Impacts are expected to be similar to other operating wind projects in the area. NSP has a Bird and Bat Conservation Strategy (BBCS) for the facility, which outlines best management practices that are undertaken for the life of the facility to minimize risks to birds, bat, and other wildlife from operation of the wind farm.

Permits and Approvals

As part of the initial permitting process, Rolette County issued a Conditional Use Permit. NSP has presented the Repower Project to the County Commission and discussed timing for a road use agreement and possible CUP update, which it was agreed should be closer to the time of construction. In addition, NSP will obtain and file with the Commission copies of all local, state, and federal licenses and permits needed prior to engaging in the repowering activities for which each permit or approval is required.

Landowner Outreach

NSP contacted participating and neighboring landowners to provide information about the planned Repower Project and is hosting a project web site with information about the Repower Project. A landowner meeting was held at the Rolette County Courthouse in March of 2022 to give landowners a chance to come in and learn more about the Repower Project and ask questions from the Repower Project team. NSP is in the process of obtaining contact information for the heirs of a non-participating landowner where a setback waiver is needed.

Conclusion

Table 4 below summarizes NSP's environmental and regulatory analysis of the Repower Project. As indicated in Table 4 and the prior sections, the Repower Project complies with the requirements of N.D.C.C. § 49-22-03(3)(a), including the Commission's current exclusion area and avoidance area criteria. Additionally, the Repower Project will continue to comply with all applicable siting laws, rules, and Commission orders, including the conditions specified in the Commission's May 2011 Order.

Summary Table

Table 4: Summary of Environmental Resource Impact Analysis and Avoidance/Minimization in Determining Consistency with Border Winds Energy Project Findings of Fact, Conclusions of Law and Order (Case No. PU-08-797)		
Resource	Potential Impact of Repower Project	Avoidance and/or Minimization Measures
Socioeconomics	Positive economic and social consequences.	None proposed.
Land Use	Utilize previously disturbed areas; will result in temporary disturbances.	Will restore temporarily impacted areas in compliance with applicable provisions of the Commission's May 2011 Order.
Public Services	Temporary increases in construction truck traffic during construction period.	Will coordinate with Rolette County regarding local road use, obtain all necessary road use permits, and restore roads impacted by the Repower Project in accordance with the requirements of the Commission's May 2011 Order and as required by Rolette County.
Human Health and Safety	Turbine lighting will continue to meet FAA and Commission requirements. Shadow flicker is predicted to be 30 hours per year or less at all occupied residences.	None proposed.
Sound	Initial modeling analysis (with standard edge blades) determined that the sound may exceed 45 dBA within 100 feet of six occupied residences. To address this issue, serrated trailing edge (STE) blades were added to 10 turbines. Further modeling was conducted, which confirmed no exceedances of the 45 dBA limit.	Will utilize STE blades on these 10 turbines.

Table 4: Summary of Environmental Resource Impact Analysis and Avoidance/Minimization in Determining Consistency with Border Winds Energy Project Findings of Fact, Conclusions of Law and Order (Case No. PU-08-797)

Resource	Potential Impact of Repower Project	Avoidance and/or Minimization Measures
Cultural Resources	Repower Project activities will occur within areas previously surveyed for cultural resources, and the Repower Project is not anticipated to impact cultural resources.	Prepared an updated Unanticipated Discoveries Plan.
Recreational Resources	No impacts to recreational resources are anticipated.	Will continue to maintain a setback of 0.25 miles from nearby WPAs.
Land Based Economics	Minimal cropland will be temporarily impacted during construction. No additional long-term impacts to agricultural use or production are anticipated.	Will compensate landowners for any temporary impacts to cropland in accordance with the terms of its wind lease agreements.
Soils	Temporary land disturbance may cause soil surface to become more prone to wind and water erosion.	Will implement Best Management Practices (BMPs) to minimize erosion and sedimentation and will restore temporarily impacted areas.
Geologic and Groundwater Resources	No impacts to geological and groundwater resources are anticipated.	None proposed.
Waterbodies, Wetlands, and Floodplain Resources	No impacts are anticipated.	Will implement BMPs to minimize erosion and sedimentation.
Vegetation	No impact to the calcareous fen present within the previously designated site boundary. Will utilize previously disturbed areas; no trees or shrubs will be removed.	Will comply with the site restoration and reseeded conditions in the Commission's May 2011 Order and all other applicable requirements.

Table 4: Summary of Environmental Resource Impact Analysis and Avoidance/Minimization in Determining Consistency with Border Winds Energy Project Findings of Fact, Conclusions of Law and Order (Case No. PU-08-797)

Resource	Potential Impact of Repower Project	Avoidance and/or Minimization Measures
Wildlife	<p>Construction impacts will be confined to previously disturbed locations.</p> <p>No significant impacts to wildlife or wildlife habitats in the area are anticipated.</p> <p>The Project is not anticipated to have an impact on threatened or endangered species or have any measurable change in impact on migrating birds or bats.</p>	<p>Will implement BMPs from the wind farm’s Bird and Bat Conservation Strategy (BBCS) to minimize risks to birds, bats, and other wildlife.</p>

Attachments

Figure 1. Repower Project Overview Map

Figure 2. Wind Turbine Diagram

Figure 3. Exclusion Area Maps

Appendix A – Noise and Shadow Flicker Modeling Reports

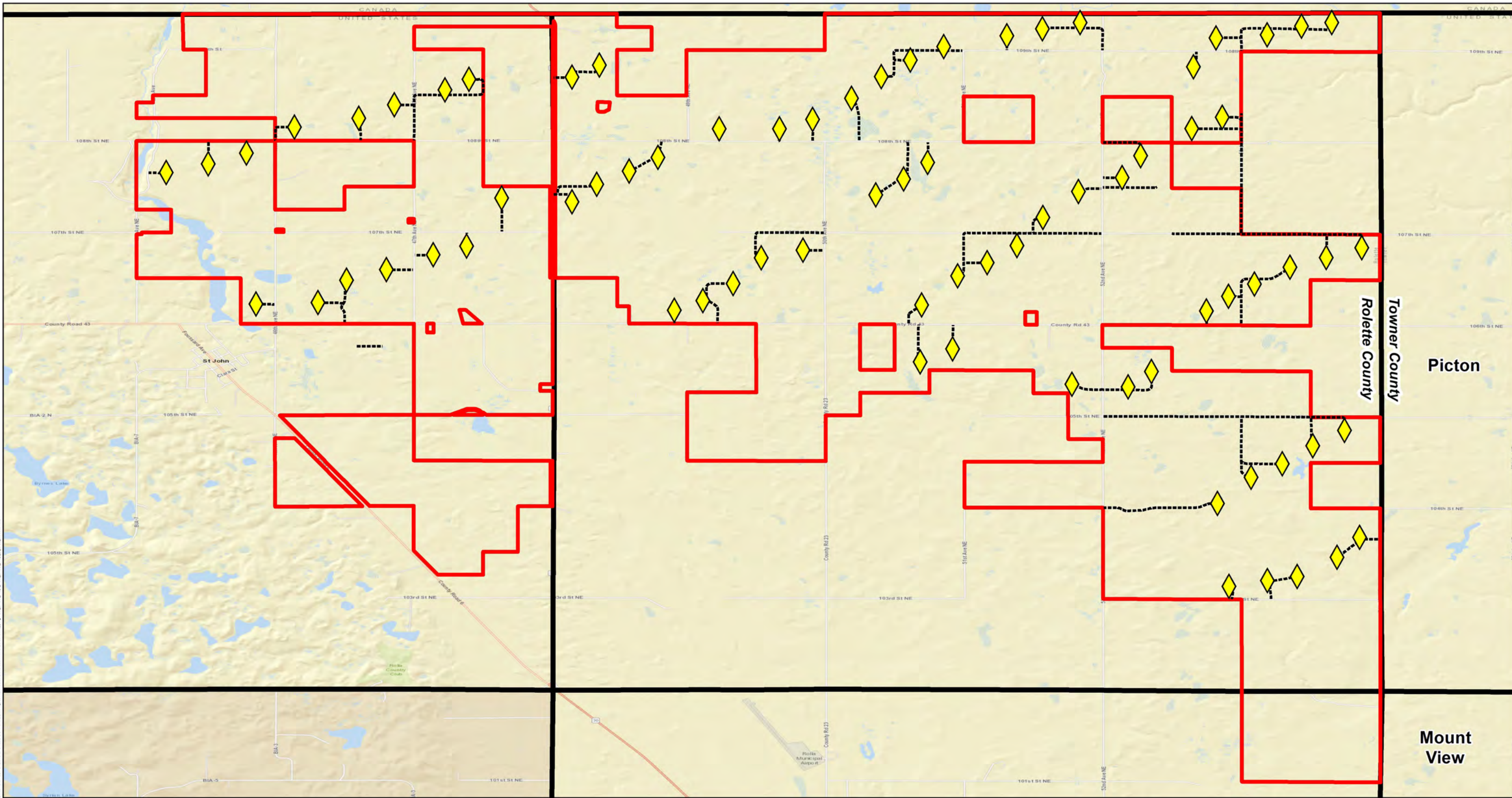
Appendix B – Obstruction Evaluation and Microwave Beam Path Analysis

