Appendix G – 2021-2022 Large Bird Use Survey

BURNS McDONNELL

South Deuel Wind 2021-2022 Large Bird Use Survey

July 2021-June 2022

DEUEL HARVEST WIND ENERGY SOUTH LLC

South Deuel Wind

5/24/2024

South Deuel Wind 2021-2022 Large Bird Use Survey

prepared for

DEUEL HARVEST WIND ENERGY SOUTH LLC
South Deuel Wind

Deuel County, South Dakota

5/24/2024

prepared by

Burns & McDonnell
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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
2021-2022 Survey	July 2021 and June 2022 Survey
BGEPA	Bald and Golden Eagle Protection Act
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
ECPG	Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Version 2
ESA	Endangered Species Act
MBTA	Migratory Bird Treaty Act
MET	Meteorological
MW	Megawatt
Project	South Deuel Wind
Project Area	Project location and components as described
RSH	Rotor-swept height
SDGFP	South Dakota Game, Fish and Parks
SGCN	South Dakota Game, Fish and Parks Species of Greatest Conservation Need
USFWS	U.S. Fish & Wildlife Service
Year 1 Survey	April 2016 to March 2017 Survey
Year 2 Survey	May 2017 to April 2018 Survey

1.0 INTRODUCTION

Deuel Harvest Wind Energy South LLC (South Deuel Wind) plans to construct the South Deuel Wind Project (Project) in Deuel County, South Dakota. The Project is located approximately 3 miles south of Clear Lake, South Dakota (Project Area) (Figure 1-1).

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) conducted the large bird use surveys described in this report. The methods for this survey are consistent with the U.S. Fish and Wildlife Service (USFWS) *Land-based Wind Energy Guidelines* (USFWS 2012), *Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Version 2* (ECPG) (USFWS 2013), and *Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests* (USFWS 2016).

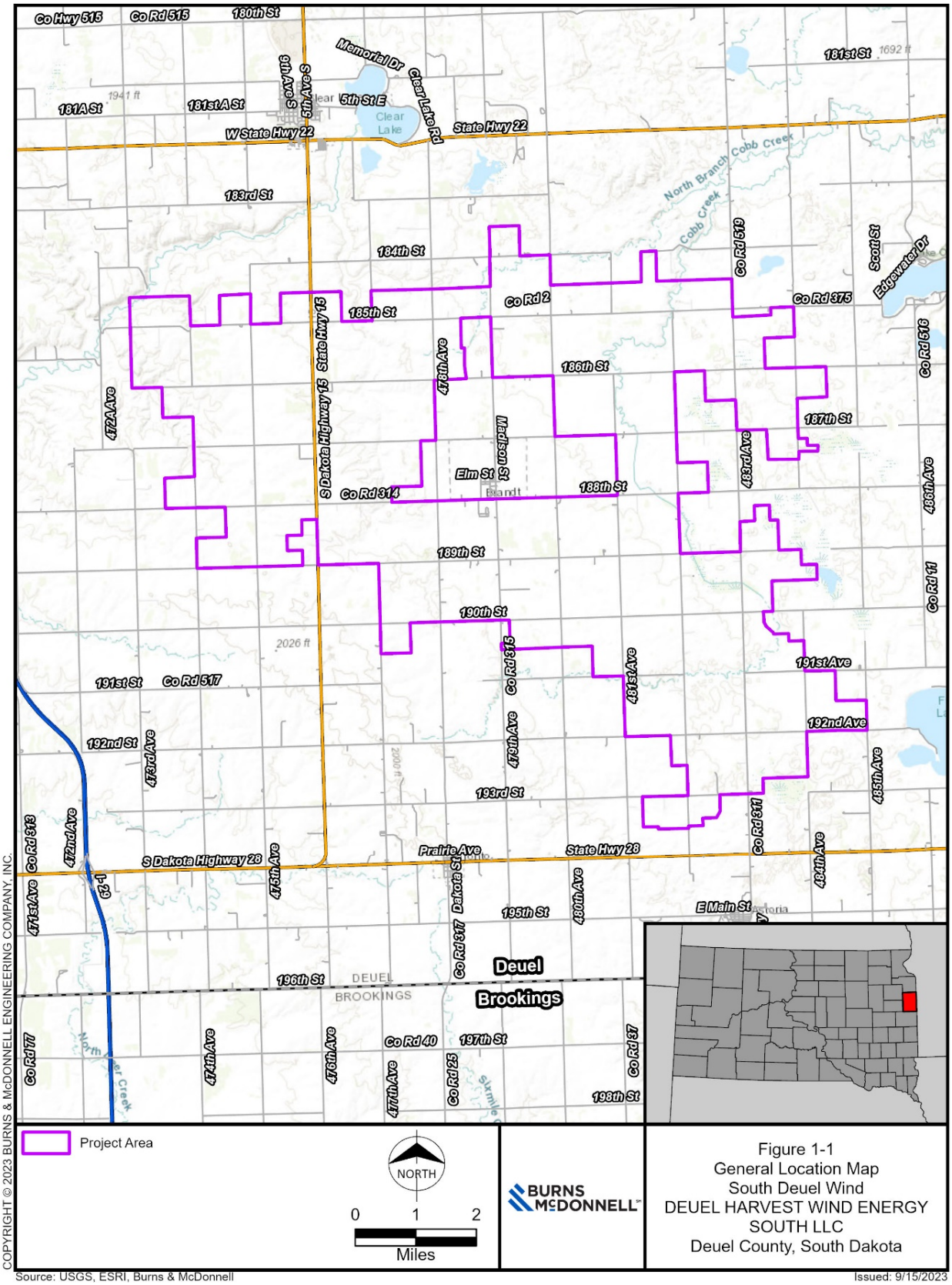
Survey objectives were to assess species composition and temporal and spatial use of large birds, including eagles, in the Project Area (Figure 1-1). Additional objectives were to document use of the Project Area by federally or state-listed threatened, endangered, and sensitive avian species.

1.1 Project Area

The Project includes approximately 34,339 acres in Deuel County, South Dakota (Figure 1-1). The survey area is located within Ecoregion 46k, the Prairie Coteau region of the Northern Glaciated Plains, which spans across the eastern edge of South Dakota (U.S. Environmental Protection Agency 2016). This ecoregion has historically supported both tallgrass and shortgrass prairies. These native grasslands, however, have been predominantly converted to agriculture croplands (Bryce et al. 1996), with soybeans (*Glycine max*) and corn (*Zea mays*) as the dominant crops (Miller 1997).

Several named streams are present within the Project Area, including portions of Bullhead Run, Cobb Creek, Hidewood Creek, and North Branch Cobb Creek. One small unnamed lake is found along the northcentral boundary of the Project Area. The topography is generally flat to gently rolling.

Figure 1-1 Project General Location Map



2.0 METHODS

2.1 Survey Methods

Burns & McDonnell biologists conducted 12 large bird use surveys, one each month for one year. Each survey consisted of 31 plots (Figure 2-1) surveyed from the middle of the plot for one hour once per month between July 2021 and June 2022 (2021-2022 Survey) (Table 2-1).

Table 2-1 Monthly 2021-2022 Large Bird Use Surveys Conducted for South Deuel Wind

Sample Event	Month	Total Hours of Large Bird Surveys
1	July 2021	31
2	August 2021	31
3	September 2021	31
4	October 2021	31
5	November 2021	31
6	December 2021	31
7	January 2022	31
8	February 2022	31
9	March 2022	31
10	April 2022	31
11	May 2022	31
12	June 2022	31
Total		372

The USFWS guidance recommends that avian point-based surveys cover 30 percent of the proposed Project Area. All plots were located on public roads and were selected to provide at least 30 percent coverage of the Project Area and to document avian use of the full range of potential habitats occurring onsite. The order of plots surveyed was varied for each survey event, but also minimized travel time between survey locations. Seasons were defined as spring (March 1 – May 31), summer (June 1 – August 31), fall (September 1 – November 30), and winter (December 1 – February 28).

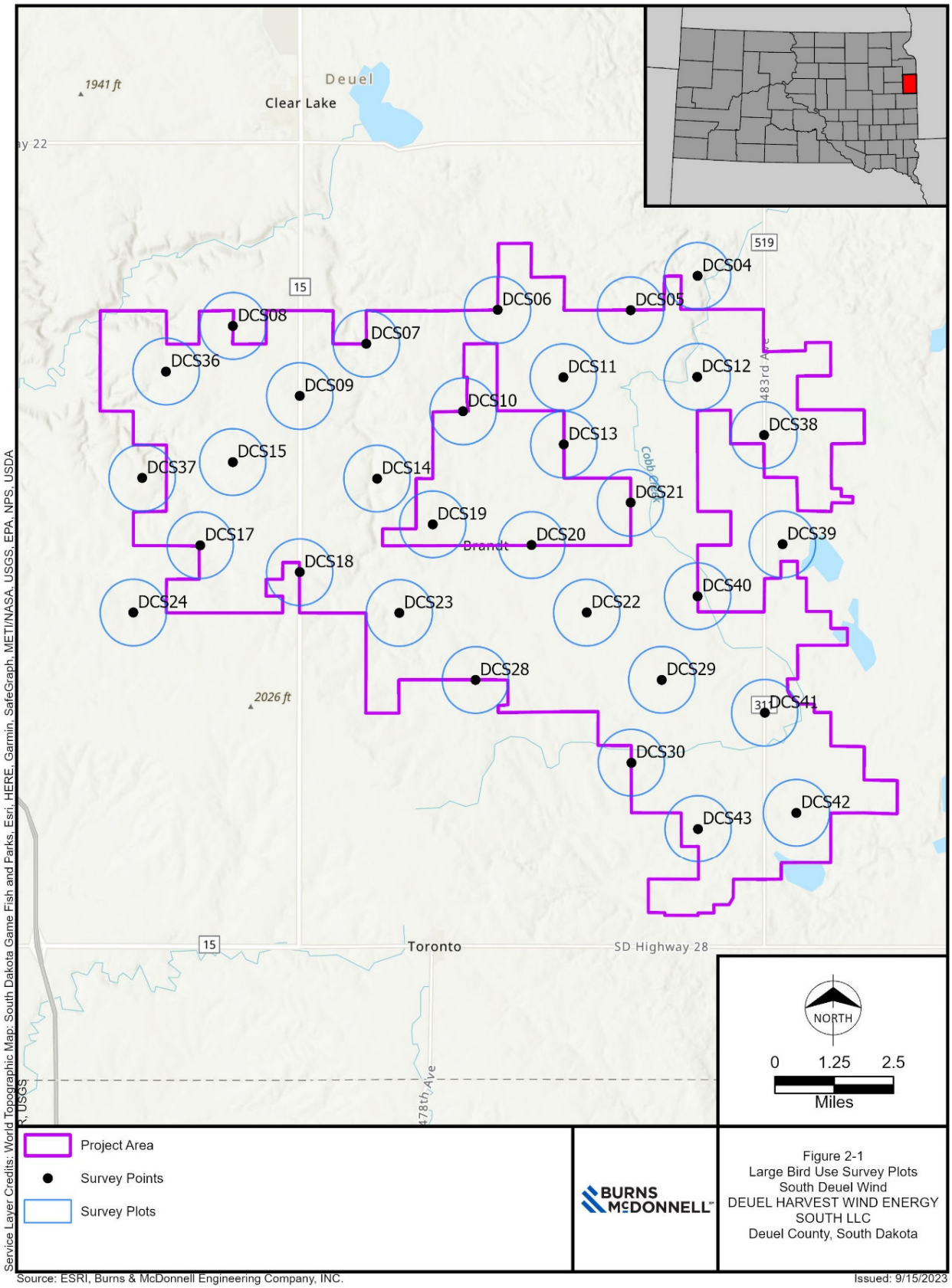
Cylindrical survey plots with an estimated 800-meter radius, and up to 200 meters in height, were established throughout the Project Area. During each survey, information on large birds (i.e., approximately greater than the size of an American crow [*Corvus brachyrhynchos*]) flying within the survey plot was recorded on paper datasheets. Information recorded during each large bird use survey included date, start and end time for each survey location, and weather conditions (temperature, wind speed, precipitation, and estimated cloud cover). Data recorded for each large bird observation included

species (or lowest identifiable taxonomic unit), number of individuals (if more than one), distance from the observer when first observed, distance from the observer when last observed, minimum and maximum flight height, and approximated flight path.

Bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) observations were recorded at one-minute intervals only while an individual was flying, documenting when an eagle was within the 800-meter plot and at or below 200 meters above ground level, per the ECPG (i.e., eagle minutes). Perched eagles or incidental observations are not counted as eagle minutes. Other data recorded for each eagle observation included species, distance from the observer when first observed, distance from the observer when last observed, minimum and maximum flight height, and approximated flight path. Eagles observed outside the survey plot were included as incidental observations.

Incidental observations were recorded when large birds were noted while the observer was driving between plots, or when large birds were noted outside the survey plot. Incidental observations focused on sensitive species. Sensitive species included species protected or listed under the Endangered Species Act (ESA), Bald and Golden Eagle Protection Act (BGEPA), or as South Dakota Game, Fish and Parks (SDGFP) Species of Greatest Conservation Need (SGCN) (SDGFP 2014), as well as candidate species however candidate species are not protected under the ESA.

