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Technical Memorandum

To: Crowned Ridge Wind II, LLC
From: SWCA Environmental Consultants
Date: February 11, 2019
Re: **Crowned Ridge II Raptor Nest Aerial Surveys / SWCA Project No. 44512**

INTRODUCTION

Crowned Ridge Wind II, LLC, an indirect, wholly owned indirect subsidiary of NextEra Energy Resources, LLC (NEER), plans to develop an approximately 300-megawatt wind facility known as the Crowned Ridge II Wind Energy Facility (the project) in Deuel, Grant, and Codington Counties, South Dakota (see project boundary, Figure 1). SWCA Environmental Consultants (SWCA) completed raptor nest aerial surveys for the project during 2017 and 2018. At the time of the 2017 survey, the study area included approximately 122,046 acres (49,390 hectares [ha]) (Figure 1). At the time of the 2018 survey, the study area encompassed approximately 57,573 acres (23,299 hectares) (Figure 2).

SWCA performed two raptor nest aerial surveys in 2017 and one in 2018 to identify nesting raptors and to provide NEER spatial and species information for use during its turbine siting process to minimize the potential for impacts during construction and operation. SWCA completed surveys on April 5 and 6, 2017, June 8 and 9, 2017, and April 25 and 26, and May 3, 2018. All raptor nests were surveyed within the study areas and a 2-mile (3.2-kilometer) buffer. The study areas plus a 10-mile (16-kilometer) buffer were surveyed to search specifically for eagle nests. SWCA used fixed-wing aerial survey methods following recommendations contained in the U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines¹ and Eagle Conservation Plan Guidance.²

METHODS

Two avian biologists and an experienced wildlife survey pilot conducted the raptor nest aerial surveys in a Cessna 172. The first nest survey in 2017 was conducted April 5 and 6 just prior to leaf-out to provide the best opportunity for nest detection. The second 2017 nest survey was conducted on June 8 and 9 (near most eagle and other large raptor fledge dates) to determine activity and productivity, if possible, of previously identified nests. Nest surveys in 2018 were completed April 25 and 26, and May 3 to better determine status during a single survey period and avoid dense canopy closures encountered during June 2017 productivity and status surveys. SWCA documented all raptor nests identified within the study area and associated 2-mile (3.2 km) buffer and all eagle nests identified within the study area and associated 10-mile (16 km) buffer. The study area and 2-mile (3.2 km) buffer survey were conducted by

¹ U.S. Fish and Wildlife Service. 2012. *Land-Based Wind Energy Guidelines*. Wind Turbine Guidelines Advisory Committee. Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service.

² U.S. Fish and Wildlife Service. 2013. *Eagle Conservation Plan Guidance, Module 1 – Land-Based Wind Energy, Version 2*. Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service, Division of Migratory Bird Management.

flying pre-established linear north–south transects at 0.5-mile (800-meter) intervals at an altitude of 300 to 700 feet (91–213 meters) above ground level, depending on terrain and flight safety issues. Transects within the 2-mile buffer were pre-established in ArcGIS software and loaded in a global positioning system (GPS) unit for guidance during the survey. The study area and 10-mile (16 km) buffer survey were conducted by flying roaming, east–west transects at 1.0- to 3.5-mile (1.6–5.6-kilometer) intervals across the entire survey area at an altitude of 300 to 700 feet above ground level, with a focus on suitable eagle nesting habitat (Figures 3 and 4).

SWCA identified suitable eagle nesting habitat during a preliminary ArcGIS software desktop analysis to guide the nest survey. Additional areas of suitable eagle nesting habitat identified during the aerial nest survey also were investigated for presence of eagle nests. Characteristics of suitable eagle nesting habitat include wooded riparian corridors, utility structures, and stands of large trees capable of supporting an eagle nest. Potential nest locations detected within the 2-mile and 10-mile buffers were observed until raptor nest status (nest/no nest, active/inactive, etc.) could be confirmed.

DATA ANALYSIS

Data recorded at each raptor nest location included nest substrate, condition (i.e., good, fair, or poor), and status (i.e., occupied or unoccupied); raptor species using occupied nests; number of adults, eggs, and/or nestlings, if observed; behavior (e.g., incubating, perched at nest, flying nearby); and GPS location. A summary of all nests detected is presented in the section below. All eagle nest data recorded during the aerial nest surveys are presented in Attachments 1 and 2. See Figure 5 for detected raptor nest locations in the 2-mile buffer during each survey year, and Figure 6 for eagle nest locations detected in the 10-mile buffer during each survey year.