Appendix C – Cultural Resource Reports and Correspondence

Appendix D – Delineated Wetland Review

Appendix E – Natural Resources Impact Assessment and Correspondence

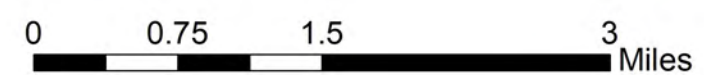
Figure 1
Project Overview Map



Border Winds Farm

Rolette County, North Dakota

- Project Boundary
- ◆ Turbines
- Access Road
- Civil Township

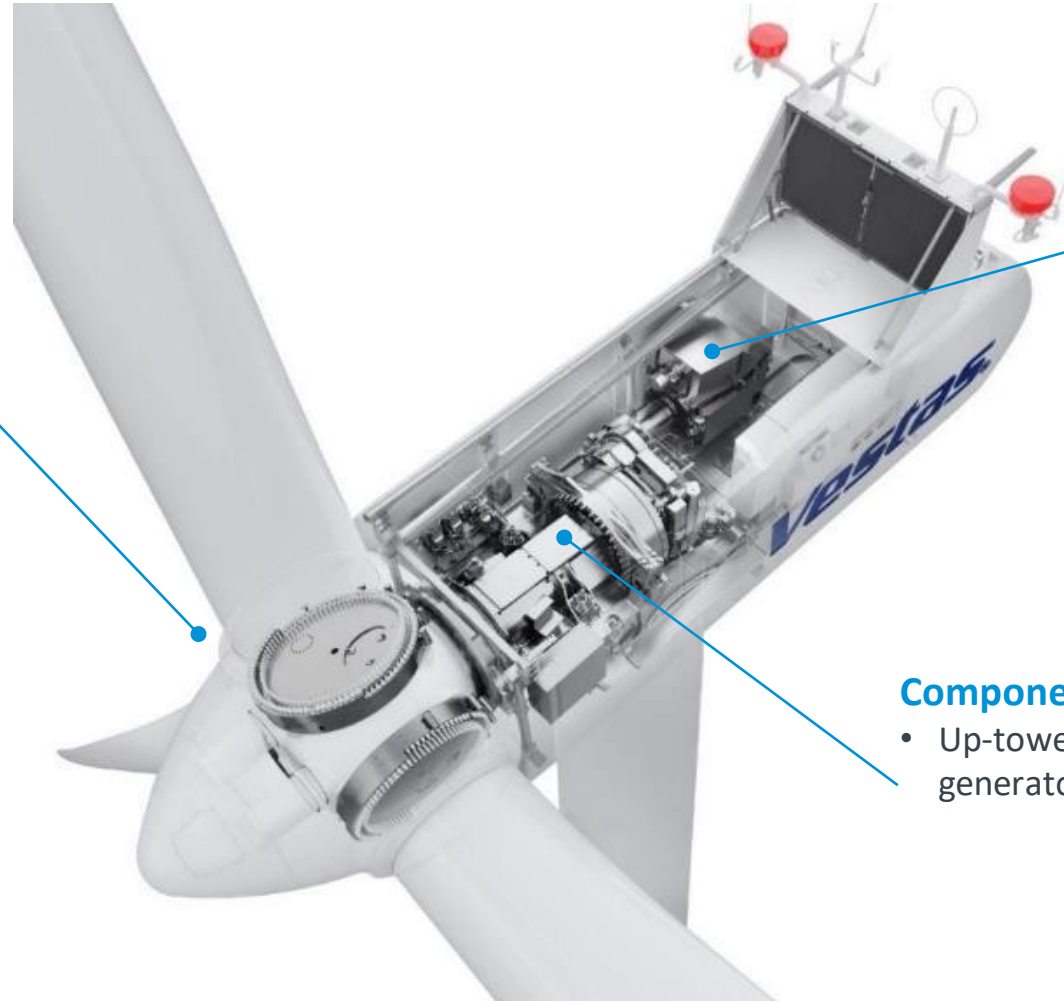


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Figure 2
Wind Turbine Diagram

V100 to V110 Drivetrain Repower

Schematic illustration of proposed component replacements for Mk10A turbines



Rotor upgrade

- The new V110 blades (54m length) will be 10% longer than the existing V100 blades
- Hub, blade bearings and pitch cylinders will be replaced to accommodate the larger rotor

Electrical system overhaul

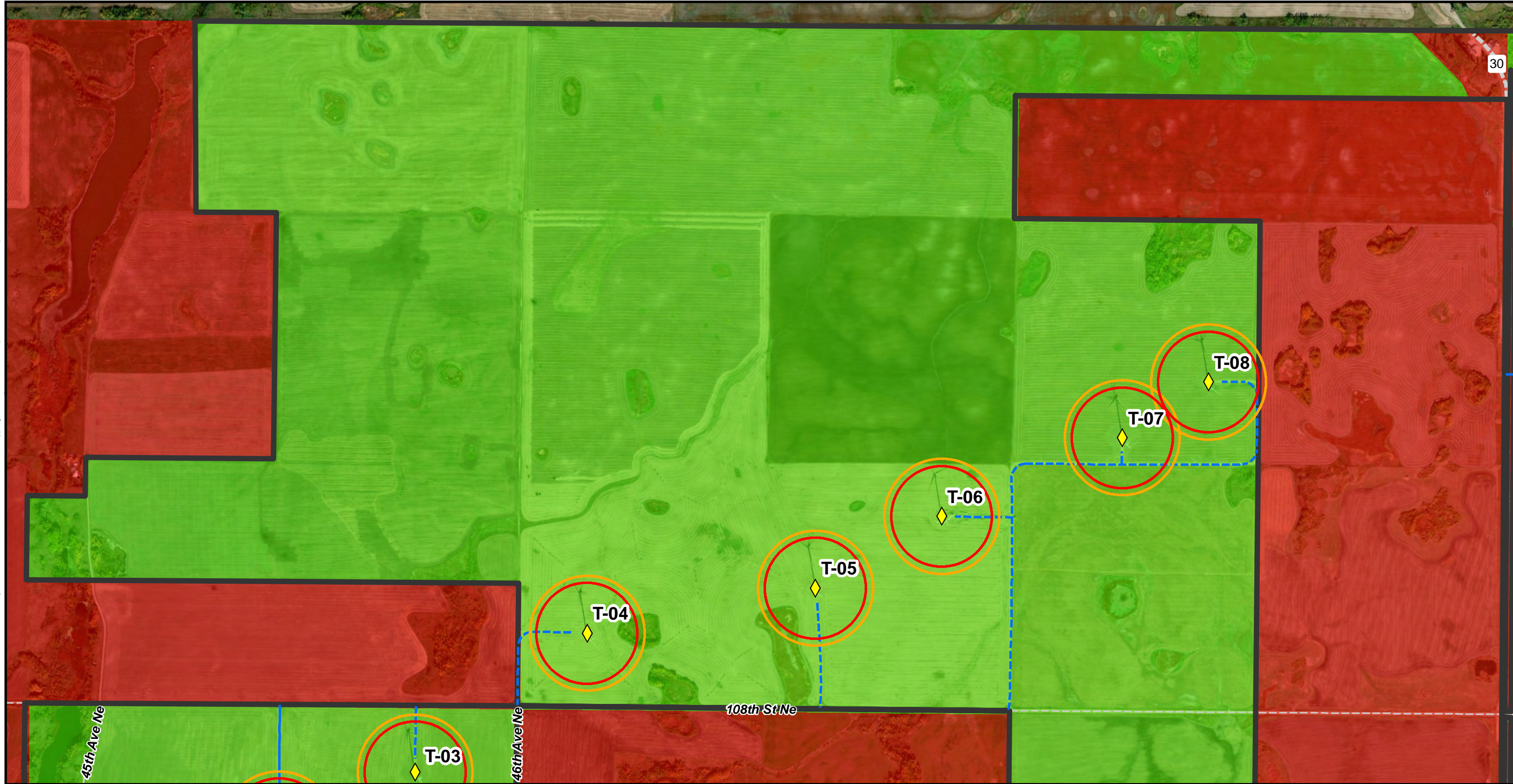
- Converter, bus cabinet, cable assembly and controls system will be upgraded to enable 2.2Mw rating

Component replacement

- Up-tower replacement of existing gearbox, generator and transformer

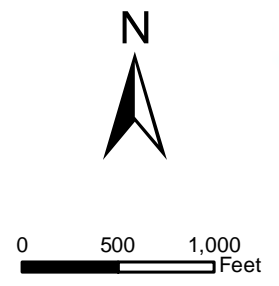
Figure 3
Exclusion Area Maps

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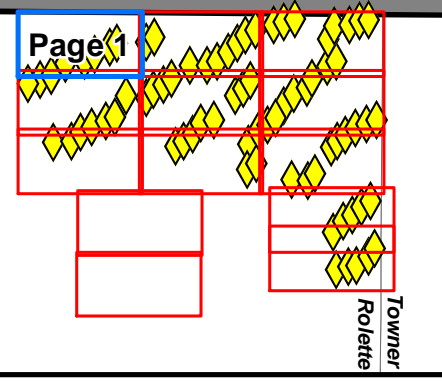
Borders Mapbook
Exclusion Areas
 Rolette County, North Dakota
 Page 1 of 13

- Participating Landowner
- Non-Participating Landowner
- Turbine
- 1.1 x Turbine Height Setback
- Local Road Setback
- Access Road Centerline
- Project Boundary
- State Hwy
- Local Road