Figure 2-1 2021-2022 Large Bird Use Survey Plots for South Deuel Wind



2.2 Data Analysis

Analysis was conducted on data collected during the one-hour surveys of established survey plots. Incidental observations were not included in these analyses but are further discussed in Section 3.7.

2.2.1 Species Composition, Relative Abundance, and Diversity

Species composition information was compiled as tables of avian species and types. Information on relative abundance (number of observations for each species/type) and diversity (total number of species) was also assessed for data collected during the surveys. These results can be found in Section 3.1.

2.2.2 Bird Use, Percent of Use, and Frequency of Occurrence

Bird use (number of birds per hour of survey) was calculated for each species and bird type overall and by season. Percent of use was calculated as the percent of bird use attributable to a particular species or bird type. Frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. These results can be found in Section 3.2.

2.2.3 Flight Height Characteristics

Flight height data recorded for each observation were categorized relative to an estimated rotor-swept height (RSH) of 25 – 150 meters. The three designated height categories were below the RSH at 0 – 24 meters, in the RSH at 25 – 150 meters, and above the RSH at 151 meters or higher. These results can be found in Section 3.3.

2.2.4 Spatial Use

Bird use among the survey plots was analyzed for each bird type to assess spatial use of the Project Area by various bird types. These results can be found in Section 3.4.

2.2.5 Eagle Minutes

Eagle minutes, defined as the number of minutes eagles were observed in flight within the three-dimensional survey plot up to 200 meters in height, were compiled and mapped to show eagle use of the Project Area among plots, seasons, and months, in accordance with the ECPG. Perched eagles or incidental eagle observations are not counted as eagle minutes. These results can be found in Section 3.5.

2.2.6 Yearly Comparison

Burns & McDonnell completed large bird surveys for South Deuel Wind from April 2016 to March 2017 [Year 1 Survey] (WEST 2017), and again from May 2017 to April 2018 [Year 2 Survey] (Burns & McDonnell 2023). A total of 40 survey plots were used for both surveys. Prior to the beginning of the

survey in July 2021, nine points were removed due to changes to reflect the Project Area, leaving 31 survey plots across the 2021-2022 Survey. Comparisons between the three surveys are in the Discussion.

3.0 RESULTS

3.1 Large Bird Species Composition, Relative Abundance, and Diversity

During the large bird use surveys, a total of 1,259 large bird observations of 26 species in 369 separate groups (i.e., flocks; Appendix A; Table 3-1) were recorded in the 800-meter radius plots. More birds were generally observed in fall (58.2 percent of observations) than in summer (21.0 percent), winter (1.5 percent), or spring (19.3 percent).

Waterfowl accounted for 51.7 percent of observations (651 observations; Appendix A), with most observations (345) recorded during fall. The most frequently observed waterfowl species was Canada goose (*Branta canadensis*), with 574 observations, which accounted for 88.2 percent of waterfowl observations. Other frequently observed waterfowl species were mallard (*Anas platyrhynchos*; 60 observations) and blue-winged teal (*Anas discors*; 9 observations).

Raptors accounted for 13.5 percent of large bird observations (170 observations; Appendix A). The most common raptor species identified was red-tailed hawk (*Buteo jamaicensis*), with 58 observations. Bald eagles accounted for 20.6 percent of raptor observations (35 observations).

Table 3-1 2021-2022 Large Bird Use Survey Percent of Total Use and Frequency of Occurrence for Each Bird Type Observed by Season During for South Deuel Wind

	Mean Use[a]				Percent of Total Use[b]				Frequency of Occurrence[c]			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterbirds	0.5	0.2	0.5	<0.1	20.6%	8.0%	6.0%	0.0%	3.2%	5.4%	14.0%	0.0%
Waterfowl	1.5	1.8	3.7	<0.1	56.4%	64.0%	47.0%	0.0%	50.5%	11.8%	22.6%	0.0%
Gulls/Terns	<0.1	<0.1	2.6	<0.1	0.8%	0.0%	33.2%	0.0%	3.2%	1.1%	4.3%	0.0%
Raptors	0.4	0.7	0.6	0.2	13.6%	23.5%	7.9%	88.9%	32.3%	49.5%	51.6%	10.8%
Buteos	0.1	0.3	0.3	<0.1	4.9%	10.6%	3.5%	27.8%	14.0%	23.7%	21.5%	0.0%
Harriers	0.1	0.3	0.2	<0.1	4.9%	9.5%	2.5%	5.6%	11.8%	17.2%	17.2%	1.1%
Eagles	<0.1	<0.1	<0.1	0.1	3.7%	3.0%	1.1%	55.6%	6.5%	7.5%	6.5%	8.6%
Owls	<0.1	<0.1	<0.1	<0.1	0.0%	0.4%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%
Falcons	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	5.4%	1.1%
Other Raptors	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	1.1%	0.0%
Vulture	0.2	0.1	0.3	<0.1	8.6%	4.5%	3.3%	0.0%	8.6%	9.7%	8.6%	0.0%
Upland Game Birds	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.5%	11.1%	0.0%	0.0%	3.2%	2.2%
Corvids	<0.1	<0.1	0.2	<0.1	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	5.4%	0.0%
Overall	2.6	2.8	7.8	0.2								

[a]Mean use: the number of individuals observed per hour of survey

[b]Percent of total use: the mean use for each bird type as a percentage of the overall mean use

[c]Frequency of occurrence: the percentage of one-hour surveys when a bird type was observed

3.2 Large Bird Seasonal Use, Percent of Use, and Frequency of Occurrence

Large bird use across the entire survey period was 3.3 observations per hour of survey, with the highest use recorded during fall (7.8), relative to summer (2.8), spring (2.6), and winter (0.2) (Table 3-1; Appendix B).

3.2.1 Waterfowl

Waterfowl use over the survey period averaged 1.8 observations per survey hour, with highest use during the fall (3.7), followed by summer (1.8), spring (1.5), and winter (<0.1). Waterfowl accounted for 64.0 percent of large bird use in summer, 56.4 percent in spring, 47.0 percent in fall, and 0.0 percent in winter. Waterfowl were observed during 50.5 percent of spring, 22.6 percent of fall 11.8 percent of summer, and 0.0 percent of winter surveys (Table 3-1).

3.2.2 Raptors

Raptor use over the survey period averaged 0.5 observations per survey hour, with highest use during the summer (0.7), followed by fall (0.6), spring (0.4), and winter (0.2). Raptor observations accounted for 88.9 percent of large bird use in winter, 23.5 percent in summer, 13.6 percent in spring, and 7.9 percent in fall. Raptors were observed during 51.6 percent of fall, 49.5 percent of summer, 32.3 percent of spring, and 10.8 percent of winter surveys (Table 3-1) (Table 3-1).

Bald eagle use was <0.1 observations per survey hour over the survey period. Eagle use was highest in winter (0.1 observations per survey hour) and lowest in summer, spring, and fall (<0.1). Eagles accounted for 55.6 percent of large e3 use in winter, 3.7 percent of bird use in spring, 3.0 percent of bird use in summer, and 1.1 percent of bird use in fall. Eagles were observed during 8.6 percent of winter surveys, 7.5 percent of summer surveys, 6.5 percent of spring and fall surveys. No golden eagles were observed during this survey.

3.3 Flight Height Characteristics

A total of 185 groups (i.e., flocks) (50.1 percent) of birds were observed flying within the estimated RSH of 25 – 150 meters (Table 3-2). A total of 73 groups of raptors were observed flying within the RSH, representing 45.1 percent of raptor observations. Buteos were the raptor type most frequently observed within the RSH (39 groups; 60.9 percent of buteo observations), followed by eagles (24 groups; 68.6 percent of eagle observations). In the first year large bird survey, 31.8 percent of observations were within the RSH, with 17.8 percent of raptor observations within the RSH, and in the second year survey, 49.4 percent of birds were observed flying within the estimated RSH.

Table 3-2 2021-2022 Large Bird Use Survey Flight Height Characteristics for Each Bird Type Observed for South Deuel Wind

	Mean Flight Height (Meters)	Percent of Groups in Flight Categories		
		0-25 Meters	25 - 150 Meters	>150 Meters
Waterbirds	49.6	20.0%	73.3%	6.7%
Waterfowl	32.2	48.8%	46.5%	4.7%
Gulls/Terns	52.8	40.0%	40.0%	20.0%
Raptors	36.2	45.1%	45.1%	9.9%
Buteos	46.9	26.6%	60.9%	12.5%
Harriers	12.9	87.3%	10.9%	1.8%
Eagles	56.3	11.4%	68.6%	20.0%
Owls	5.0	100.0%	0.0%	0.0%
Falcons	26.9	33.3%	66.7%	0.0%
Other Raptors	10.0	100.0%	0.0%	0.0%
Vultures	54.6	10.3%	82.8%	6.9%
Upland Game Birds	3.8	100.0%	0.0%	0.0%
Corvids	24.0	40.0%	60.0%	0.0%
Overall	37.1	42.3%	50.1%	7.6%

3.4 Spatial Use

Across the 31 large bird use survey plots, large bird use (total number of birds observed in a plot divided by the number of survey hours at that plot) ranged from 0.25 to 12.2 observations per hour of survey. Bird use was highest at survey site 9 and was lowest at site 29 (Appendix C, Table C-1).

3.4.1 Waterfowl

Waterfowl were observed at 26 of the 31 survey plots. Waterfowl use ranged from 0 to 11.8 observations per survey hour across the survey plots. Waterfowl use was highest at site 9 (11.8 observations per survey hour), and lowest at sites 10, 18, 29, 36, and 37 (0 individuals observed per hour of survey).

3.4.2 Raptors

Raptors were observed at 30 of the 31 survey plots. Raptor use ranged from 0 to 1.2 observations per survey hour across the survey plots. Raptor use was highest at site 4 (1.2 observations per survey hour), followed by site 40 (1.1 observations per survey hour each). Buteos were observed at 26 plots, with highest use at site 14 (0.6 individuals per hour of survey each). Bald eagles were observed at 16 survey points, with highest use observed at site 21 and site 40 (0.5 individuals per hour of survey). Bald eagles were observed at sites 4, 7, 8, 10, 11, 12, 14, 15, 19, 20, 21, 23, 39, 40, 41, and 42.

3.5 Eagle Minutes

A total of 35 eagles (35 bald eagles and 0 golden eagles) were observed during the 22,320 minutes (372 hours) spent surveying between July 2021 to June 2022 for a collective total of 70 eagle-minutes (Table 3-3; Table 3-4). The number of individual eagles peaked in December 2021 and the number of eagle-minutes peaked in August 2021 (Figure 3-1). Eagles were observed across several survey plots (Figure 3-2).

3.5.1 Eagle Flight Paths

A total of 14 survey plots had eagles flying through them at some point from July 2021 to June 2022 (Figure 3-3). The highest concentration of flights was at sites 21, 39, and 40, which are in the eastern portion of the Project Area.

3.6 Incidental Observations

Four bald eagles were observed, outside of plot 21 in March 2022, perched in plot 17 for the duration of the survey in April 2022, and perched in plot 6 for the duration of the survey in May 2022. These observations have not been included in the eagle minutes data.

