

Memorandum

To	North Dakota Public Service Commission	Pages	2
Subject	Case Number PU-18-280 Emmons-Logan Wind Energy Center Modifications of Energy Conversion Facility and Site Plan		
From	Emmons-Logan Wind, LLC		
Date	October 7, 2019		

Introduction

Pursuant to Certification Relating to Order Provision Numbers 8, 9, and 38, Emmons-Logan Wind, LLC (Emmons-Logan Wind) submits to the North Dakota Public Service Commission (Commission) this supporting documentation for proposed modifications to the Emmons-Logan Wind Energy Center (Project) and Project Site Plan (Attachments 1 through 4). Project modifications include a reduction in the number of as-built wind turbines and nameplate capacity, reassignment of wind turbine generator models at previously permitted locations, a renumbering of turbines, and limited reconfigurations of certain collection lines.

Wind Turbine Generator Modifications

Emmons-Logan Wind was expecting to use 35 General Electric (GE) 1.715 megawatt (MW) and 88 GE 2.72 MW turbines (Table 1). Although Emmons-Logan Wind will utilize the same type of turbine technology, Emmons-Logan Wind is now proposing to use 61 GE 1.715 MW turbines and 41 GE 2.72 MW turbines at the previously permitted turbine locations (Attachments 2 and 3).

Table 1. Wind Turbine Generator Modification Comparison

Turbine Model	Rotor Diameter (feet)	Hub Height (feet)	Tip Height (feet)	# of Turbines in Permitted Site Plan	# of Turbines in Modified Site Plan
GE 1.715 MW	338	262	431.5	35	61
GE 2.72 MW	381	295	485.5	68	21
GE 2.72 MW	381	262	452.5	20	20

Modifications in turbine technology and to the number of as-built wind turbines will decrease the Project's nameplate capacity from 299.4 MW to 216.1 MW. The engineering and operational design considerations for the turbine model modifications are consistent with the Findings of Fact, Conclusions of Law and Order, specifically:

- The Project will continue to utilize either GE 1.715 MW or GE 2.72 MW wind turbine models in the permitted locations.
- The maximum turbine tip height used for setbacks was unchanged and thus there continue to be no setback exceedances.
- Sound levels, as described below, continue to comply with the Commission's requirement.
- Shadow flicker, as described below, continue to meet the Commission's recognized standard.

Sound Levels

Emmons-Logan Wind contracted AECOM to update the acoustic assessment as a result of the wind turbine model modifications and a reduction in wind turbines. AECOM utilized the same methodology outlined in the Project's November 2018 Acoustic Assessment (Docket No. 60). The predicted operational acoustic modeling demonstrates that the Project will not generate exceedances of the Commission threshold at any occupied receptors due to utilizing Low Noise Trailing Edge (LNTE) technology on Turbine 75. Utilizing LNTE technology will reduce the

Project's operational sound at the nearest receptor to the Commission's limit. The highest predicted operational sound level at an occupied receptor is 50 dBA. Attachment 5 compares the results of the updated acoustic assessment to the May 1, 2019 Acoustic Assessment, and Attachment 6 provides an acoustic modeling map.

Shadow Flicker

Emmons-Logan Wind contracted AECOM to update the shadow flicker assessment as a result of the wind turbine model modifications and a reduction in wind turbines. AECOM utilized the same methodology outlined in the Project's November 2018 Shadow Flicker Assessment (Docket No. 62). The predictive shadow flicker modeling demonstrates that the Project has no new, additional residences that have shadow flicker impacts over 30 hours per year based on the May 1, 2019 Shadow Flicker Assessment. All residences with shadow flicker exceedances are owned by landowners that are participating in the Project and have signed waivers for shadow flicker exceedances, which have been filed with the Commission. Attachments 7 and 8 compare the results of the updated shadow flicker assessment to the May 1, 2019 Shadow Flicker Assessment, and Attachment 9 provides a shadow flicker modeling map.

Project Site Plan Modifications

Project Site Plan modifications include alterations to the collection lines. Attachment 3 illustrates locations of the Site Plan modifications, whereas modifications that are imperceptible at the map scale can be viewed using the GIS shapefiles (Attachment 10). Most collection line alterations and all access road reductions are a result of the reduction in as-built wind turbines. Although turbine locations have not changed, three new numbers have been designated for turbines due to the omission of alternative turbines (Attachment 3). The Project Site Plan modifications occur in areas previously surveyed for wetlands, cultural and tribal resources as described below. Attachments 1, 3, and 4 provide updated site plan maps.

Other Impacts

The Site Plan modifications avoid wetland impacts per wetland delineations completed by AECOM. The Site Plan modifications do not impact any cultural or tribal resources per a joint Class III Cultural Resources and tribal survey completed by AECOM. The Site Plan modifications fall within areas previously covered by the avian, raptor, lek, and nest surveys and the whooping crane and bat habitat desktop assessments. There are no new impacts to native prairie or unbroken grasslands. The Site Plan modifications occur in areas previously permitted by the Commission and thus still follow the Commission's Exclusion and Avoidance Criteria as presented in Tables 3-1 and 3-2 of the Project Application.

Conclusion

The Project modifications comply with Exclusion, Avoidance, Selection, and Policy Criteria and are consistent with the Project's Findings of Fact, Conclusions of Law and Order.

Attachments:

1. Modified Energy Conversion Facility Site Plan Overview Map
2. Turbine Modification Comparison Table
3. Site Plan Modification Map Book
4. Modified Energy Conversion Facility Site Plan Map Book
5. Predicted Sound Levels
6. Predicted Sound Levels Map
7. Predicted Shadow Flicker
8. Predicted Shadow Flicker at Receptors
9. Predicted Shadow Flicker Map
10. Electronic submittal of GIS shapefiles

EMMONS-LOGAN WIND ENERGY CENTER EMMONS AND LOGAN COUNTIES, ND

LEGEND

- County Road
- Existing 230 kV Heskett-Wishek Transmission Line
- ▭ County Boundary
- ▭ PLS Township
- ▭ PLS Section

- ▣ Occupied Residence - Participating Landowner
- ▣ Occupied Residence - Non-Participating Landowner
- ▣ *Non-participating Landowner
- ▣ **Non-participating Parcel

Project Features

Turbines

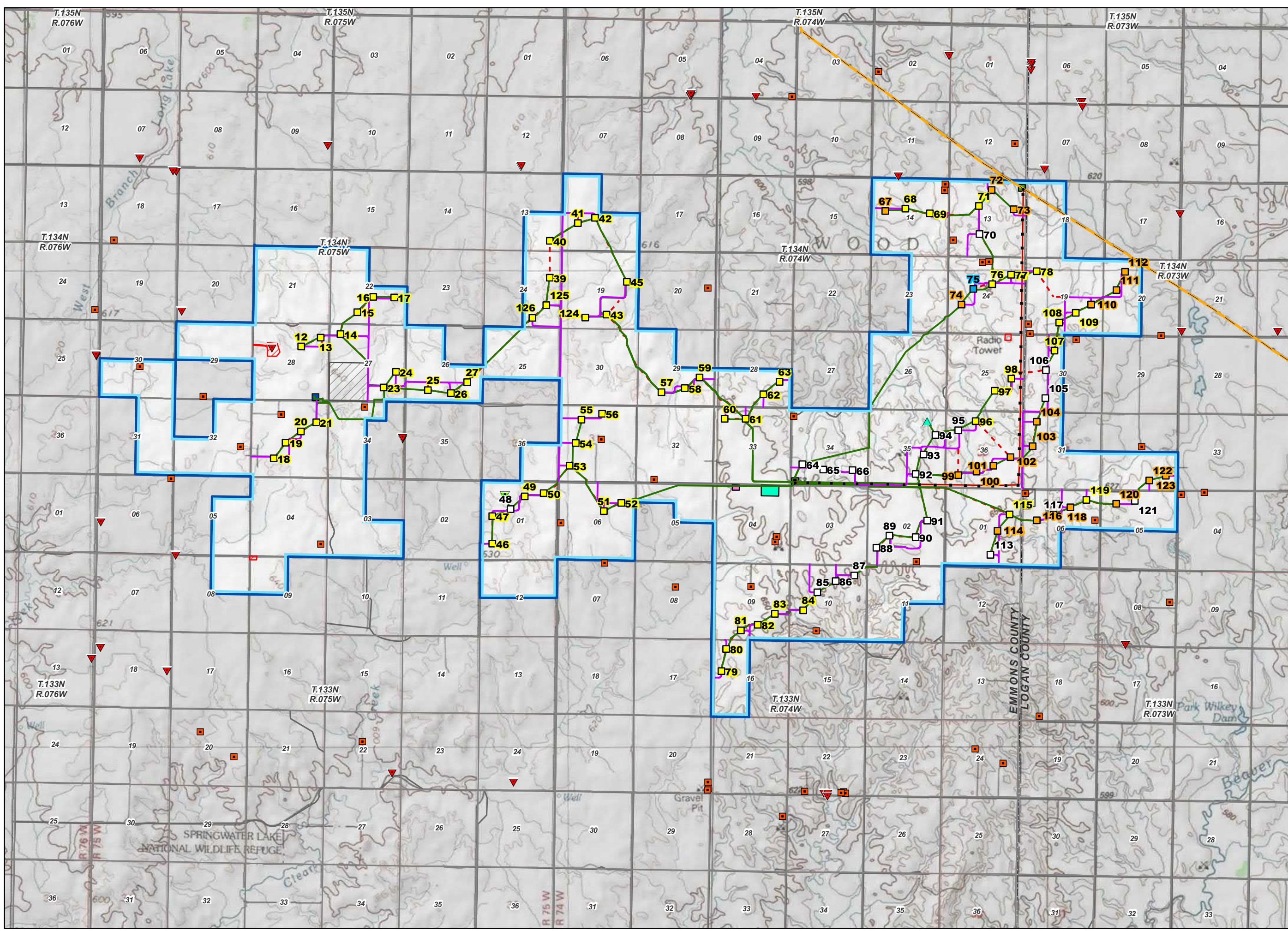
- ▣ GE 1.715 MW 103RD 80HH
- ▣ GE 2.72 116RD 80HH
- ▣ GE 2.72 MW 116RD 90HH
- ▣ GE 2.72 116RD 80HH, LNTE
- ▲ Met Tower
- ▲ Alternative Met Tower
- Service Road
- Collection Line
- - - Crane Path
- 230 kV Transmission Line Route
- ▭ 230 kV Transmission Line Corridor
- ▣ 230 kV Transmission Line Pole Location
- ▭ Revised Emmons-Logan Wind Energy Center Project Area (28,097 Acres)
- ▣ Substation
- ▣ O&M Building
- ▣ Batch Plant
- ▣ Laydown Yard

*Non-participating Landowners outside of the Project Area are not shown on map.

**Owns land participating in the Project Area elsewhere.



Attachment 1 Modified Energy Conversion Facility Site Plan Overview



Attachment 2. Turbine Modification Comparison Table












Permitted Site Plan Turbine Number	Permitted Site Plan Turbine Model	Modified Site Plan Turbine Number	Modified Site Plan Turbine Model
1	GE 2.72 MW 295 HH		Omitted from site plan
2	GE 2.72 MW 295 HH		Omitted from site plan
3	GE 2.72 MW 295 HH		Omitted from site plan
4	GE 2.72 MW 295 HH		Omitted from site plan
5	GE 2.72 MW 295 HH		Omitted from site plan
6	GE 2.72 MW 295 HH		Omitted from site plan
7	GE 2.72 MW 295 HH		Omitted from site plan
8	GE 2.72 MW 295 HH		Omitted from site plan
9	GE 2.72 MW 295 HH, LNTE		Omitted from site plan
10	GE 2.72 MW 295 HH, LNTE		Omitted from site plan
11	GE 2.72 MW 295 HH, LNTE		Omitted from site plan
12	GE 2.72 MW 295 HH	12	GE 1.715 MW
13	GE 2.72 MW 295 HH	13	GE 1.715 MW
14	GE 2.72 MW 295 HH	14	GE 1.715 MW
15	GE 2.72 MW 295 HH	15	GE 1.715 MW
16	GE 2.72 MW 295 HH	16	GE 1.715 MW
17	GE 2.72 MW 295 HH	17	GE 1.715 MW
18	GE 2.72 MW 295 HH, LNTE	18	GE 1.715 MW
19	GE 2.72 MW 295 HH, LNTE	19	GE 1.715 MW
20	GE 2.72 MW 295 HH, LNTE	20	GE 1.715 MW
21	GE 2.72 MW 295 HH, LNTE	21	GE 1.715 MW
22	GE 2.72 MW 295 HH		Omitted from site plan
23	GE 2.72 MW 295 HH	23	GE 1.715 MW
24	GE 2.72 MW 295 HH	24	GE 1.715 MW
25	GE 2.72 MW 295 HH	25	GE 1.715 MW
26	GE 2.72 MW 295 HH	26	GE 1.715 MW
27	GE 2.72 MW 295 HH	27	GE 1.715 MW
28	GE 2.72 MW 295 HH		Omitted from site plan
29	GE 2.72 MW 295 HH		Omitted from site plan
30	GE 2.72 MW 295 HH		Omitted from site plan
31	GE 1.715 MW		Omitted from site plan
32	GE 1.715 MW		Omitted from site plan
33	GE 1.715 MW		Omitted from site plan
34	GE 2.72 MW 295 HH		Omitted from site plan
35	GE 2.72 MW 295 HH		Omitted from site plan
36	GE 2.72 MW 295 HH		Omitted from site plan
37	GE 2.72 MW 295 HH		Omitted from site plan
38	GE 1.715 MW		Omitted from site plan
39	GE 1.715 MW	39	GE 1.715 MW
40	GE 1.715 MW	40	GE 1.715 MW
41	GE 1.715 MW	41	GE 1.715 MW
42	GE 1.715 MW	42	GE 1.715 MW
43	GE 2.72 MW 295 HH	43	GE 1.715 MW
44	GE 2.72 MW 295 HH		Omitted from site plan
45	GE 2.72 MW 295 HH	45	GE 1.715 MW
46	GE 1.715 MW	46	GE 1.715 MW
47	GE 1.715 MW	47	GE 1.715 MW
48	GE 2.72 MW 295 HH	48	GE 2.72 MW 262 HH
49	GE 1.715 MW	49	GE 1.715 MW
50	GE 1.715 MW	50	GE 1.715 MW