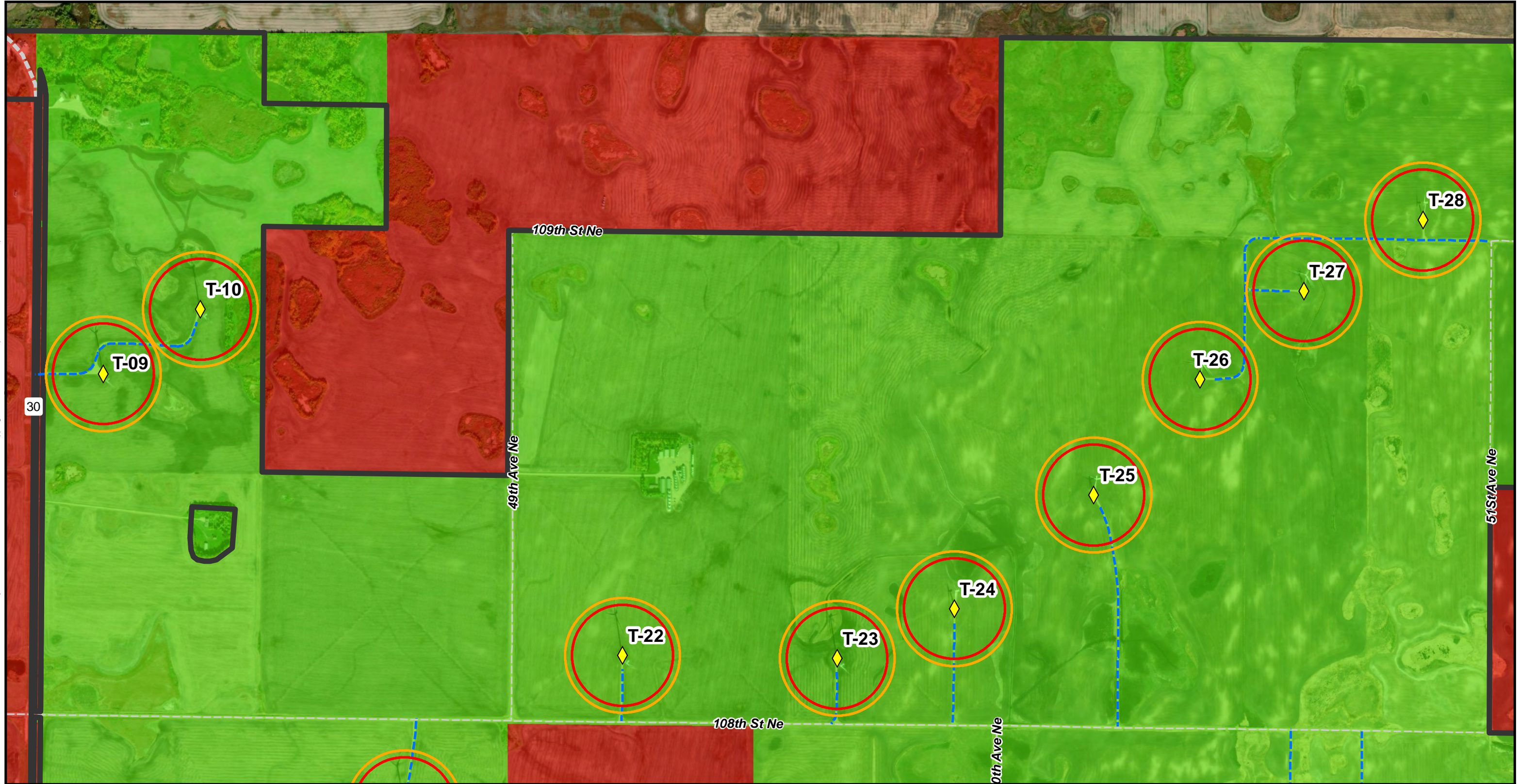


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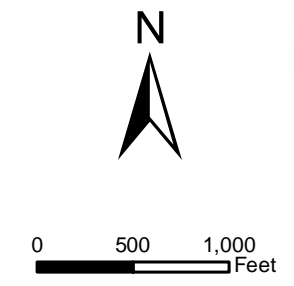
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Exclusion Areas

Rolette County, North Dakota

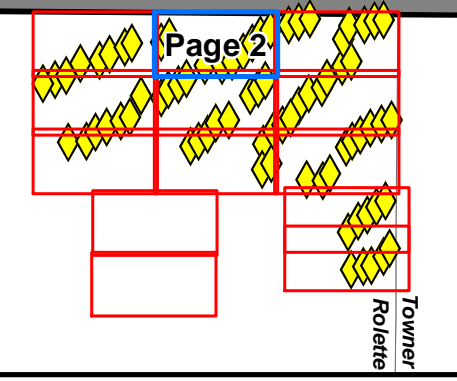
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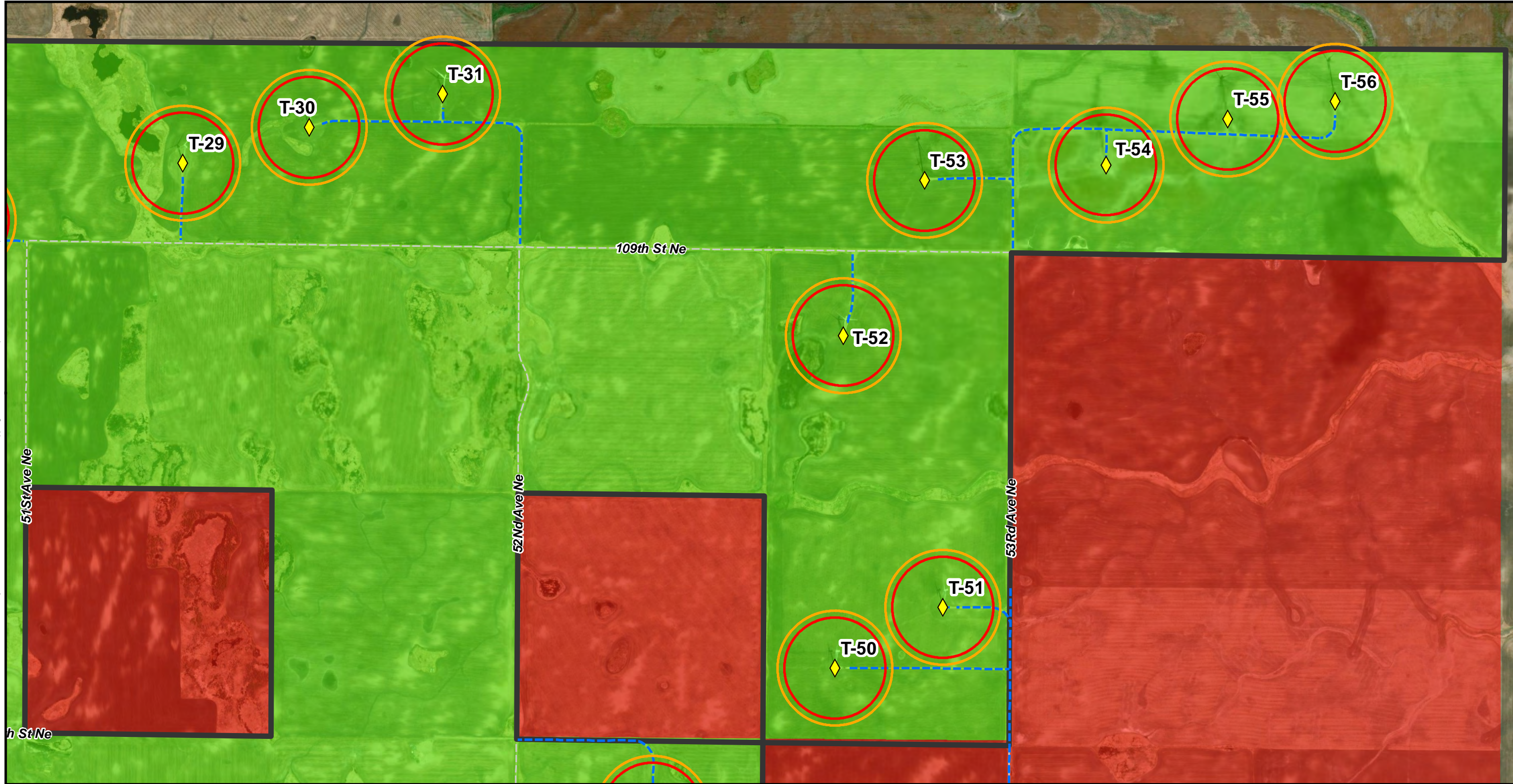