Table 3-3 2021-2022 Large Bird Use Survey Eagle Minutes Documented by Season for South Deuel Wind

Season	Eagle Minutes	Survey Effort (hours)	Survey Effort (minutes)	Eagle Minutes per Minute Survey
Spring	13	93	5,580	0.0023
Summer	20	93	5,580	0.0036
Fall	19	93	5,580	0.0034
Winter	18	93	5,580	0.0032
Total	**70**	**458**	**22,320**	**0.0031**

Table 3-4 2021-2022 Large Bird Use Survey Monthly Eagle Observations and Minutes for South Deuel Wind

Month	Eagle Observations	Eagle Minutes
July 2021	0	0
August 2021	6	16
September 2021	5	13
October 2021	3	6
November 2021	0	0
December 2021	7	13
January 2022	1	1
February 2022	2	4
March 2022	2	3
April 2022	4	5
May 2022	3	5
June 2022	2	4
Total	**35**	**70**

Figure 3-1 2021-2022 Large Bird Use Survey Graph of Monthly Eagle Minutes for South Deuel Wind

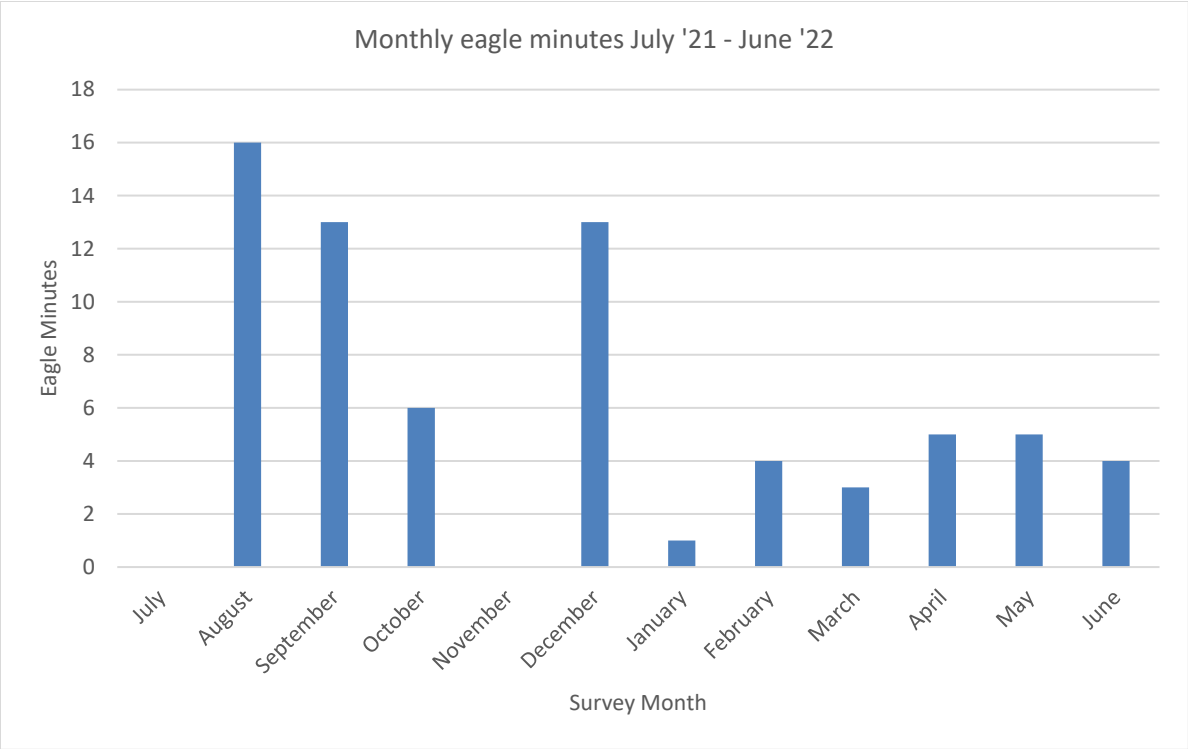


Figure 3-2 2021-2022 Large Bird Use Survey Eagle Minute Map for South Deuel Wind

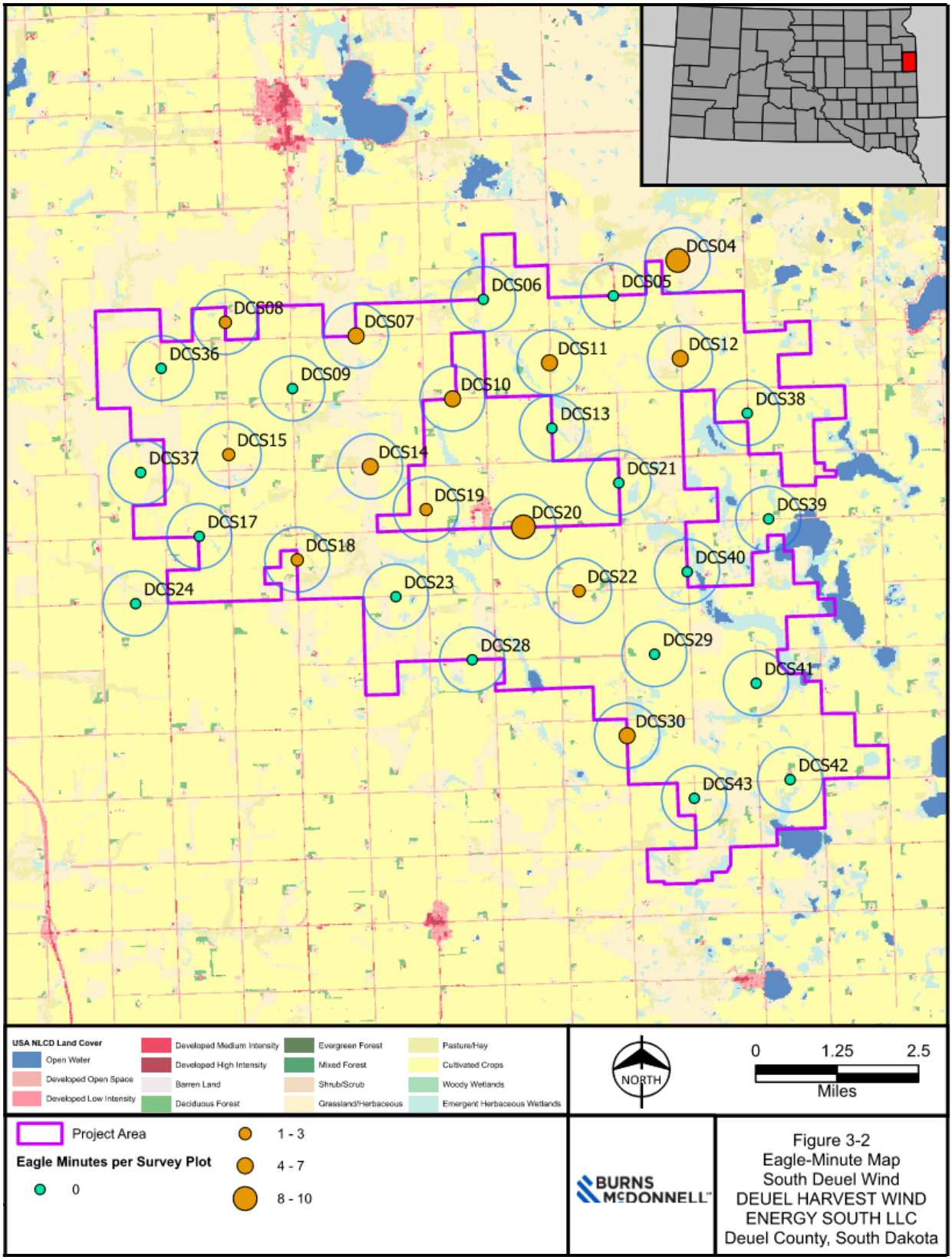
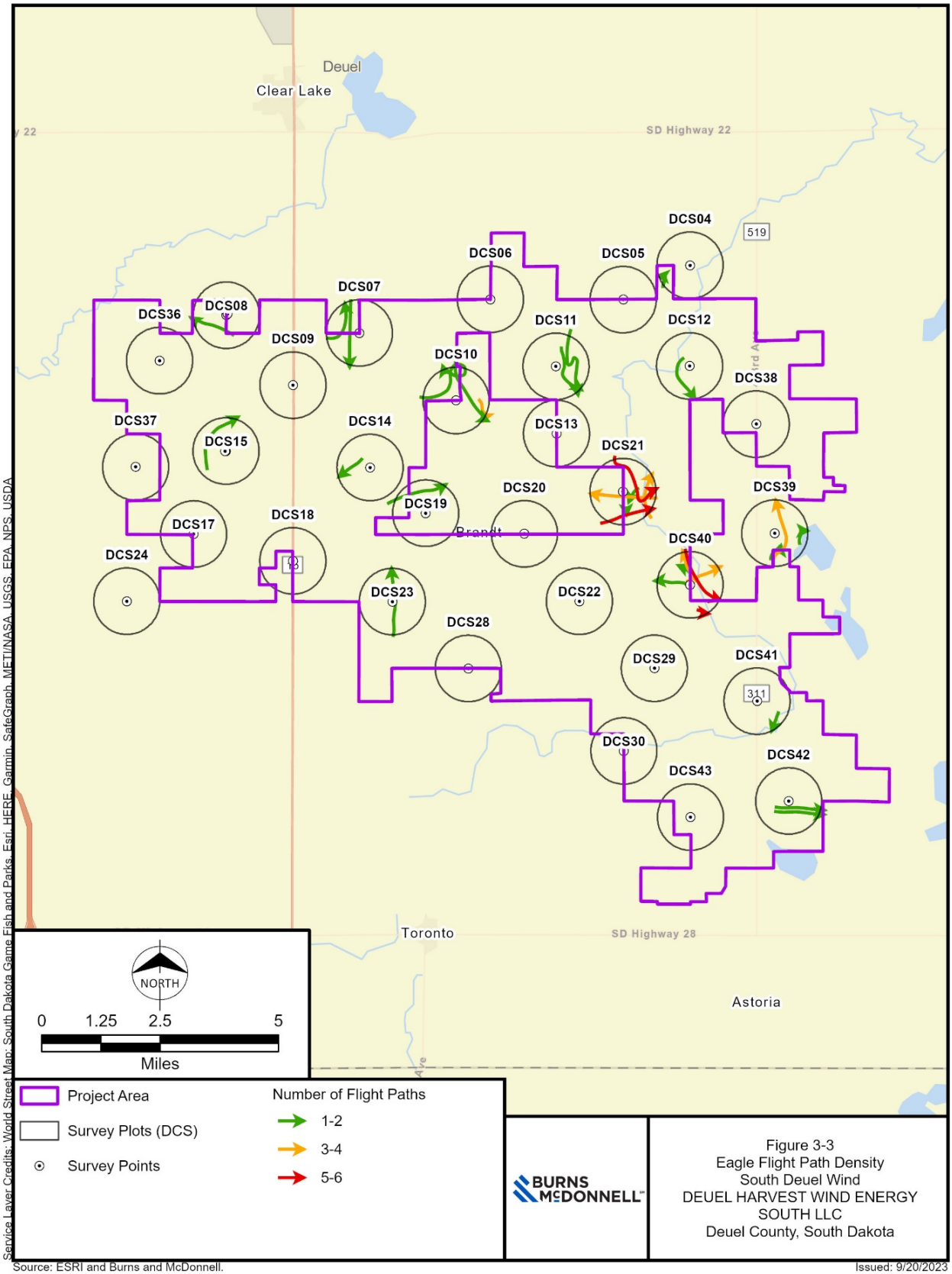


Figure 3-3 Eagle Flight Path Density for South Deuel Wind



3.7 Sensitive Species

No federally threatened or endangered species were observed during the 2021-2022 survey. The American white pelican (*Pelecanus erythrorhynchos*), while not threatened or endangered, is listed as one of South Dakota's Species of Greatest Conservation Need. These were observed mostly in large flocks using ponds as stop-over plots during migration. Bald eagles and golden eagles are protected under the BGEPA. A total of 35 bald eagles and 0 golden eagles were observed during the 2021-2022 Survey.

Table 3-5 2021-2022 Large Bird Use Survey Sensitive Species Observed for South Deuel Wind

Common Name	Scientific Name	Status[a]	Groups Observed	Observations
American white pelican	*Pelecanus erythrorhynchos*	SGCN	10	60
Bald eagle	*Haliaeetus leucocephalus*	BGEPA	35	35

[a]BGEPA: Bald and Golden Eagle Protection Act; SGCN: South Dakota Game, Fish and Parks Species of Greatest Conservation Need

4.0 DISCUSSION

4.1 Yearly Comparison

The data collection methods of the 2021-2022 Survey and Year 2 Survey differed from the methods of the Year 1 Survey. During the Year 1 Survey, all observations were recorded beyond 800 meters and above 200 meters, to account for species composition, diversity, and frequency. Additionally, smaller species such as American crow and rock pigeon (*Columba livia*) were counted as "large birds" during the Year 1 Survey. As a result, more species were observed in the Year 1 Survey (41) than in the Year 2 Survey (24) or 2021-2022 Survey (26).

Large bird use was higher in the Year 1 Survey (33.4 observations per survey hour) than in the Year 2 Survey (4.5 observations per survey hour) or the 2021-2022 Survey (3.3 observations per survey hour), partly because observations were recorded above 200 meters, and due to large numbers of waterfowl observed in the Year 1 Survey. Waterfowl use in the Year 1 Survey was 29.3 observations per survey hour, compared to 3.7 observations per survey hour in the Year 2 Survey, and 11.8 observations per survey hour in the 2021-2022 Survey.

A similar number of raptors were observed in 2021-2022 Survey (170 observations) compared to the Year 1 Survey and Year 2 Survey (200 observations and 195 observations respectively). Species composition of raptors for the 2021-2022 Survey was similar to the other surveys, with red-tailed hawk being the most frequently observed raptor.

Eagle use was the same in the 2021-2022 Survey as in the Year 1 Survey, when less than 0.1 eagle observations were recorded per survey hour. This is less than in the Year 2 Survey, when 0.1 eagle observations per survey hour were recorded. Bald eagle observations in the Year 1 Survey accounted for 6.0 percent of raptor observations (12 observations) and 14.9 percent of raptor observations (29 observations) in the Year 2 Survey. Bald eagles were observed more often in winter for the 2021-2022 Survey (10 observations; 28.5 percent of all eagle observations) than other seasons. Bald eagles were observed least often in fall and summer (8 observations each).

In the 2022-2021 Survey, a similar composition of sensitive species was observed to the two previous surveys: American white pelican, bald eagle. Unlike the previous surveys, no golden eagles were seen during the 2021-2022 Survey.