Though all nests observed during the aerial nest survey were documented, it is possible that nests of certain species (e.g., American kestrel [*Falco sparverius*], prairie falcon [*Falco mexicanus*], and northern harrier [*Circus cyaneus*]) were not located due to the nature of aerial surveys. This is primarily due to the height and speed at which aerial surveys are conducted, and because of the nest structure and preferred substrate of these species (i.e., built in small cavities along rock outcrops or in trees, or built on the ground nestled in tall grasslands).

RESULTS

2017 Non-Eagle Raptor Nests

The April 2017 raptor nest aerial surveys identified 20 non-eagle raptor nest structures within the 2-mile buffer (see Figure 5). Six of these nests were considered occupied due to the presence of an adult in incubation position; three of the six nests were located within the study area (Table 1). Fourteen nests were considered unoccupied due to a lack of an attending/incubating adult, nestlings, or eggs at the time of the survey. The non-eagle raptor nests were of medium size, built with sticks, and located in small- to medium-sized deciduous trees. Given that the nest survey was conducted just prior to leaf-out, it was difficult to determine the exact species of a nest tree. The species composition of the occupied non-eagle raptor nests consisted of three red-tailed hawks (*Buteo jamaicensis*), and three Swainson's hawks (*Buteo swainsoni*). The 14 unoccupied nests were consistent in size and composition to those made by a *Buteo* species.

Visibility of the raptor nests was restricted during June status surveys because of dense foliage (i.e., deciduous trees had fully leafed out). As such, no new nests not already documented during April surveys were discovered during the June status survey. Only eagle nests located during the April survey were observed from the aircraft during the June survey (discussed below).

2018 Non-Eagle Raptor Nests

The April 2018 aerial raptor nest survey identified 37 non-eagle raptor nest structures within the 2-mile buffer (see Figure 5). Eleven nests were considered occupied due to the presence of an adult in incubation position; six of the 11 nests were located within the study area (Table 1). Twenty-six (26) nests were considered unoccupied due to a lack of an attending/incubating adult, nestlings, or eggs at the time of the survey. Of the 11 active non-eagle raptor nests, one (No. 122-2018, red-tailed hawk nest) was located within the 2-mile buffer of *both* the Crowned Ridge I and Crowned Ridge II project boundaries. The non-eagle raptor nests were of medium size, built with sticks, and located in small- to medium-sized deciduous trees. Given that the nest survey was conducted just prior to leaf-out, it was difficult to determine the exact species of a nest tree. The species composition of occupied non-eagle raptor nests consisted of two great-horned owl nests and eight red-tailed hawk nests, and one unknown species (unable to determine from aerial vantage point). The 26 unoccupied nests were consistent in size and composition to those made by a *Buteo* species.

Table 1. Occupied Non-Eagle Raptor Nests within the Study Area and 2-mile Buffer

Nest No.	Nesting Species	Nest Condition	Nest Contents	Location	Coordinates
2017 Nest Surveys					
04-2017	Red-tailed hawk	Good	Incubating adult	Within study area	44.8416 N, -96.9404 W
28-2017	Red-tailed hawk	Good	Incubating adult	Within study area	44.7796 N, -96.8459 W
59-2017	Swainson's hawk	Good	Incubating adult	Within study area	44.9577 N, -96.8694 W
19-2017	Swainson's hawk	Good	Incubating adult	2-mile buffer	44.8157 N, -96.9676 W
21-2017	Red-tailed hawk	Good	Incubating adult	2-mile buffer	44.8304 N, -96.9920 W
27-2017	Swainson's hawk	Good	Incubating adult	2-mile buffer	44.7775 N, -96.7904 W
2018 Nest Survey					
30-2018	Great horned owl	Good	Incubating adult	Within study area	44.9425 N, -96.9000 W
113-2018	Red-tailed hawk	Good	Incubating adult	Within study area	44.8698 N, -96.8987 W
114-2018	Great-horned owl	Good	Incubating adult	Within study area	44.8697 N, -96.8952 W
119-2018	Red-tailed hawk	Good	Incubating adult	Within study area	44.8339 N, -96.8733 W
154-2018	Red-tailed hawk	Good	Incubating adult	Within study area	44.9074 N, -96.7769 W
131-2018	Red-tailed hawk	Good	Incubating adult	Within study area	44.7950 N, -96.8428 W
136-2018	Red-tailed hawk	Good	Incubating adult	2-mile buffer	44.9737 N, -96.8154 W
148-2018	Unknown	Good	Incubating adult	2-mile buffer	44.9288 N, -96.7893 W
105-2018	Red-tailed hawk	Good	Incubating adult	2-mile buffer	44.8284 N, -96.9221 W
122-2018	Red-tailed hawk	Good	Incubating adult	2-mile buffer	45.0032 N, -96.8694 W
149-2018	Red-tailed hawk	Good	Incubating adult	2-mile buffer	44.9273 N, -96.7908 W