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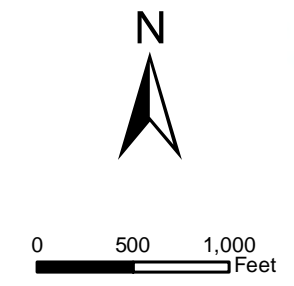
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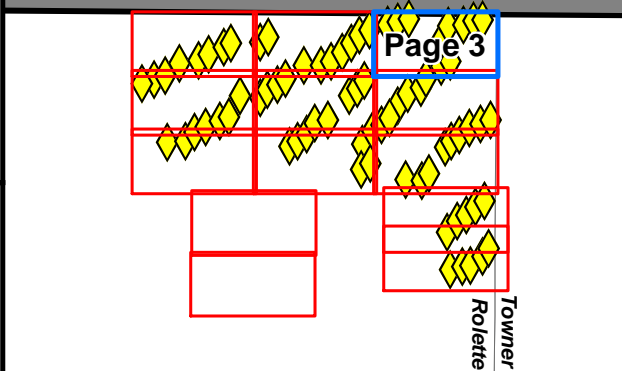
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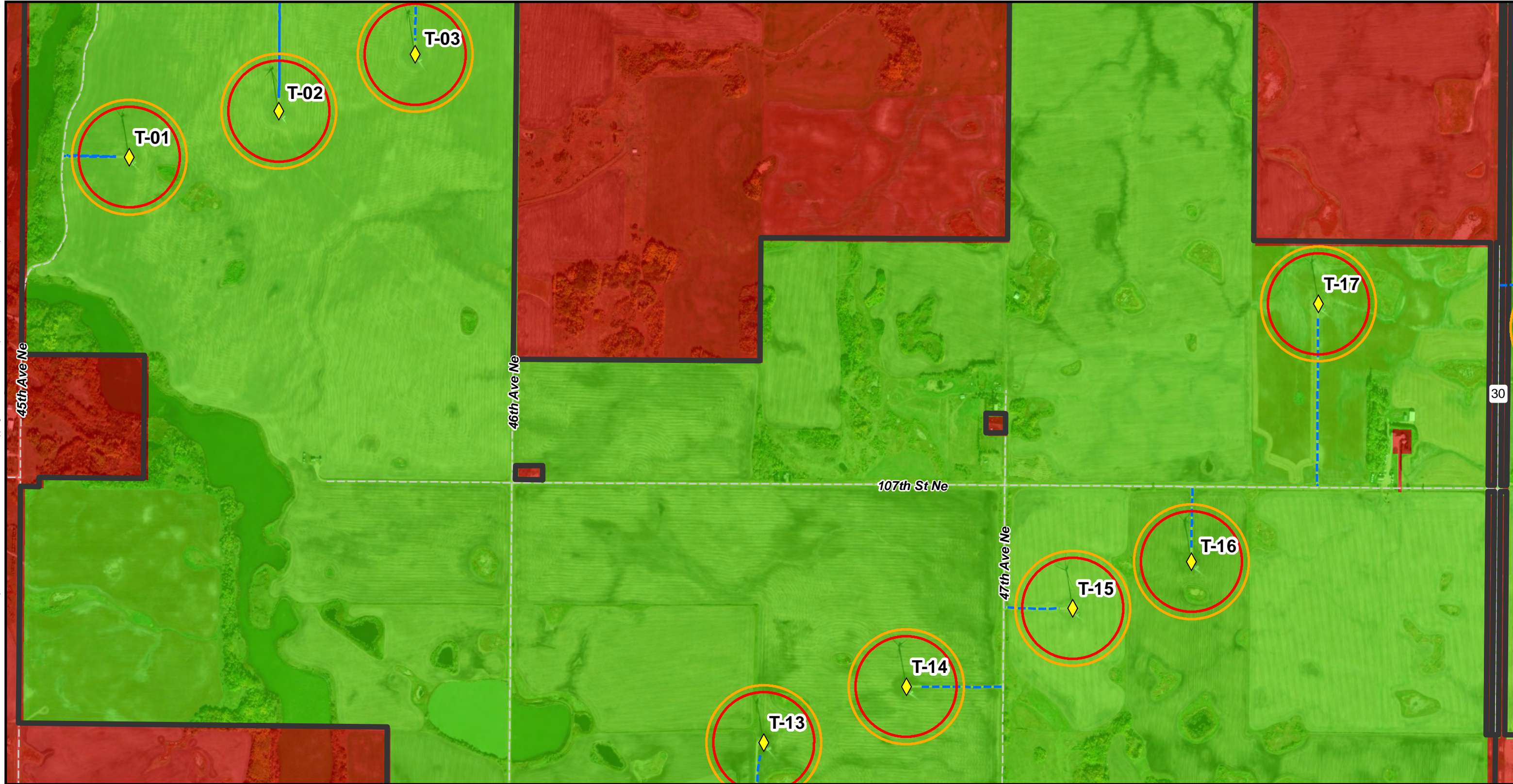


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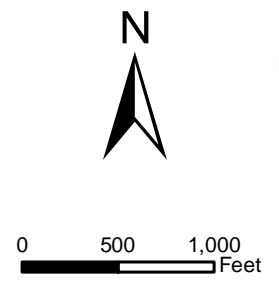
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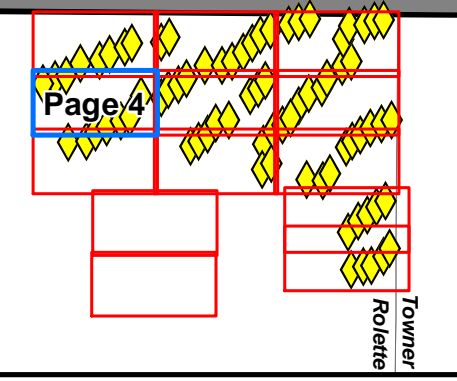
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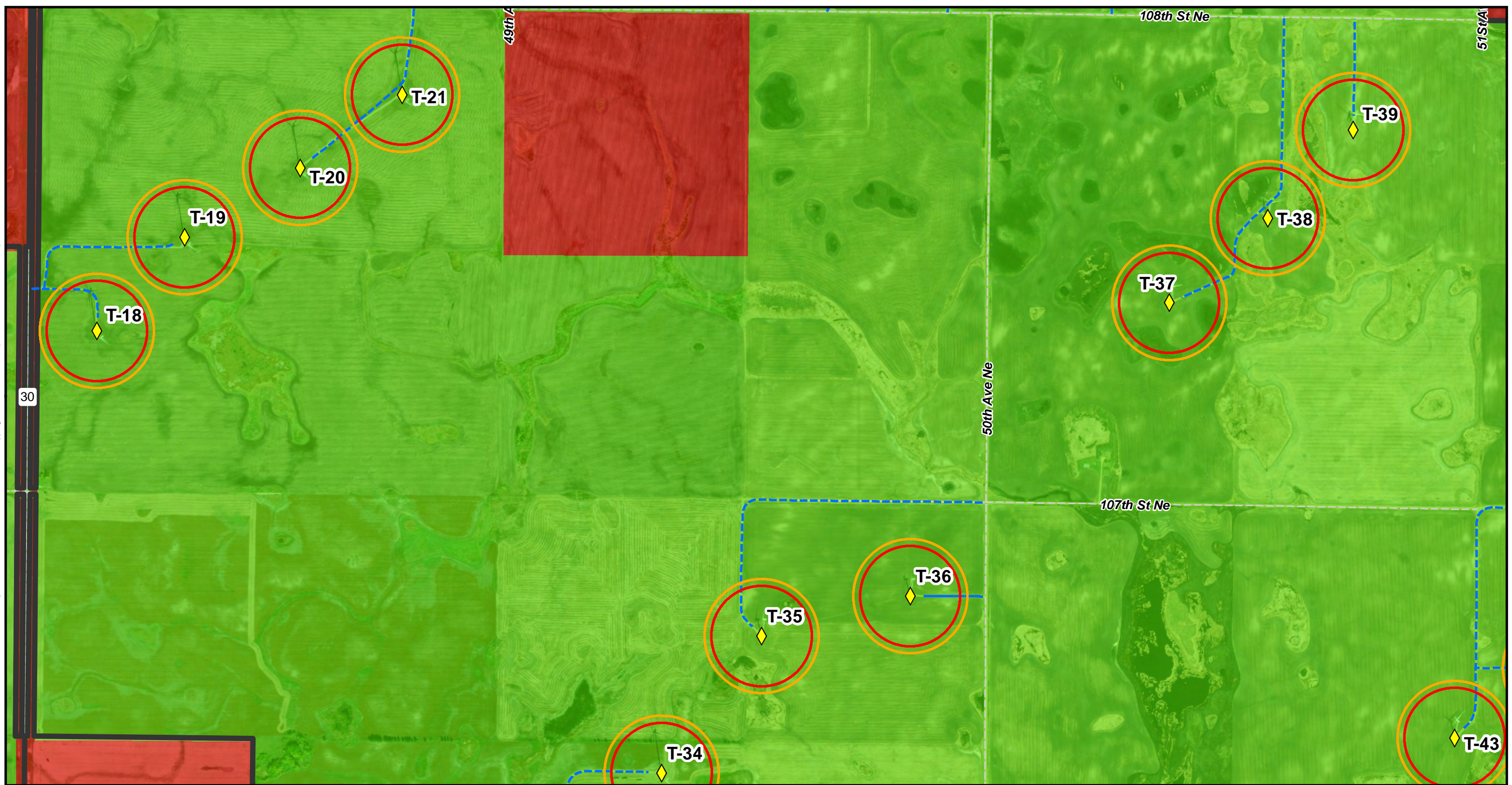