Permitted Site Plan Turbine Number	Permitted Site Plan Turbine Model	Modified Site Plan Turbine Number	Modified Site Plan Turbine Model
51	GE 2.72 MW 295 HH	51	GE 1.715 MW
52	GE 2.72 MW 295 HH	52	GE 1.715 MW
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69	GE 1.715 MW	69	GE 1.715 MW
70	GE 2.72 MW 295 HH	70	GE 2.72 MW 262 HH
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72	GE 2.72 MW 262 HH	72	GE 2.72 MW 262 HH
73	GE 2.72 MW 262 HH	73	GE 2.72 MW 262 HH
74	GE 2.72 MW 262 HH, LNTE	74	GE 2.72 MW 262 HH
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76	GE 1.715 MW	76	GE 1.715 MW
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96	GE 1.715 MW	96	GE 1.715 MW
97	GE 1.715 MW	97	GE 1.715 MW
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99	GE 2.72 MW 262 HH	99	GE 2.72 MW 262 HH
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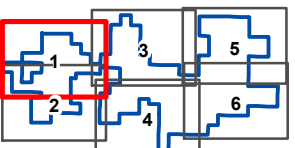
Permitted Site Plan Turbine Number	Permitted Site Plan Turbine Model	Modified Site Plan Turbine Number	Modified Site Plan Turbine Model
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105	GE 2.72 MW 295 HH	105	GE 2.72 MW 262 HH
106	GE 2.72 MW 295 HH	106	GE 2.72 MW 262 HH
107	GE 1.715 MW	107	GE 1.715 MW
108	GE 1.715 MW	108	GE 1.715 MW
109	GE 1.715 MW	109	GE 1.715 MW
110	GE 2.72 MW 262 HH	110	GE 2.72 MW 262 HH
111	GE 2.72 MW 262 HH	111	GE 2.72 MW 262 HH
112	GE 2.72 MW 262 HH	112	GE 2.72 MW 262 HH
113	GE 2.72 MW 295 HH	113	GE 2.72 MW 262 HH
114	GE 2.72 MW 262 HH	114	GE 2.72 MW 262 HH
115	GE 1.715 MW	115	GE 1.715 MW
116	GE 2.72 MW 262 HH, LNTE	116	GE 2.72 MW 262 HH
117	GE 2.72 MW 295 HH, LNTE	117	GE 2.72 MW 262 HH
118	GE 2.72 MW 262 HH, LNTE	118	GE 2.72 MW 262 HH
119	GE 1.715 MW	119	GE 1.715 MW
120	GE 2.72 MW 262 HH, LNTE	120	GE 2.72 MW 262 HH
121	GE 2.72 MW 295 HH, LNTE	121	GE 2.72 MW 262 HH
122	GE 2.72 MW 262 HH	122	GE 2.72 MW 262 HH
123	GE 2.72 MW 262 HH	123	GE 2.72 MW 262 HH
Alt1	GE 2.72 MW 295 HH	124	GE 1.715 MW
Alt2	GE 2.72 MW 295 HH	126	GE 1.715 MW
Alt3	GE 2.72 MW 295 HH	125	GE 1.715 MW
Alt4	GE 2.72 MW 295 HH	Omitted from site plan	
Alt5	GE 2.72 MW 295 HH	Omitted from site plan	
Alt6	GE 2.72 MW 295 HH	Omitted from site plan	

**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

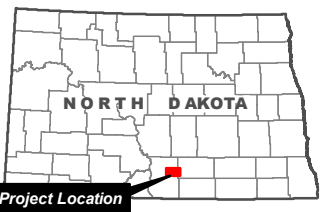
LEGEND

-  County Boundary
-  Existing Road
- Project Features**
-  Turbine Location - October 2019
-  Turbine Location - July 2019
-  Service Road - No Revisions
-  Collection Lines Revised October 2019
-  Collection Line - No Revisions
-  Collection Line - July 2019
-  Emmons-Logan Wind Energy Center Project Area
-  Substation
-  O&M Building

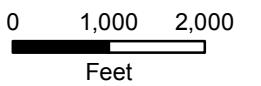
Disclaimer: Call-outs highlight locations of the more notable Site Plan modifications; whereas minor modifications that are imperceptible at the map scale can be viewed using the provided GIS shapefiles.



Map 1 of 6

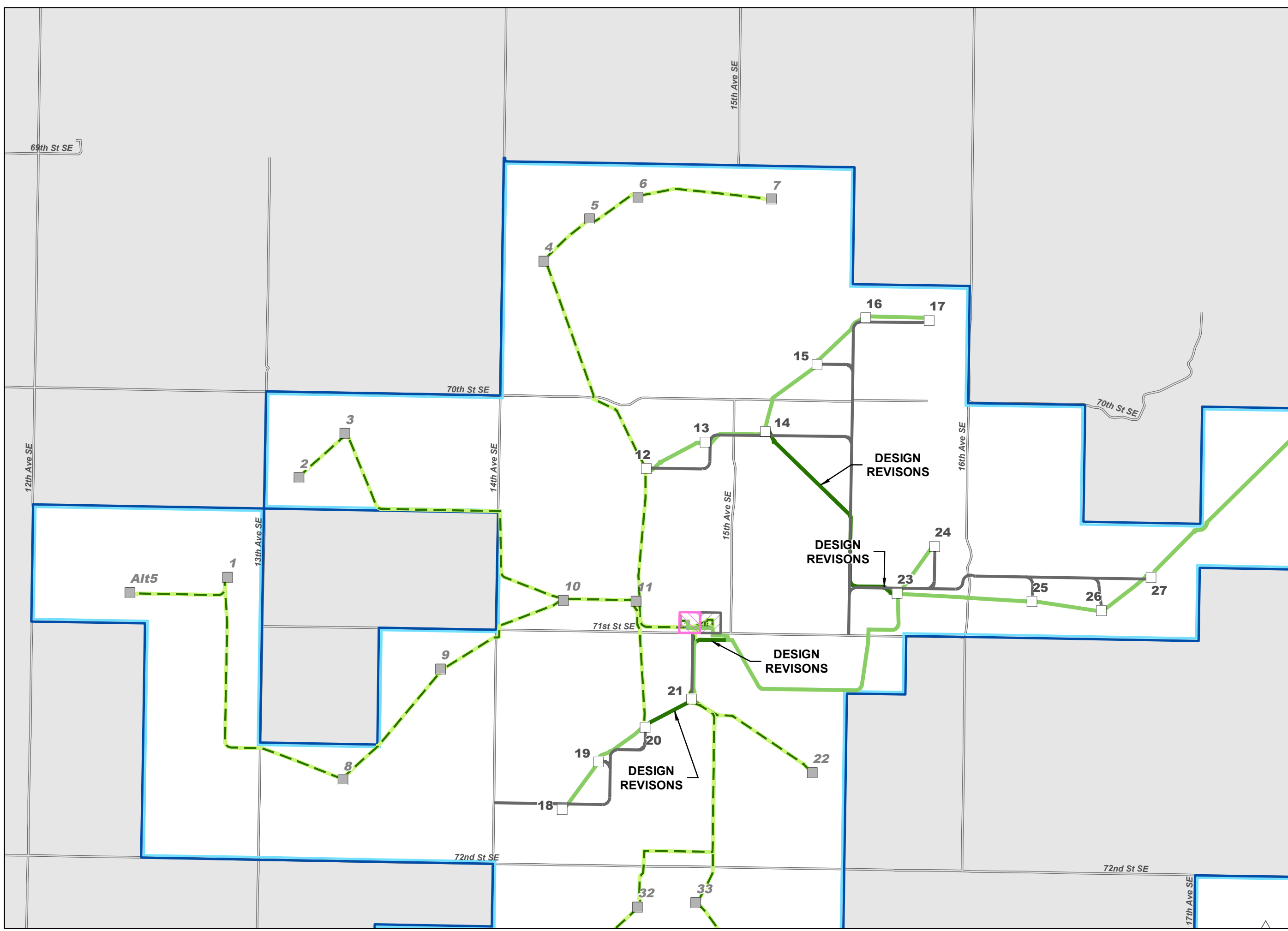


Project Location



**Attachment 3
Sheet 1 of 6**

**Site Plan Modification
Map Book**



**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

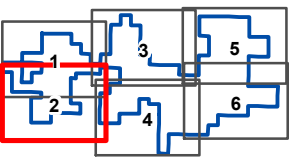
LEGEND

- County Boundary
- Existing Road

Project Features

- Turbine Location - October 2019
- Turbine Location - July 2019
- Met Tower Location - July 2019
- Service Road - No Revisions
- Collection Lines Revised October 2019
- Collection Line - No Revisions
- Collection Line - July 2019
- Emmons-Logan Wind Energy Center Project Area
- Substation
- O&M Building

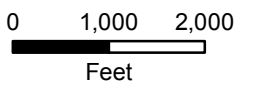
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Map 2 of 6

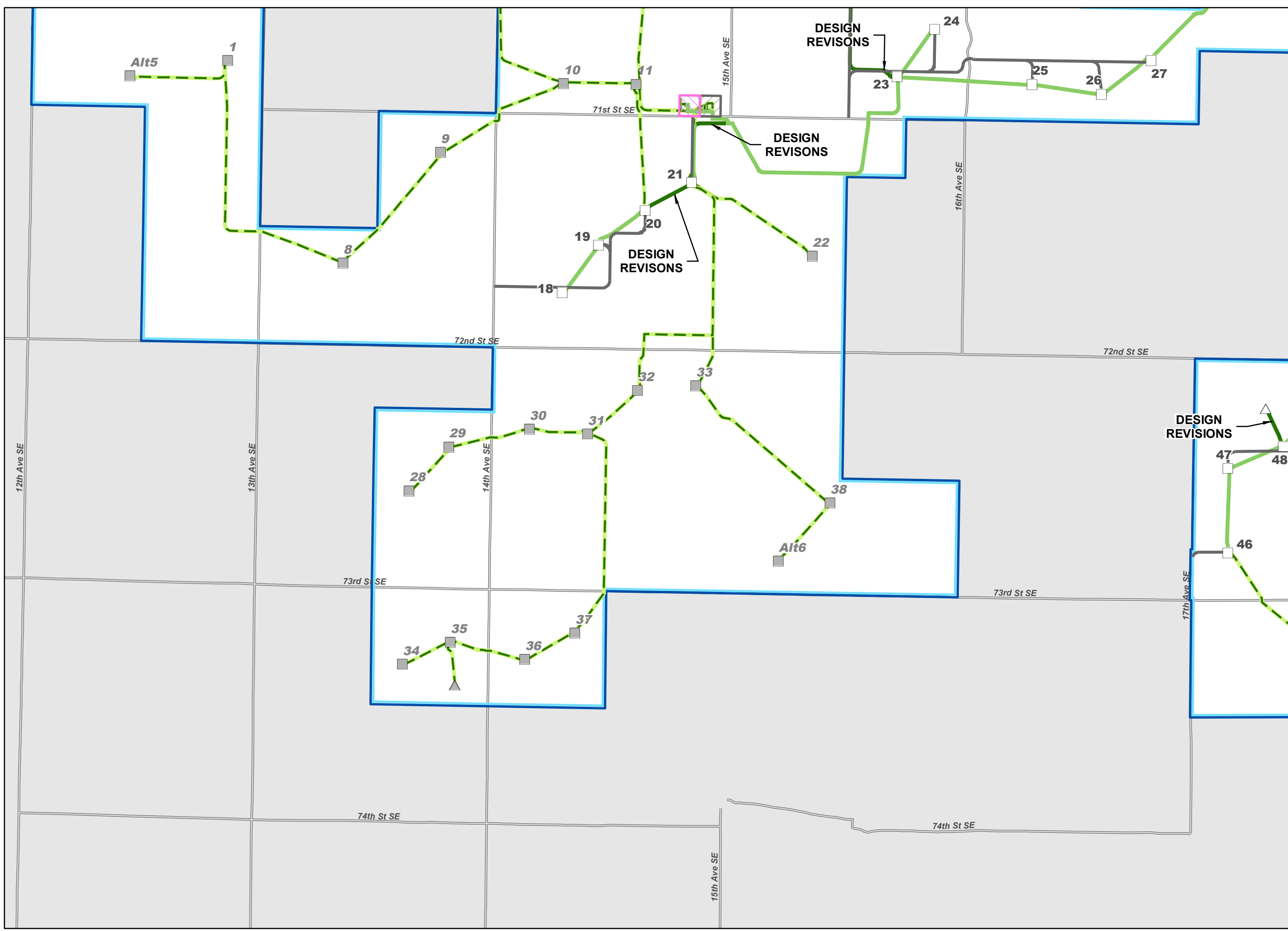


Project Location





**Attachment 3
Sheet 2 of 6**

**Site Plan Modification
Map Book**











**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

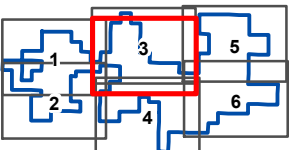
LEGEND

-  County Boundary
-  Existing Road

Project Features

-  Turbine Location - October 2019
-  Turbine Location - July 2019
-  Service Road - No Revisions
-  Collection Lines Revised October 2019
-  Collection Line - No Revisions
-  Collection Line - July 2019
-  Emmons-Logan Wind Energy Center Project Area
-  Substation

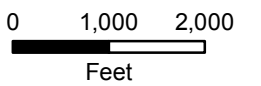
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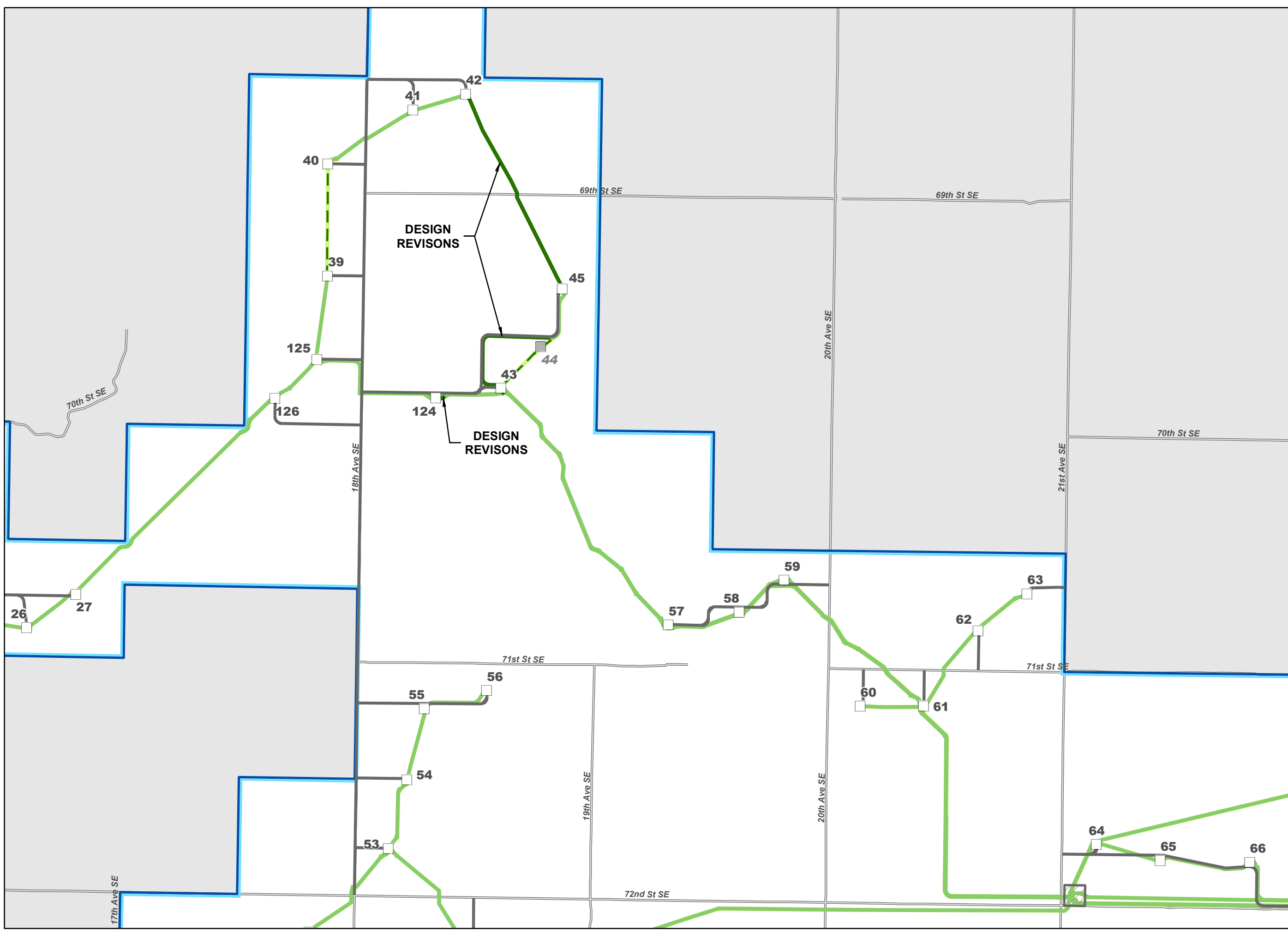
Map 3 of 6