2017 Bald Eagle Nests

No bald eagle nests were observed within the study area during 2017 surveys. One unoccupied and one occupied bald eagle (*Haliaeetus leucocephalus*) nest was observed within the 2-mile buffer. The unoccupied bald eagle nest was located approximately 0.62 miles (0.99 km) outside the study area, and the occupied bald eagle nest was located approximately 0.98 miles (1.57 km) outside of the study area (Table 2; Figure 6). The occupied bald eagle nest was identified as such due to the presence of an adult in incubation position in April and presence of nestlings in June. Both eagle nests were found in medium- to large-sized eastern cottonwood (*Populus deltoides*) trees. The occupied bald eagle nest (No. 42-2017) was located within the 2-mile buffer of *both* the Crowned Ridge I and Crowned Ridge II project

boundaries on the northeast shore of Crooked Lake. The unoccupied eagle nest (No. 44-2017) was in an eastern cottonwood stand consisting of small- to large-sized trees just north of Wigdale Lake. SWCA observed no activity at this nest after three passes during April and June surveys, and determined the nest was unoccupied.

Two occupied, and two unoccupied bald eagle nests were identified within the 10-mile buffer (Table 3; Figure 6). All four nests were located in medium- to large-sized eastern cottonwood trees (Table 3).

A second and final survey was completed in June 2017. No new nests not already documented during April surveys were discovered. Bald eagle nests located in April were still active in June. Nests No. 05-2017 (within the Crowned Ridge II study area 10-mile buffer) and No. 42-2017 (within the 2-mile buffer) had one eaglet and observations of a nearby adult were recorded. Nest No. 60-2017 (within the 10-mile buffer) had two eaglets and an adult was observed nearby. Nest No. 05-2017 is also within the Crowned Ridge I study area 2-mile buffer.

2018 Bald Eagle Nests

No bald eagle nests were observed within the study area during 2018 surveys. Three occupied bald eagle nests and one unoccupied eagle nest were observed within the 2-mile buffer; ranging from 0.62 miles (0.99 km) – 2.36 miles (3.79 km) from the study area (Table 2, Figure 6). The three occupied bald eagle nests were identified as such due to the presence of an adult in incubation position. Given that the nest survey was conducted just prior to leaf-out, it was difficult to determine the exact species of nest trees. Nest No. 88-2018 (occupied) was the same nest as No. 44-2017 (unoccupied) identified during 2017 surveys. Occupied eagle nest No. 124-2018 was in the 2-mile buffer of both the Crowned Ridge I and Crowned Ridge II project boundaries and may be used by the same bald eagle pair that occupied Nest No. 42-2017 during the previous year. Unoccupied Nest No. 87-2018 is the same as occupied (during 2017) Nest No. 42-2017. Occupied Nest No. 103-2018 appears to be the only new nest site not detected in previous surveys.

Four bald eagle nests were identified within the 10-mile buffer (outside the 2-mile buffer [see Figure 6]). All nests (three occupied and one unoccupied) located in the 10-mile buffer were in medium- to large-sized trees (see Table 3). Occupied Nest No. 56-2018 appears to be the same as occupied Nest No. 60-2017 identified during 2017 surveys. Occupied Nest No. 92-2018 appears to be a new nest site. Occupied Nest No. 04-2018 is the same nest as 2017 occupied nest 05-2017 that is within the 10-mile buffer of Crowned Ridge II and within the 2-mile buffer of the Crowned Ridge I study area.