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APPENDIX A - SPECIES OBSERVED DURING THE 2021-2022 LARGE BIRD USE SURVEYS CONDUCTED AT SOUTH DEUEL WIND

		Spring			Summer			Fall			Winter		
Common Name	**Scientific Name**	**Grps[a]**	**Ind[b]**	**% Ind[c]**	**Grps[a]**	**Ind[b]**	**% Ind[c]**	**Grps[a]**	**Ind[b]**	**% Ind[c]**	**Grps[a]**	**Ind[b]**	**% Ind[c]**
Waterbirds		**10**	**50**	**20.6%**	**11**	**21**	**8.0%**	**9**	**44**	**6.0%**	**0**	**0**	**0.0%**
American white pelican	*Pelecanus erythrorhynchos*	7	47	19.3%	3	13	4.9%	0	0	0.0%	0	0	0.0%
Double-crested cormerant	*Phalacrocorax auritus*	1	1	0.4%	2	2	0.8%	5	32	4.4%	0	0	0.0%
Great blue heron	*Ardea herodias*	2	2	0.8%	6	6	2.3%	2	2	0.3%	0	0	0.0%
White-faced ibis	*Plegadis chihi*	0	0	0.0%	0	0	0.0%	2	10	1.4%	0	0	0.0%
Waterfowl		**70**	**137**	**56.4%**	**11**	**169**	**64.0%**	**46**	**345**	**47.0%**	**0**	**0**	**0.0%**
Blue-winged teal	*Anas discors*	4	7	2.9%	1	1	0.4%	1	1	0.1%	0	0	0.0%
Canada goose	*Branta canadensis*	37	82	33.7%	6	160	60.6%	43	332	45.2%	0	0	0.0%
Gadwall	*Mareca strepera*	0	0	0.0%	0	0	0.0%	1	3	0.4%	0	0	0.0%
Mallard	*Anas platyrhynchos*	28	46	18.9%	2	5	1.9%	1	9	1.2%	0	0	0.0%
Northern shoveler	*Spatula clypeata*	0	0	0.0%	1	1	0.4%	0	0	0.0%	0	0	0.0%
Tundra swan	*Cygnus columbianus*	0	0	0.0%	1	2	0.8%	0	0	0.0%	0	0	0.0%
Wood duck	*Aix sponsa*	1	2	0.8%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Gulls/Terns		**2**	**2**	**0.8%**	**0**	**0**	**0.0%**	**8**	**244**	**33.2%**	**0**	**0**	**0.0%**
Laridae spp.	*Laridae*	0	0	0.0%	0	0	0.0%	4	166	22.6%	0	0	0.0%
Herring gull	*Larus argentatus*	0	0	0.0%	0	0	0.0%	2	2	0.3%	0	0	0.0%
Ring-billed gull	*Larus delawarensis*	2	2	0.8%	0	0	0.0%	2	75	10.2%	0	0	0.0%
Raptors		**31**	**33**	**13.6%**	**60**	**62**	**23.5%**	**56**	**58**	**7.9%**	**15**	**17**	**89.5%**
Buteos		**10**	**12**	**4.9%**	**27**	**28**	**10.6%**	**24**	**26**	**3.5%**	**3**	**5**	**26.3%**
Red-tailed hawk	*Buteo jamaicensis*	10	12	4.9%	21	21	8.0%	23	25	3.4%	0	0	0.0%
Rough-legged hawk	*Buteo lagopus*	0	0	0.0%	0	0	0.0%	0	0	0.0%	3	5	26.3%
Swainson's hawk	*Buteo swainsoni*	0	0	0.0%	6	7	2.7%	1	1	0.1%	0	0	0.0%
Northern harrier		**12**	**12**	**4.9%**	**24**	**25**	**9.5%**	**18**	**18**	**2.5%**	**1**	**1**	**5.3%**
Northern harrier	*Circus cyaneus*	12	12	4.9%	24	25	9.5%	18	18	2.5%	1	1	5.3%
Eagles		**9**	**9**	**3.7%**	**8**	**8**	**3.0%**	**8**	**8**	**1.1%**	**10**	**10**	**52.6%**
Bald eagle	*Haliaeetus leucocephalus*	9	9	3.7%	8	8	3.0%	8	8	1.1%	10	10	52.6%
Owls		**0**	**0**	**0.0%**	**1**	**1**	**0.4%**	**0**	**0**	**0.0%**	**0**	**0**	**0.0%**
Great-horned owl	*Bubo virginianus*	0	0	0.0%	1	1	0.4%	0	0	0.0%	0	0	0.0%
Falcons		**0**	**0**	**0.0%**	**0**	**0**	**0.0%**	**5**	**5**	**0.7%**	**1**	**1**	**5.3%**
American kestrel	*Falco sparverius*	0	0	0.0%	0	0	0.0%	5	5	0.7%	0	0	0.0%
Prairie falcon	*Falco mexicanus*	0	0	0.0%	0	0	0.0%	0	0	0.0%	1	1	5.3%
Other Raptors		**0**	**0**	**0.0%**	**0**	**0**	**0.0%**	**1**	**1**	**0.1%**	**0**	**0**	**0.0%**

		Spring			Summer			Fall			Winter		
Common Name	**Scientific Name**	**Grps[a]**	**Ind[b]**	**% Ind[c]**	**Grps[a]**	**Ind[b]**	**% Ind[c]**	**Grps[a]**	**Ind[b]**	**% Ind[c]**	**Grps[a]**	**Ind[b]**	**% Ind[c]**
Hawk Spp.	*Accipitridae*	0	0	0.0%	0	0	0.0%	1	1	0.1%	0	0	0.0%
Vulture		**8**	**21**	**8.6%**	**10**	**12**	**4.5%**	**11**	**24**	**3.3%**	**0**	**0**	**0.0%**
Turkey vulture	*Cathartes aura*	8	21	8.6%	10	12	4.5%	11	24	3.3%	0	0	0.0%
Upland Game Birds		**0**	**0**	**0.0%**	**0**	**0**	**0.0%**	**4**	**4**	**0.5%**	**2**	**2**	**10.5%**
Ring-necked pheasant	*Phasianus colchicus*	0	0	0.0%	0	0	0.0%	4	4	0.5%	2	2	10.5%
Corvids		**0**	**0**	**0.0%**	**0**	**0**	**0.0%**	**5**	**15**	**2.0%**	**0**	**0**	**0.0%**
American crow	*Corvus brachyrhynchos*	0	0	0.0%	0	0	0.0%	5	15	2.0%	0	0	0.0%
		121	**243**	**100%**	**92**	**264**	**100%**	**139**	**734**	**100%**	**17**	**19**	**100%**

[a]Number of groups observed for each bird type by season

[b]Number of idividuals observed for each bird type by season

[c]Percentage of total individuals observed for the season

APPENDIX B - MEAN USE, PERCENT OF USE, AND FREQUENCY OF OCCURRENCE FOR EACH BIRD TYPE AND SPECIES OBSERVED DURING THE 2021-2022 LARGE BIRD USE SURVEYS FOR SOUTH DEUEL WIND

Appendix B: Mean Use, Percent of Use, and Frequency of Occurrence for Each Bird Type and Species Observed During the 2021-2022 Large Bird Use Surveys for South Deuel Wind

	Mean use[a]					Percent of total use[b]				Frequency of Occurrence[c]			
	Study Period	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterbirds	**0.3**	**0.5**	**0.2**	**0.5**	**<0.1**	**20.6%**	**8.0%**	**6.0%**	**0.0%**	**3.2%**	**5.4%**	**14.0%**	**0.0%**
American white pelican	0.2	0.5	0.1	<0.1	<0.1	19.3%	4.9%	0.0%	0.0%	0.0%	0.0%	5.4%	0.0%
Double-crested cormerant	<0.1	<0.1	<0.1	0.3	<0.1	0.4%	0.8%	4.4%	0.0%	1.1%	2.2%	4.3%	0.0%
Great blue heron	<0.1	<0.1	<0.1	<0.1	<0.1	0.8%	2.3%	0.3%	0.0%	2.2%	3.2%	2.2%	0.0%
White-faced ibis	<0.1	<0.1	<0.1	0.1	<0.1	0.0%	0.0%	1.4%	0.0%	0.0%	0.0%	2.2%	0.0%
Waterfowl	**1.8**	**1.5**	**1.8**	**3.7**	**<0.1**	**56.4%**	**64.0%**	**47.0%**	**0.0%**	**50.5%**	**11.8%**	**22.6%**	**0.0%**
Blue-winged teal	<0.1	<0.1	<0.1	<0.1	<0.1	2.9%	0.4%	0.1%	0.0%	2.2%	1.1%	1.1%	0.0%
Canada goose	1.5	0.9	1.7	3.6	<0.1	33.7%	60.6%	45.2%	0.0%	25.8%	6.5%	19.4%	0.0%
Gadwall	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	1.1%	0.0%
Mallard	0.2	0.5	<0.1	<0.1	<0.1	18.9%	1.9%	1.2%	0.0%	21.5%	2.2%	1.1%	0.0%
Northern shoveler	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.4%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%
Tundra swan	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.8%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%
Wood duck	<0.1	<0.1	<0.1	<0.1	<0.1	0.8%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%
Gulls/Terns	**0.7**	**<0.1**	**<0.1**	**2.6**	**<0.1**	**0.8%**	**0.0%**	**33.2%**	**0.0%**	**3.2%**	**1.1%**	**4.3%**	**0.0%**
Gull Spp.	0.4	<0.1	<0.1	1.8	<0.1	0.0%	0.0%	22.6%	0.0%	0.0%	0.0%	4.3%	0.0%
Herring gull	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.3%	0.0%	1.1%	0.0%	0.0%	0.0%
Ring-billed gull	0.2	<0.1	<0.1	0.8	<0.1	0.8%	0.0%	10.2%	0.0%	2.2%	1.1%	0.0%	0.0%
Raptors	**0.5**	**0.4**	**0.7**	**0.6**	**0.2**	**13.6%**	**23.5%**	**7.9%**	**88.9%**	**32.3%**	**49.5%**	**51.6%**	**10.8%**
Buteos	**0.2**	**0.1**	**0.3**	**0.3**	**<0.1**	**4.9%**	**10.6%**	**3.5%**	**27.8%**	**14.0%**	**23.7%**	**21.5%**	**0.0%**
Red-tailed hawk	0.2	0.1	0.2	0.3	<0.1	4.9%	8.0%	3.4%	0.0%	10.8%	18.3%	20.4%	0.0%
Rough-legged hawk	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.0%	27.8%	3.2%	0.0%	0.0%	0.0%
Swainson's hawk	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	2.7%	0.1%	0.0%	0.0%	5.4%	1.1%	0.0%
Northern harrier	**0.2**	**0.1**	**0.3**	**0.2**	**<0.1**	**4.9%**	**9.5%**	**2.5%**	**5.6%**	**11.8%**	**17.2%**	**17.2%**	**1.1%**
Northern harrier	0.2	0.1	0.3	0.2	<0.1	4.9%	9.5%	2.5%	5.6%	11.8%	17.2%	17.2%	1.1%
Eagles	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.1**	**3.7%**	**3.0%**	**1.1%**	**55.6%**	**6.5%**	**7.5%**	**6.5%**	**8.6%**
Bald eagle	<0.1	<0.1	<0.1	<0.1	0.1	3.7%	3.0%	1.1%	55.6%	6.5%	7.5%	6.5%	8.6%
Owls	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.0%**	**0.4%**	**0.0%**	**0.0%**	**0.0%**	**1.1%**	**0.0%**	**0.0%**
Great-horned owl	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.4%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%
Falcons	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.0%**	**0.0%**	**0.7%**	**0.0%**	**0.0%**	**0.0%**	**5.4%**	**1.1%**
American kestrel	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	5.4%	0.0%
Prairie falcon	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.0%	5.6%	0.0%	0.0%	0.0%	1.1%

Appendix B: Mean Use, Percent of Use, and Frequency of Occurrence for Each Bird Type and Species Observed During the 2021-2022 Large Bird Use Surveys for South Deuel Wind