Project Location



**Attachment 3
Sheet 3 of 6
Site Plan Modification
Map Book**



**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

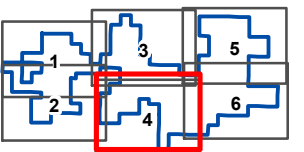
LEGEND

- County Boundary
- Existing Road

Project Features

- Turbine Location - October 2019
- Turbine Location - July 2019
- Service Road - No Revisions
- Collection Lines Revised October 2019
- Collection Line - No Revisions
- Collection Line - July 2019
- Emmons-Logan Wind Energy Center Project Area
- Substation

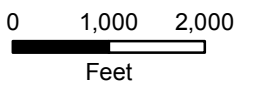
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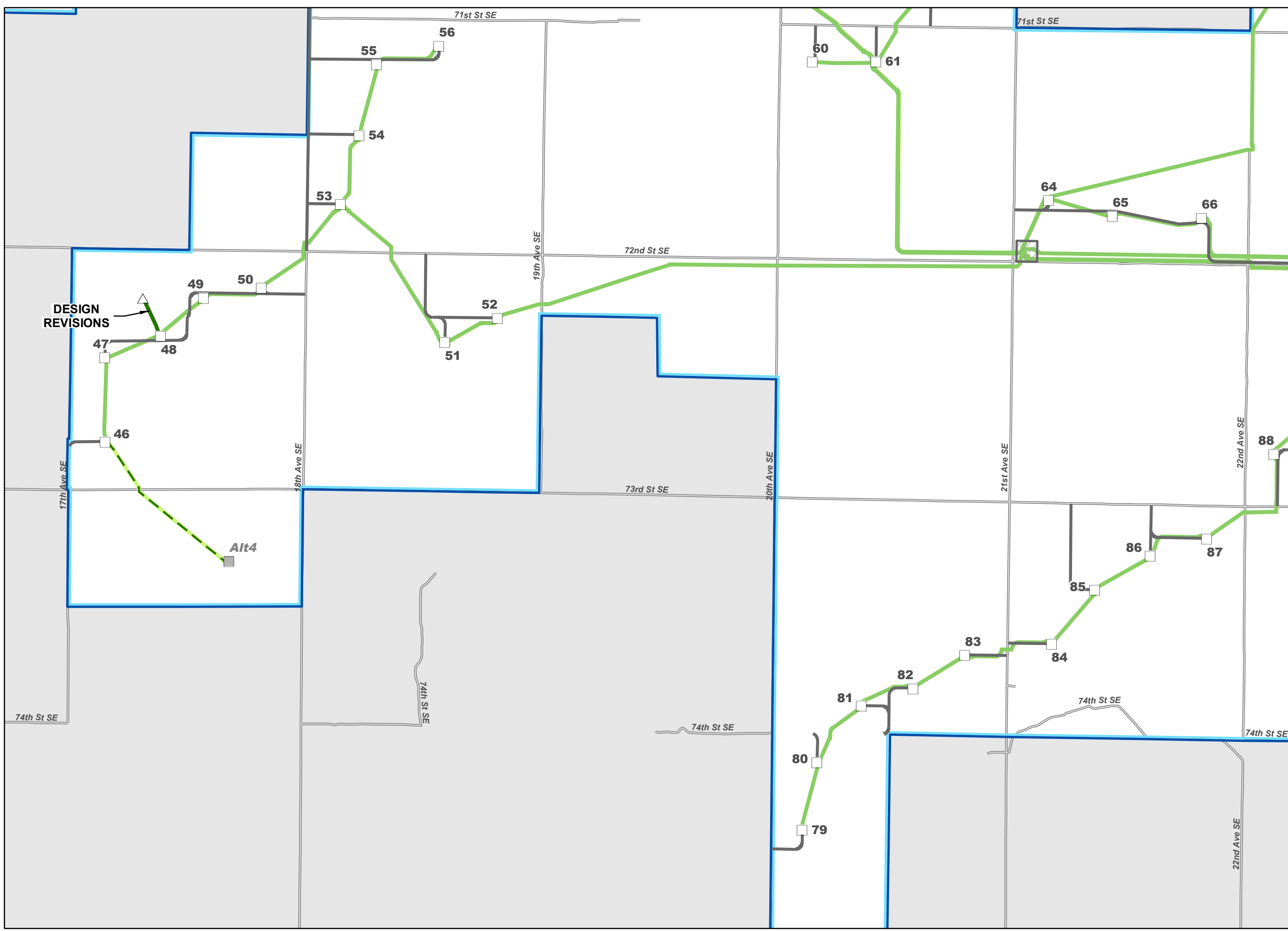
Map 4 of 6



Project Location



**Attachment 3
Sheet 4 of 6
Site Plan Modification
Map Book**



DESIGN REVISIONS

**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

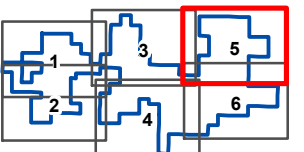
LEGEND

- County Boundary
- Existing Road

Project Features

- Turbine Location - October 2019
- Turbine Location - July 2019
- Service Road - No Revisions
- Collection Line - No Revisions
- Collection Line - July 2019
- Emmons-Logan Wind Energy Center Project Area

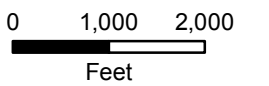
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Map 5 of 6

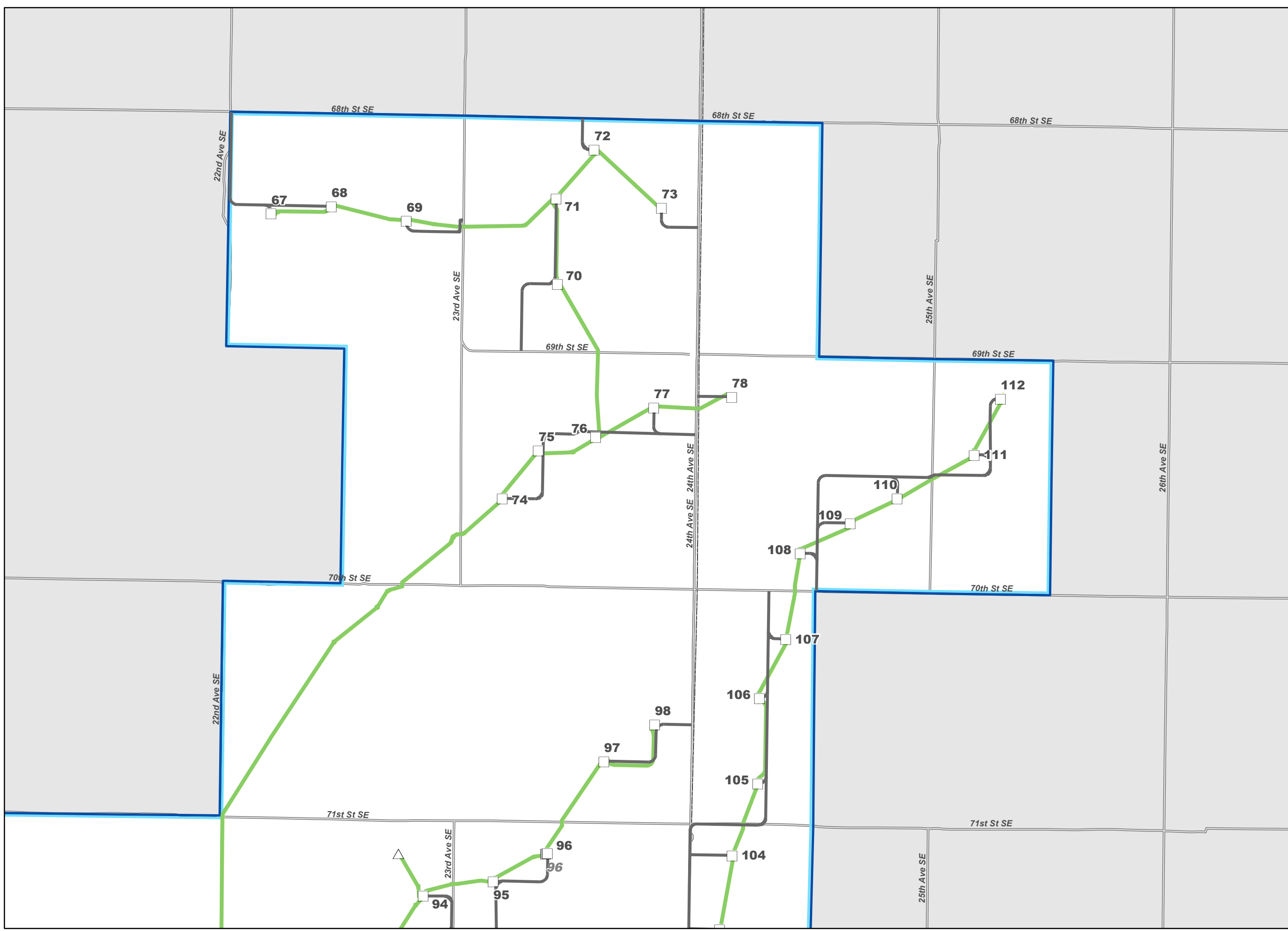


Project Location



**Attachment 3
Sheet 5 of 6**

**Site Plan Modification
Map Book**



**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

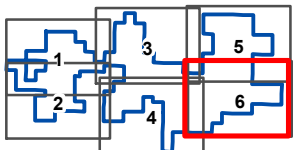
LEGEND

- County Boundary
- Existing Road

Project Features

- Turbine Location - October 2019
- Turbine Location - July 2019
- Service Road - No Revisions
- Collection Lines Revised October 2019
- Collection Line - No Revisions
- Collection Line - July 2019
- Emmons-Logan Wind Energy Center Project Area
- Substation

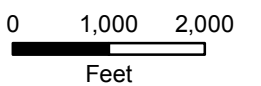
Disclaimer: Call-outs highlight locations of the more notable Site Plan modifications; whereas minor modifications that are imperceptible at the map scale can be viewed using the provided GIS shapefiles.