Table 2. Bald Eagle Nests within the 2-mile Buffer (and Outside the Study Area)

Nest No.	Survey Year	Status	Tree Type	Nest Condition	Nest Contents	Nest Coordinates
42-2017*	2017	Occupied	Cottonwood	Sticks – intact	1 nesting	45.0236 N, -96.8553 W
44-2017†	2017	Unoccupied	Cottonwood	Sticks – deteriorating	Empty	44.9263 N, -96.7942 W
87-2018*	2018	Unoccupied	Unknown	Excellent	Incubating adult	45.0238 N, -96.8553 W
88-2018†	2018	Occupied	Unknown	Excellent	Incubating adult	44.9263 N, -96.7942 W
103-2018	2018	Occupied	Unknown	Excellent	Perched adult	44.7947 N, -96.9330 W
124-2018	2018	Occupied	Unknown	Excellent	Incubating adult	44.0123 N, -96.8440 W

* Indicates the same nest site between years

† Indicates the same nest site between years

Table 3. Bald Eagle Nests within the 10-mile Buffer (and Outside Study Area and 2-mile Buffer)

Nest ID	Survey Year	Status	Tree Type	Nest Condition	Nest Contents	Nest Coordinates
05-2017*	2017	Occupied	Cottonwood	Sticks – intact	1 nestling	45.1172 N, -96.9126 W

Nest ID	Survey Year	Status	Tree Type	Nest Condition	Nest Contents	Nest Coordinates
60-2017 [†]	2017	Occupied	Cottonwood	Sticks – intact	2 nestlings	44.7992 N, -96.6910 W
61-2017	2017	Unoccupied	Cottonwood	Destroyed	Empty	44.8550 N, -96.6420 W
62-2017	2017	Unoccupied	Cottonwood	Destroyed	Empty	44.8764 N, -96.6573 W
04-2018*	2018	Occupied	Cottonwood	Excellent	Incubating adult	45.1172 N, -96.9126 W
56-2018 [†]	2018	Occupied	Unknown	Excellent	Incubating adult	44.7992 N, -96.6910 W
92-2018	2018	Occupied	Unknown	Excellent	Incubating adult	44.8931 N, -96.6309 W
165-2018	2018	Unoccupied	Unknown	Good	Empty	44.7973 N, -97.0538 W