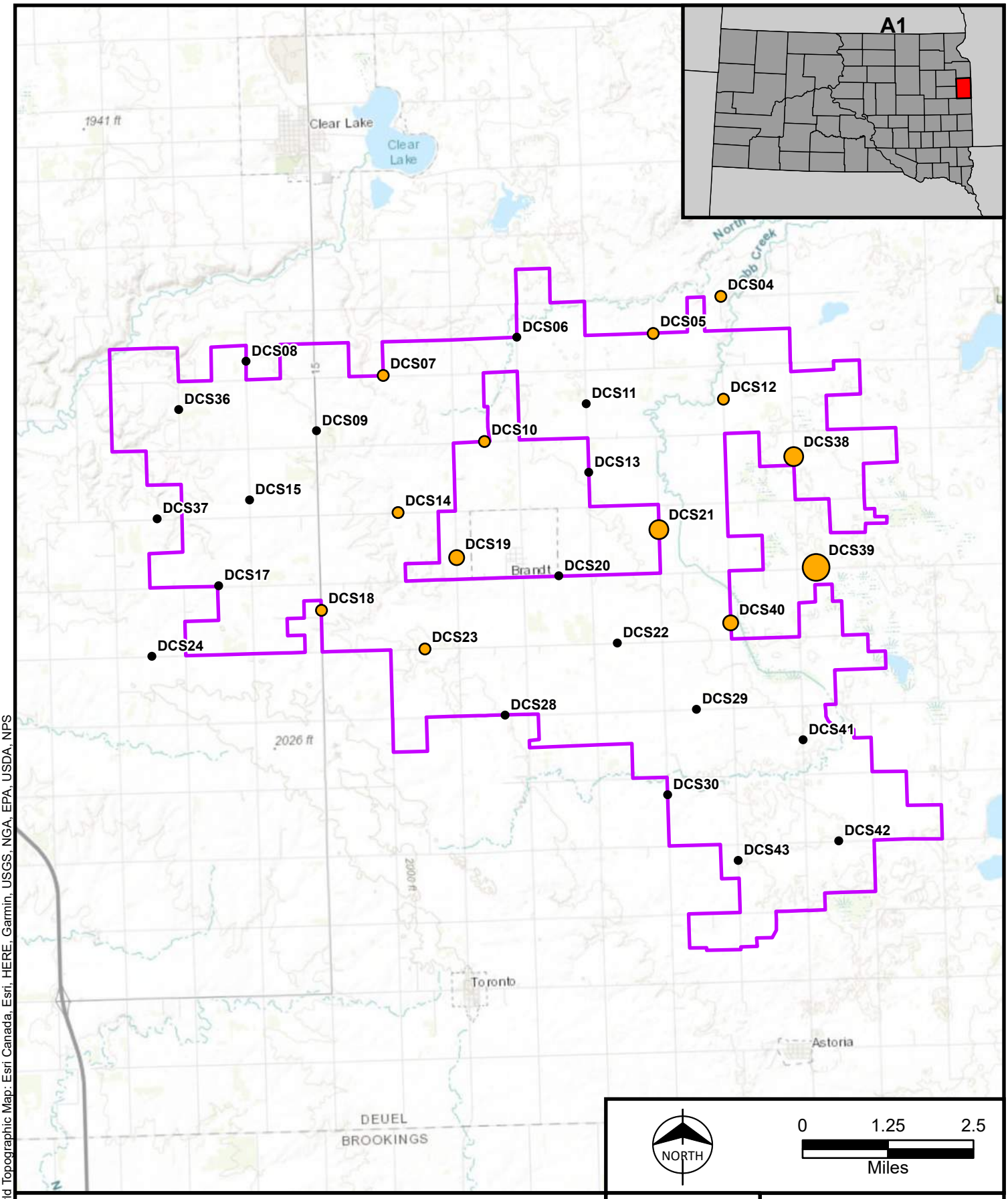
	Mean use[a]					Percent of total use[b]				Frequency of Occurrence[c]			
	Study Period	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Other Raptors	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.0%**	**0.0%**	**0.1%**	**0.0%**	**0.0%**	**0.0%**	**1.1%**	**0.0%**
Hawk Spp.	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	1.1%	0.0%
Vulture	**0.2**	**0.2**	**0.1**	**0.3**	**<0.1**	**8.6%**	**4.5%**	**3.3%**	**0.0%**	**8.6%**	**9.7%**	**8.6%**	**0.0%**
Turkey vulture	0.2	0.2	0.1	0.3	<0.1	8.6%	4.5%	3.3%	0.0%	8.6%	9.7%	8.6%	0.0%
Upland Game Birds	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.0%**	**0.0%**	**0.5%**	**11.1%**	**0.0%**	**0.0%**	**3.2%**	**2.2%**
Ring-necked pheasant	<0.1	<0.1	<0.1	<0.1	<0.1	0.0%	0.0%	0.5%	11.1%	0.0%	0.0%	3.2%	2.2%
Corvids	**<0.1**	**<0.1**	**<0.1**	**0.2**	**<0.1**	**0.0%**	**0.0%**	**2.0%**	**0.0%**	**0.0%**	**0.0%**	**5.4%**	**0.0%**
American crow	<0.1	<0.1	<0.1	0.2	<0.1	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	5.4%	0.0%
Overall	**3.3**	**2.6**	**2.8**	**7.8**	**0.2**								

[a]Mean use: the number of individuals observed per hour of survey

[b]Percent of total use: the mean use for each bird type as a percentage of the overall mean use

[c]Frequency of occurrence: the percentage of one-hour surveys when a bird type was observed

APPENDIX C - LARGE BIRD USE BY PLOT FOR EACH BIRD TYPE DURING THE 2021-2022 LARGE BIRD USE SURVEYS FOR SOUTH DEUEL WIND



Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

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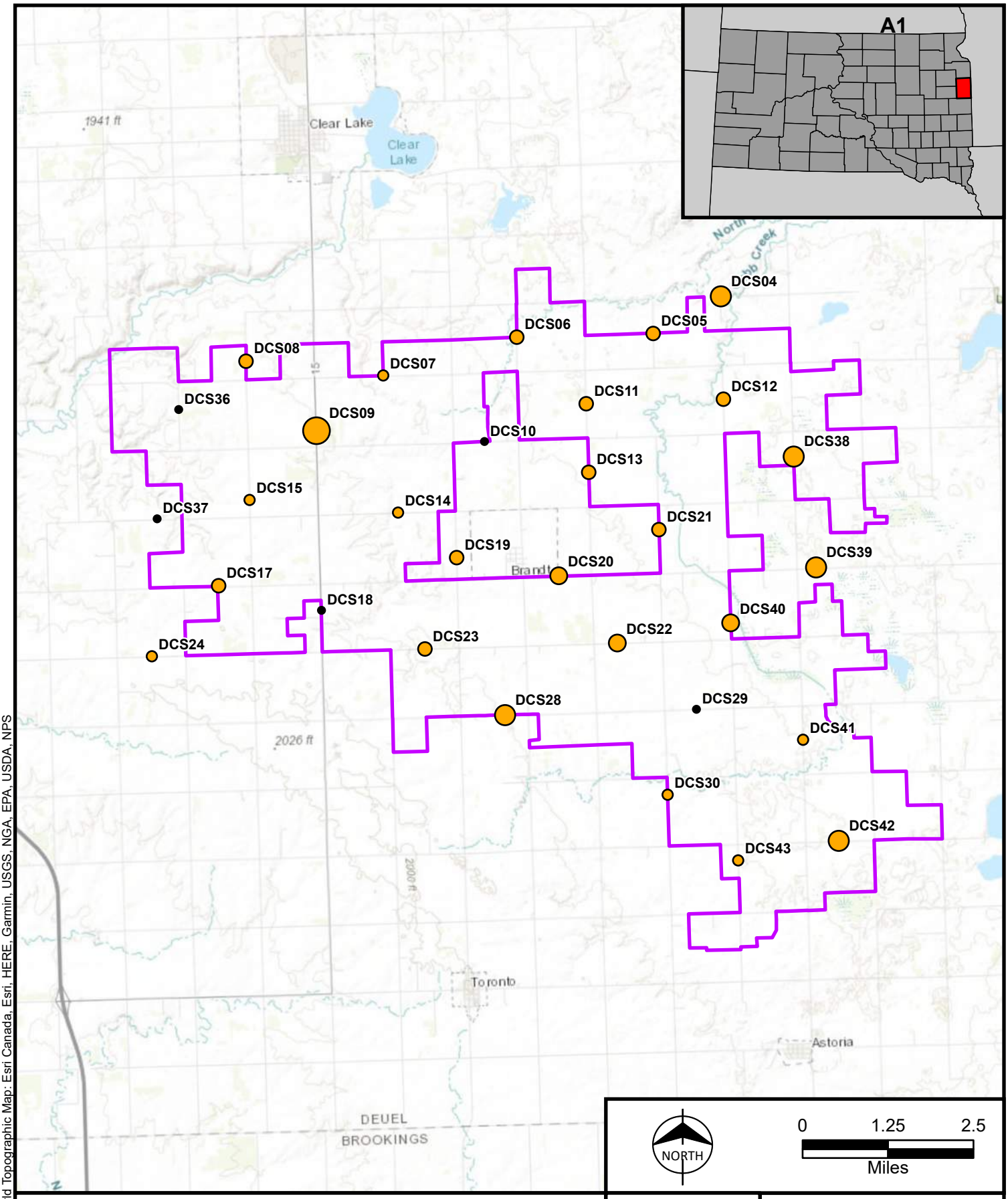
Figure C-1
Waterbird Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023