Map 6 of 6

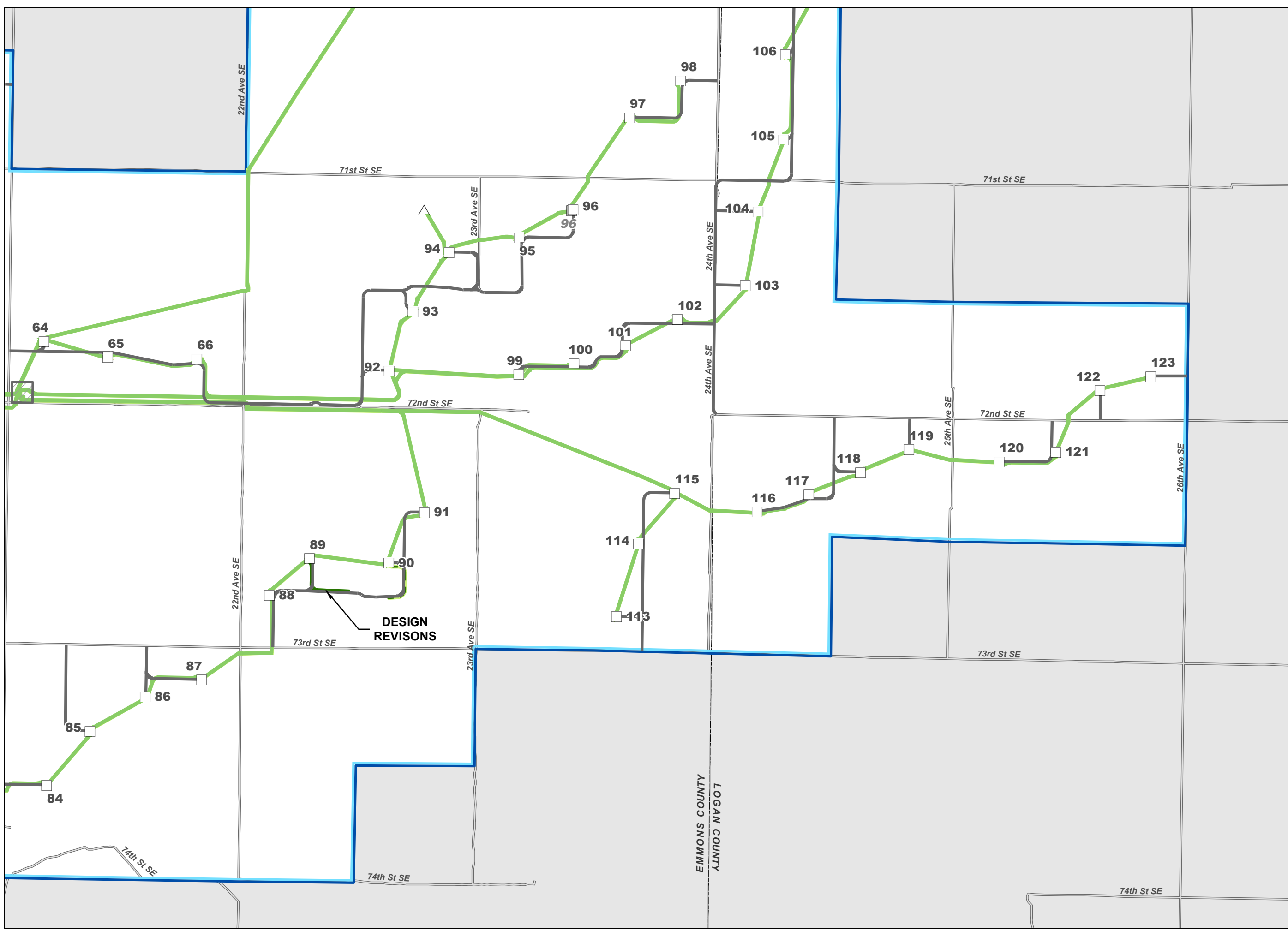


Project Location



**Attachment 3
Sheet 6 of 6**

**Site Plan Modification
Map Book**



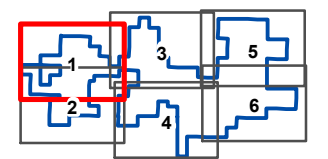
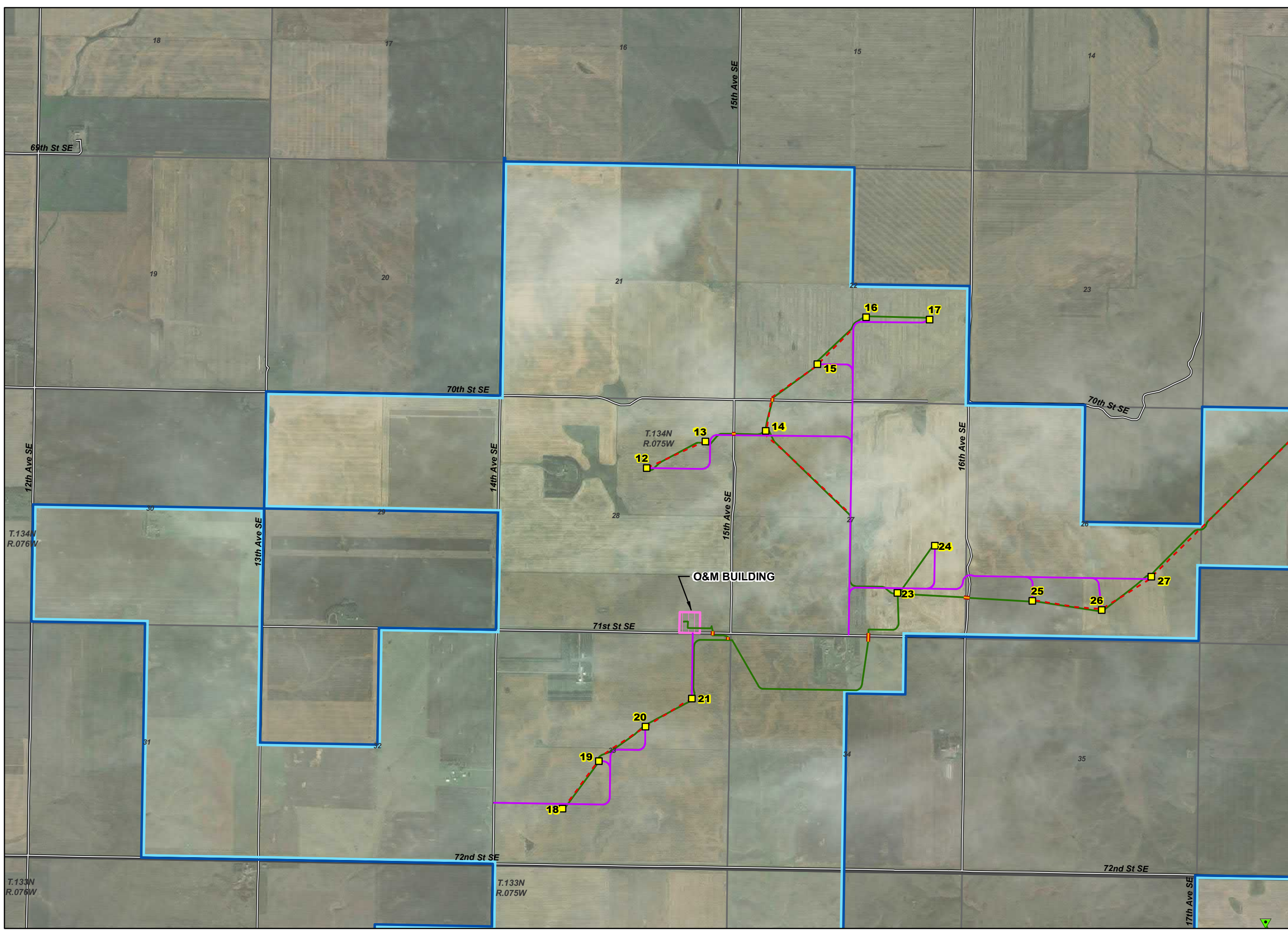
**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

LEGEND

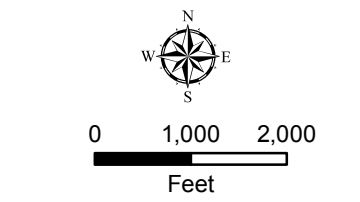
- County Boundary
- PLS Township
- PLS Section
- Existing Road

Project Features

- Turbines**
- GE1.715 MW 103RD 80HH
 - Alternative Met Tower
 - Service Road
 - Collection Line
 - Collection Line Bore Location
 - Crane Path
 - Emmons-Logan Wind Energy Center Project Area
 - O&M Building
















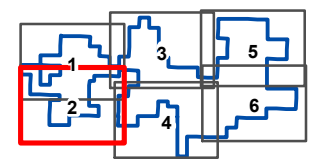
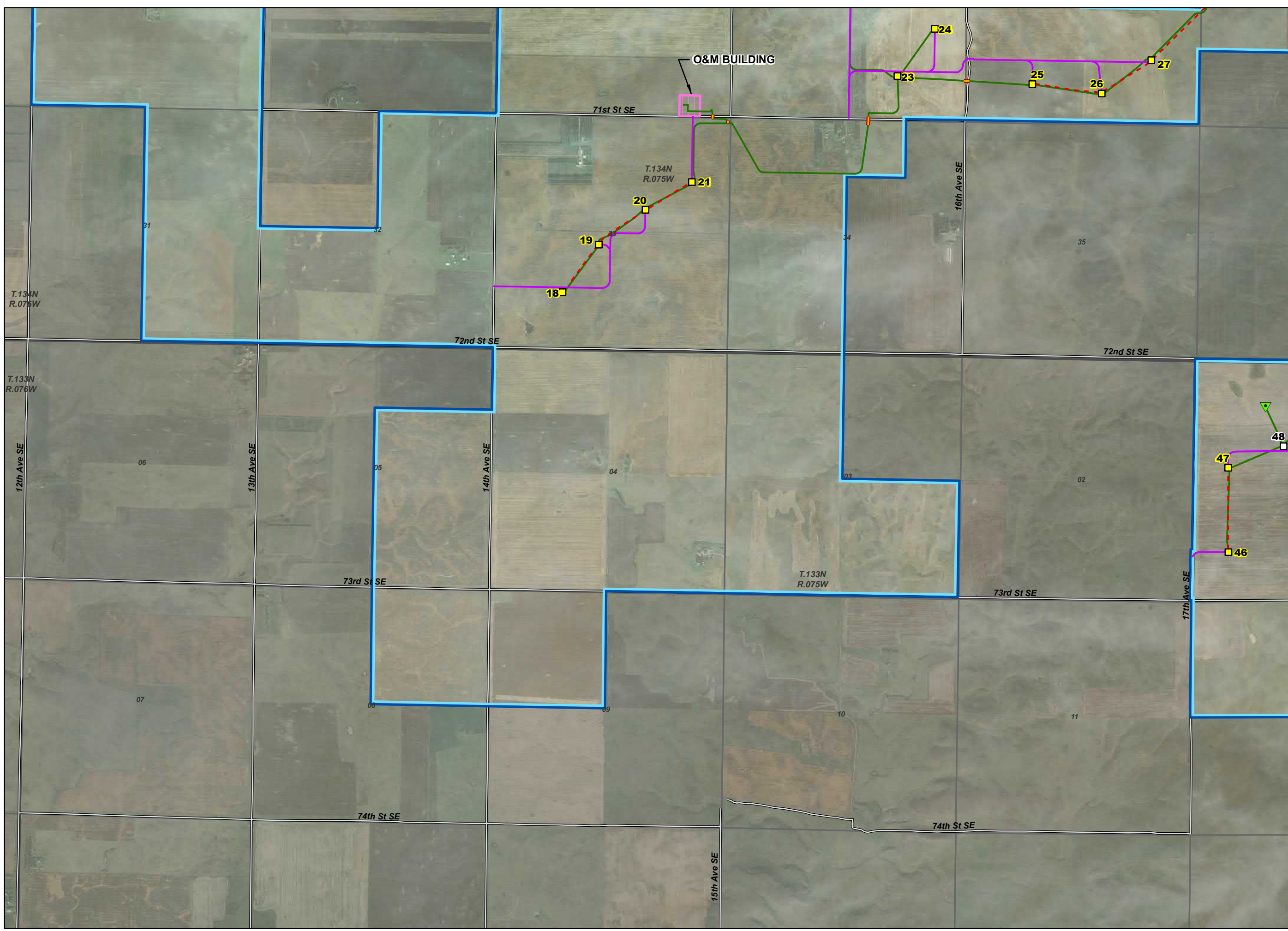
Map 1 of 6



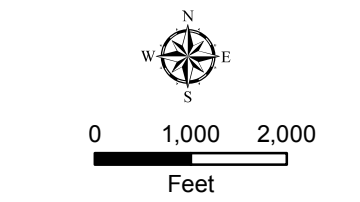
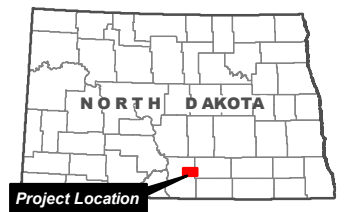
**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

LEGEND

-  County Boundary
-  PLSS Township
-  PLSS Section
-  Existing Road
- Project Features**
- Turbines**
-  GE 1.715 MW 103RD 80HH
-  GE 2.72 MW 116RD 90HH
-  Alternative Met Tower
-  Service Road
-  Collection Line
-  Collection Line Bore Location
-  Crane Path
-  Emmons-Logan Wind Energy Center Project Area
-  O&M Building







Map 2 of 6









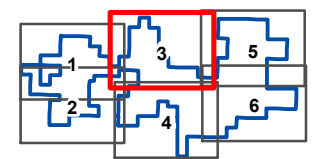
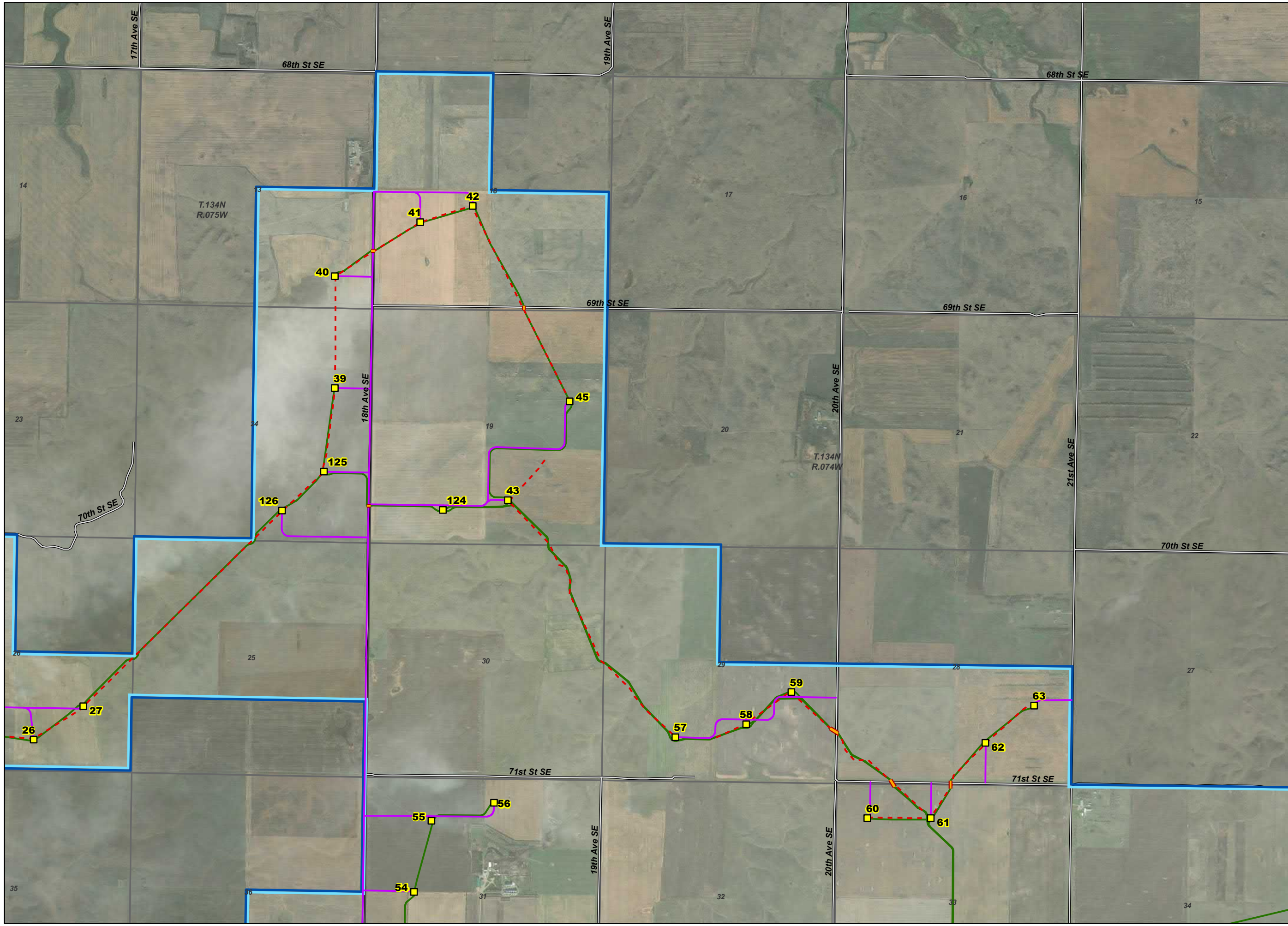
**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

LEGEND

-  County Boundary
-  PLSS Township
-  PLSS Section
-  Existing Road

Project Features

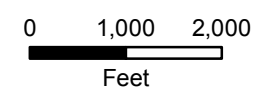
- Turbines**
-  GE1.715 MW 103RD 80HH
 -  Service Road
 -  Collection Line
 -  Collection Line Bore Location
 -  Crane Path
 -  Emmons-Logan Wind Energy Center Project Area