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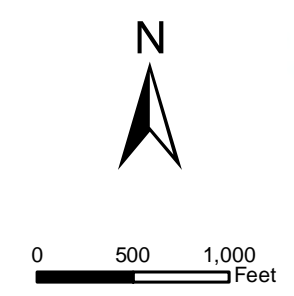
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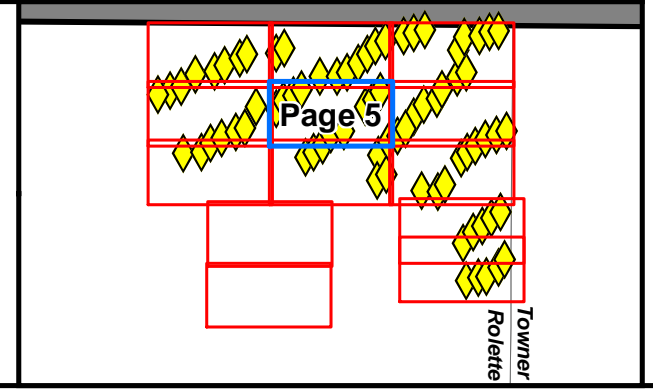
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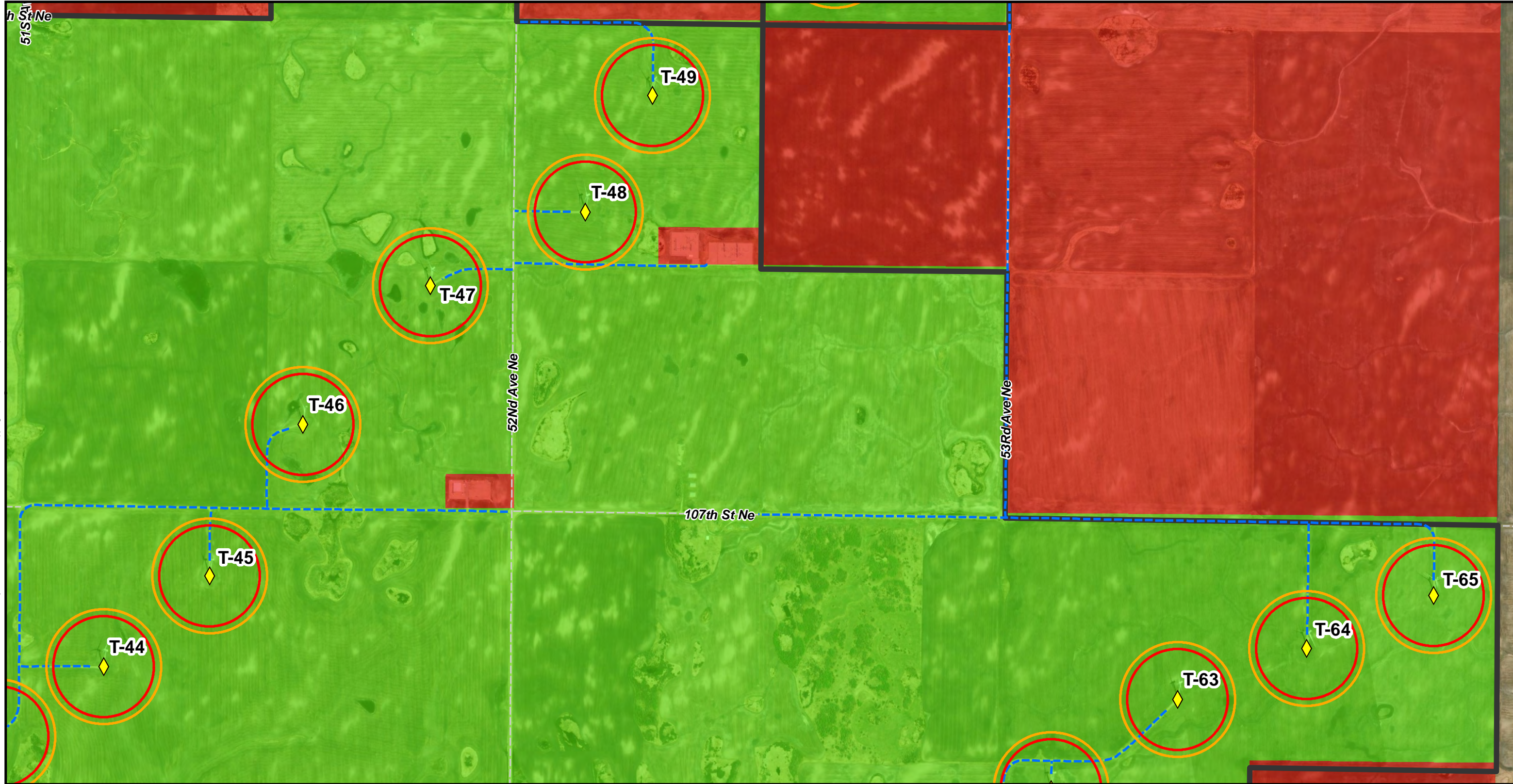


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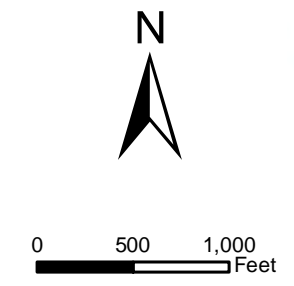
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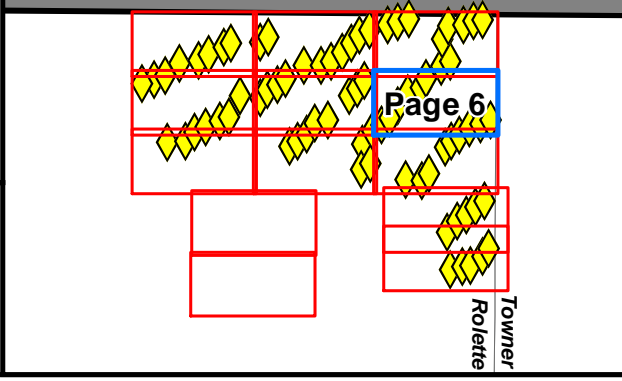
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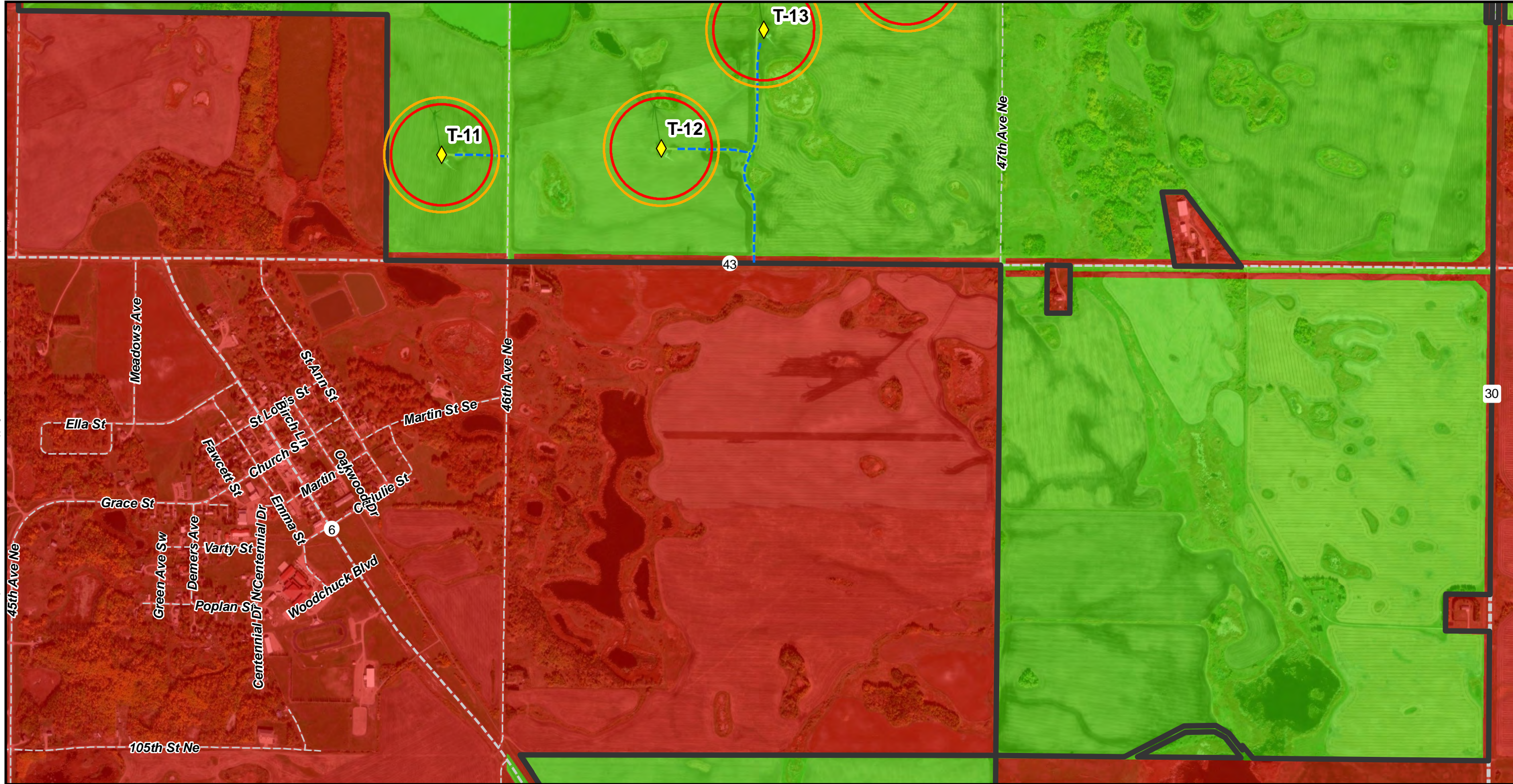