* Nest located within 2-mile buffer of Crowned Ridge I study area

[†] Indicates same nest site between years

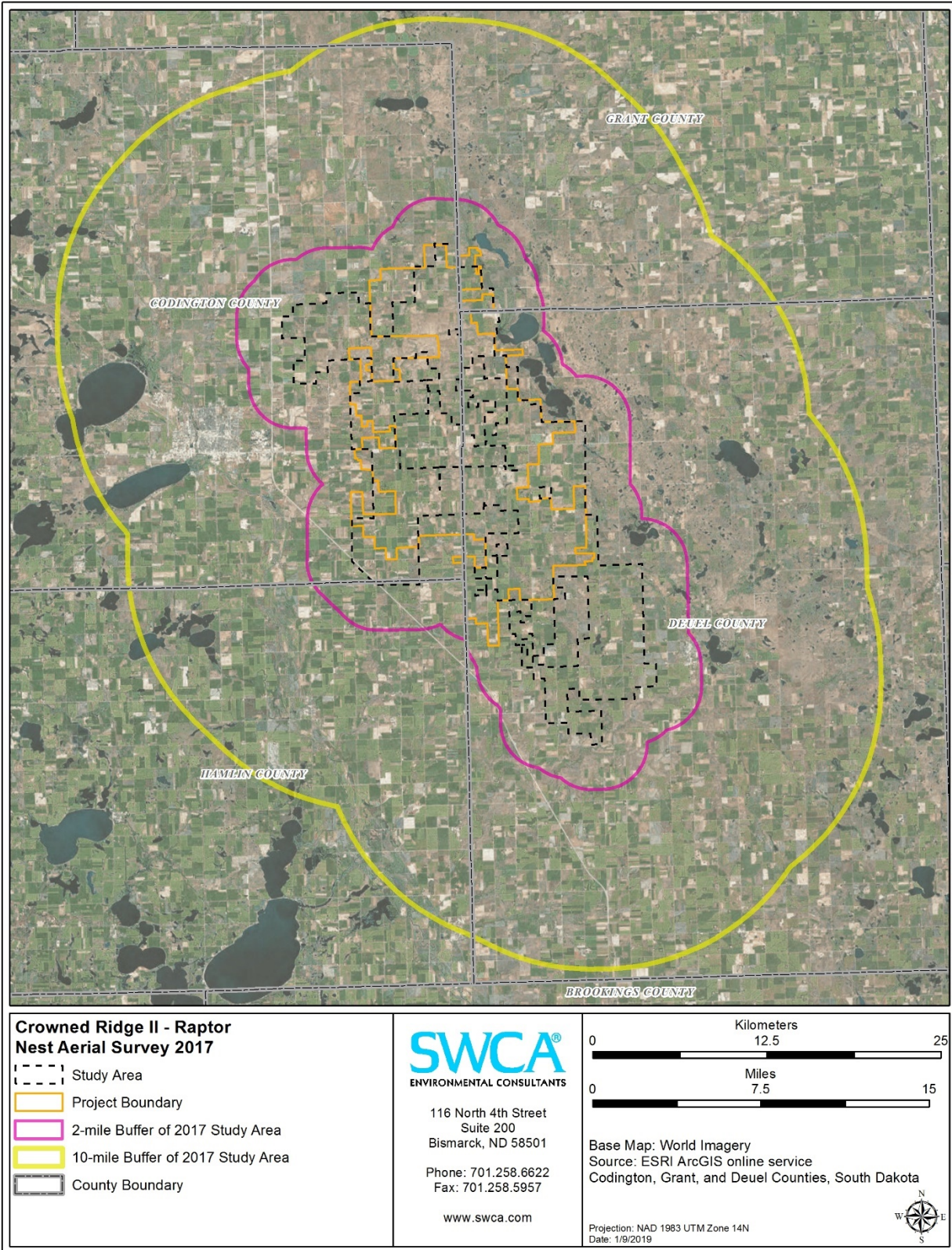


Figure 1. Study areas, 2017.