Map 3 of 6



Project Location



**Attachment 4
Sheet 3 of 6**

**Modified Energy
Conversion Facility
Site Plan Map Book**



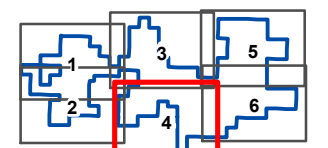
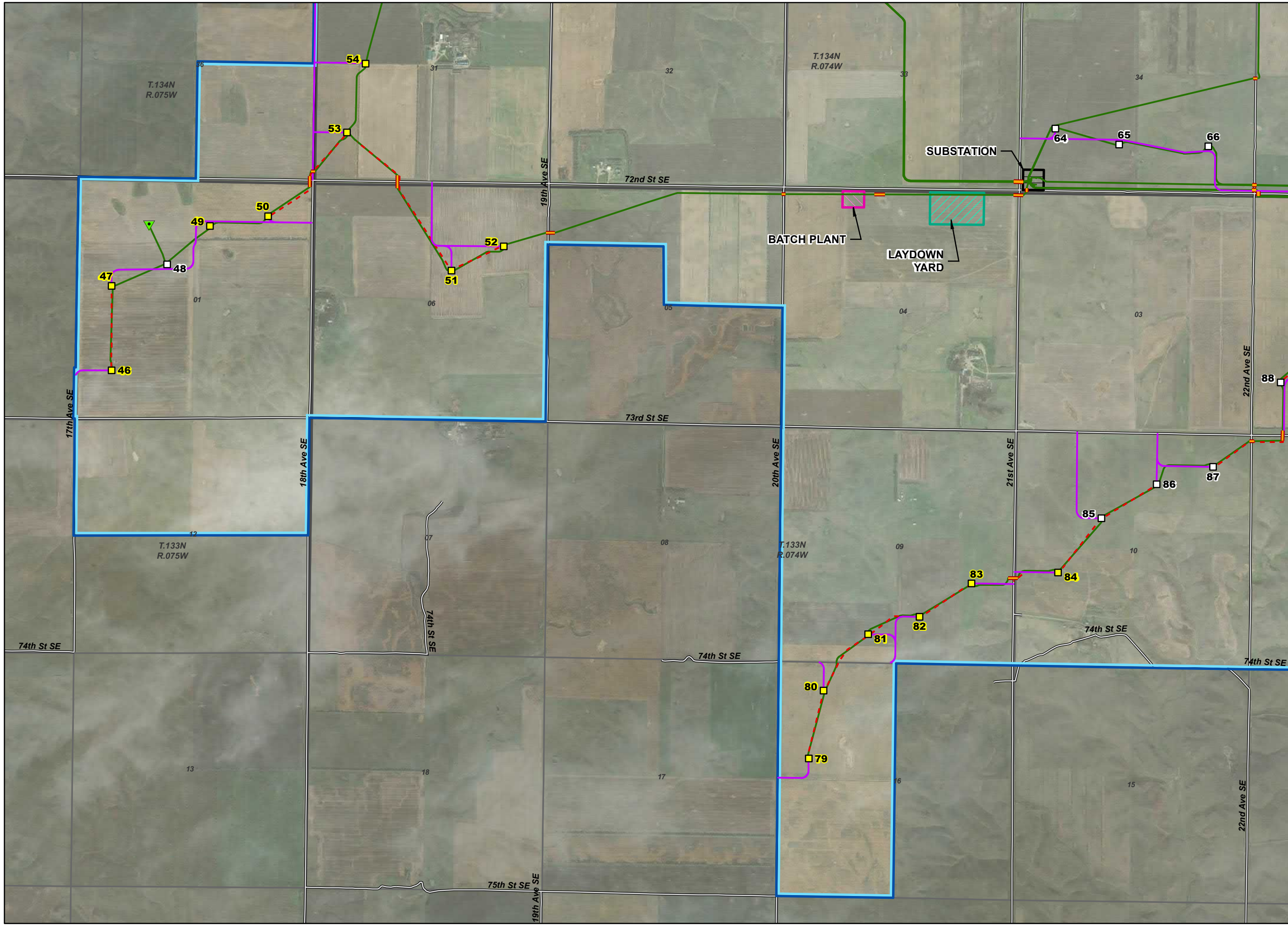
**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

LEGEND

- County Boundary
- PLSS Township
- PLSS Section
- Existing Road

Project Features

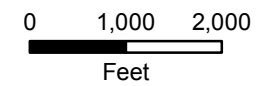
- Turbines**
- GE 1.715 MW 103RD 80HH
 - GE 2.72 MW 116RD 90HH
 - Alternative Met Tower
 - Service Road
 - Collection Line
 - Collection Line Bore Location
 - Crane Path
 - Emmons-Logan Wind Energy Center Project Area
 - Substation
 - Batch Plant
 - Laydown Yard



Map 4 of 6



Project Location



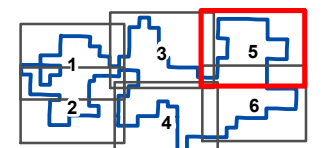
**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

LEGEND

- County Boundary
- PLSS Township
- PLSS Section
- Existing Road

Project Features

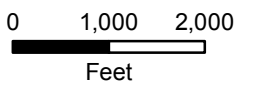
- Turbines**
- GE 1.715 MW 103RD 80HH
 - GE 2.72 116RD 80HH
 - GE 2.72 MW 116RD 90HH
 - GE 2.72 116RD 80HH, LNTE
 - Met Tower
 - Service Road
 - Collection Line
 - Collection Line Bore Location
 - Crane Path
 - Emmons-Logan Wind Energy Center Project Area



Map 5 of 6

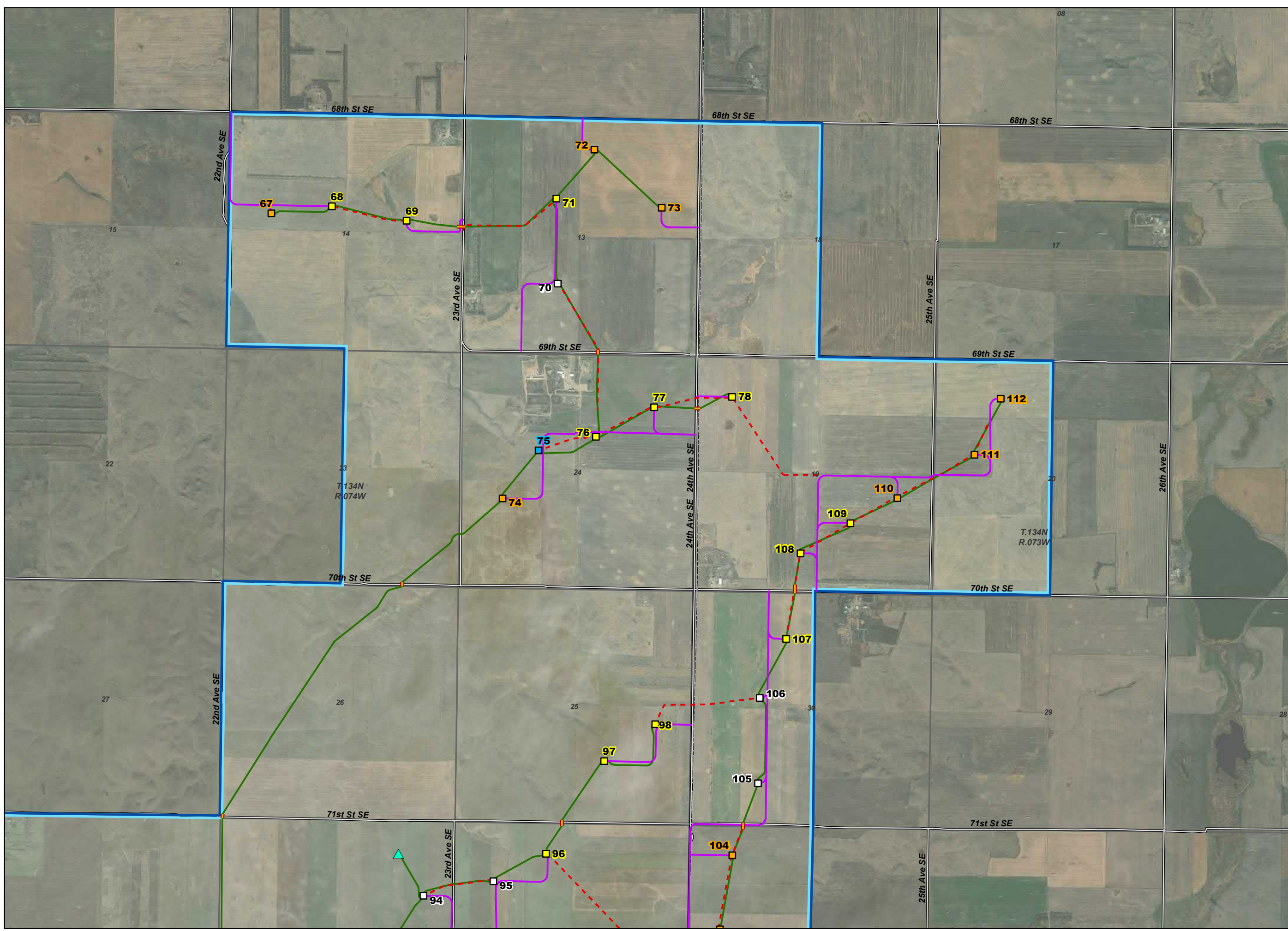


Project Location



**Attachment 4
Sheet 5 of 6**

**Modified Energy
Conversion Facility
Site Plan Map Book**



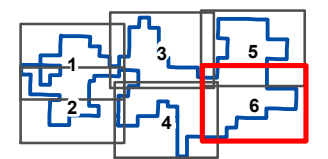
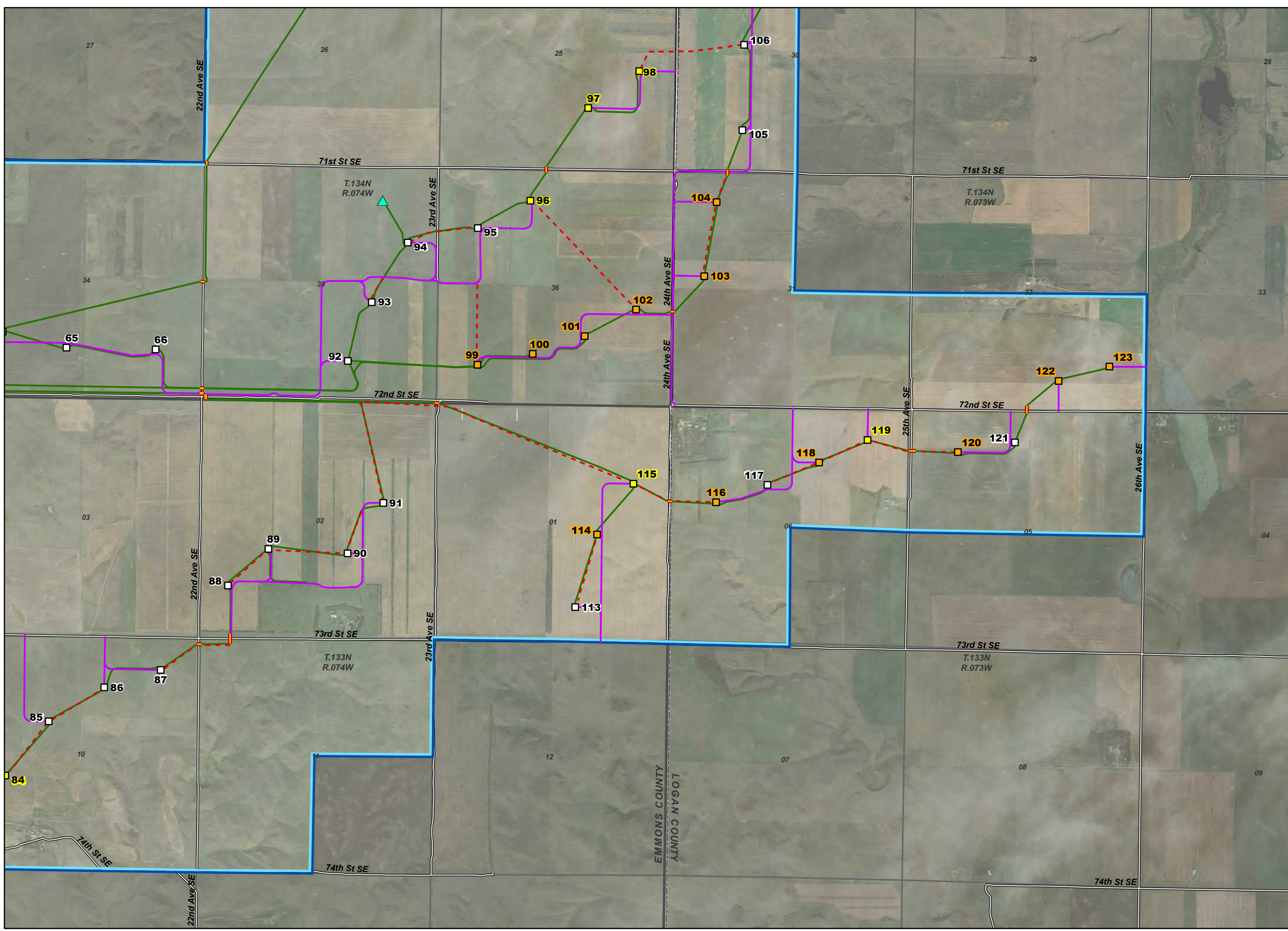
**EMMONS-LOGAN
WIND ENERGY CENTER
EMMONS AND LOGAN
COUNTIES, ND**

LEGEND

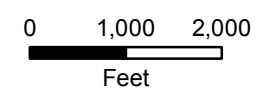
- County Boundary
- PLSS Township
- PLSS Section
- Existing Road

Project Features

- Turbines**
- GE 1.715 MW 103RD 80HH
 - GE 2.72 116RD 80HH
 - GE 2.72 MW 116RD 90HH
 - Met Tower
 - Service Road
 - Collection Line
 - Collection Line Bore Location
 - Crane Path
 - Emmons-Logan Wind Energy Center Project Area