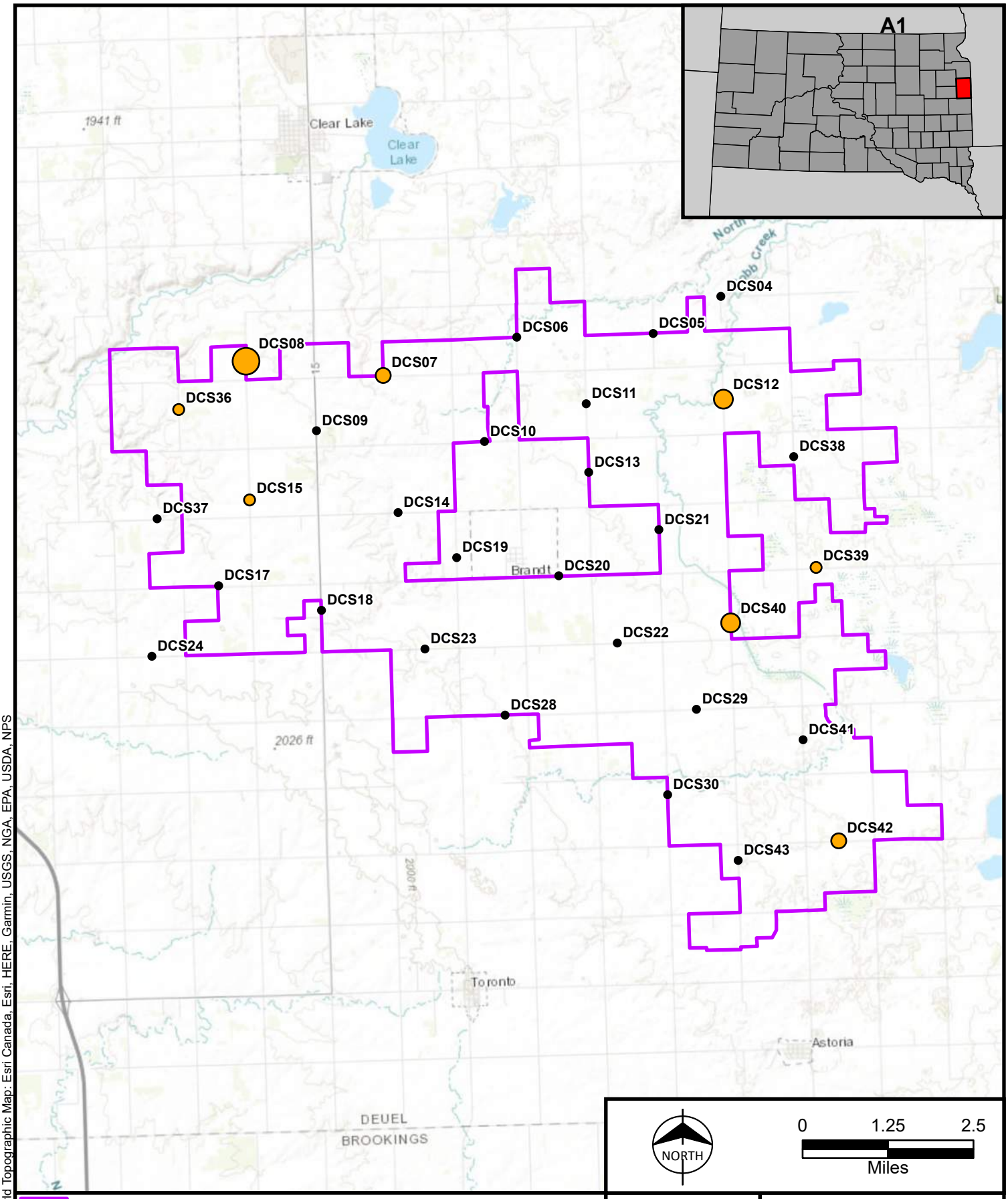


BURNS McDONNELL

Figure C-2
Waterfowl Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023



Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023

BURNS McDONNELL

Figure C-3
Gull and Tern Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

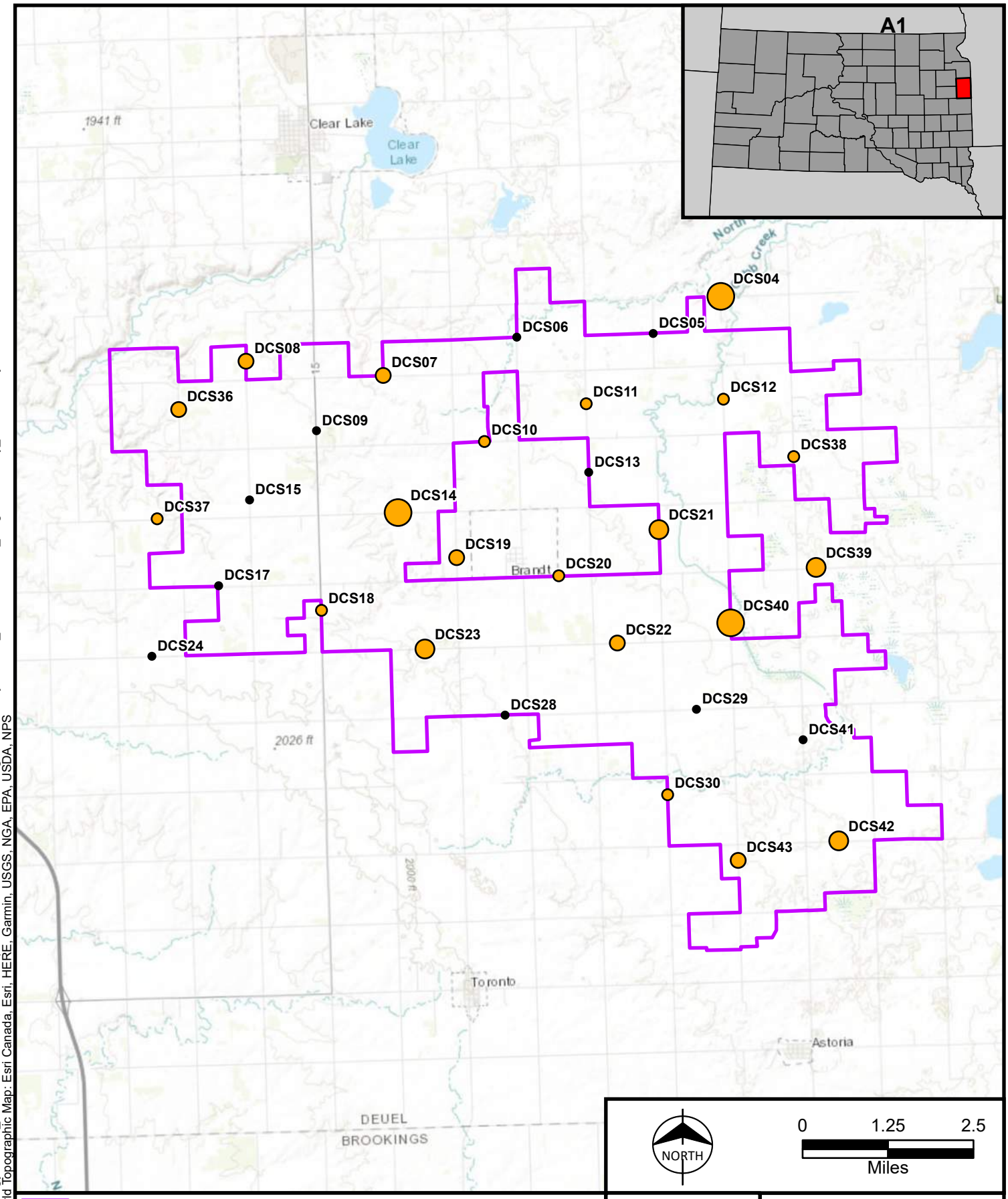
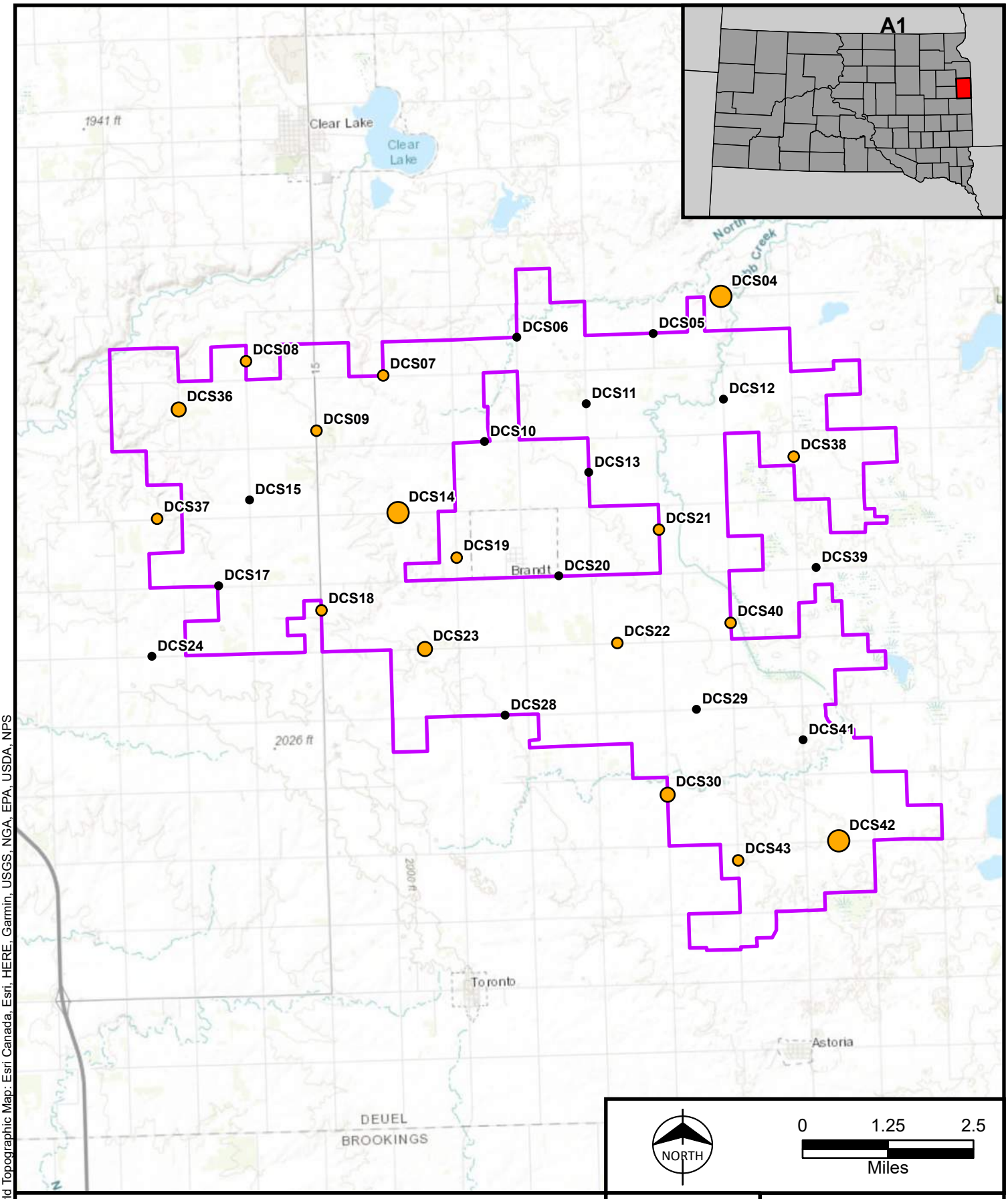


Figure C-4
Raptor Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

Path: Z:\Clients\ENS\Invenergy\134150_DeuelSouthEnv\Studies\Geospatial\DataFiles\ArcDocs\2021 Large Bird Survey\134150_DeuelSouthEnv_LargeBirdSurvey_08302023 cjadams 8/30/2023
Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023



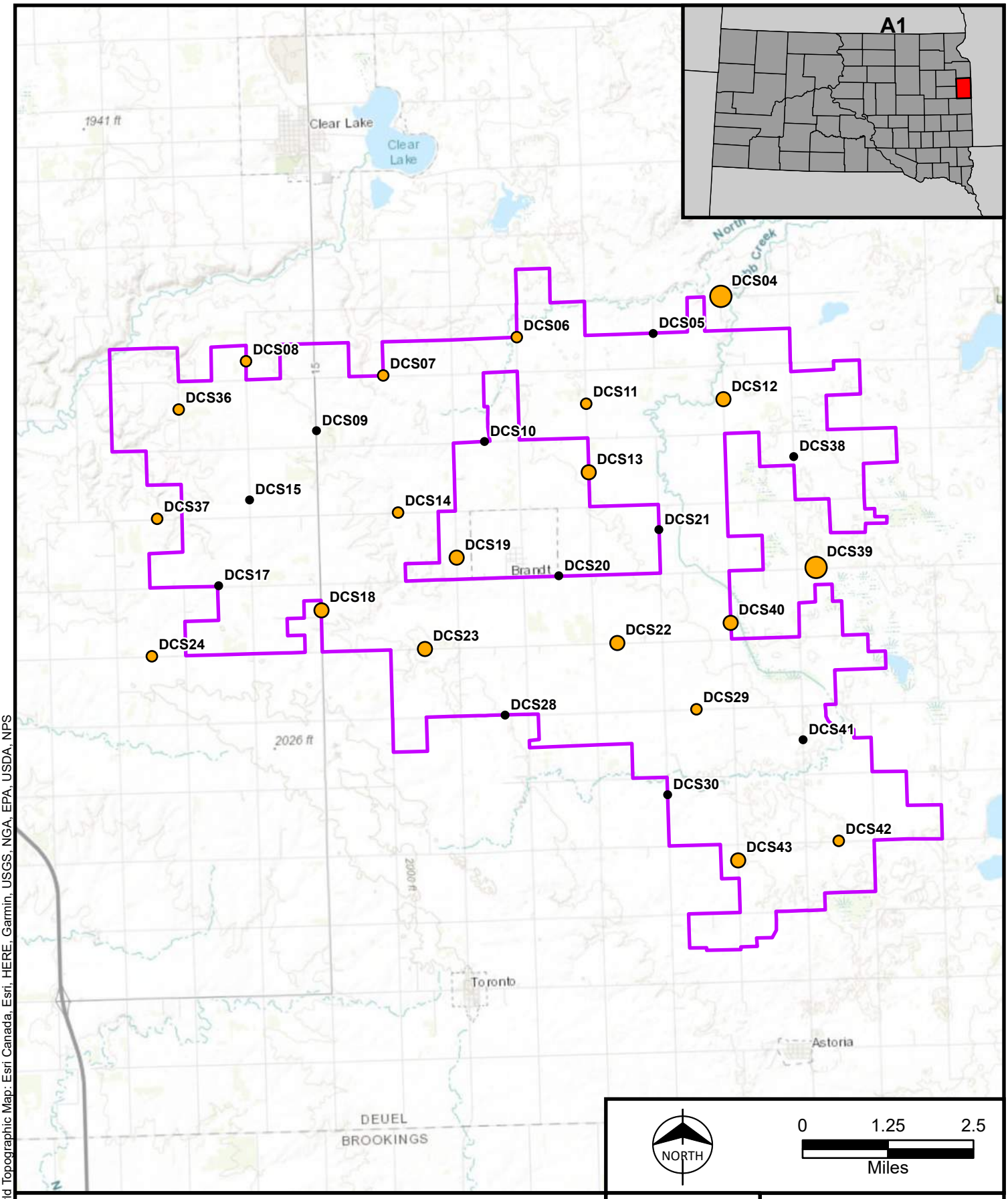
Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023

BURNS McDONNELL

Figure C-5
Buteo Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota



BURNS McDONNELL

Figure C-6
Northern Harrier Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023