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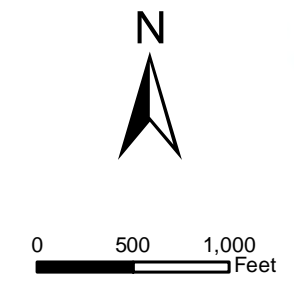
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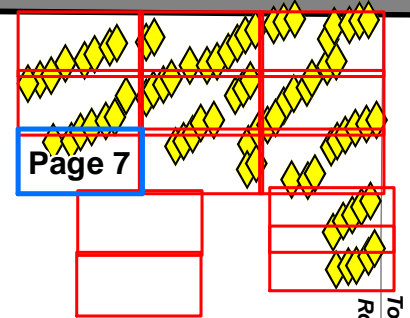
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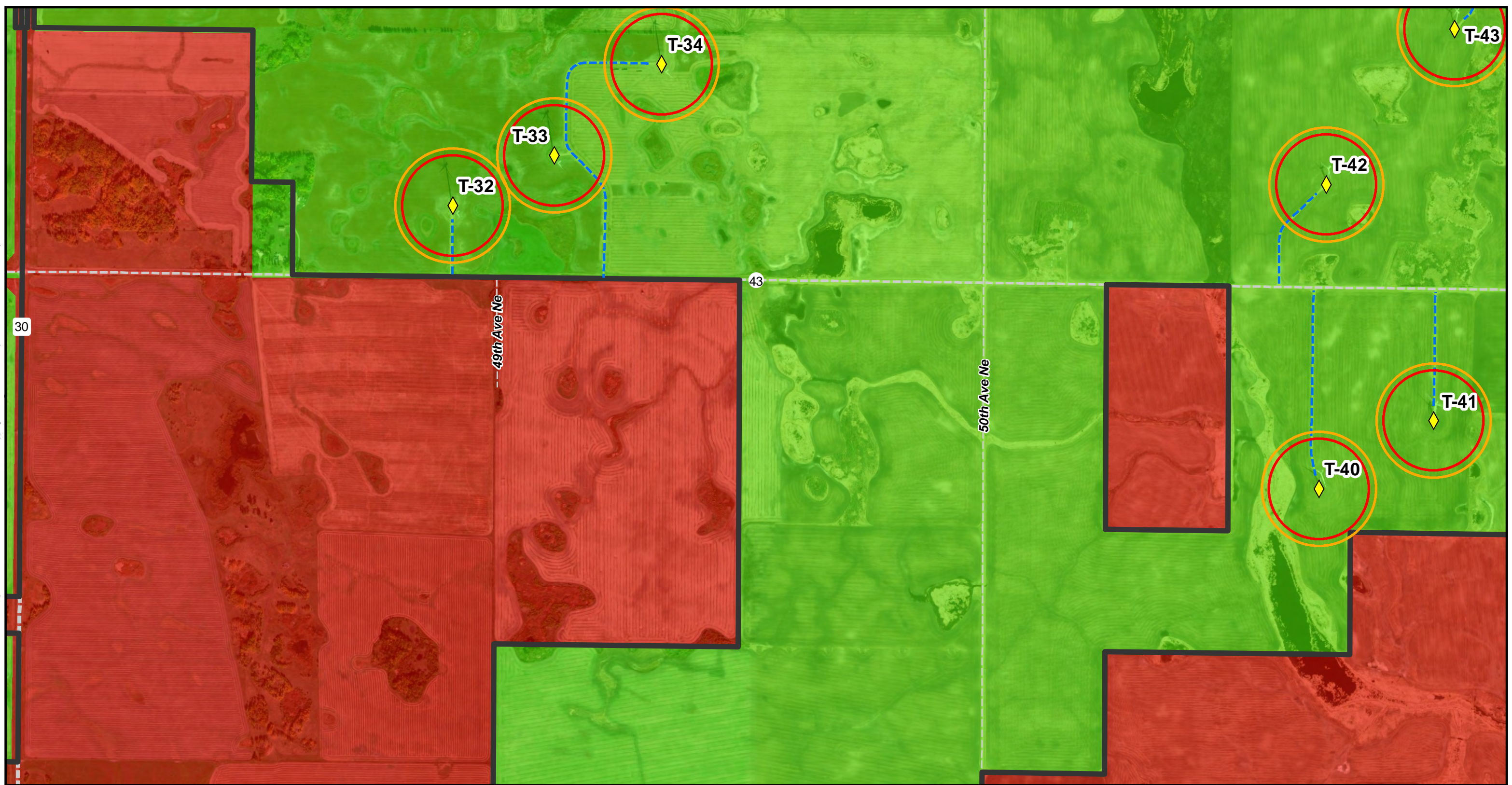


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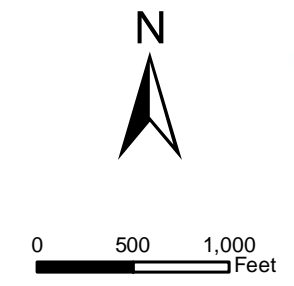
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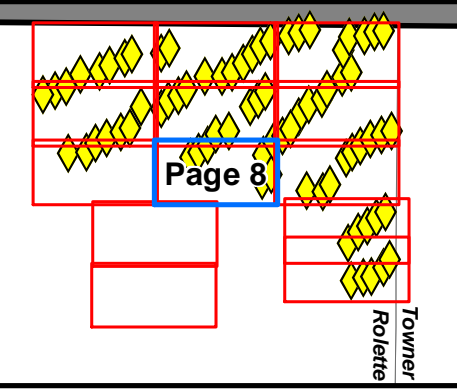
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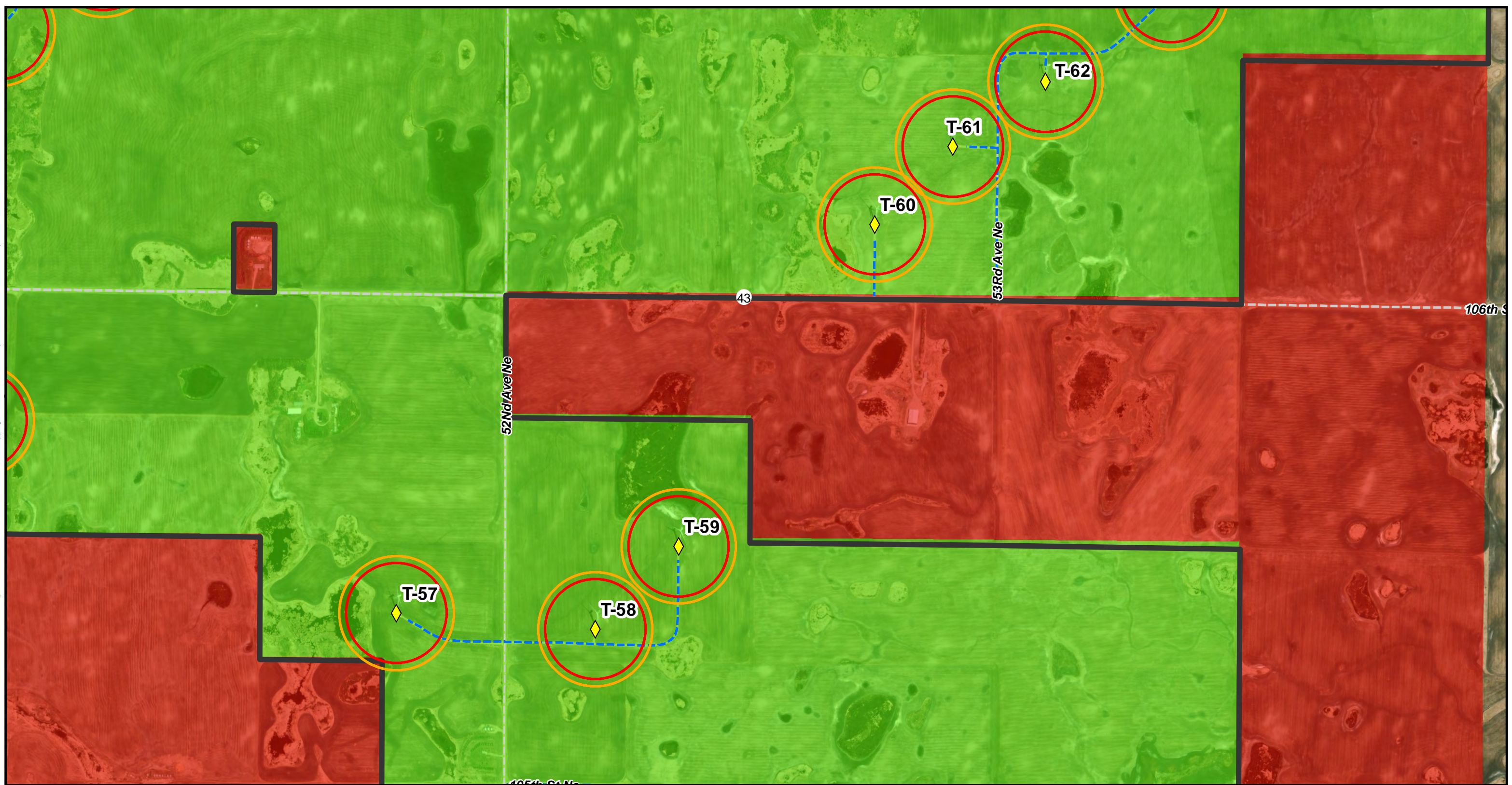


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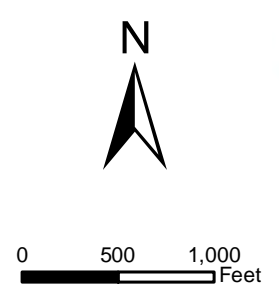
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Exclusion Areas