Map 6 of 6



Attachment 4
Sheet 6 of 6
Modified Energy
Conversion Facility
Site Plan Map Book

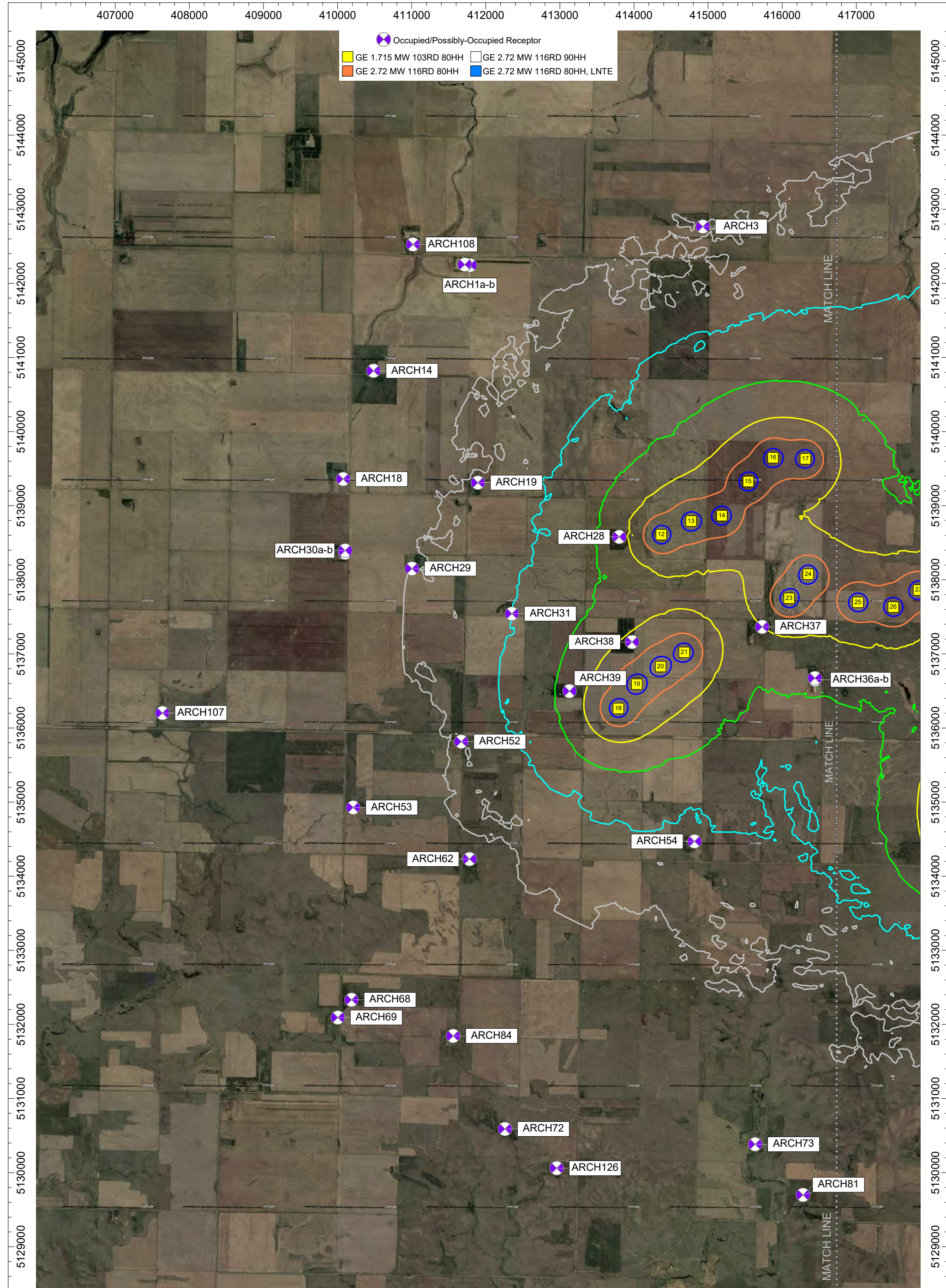


Attachment 5. Predicted Sound Levels

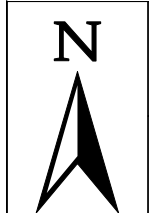
Receiver ID	Participating Landowner?	Nearest Turbine Number	Distance to Nearest Turbine (meters)	Receptor Coordinates (UTM Zone 14, NAD 83)		May 1, 2019 Acoustic Assessment (Leq, dBA)	Updated Acoustic with LTNE on Turbine 75 (Leq, dBA) ¹	Change in Acoustic (Leq, dBA)
				Easting (m)	Northing (m)			
ARCH1a	No	12	4505	411748	5142273	32	27	-5
ARCH1b	No	12	4553	411681	5142284	32	27	-5
ARCH3	No	16	3310	414922	5142811	34	30	-4
ARCH4a	No	40	1656	418970	5142363	36	37	+1
ARCH4b	No	40	1683	418976	5142395	36	37	+1
ARCH7	No	68	697	426874	5142180	45	45	0
ARCH9a	Yes	69	693	427858	5142012	46	46	0
ARCH9b	Yes	69	578	427845	5141887	47	47	0
ARCH10	Yes	72	1098	429319	5142869	41	41	0
ARCH11	No	73	1052	429934	5142318	42	42	0
ARCH12	No	112	1671	432773	5141382	36	37	+1
ARCH14	Yes	12	4515	410443	5140839	33	26	-7
ARCH15	Yes	70	566	428022	5140842	48	48	0
ARCH16a	Yes	76	513	428633	5140382	49	50	+1
ARCH16b	Yes	76	482	428774	5140389	50	50	0
ARCH17	Yes	45	1702	422884	5139836	39	37	-2
ARCH18	Yes	19	4873	410039	5139386	35	25	-10
ARCH19	No	12	2597	411861	5139343	46	32	-14
ARCH20a	Yes	107	629	429635	5138886	48	48	0
ARCH20b	Yes	108	654	429592	5139083	47	48	+1
ARCH21	No	111	1620	432803	5138909	39	39	0
ARCH22	No	112	3441	434822	5138912	30	33	+3
ARCH24	Yes	111	1333	432380	5138841	41	41	0
ARCH25	Yes	108	498	430597	5138756	50	50	0
ARCH28	Yes	12	613	413756	5138574	47	44	-3
ARCH29	Yes	12	3398	410988	5138194	45	30	-15
ARCH30a	No	18	4281	410075	5138403	37	28	-9
ARCH30b	No	18	4299	410068	5138425	37	28	-9
ARCH31	Yes	18	1967	412313	5137566	46	36	-10
ARCH33	Yes	63	772	424685	5137154	47	46	-1
ARCH34	Yes	122	728	431973	5136509	46	46	0
ARCH35	Yes	56	525	420653	5136674	49	48	-1
ARCH36a	No	22	989	416487	5136666	45	42	-3
ARCH36b	No	22	991	416500	5136699	45	42	-3
ARCH37	Yes	23	575	415694	5137337	48	45	-3

Receiver ID	Participating Landowner?	Nearest Turbine Number	Distance to Nearest Turbine (meters)	Receptor Coordinates (UTM Zone 14, NAD 83)		May 1, 2019 Acoustic Assessment (Leq, dBA)	Updated Acoustic with LTNE on Turbine 75 (Leq, dBA) ¹	Change in Acoustic (Leq, dBA)
				Easting (m)	Northing (m)			
ARCH38	Yes	20	546	413943	5137194	50	47	-3
ARCH39	Yes	18	743	413090	5136520	47	43	-4
ARCH42	Yes	52	857	421759	5135832	44	42	-2
ARCH45	Yes	123	871	433280	5135553	42	43	+1
ARCH46	Yes	123	508	432802	5135504	48	48	0
ARCH47	Yes	119	457	430992	5134971	49	50	+1
ARCH48	Yes	115	550	429531	5135533	50	50	0
ARCH49a	Yes	85	1391	424296	5134528	42	42	0
ARCH49b	Yes	85	1450	424324	5134624	43	43	0
ARCH51	Yes	50	716	419802	5134912	46	45	-1
ARCH52	Yes	18	2189	411640	5135851	43	32	-11
ARCH53	No	18	3862	410166	5134921	35	27	-8
ARCH54	Yes	18	2034	414773	5134478	44	33	-11
ARCH55	Yes	90	506	427252	5134105	49	49	0
ARCH57	Yes	121	2246	432556	5133251	35	37	+2
ARCH59	Yes	83	759	423789	5133578	45	45	0
ARCH60	Yes	81	1650	422205	5133575	39	39	0
ARCH61a	Yes	51	1079	420718	5134080	41	40	-1
ARCH62	No	18	2886	411735	5134229	43	29	-14
ARCH64	Yes	84	504	425154	5132657	47	47	0
ARCH66	No	120	2970	431631	5132346	33	35	+2
ARCH68	No	18	5373	410162	5132295	30	18	-12
ARCH69	No	18	5673	409972	5132060	29	19	-10
ARCH70	Yes	113	3531	429825	5130862	25	28	+3
ARCH72	Yes	18	5921	412251	5130545	24	17	-7
ARCH73	Yes	46	4948	415645	5130338	23	22	-1
ARCH74	Yes	113	4079	428480	5130176	29	32	+3
ARCH75	Yes	113	4374	429070	5129877	23	28	+5
ARCH76a	Yes	79	3594	425726	5129279	28	29	+1
ARCH76b	Yes	79	3640	425766	5129255	28	29	+1
ARCH76c	Yes	79	3572	425673	5129258	28	29	+1
ARCH77a	No	79	3372	425349	5129233	27	30	+3
ARCH77b	No	79	3348	425314	5129234	29	31	+2
ARCH77c	No	79	3403	425393	5129229	27	30	+3
ARCH77d	No	79	3443	425391	5129175	26	28	+2
ARCH79a	Yes	79	2455	422894	5129362	30	32	+2
ARCH79b	Yes	79	2502	422880	5129316	30	32	+2
ARCH79c	Yes	79	2332	422886	5129487	31	32	+1

Receiver ID	Participating Landowner?	Nearest Turbine Number	Distance to Nearest Turbine (meters)	Receptor Coordinates (UTM Zone 14, NAD 83)		May 1, 2019 Acoustic Assessment (Leq, dBA)	Updated Acoustic with LTNE on Turbine 75 (Leq, dBA) ¹	Change in Acoustic (Leq, dBA)
				Easting (m)	Northing (m)			
ARCH80	No	46	5017	418813	5129471	18	26	+8
ARCH81	No	46	5248	416269	5129655	15	20	+5
ARCH83	Yes	79	3298	424451	5128764	23	25	+2
ARCH84	No	18	4982	411554	5131800	34	21	-13
ARCH107	No	18	6197	407590	5136204	23	22	-1
ARCH108	No	12	17,084	410981	5142552	29	26	-3
ARCH111a	No	42	3248	422531	5143856	28	30	+2
ARCH111b	No	42	3236	422512	5143854	26	29	+3
ARCH111c	No	42	3243	422510	5143865	26	29	+3
ARCH111d	No	42	3280	422528	5143898	28	31	+3
ARCH112	No	67	3616	423893	5143839	26	30	+4
ARCH115	Yes	67	3101	424647	5143854	28	31	+3
ARCH117	Yes	67	2931	426457	5144375	31	32	+1
ARCH119	No	72	2946	427937	5144695	31	33	+2
ARCH120a	No	72	2642	429651	5144397	32	33	+1
ARCH120b	No	72	2744	429656	5144503	32	33	+1
ARCH120c	No	72	2794	429659	5144554	32	33	+1
ARCH121a	No	72	2615	430675	5143737	33	34	+1
ARCH121b	No	72	2637	430715	5143728	33	34	+1
ARCH122	No	72	2579	430727	5143631	34	34	0
ARCH123	Yes	79	3065	424917	5129298	30	32	+2
ARCH126	Yes	18	6301	412953	5130014	27	17	-10



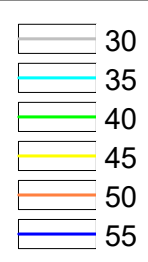
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 GE 1.715 MW 103RD 80HH GE 2.72 MW 116RD 90HH
 GE 2.72 MW 116RD 80HH GE 2.72 MW 116RD 80HH, LNT



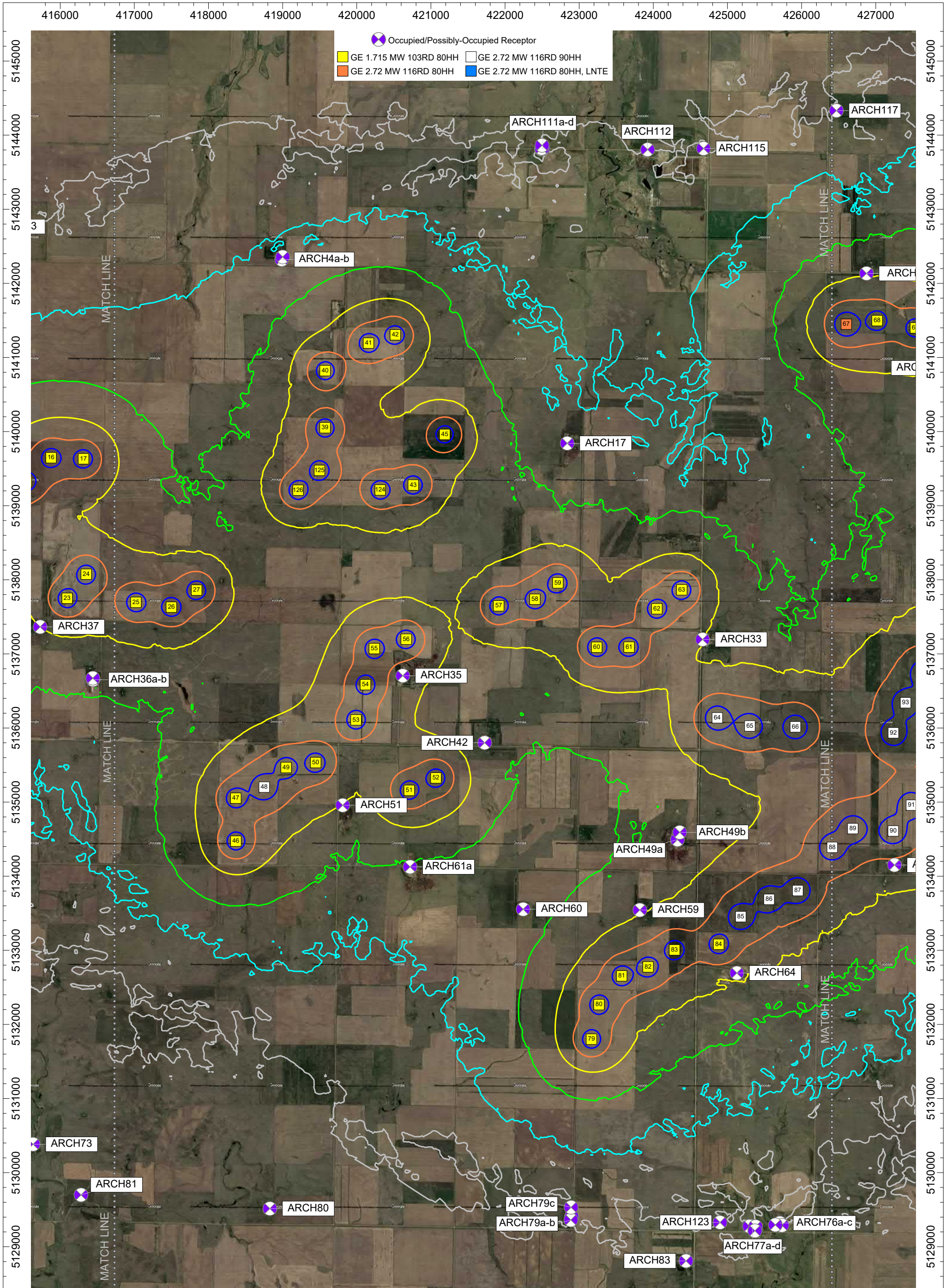
Date Created:
 09/30/2019
 Created by:
 CK

Attachment 6a - Predicted Sound Levels Map Wind Turbines at Maximum Rotational Wind Speed

Sound Level Contour Ranges (dBA)



Predicted Project Operation Noise Contours
Emmons-Logan Wind Energy Center
Emmons and Logan Counties, ND



N

Date Created:
09/30/2019

Created by:
CK

AECOM Imagine it.
Delivered.