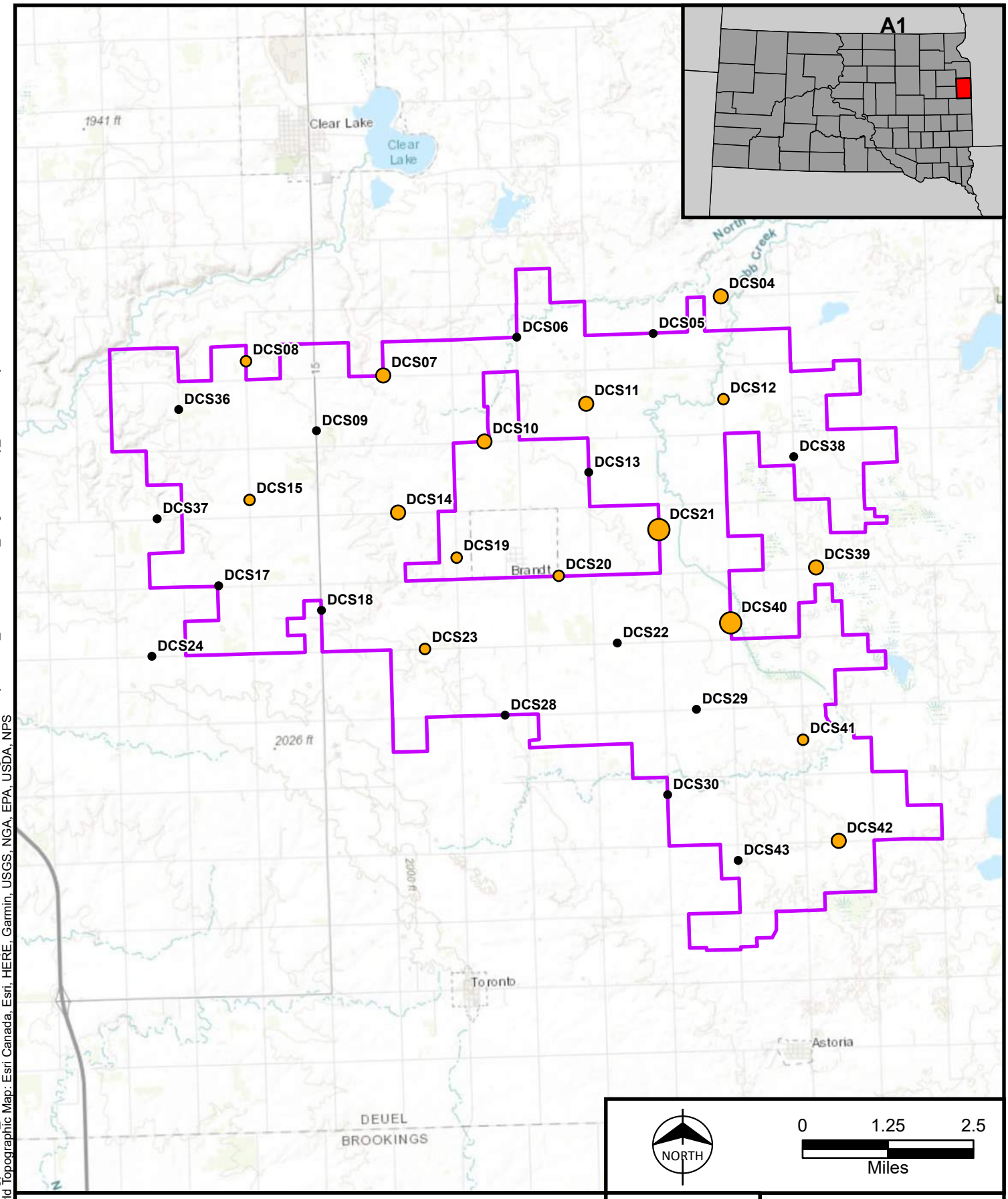
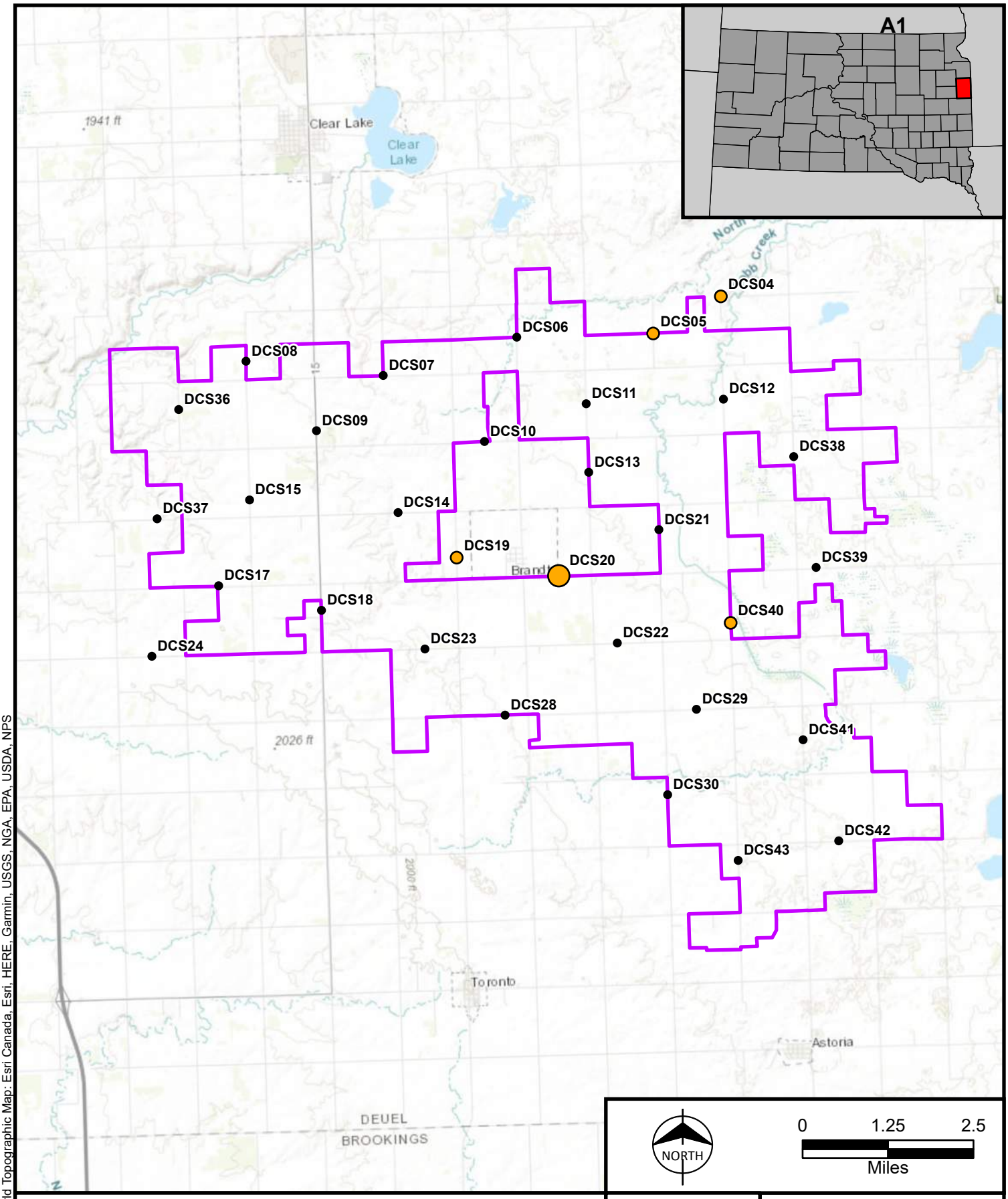


Figure C-7
Eagle Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

Path: Z:\Clients\ENS\Invenergy\134150_DeuelSouthEnv\Studies\Geospatial\DataFiles\ArcDocs\2021 Large Bird Survey\134150_DeuelSouthEnv_LargeBirdSurvey_08302023 cjadams 8/30/2023
Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023



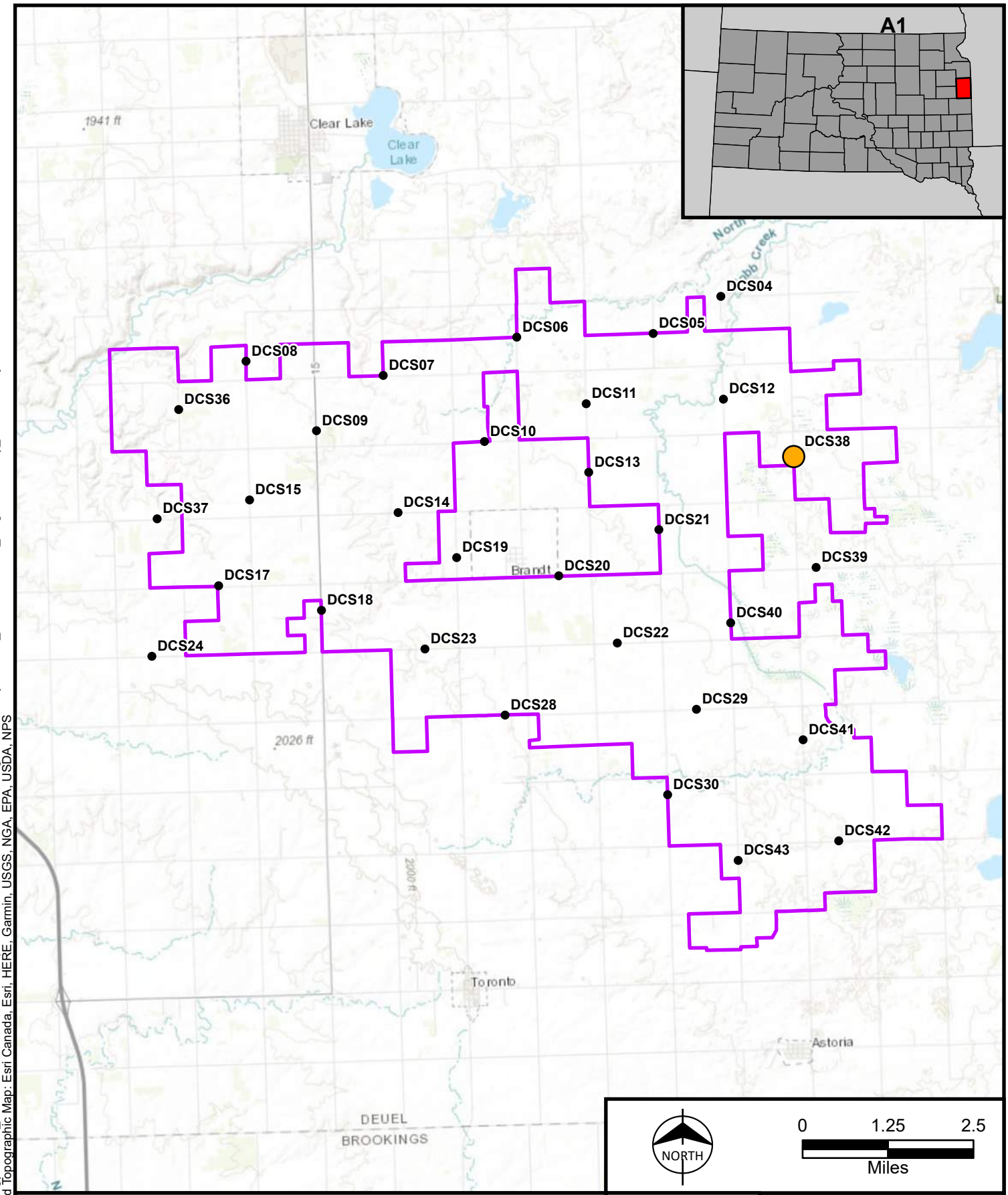
Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023

BURNS McDONNELL

Figure C-8
Falcon Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota



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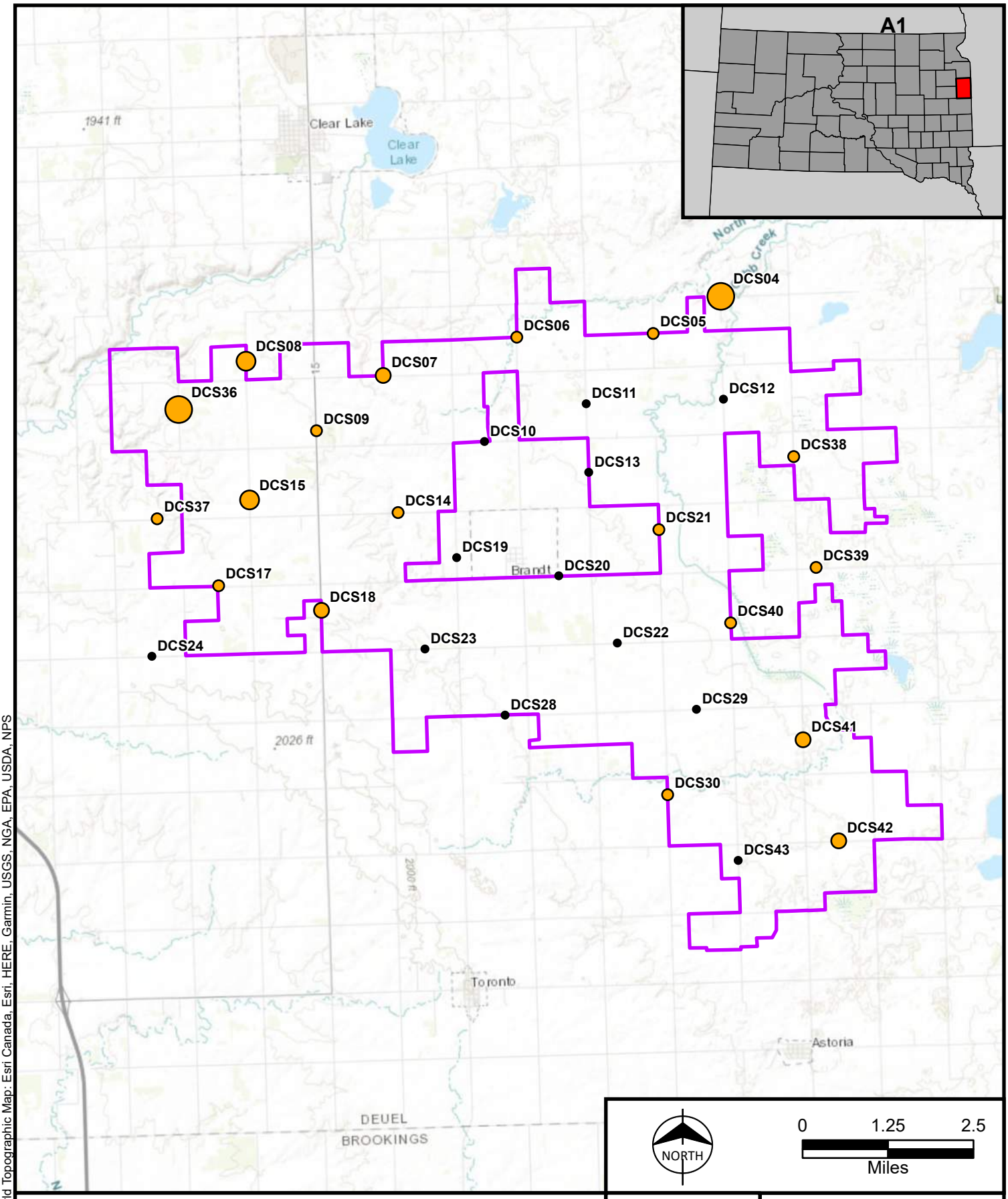
Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023