Rolette County, North Dakota

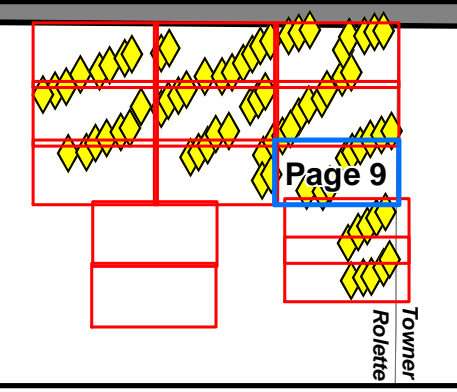
Page 9 of 13

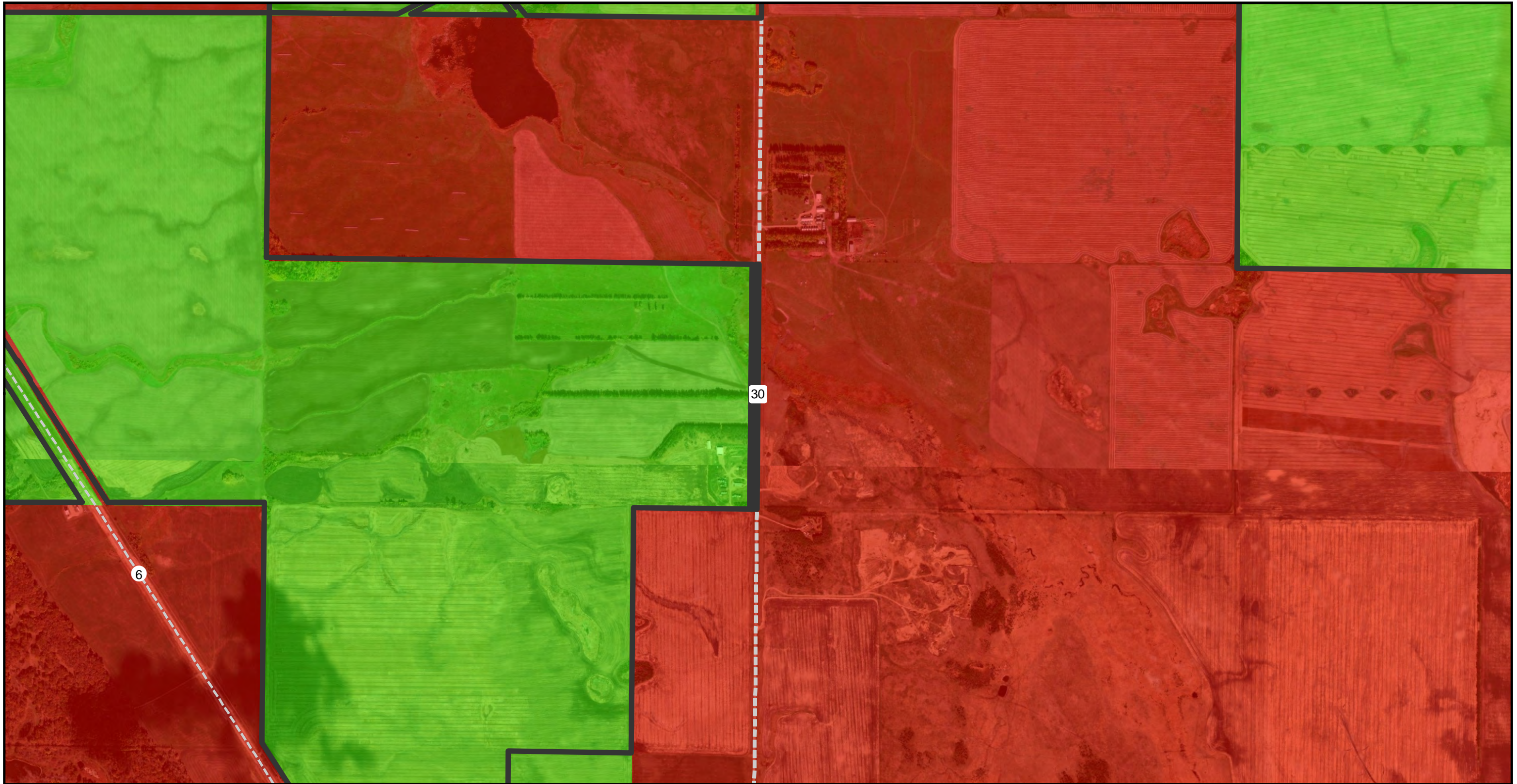
- Participating Landowner
- Non-Participating Landowner
- Turbine
- 1.1 x Turbine Height Setback
- Local Road Setback
- Access Road Centerline
- Project Boundary
- County Road
- Local Road



DISCLAIMER: This information is believed to be correct but is subject to change and is not warranted.

Date: 3/28/2022





Borders Mapbook

Exclusion Areas

Rolette County, North Dakota

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- Participating Landowner
- Non-Participating Landowner
- Project Boundary
- State Hwy
- County Road

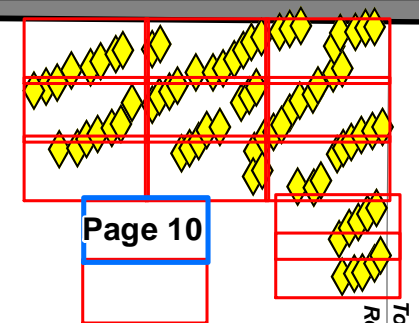


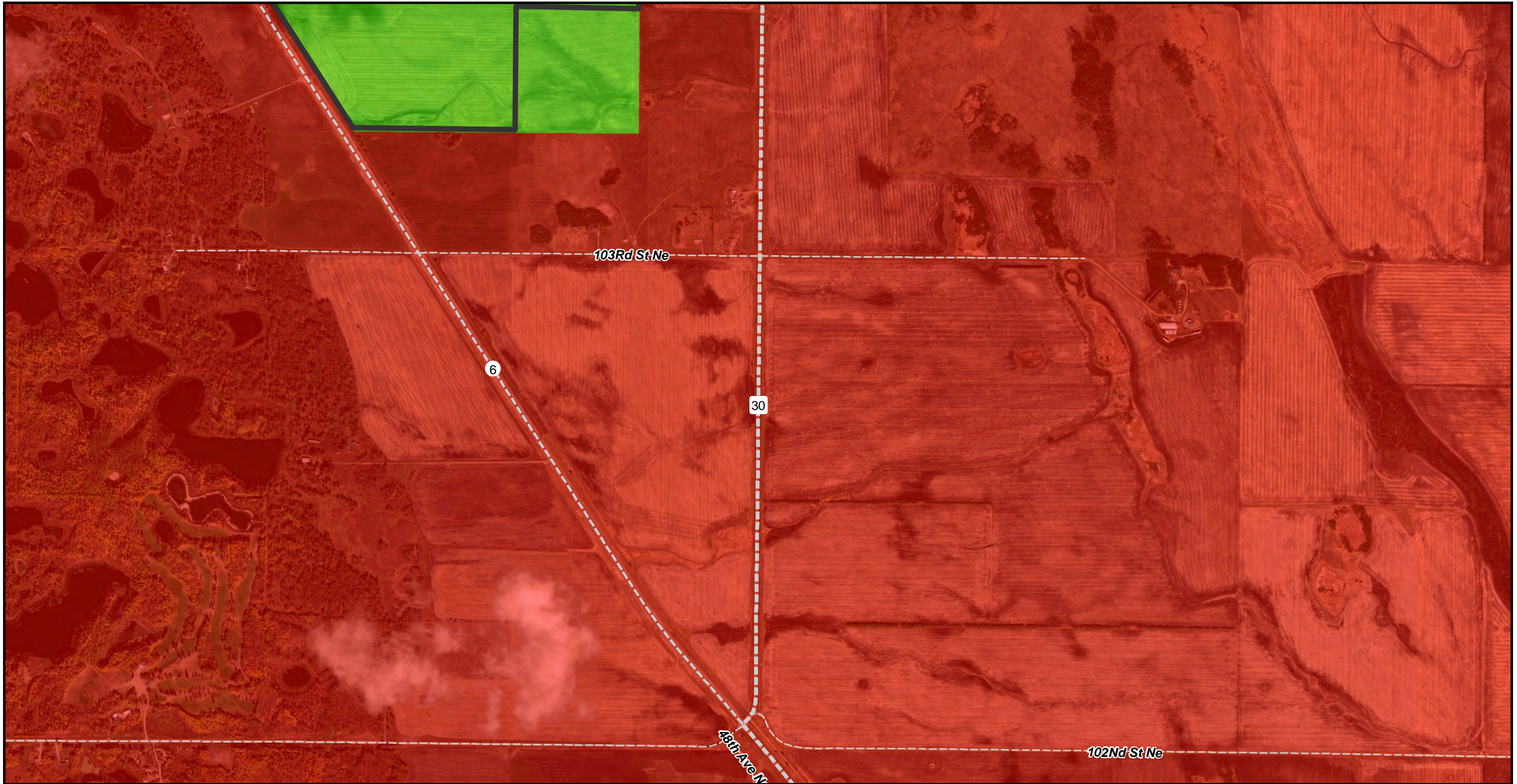
0 500 1,000 Feet



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Date: 3/28/2022











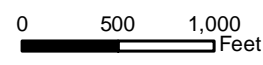
Borders Mapbook

Exclusion Areas

Rolette County, North Dakota

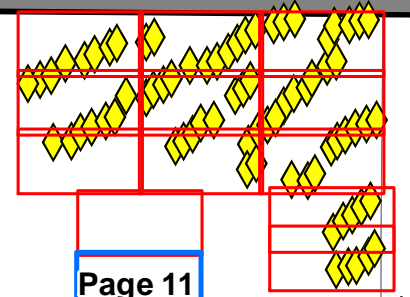
Page 11 of 13

-  Participating Landowner
-  Non-Participating Landowner
-  Project Boundary
-  State Hwy
-  County Road
-  Local Road