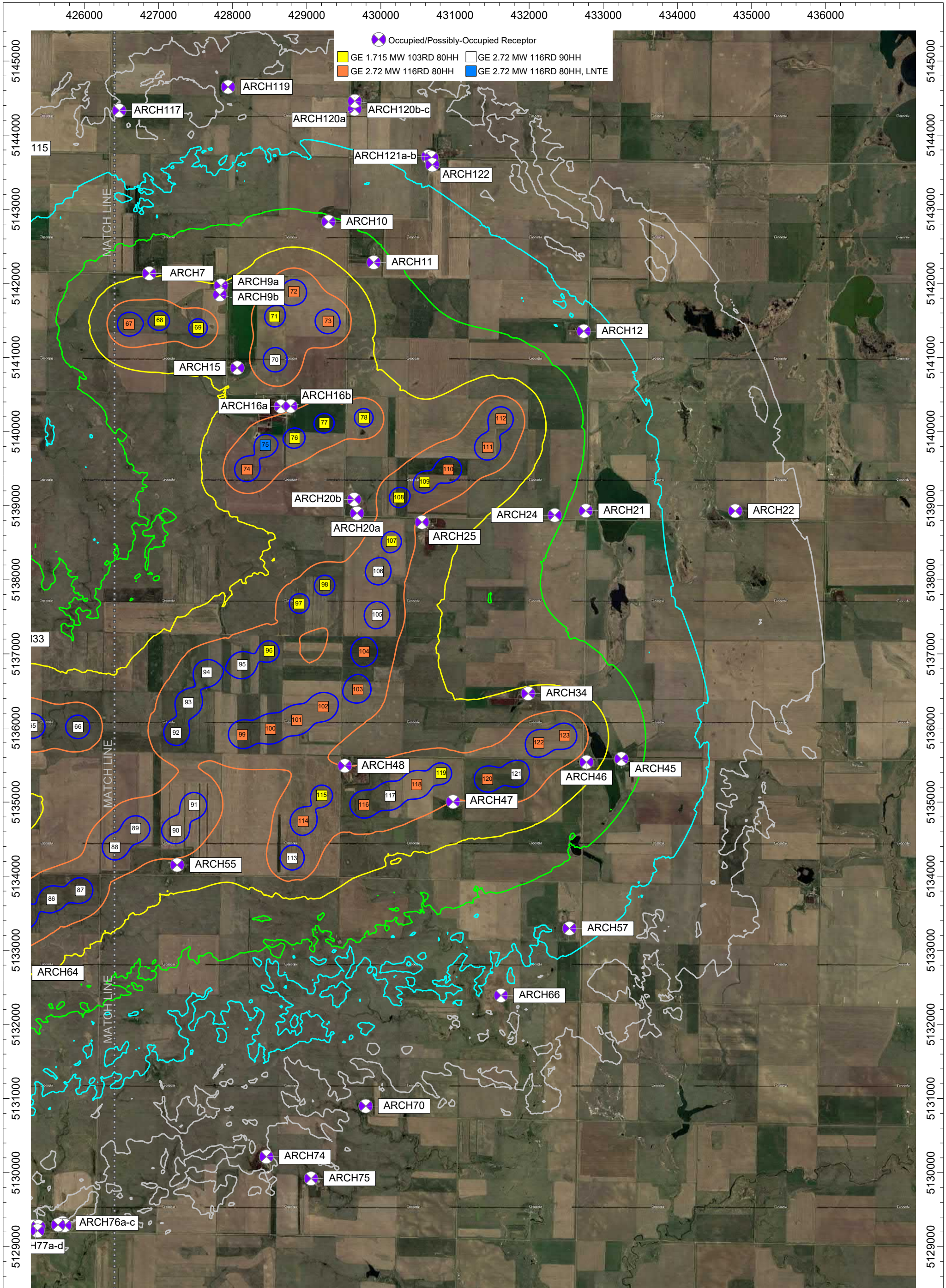
Acoustics & Noise Control Practice

**Attachment 6b - Predicted Sound Levels Map
Wind Turbines at Maximum Rotational Wind Speed**

**Predicted Project Operation Noise Contours
Emmons-Logan Wind Energy Center
Emmons and Logan Counties, ND**

Sound Level Contour Ranges (dBA)

	30
	35
	40
	45
	50
	55

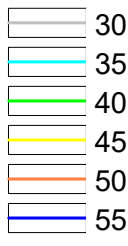


Date Created:
09/30/2019

Created by:
CK

Attachment 6c - Predicted Sound Levels Map Wind Turbines at Maximum Rotational Wind Speed

Sound Level Contour Ranges (dBA)



Predicted Project Operation Noise Contours
Emmons-Logan Wind Energy Center
Emmons and Logan Counties, ND

Attachment 7. Predicted Shadow Flicker

Receiver ID	Participating Landowner?	Nearest Turbine Number	Distance to Nearest Turbine (meters)	Receptor Coordinates (UTM Zone 14, NAD 83)		May 1, 2019 Shadow Flicker Assessment (hours/year)	Updated Shadow Flicker (hours/year) ¹	Change in Shadow Flicker (hours/year)
				Easting (m)	Northing (m)			
ARCH1a	No	12	4505	411748	5142273	0	0	0
ARCH1b	No	12	4553	411681	5142284	0	0	0
ARCH3	No	16	3310	414922	5142811	0	0	0
ARCH4a	No	40	1656	418970	5142363	0	0	0
ARCH4b	No	40	1683	418976	5142395	0	0	0
ARCH7	No	68	697	426874	5142180	0	0	0
ARCH9a	Yes	69	693	427858	5142012	16	16	0
ARCH9b	Yes	69	578	427845	5141887	15	15	0
ARCH10	Yes	72	1098	429319	5142869	0	0	0
ARCH11	No	73	1052	429934	5142318	0	0	0
ARCH12	No	112	1671	432773	5141382	0	0	0
ARCH14	Yes	12	4515	410443	5140839	0	0	0
ARCH15	Yes	70	566	428022	5140842	22	22	0
ARCH16a	Yes	76	513	428633	5140382	11	11	0
ARCH16b	Yes	76	482	428774	5140389	19	19	0
ARCH17	Yes	45	1702	422884	5139836	0	0	0
ARCH18	Yes	19	4873	410039	5139386	0	0	0
ARCH19	No	12	2597	411861	5139343	17	0	-17
ARCH20a	Yes	107	629	429635	5138886	37	37	0
ARCH20b	Yes	108	654	429592	5139083	22	22	0
ARCH21	No	111	1620	432803	5138909	0	0	0
ARCH22	No	112	3441	434822	5138912	0	0	0
ARCH24	Yes	111	1333	432380	5138841	0	0	0
ARCH25	Yes	108	498	430597	5138756	25	25	0
ARCH28	Yes	12	613	413756	5138574	18	14	-4
ARCH29	Yes	12	3398	410988	5138194	24	0	-24
ARCH30a	No	18	4281	410075	5138403	0	0	0
ARCH30b	No	18	4299	410068	5138425	0	0	0
ARCH31	Yes	18	1967	412313	5137566	18	0	-18
ARCH33	Yes	63	772	424685	5137154	4	3	-1
ARCH34	Yes	122	728	431973	5136509	3	3	0
ARCH35	Yes	56	525	420653	5136674	27	24	-3
ARCH36a	No	22	989	416487	5136666	4	0	-4
ARCH36b	No	22	991	416500	5136699	4	0	-4
ARCH37	Yes	23	575	415694	5137337	4	3	-1

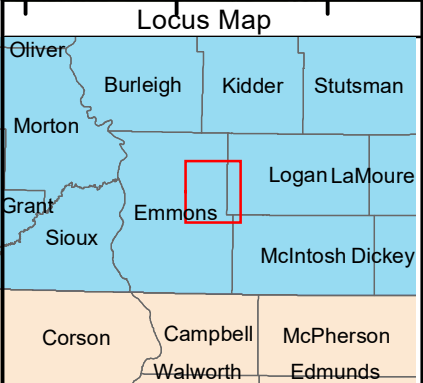
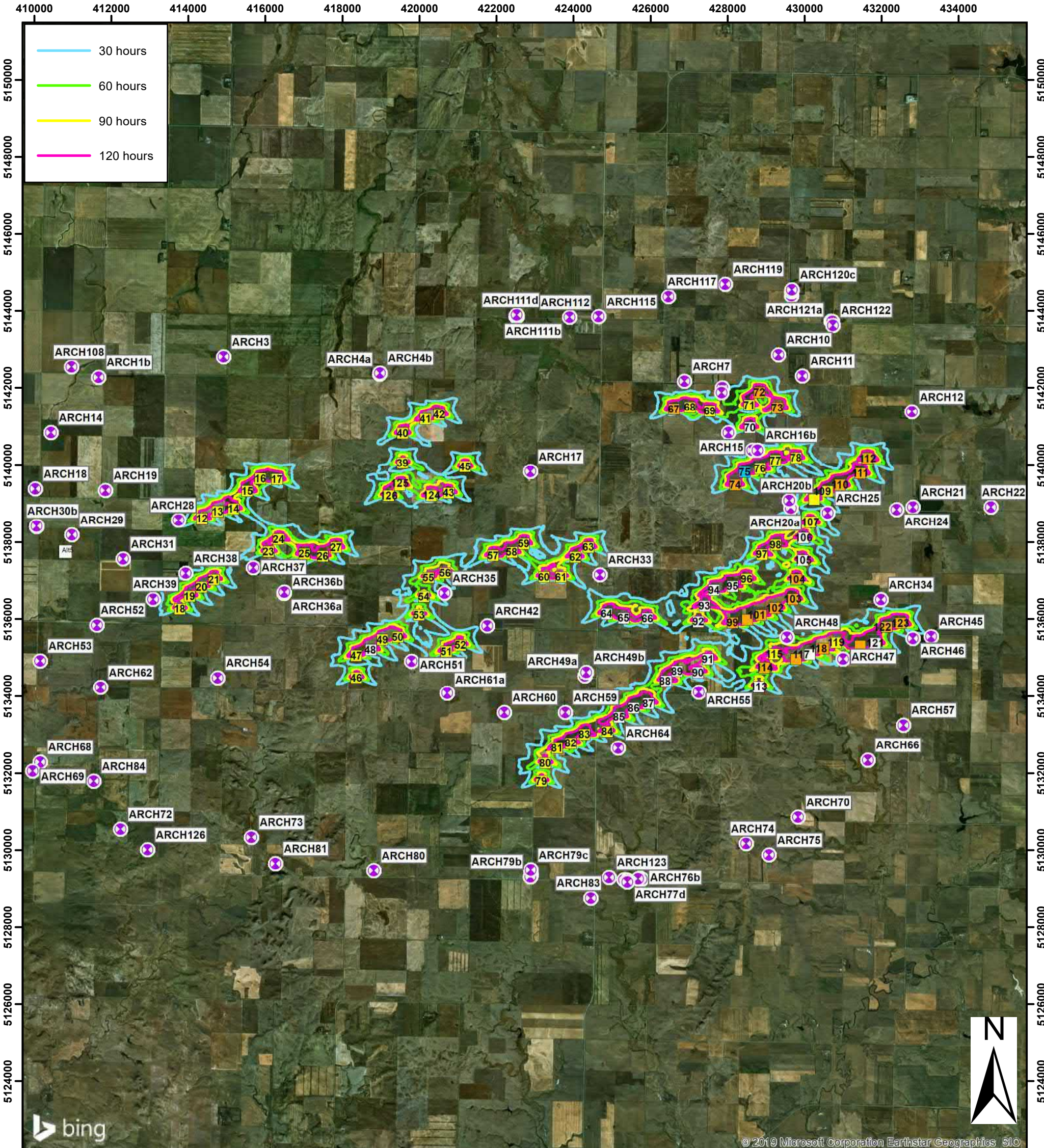
Receiver ID	Participating Landowner?	Nearest Turbine Number	Distance to Nearest Turbine (meters)	Receptor Coordinates (UTM Zone 14, NAD 83)		May 1, 2019 Shadow Flicker Assessment (hours/year)	Updated Shadow Flicker (hours/year) ¹	Change in Shadow Flicker (hours/year)
				Easting (m)	Northing (m)			
ARCH38	Yes	20	546	413943	5137194	42	32	-10
ARCH39	Yes	18	743	413090	5136520	21	11	-10
ARCH42	Yes	52	857	421759	5135832	13	10	-3
ARCH45	Yes	123	871	433280	5135553	11	11	0
ARCH46	Yes	123	508	432802	5135504	26	26	0
ARCH47	Yes	119	457	430992	5134971	42	42	0
ARCH48	Yes	115	550	429531	5135533	33	33	0
ARCH49a	Yes	85	1391	424296	5134528	0	0	0
ARCH49b	Yes	85	1450	424324	5134624	0	0	0
ARCH51	Yes	50	716	419802	5134912	11	9	-2
ARCH52	Yes	18	2189	411640	5135851	0	0	0
ARCH53	No	18	3862	410166	5134921	0	0	0
ARCH54	Yes	18	2034	414773	5134478	14	0	-14
ARCH55	Yes	90	506	427252	5134105	9	9	0
ARCH57	Yes	121	2246	432556	5133251	0	0	0
ARCH59	Yes	83	759	423789	5133578	7	7	0
ARCH60	Yes	81	1650	422205	5133575	0	0	0
ARCH61a	Yes	51	1079	420718	5134080	0	0	0
ARCH62	No	18	2886	411735	5134229	5	0	-5
ARCH64	Yes	84	504	425154	5132657	7	7	0
ARCH66	No	120	2970	431631	5132346	0	0	0
ARCH68	No	18	5373	410162	5132295	0	0	0
ARCH69	No	18	5673	409972	5132060	0	0	0
ARCH70	Yes	113	3531	429825	5130862	0	0	0
ARCH72	Yes	18	5921	412251	5130545	0	0	0
ARCH73	Yes	46	4948	415645	5130338	0	0	0
ARCH74	Yes	113	4079	428480	5130176	0	0	0
ARCH75	Yes	113	4374	429070	5129877	0	0	0
ARCH76a	Yes	79	3594	425726	5129279	0	0	0
ARCH76b	Yes	79	3640	425766	5129255	0	0	0
ARCH76c	Yes	79	3572	425673	5129258	0	0	0
ARCH77a	No	79	3372	425349	5129233	0	0	0
ARCH77b	No	79	3348	425314	5129234	0	0	0
ARCH77c	No	79	3403	425393	5129229	0	0	0
ARCH77d	No	79	3443	425391	5129175	0	0	0
ARCH79a	Yes	79	2455	422894	5129362	0	0	0
ARCH79b	Yes	79	2502	422880	5129316	0	0	0
ARCH79c	Yes	79	2332	422886	5129487	0	0	0

Receiver ID	Participating Landowner?	Nearest Turbine Number	Distance to Nearest Turbine (meters)	Receptor Coordinates (UTM Zone 14, NAD 83)		May 1, 2019 Shadow Flicker Assessment (hours/year)	Updated Shadow Flicker (hours/year) ¹	Change in Shadow Flicker (hours/year)
				Easting (m)	Northing (m)			
ARCH80	No	46	5017	418813	5129471	0	0	0
ARCH81	No	46	5248	416269	5129655	0	0	0
ARCH83	Yes	79	3298	424451	5128764	0	0	0
ARCH84	No	18	4982	411554	5131800	0	0	0
ARCH107	No	18	6197	407590	5136204	0	0	0
ARCH108	No	12	17,084	410981	5142552	0	0	0
ARCH111a	No	42	3248	422531	5143856	0	0	0
ARCH111b	No	42	3236	422512	5143854	0	0	0
ARCH111c	No	42	3243	422510	5143865	0	0	0
ARCH111d	No	42	3280	422528	5143898	0	0	0
ARCH112	No	67	3616	423893	5143839	0	0	0
ARCH115	Yes	67	3101	424647	5143854	0	0	0
ARCH117	Yes	67	2931	426457	5144375	0	0	0
ARCH119	No	72	2946	427937	5144695	0	0	0
ARCH120a	No	72	2642	429651	5144397	0	0	0
ARCH120b	No	72	2744	429656	5144503	0	0	0
ARCH120c	No	72	2794	429659	5144554	0	0	0
ARCH121a	No	72	2615	430675	5143737	0	0	0
ARCH121b	No	72	2637	430715	5143728	0	0	0
ARCH122	No	72	2579	430727	5143631	0	0	0
ARCH123	Yes	79	3065	424917	5129298	0	0	0
ARCH126	Yes	18	6301	412953	5130014	0	0	0

¹ Shadow flicker at or over 30 hours per year in bold.