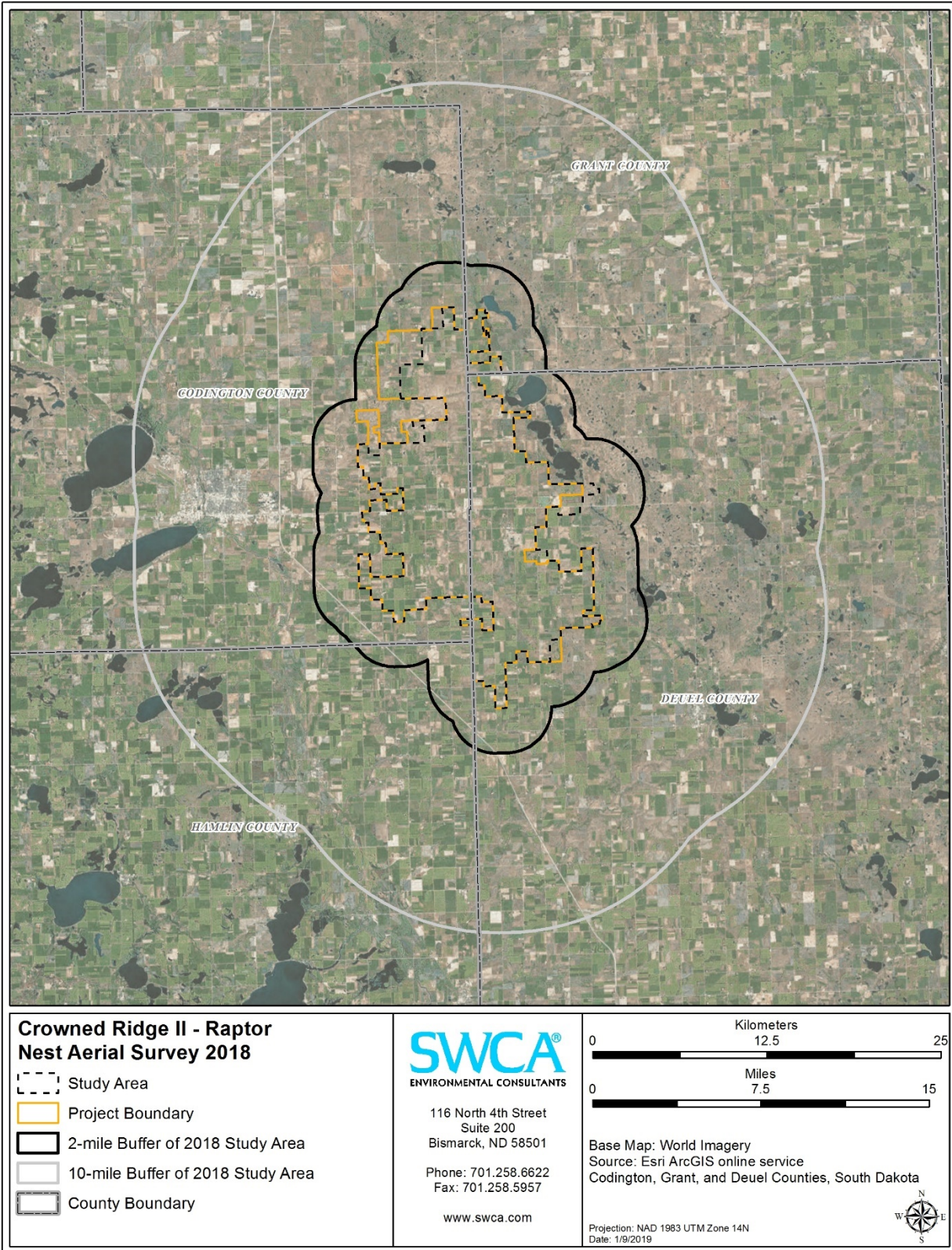


Figure 2. Study areas, 2018.