BURNS McDONNELL

Figure C-9
Other Raptor Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota



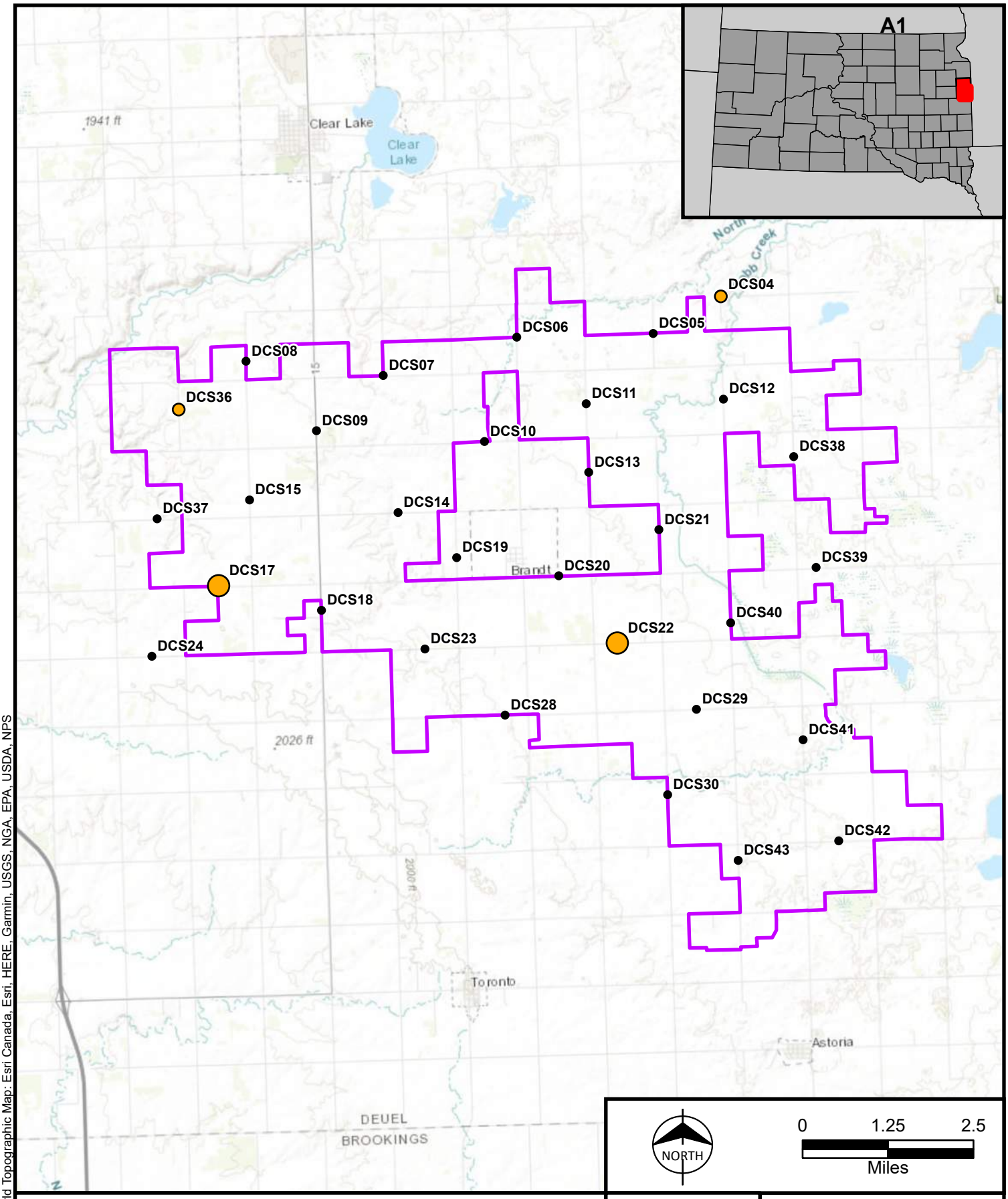
Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

Issued: 9/15/2023

BURNS McDONNELL

Figure C-10
Vulture Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota



Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Figure C-11
Upland Bird Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

Source: ESRI, Burns & McDonnell

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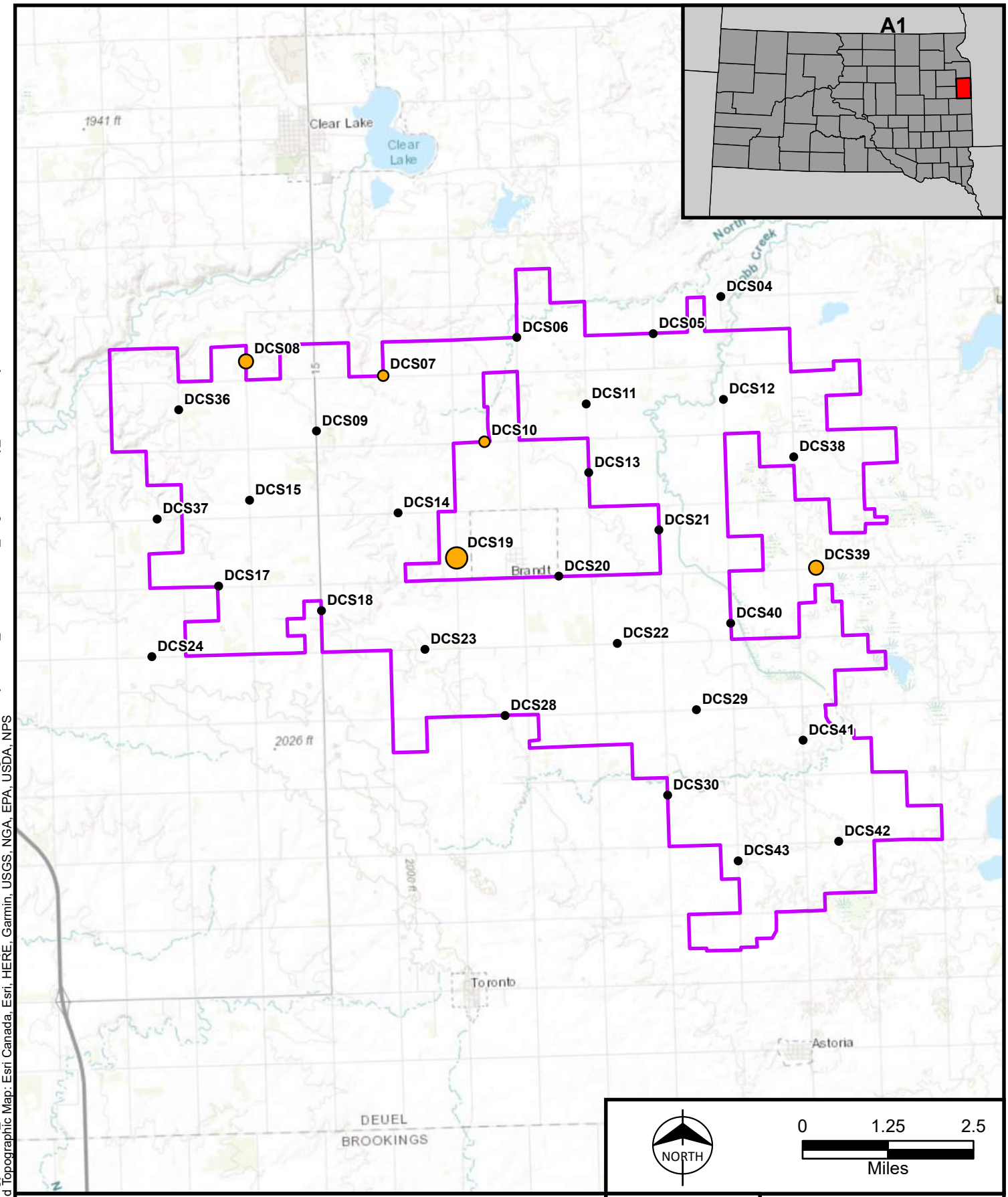

Figure C-12
Corvid Bird Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

Path: Z:\Clients\ENS\Invenergy\134150_DeuelSouthEnv\Studies\Geospatial\DataFiles\ArcDocs\2021 Large Bird Survey\134150_DeuelSouthEnv_LargeBirdSurvey_08302023 cjadams 8/30/2023
Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

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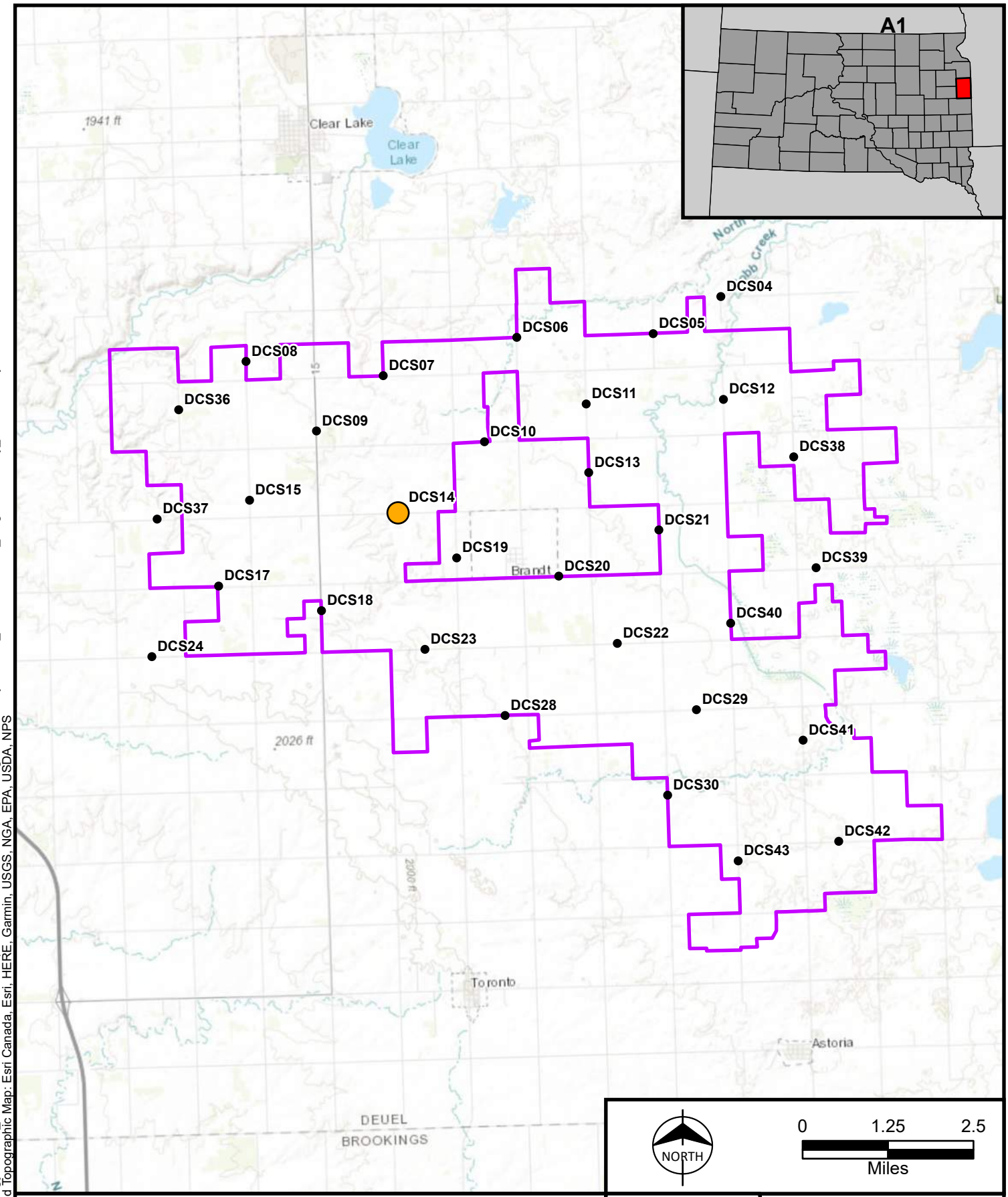

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Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Source: ESRI, Burns & McDonnell

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BURNS McDONNELL

Figure C-13
Owl Use
South Deuel Wind
DEUEL HARVEST WIND ENERGY SOUTH LLC
Deuel County, South Dakota

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CREATE AMAZING.

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