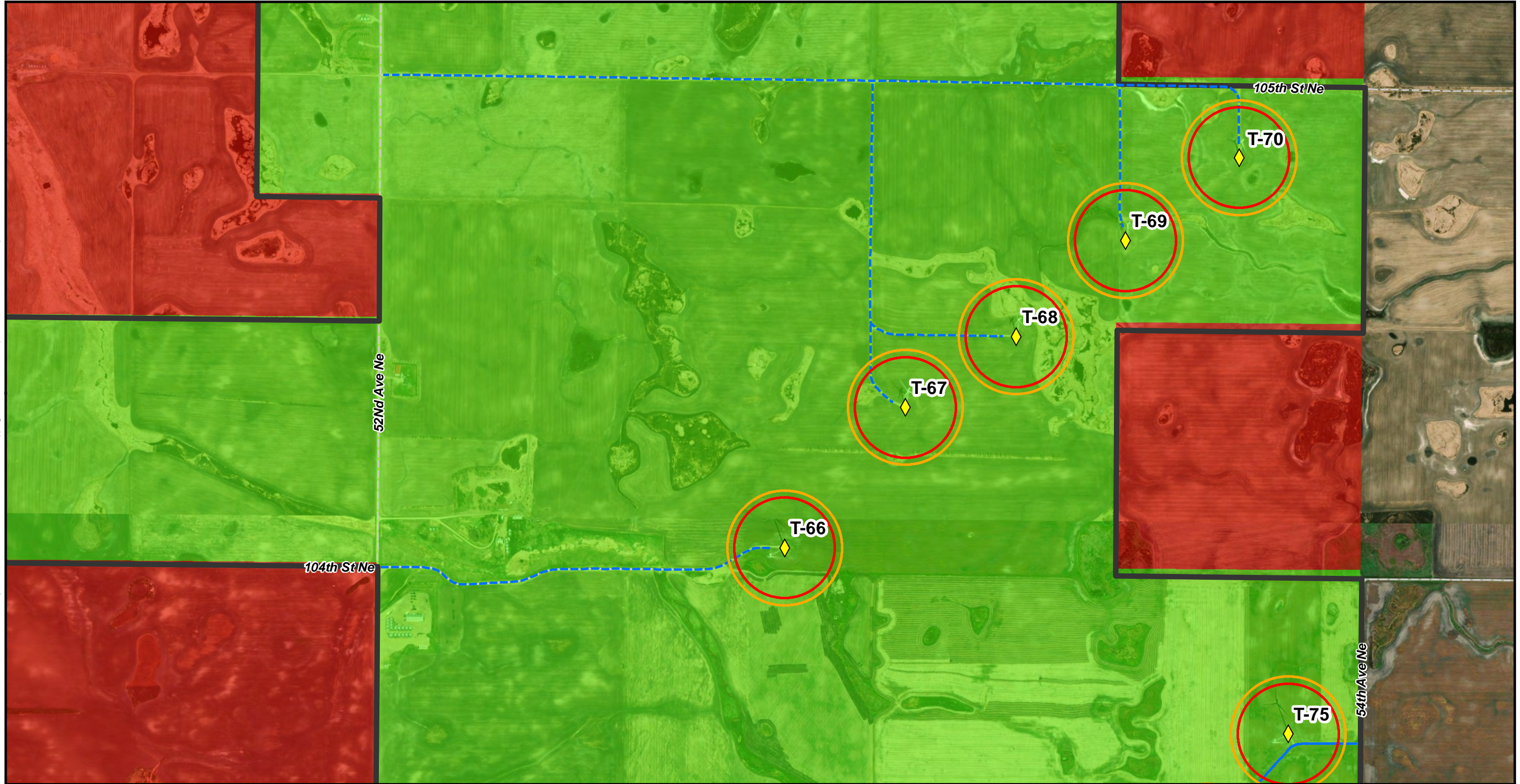
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Date: 3/28/2022



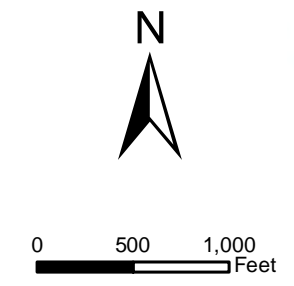
Towner
Rolette

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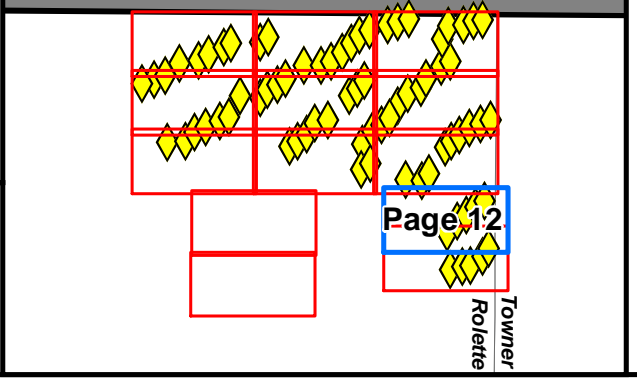
Borders Mapbook
Exclusion Areas
 Rolette County, North Dakota
 Page 12 of 13

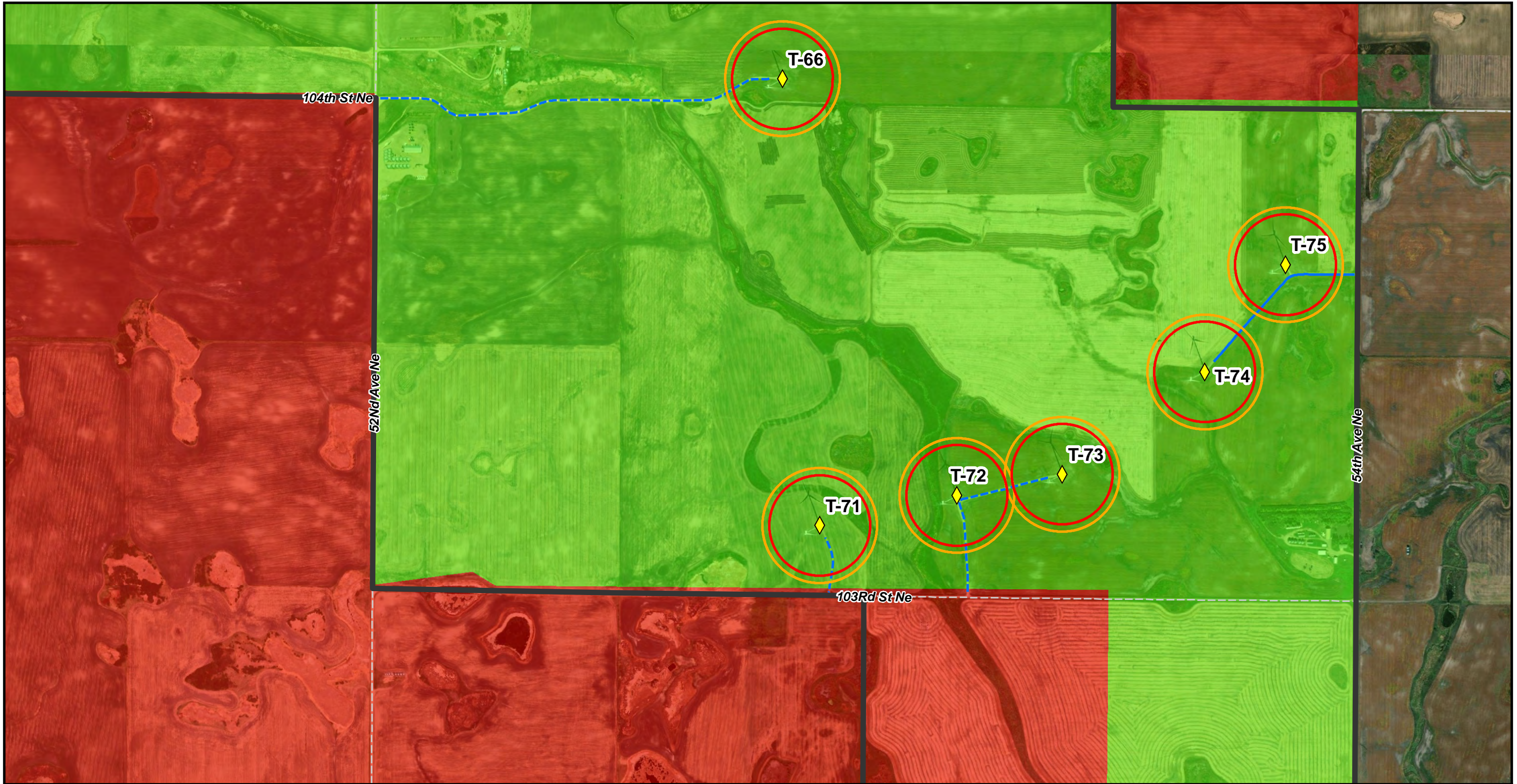
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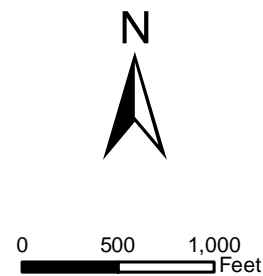
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Borders Mapbook
Exclusion Areas
 Rolette County, North Dakota
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