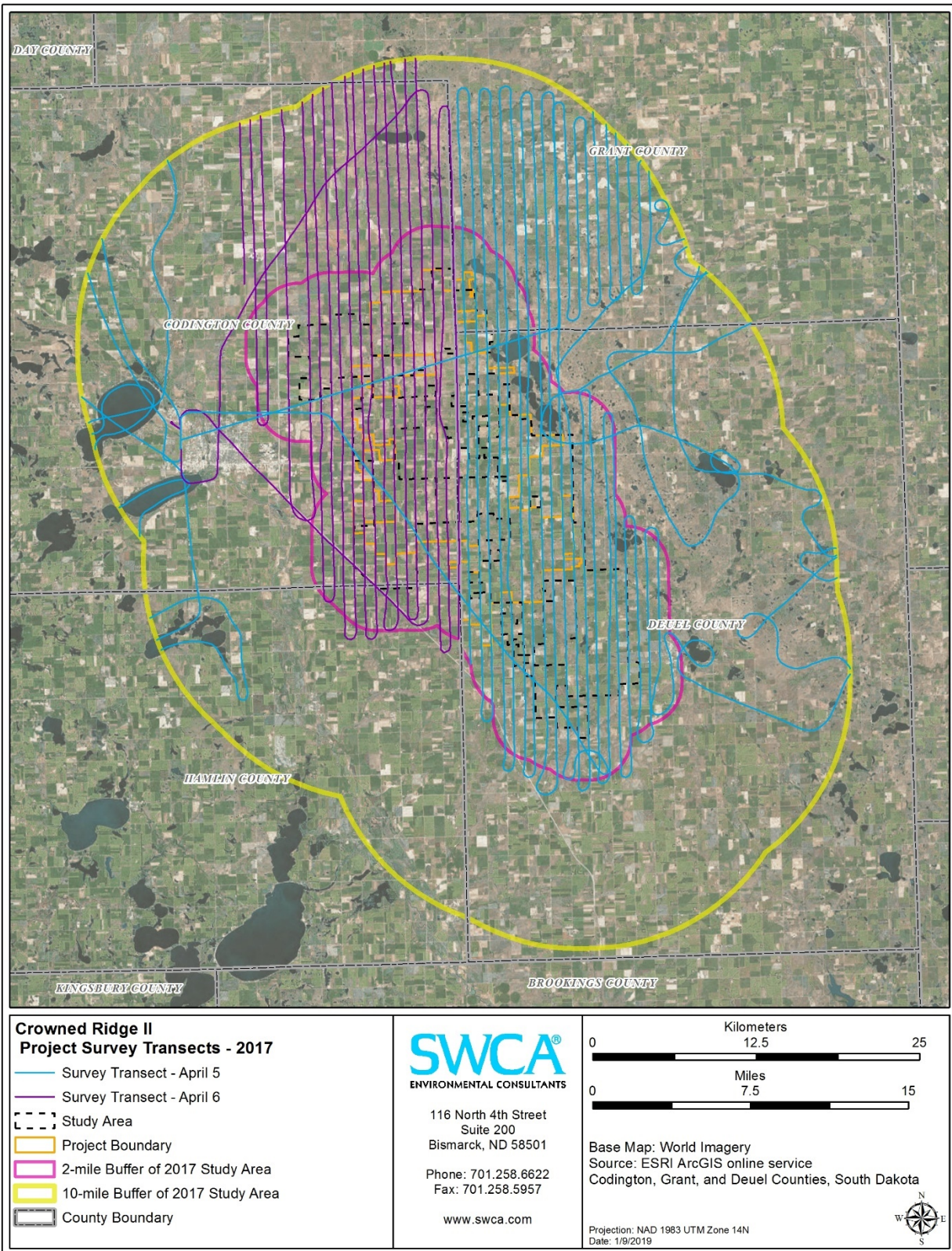


Figure 3. Survey transects, 2017.

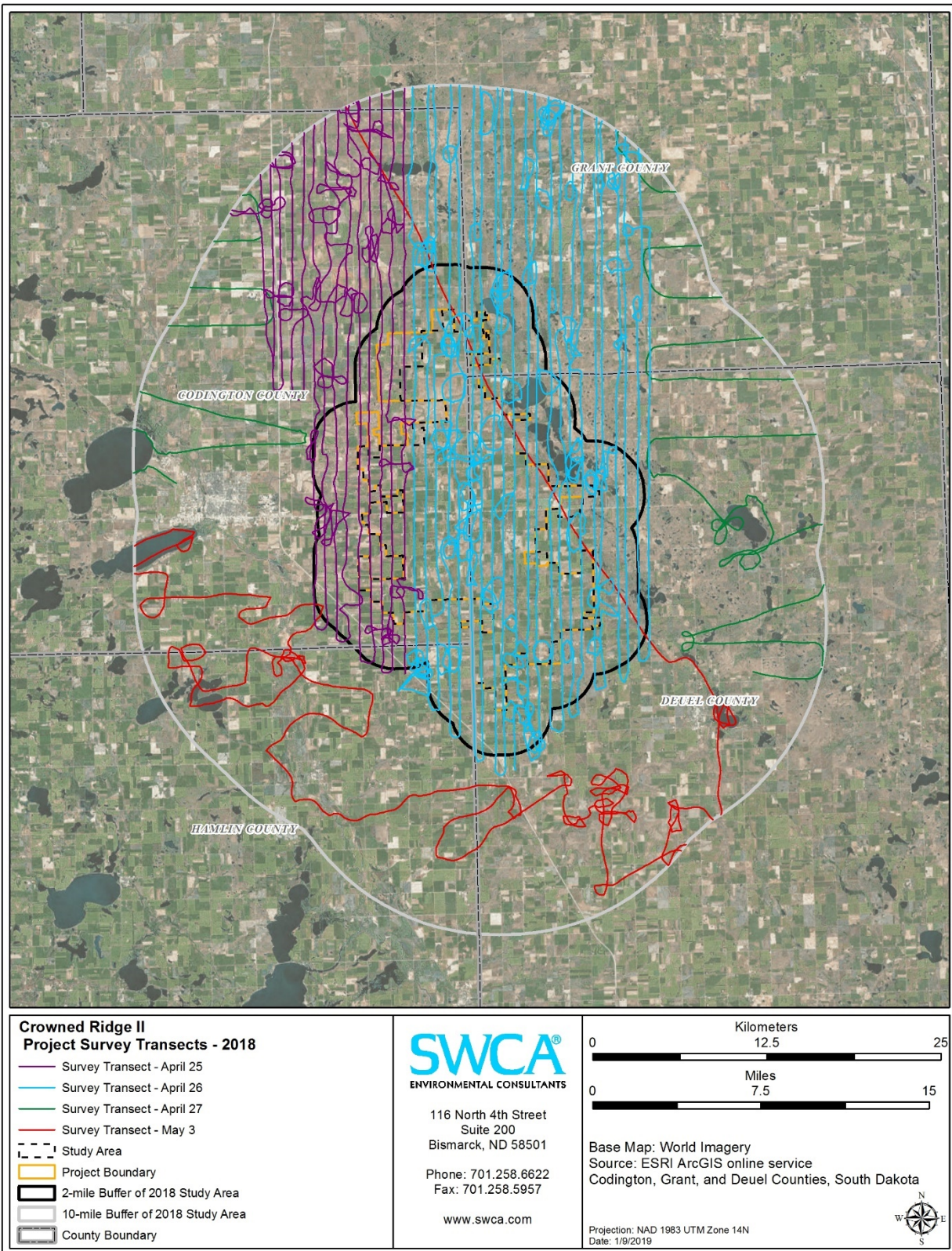


Figure 4. Survey transects, 2018.