Attachment 8. Predicted Shadow Flicker at Receptors

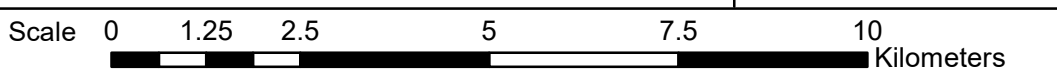
Total Shadow Flicker Time (expected)	May 1, 2019 Shadow Flicker Assessment (number of receptors)	Updated Shadow Flicker (number of receptors)
Total	95	95
= 0 Hours	64	71
> 0 Hours < 10 Hours	9	7
> 10 Hours < 20 Hours	11	8
> 20 Hours < 30 Hours	7	5
> 30 Hours	4	4

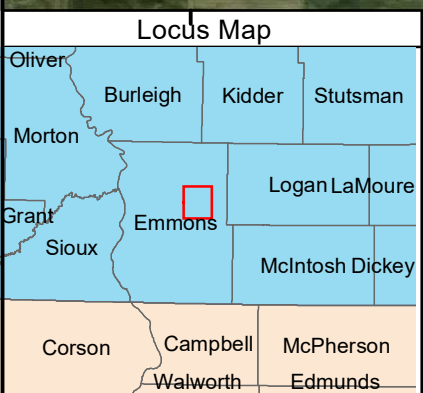
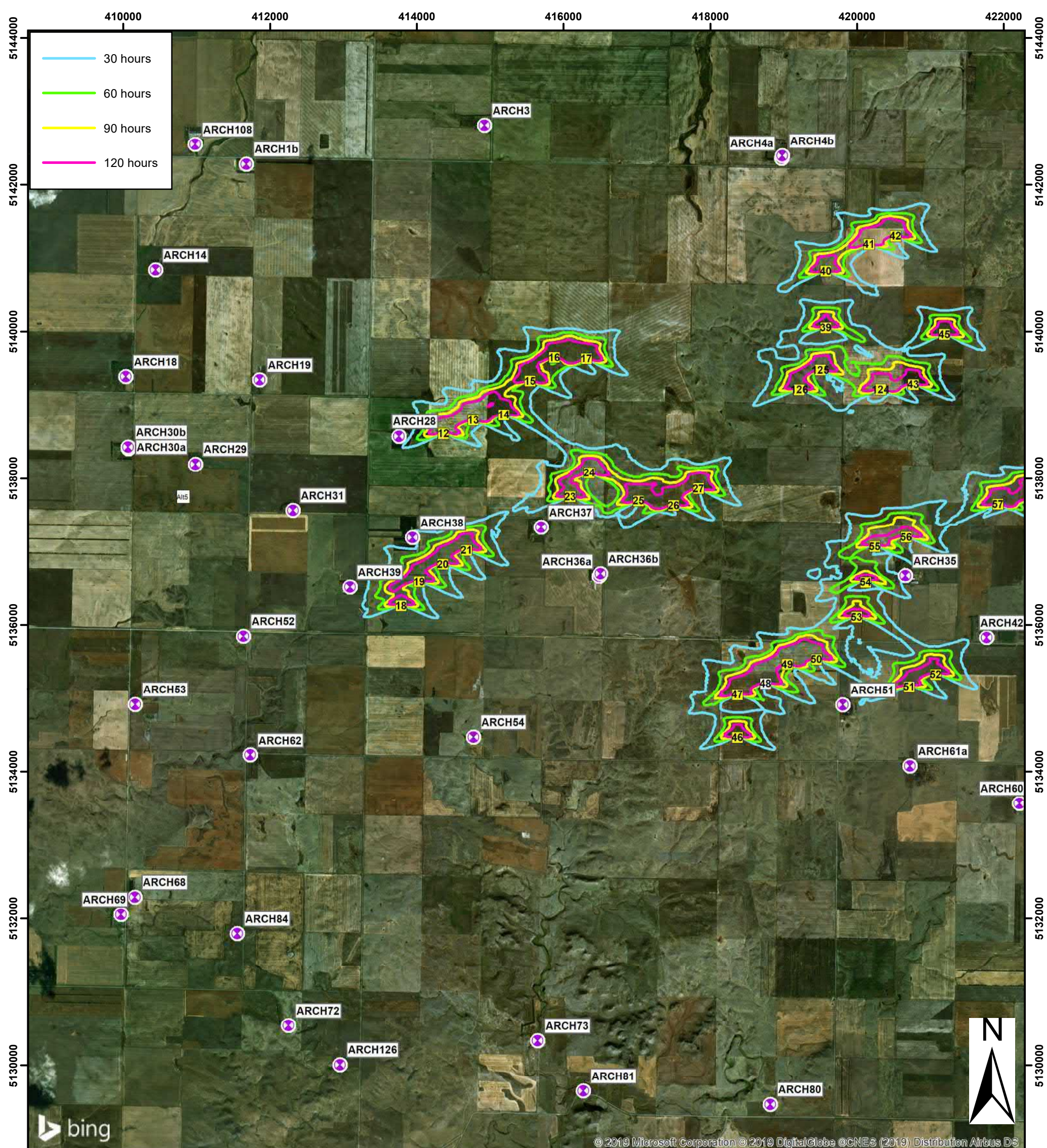


- GE 1.715 MW 103RD 80HH
- GE 2.72 MW 116RD 80HH
- GE 2.72 MW 116RD 80HH, LNTE
- GE 2.72 MW 116RD 90HH
- ✕ Occupied / Possibly Occupied Receptor

Emmons-Logan Wind Energy Center Emmons and Logan Counties, ND

Attachment 9 Predicted Shadow Flicker Map





- GE 1.715 MW 103RD 80HH
- GE 2.72 MW 116RD 80HH
- GE 2.72 MW 116RD 80HH, LNTE
- GE 2.72 MW 116RD 90HH
- ✕ Occupied / Possibly Occupied Receptor

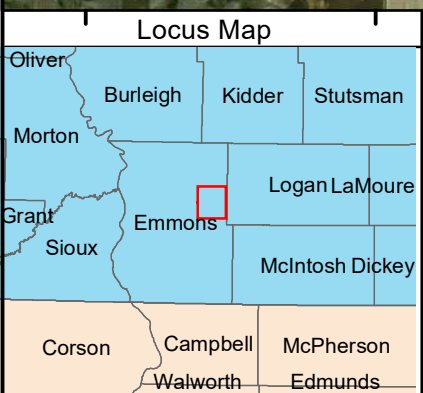
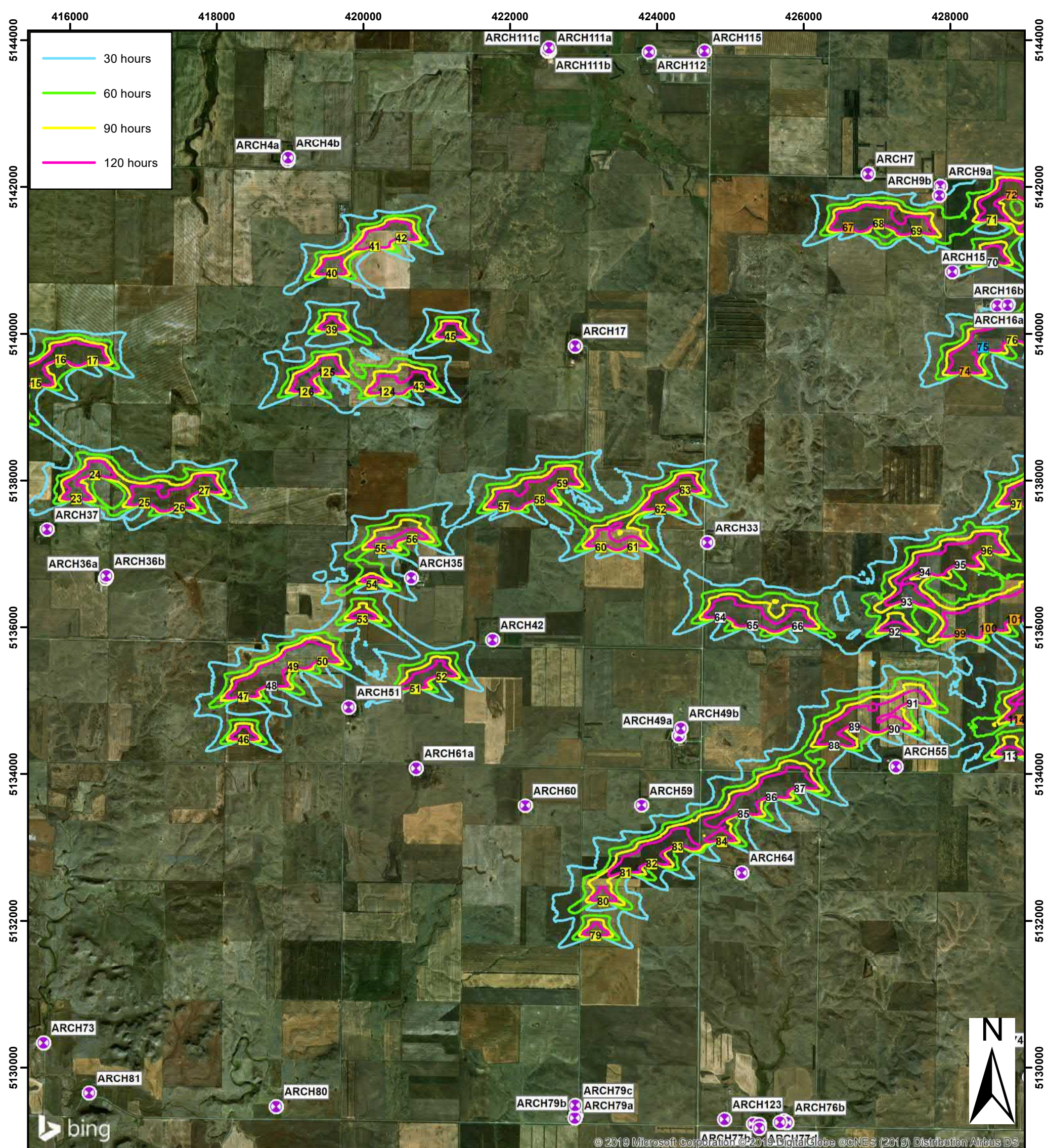
Emmons-Logan Wind Energy Center
Emmons and Logan Counties, ND

Attachment 9a
Predicted Shadow Flicker Map

Scale 0 0.5 1 2 3 4 Kilometers



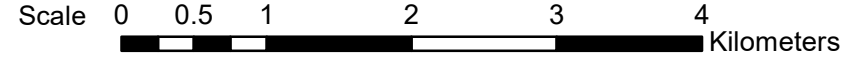
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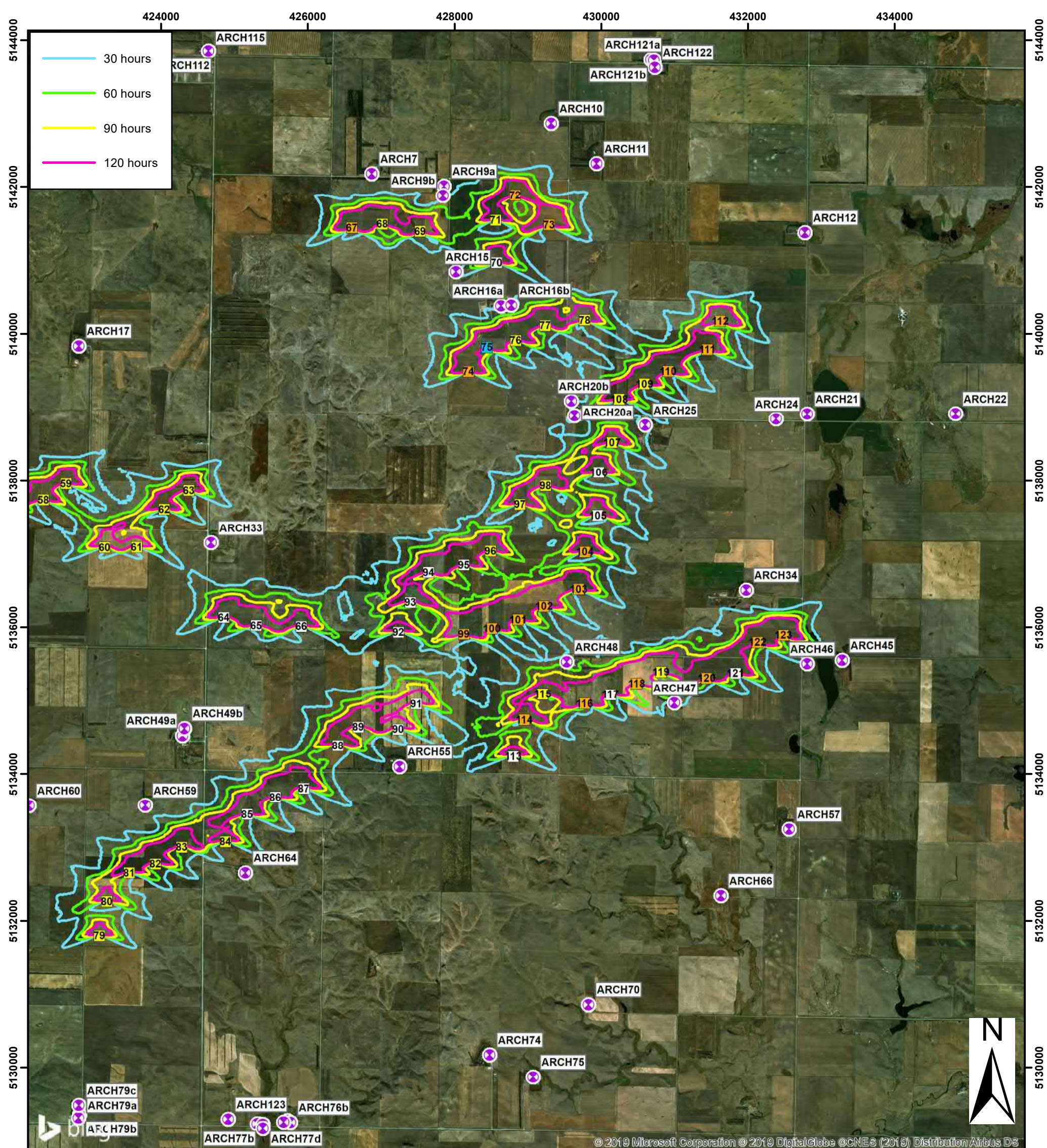
- GE 1.715 MW 103RD 80HH
- GE 2.72 MW 116RD 80HH
- GE 2.72 MW 116RD 80HH, LNTE
- GE 2.72 MW 116RD 90HH
- ✕ Occupied / Possibly Occupied Receptor

Emmons-Logan Wind Energy Center
Emmons and Logan Counties, ND

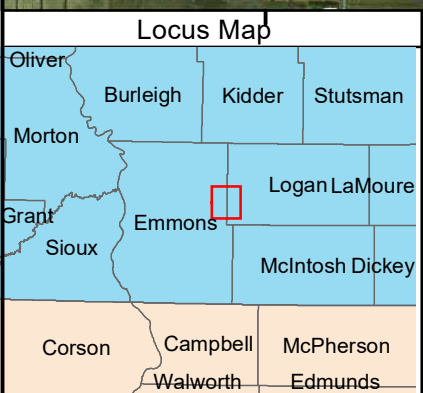
Attachment 9b
Predicted Shadow Flicker Map



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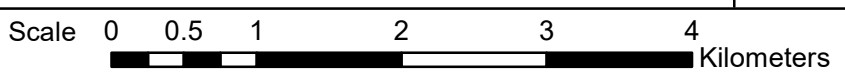
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- GE 1.715 MW 103RD 80HH
- GE 2.72 MW 116RD 80HH
- GE 2.72 MW 116RD 80HH, LNTE
- GE 2.72 MW 116RD 90HH
- ✕ Occupied / Possibly Occupied Receptor

Emmons-Logan Wind Energy Center Emmons and Logan Counties, ND

Attachment 9c Predicted Shadow Flicker Map



Attachment 10. Electronic submittal of GIS shapefiles

[Submitted via physical media]