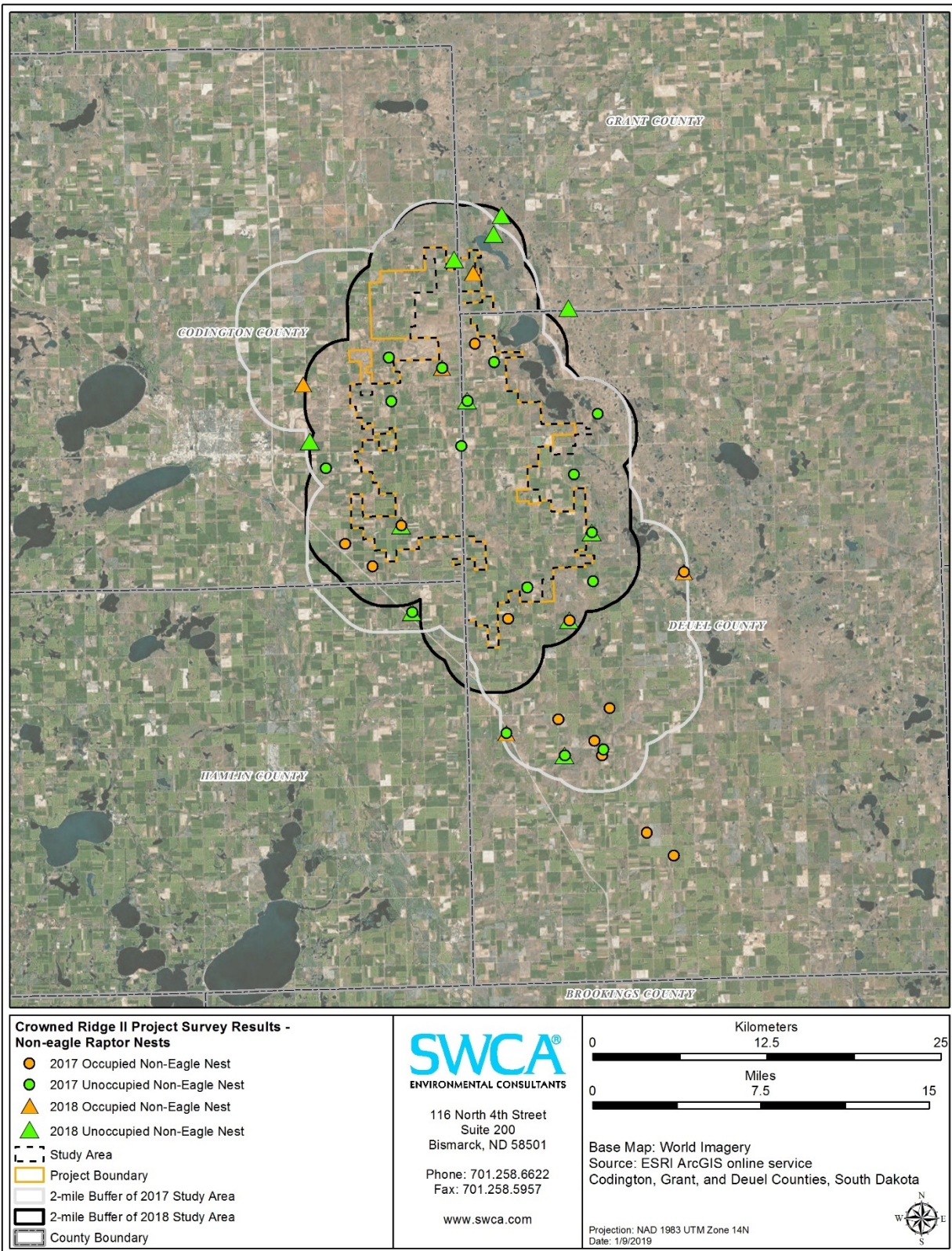


Figure 5. Survey results: non-eagle raptor nests.

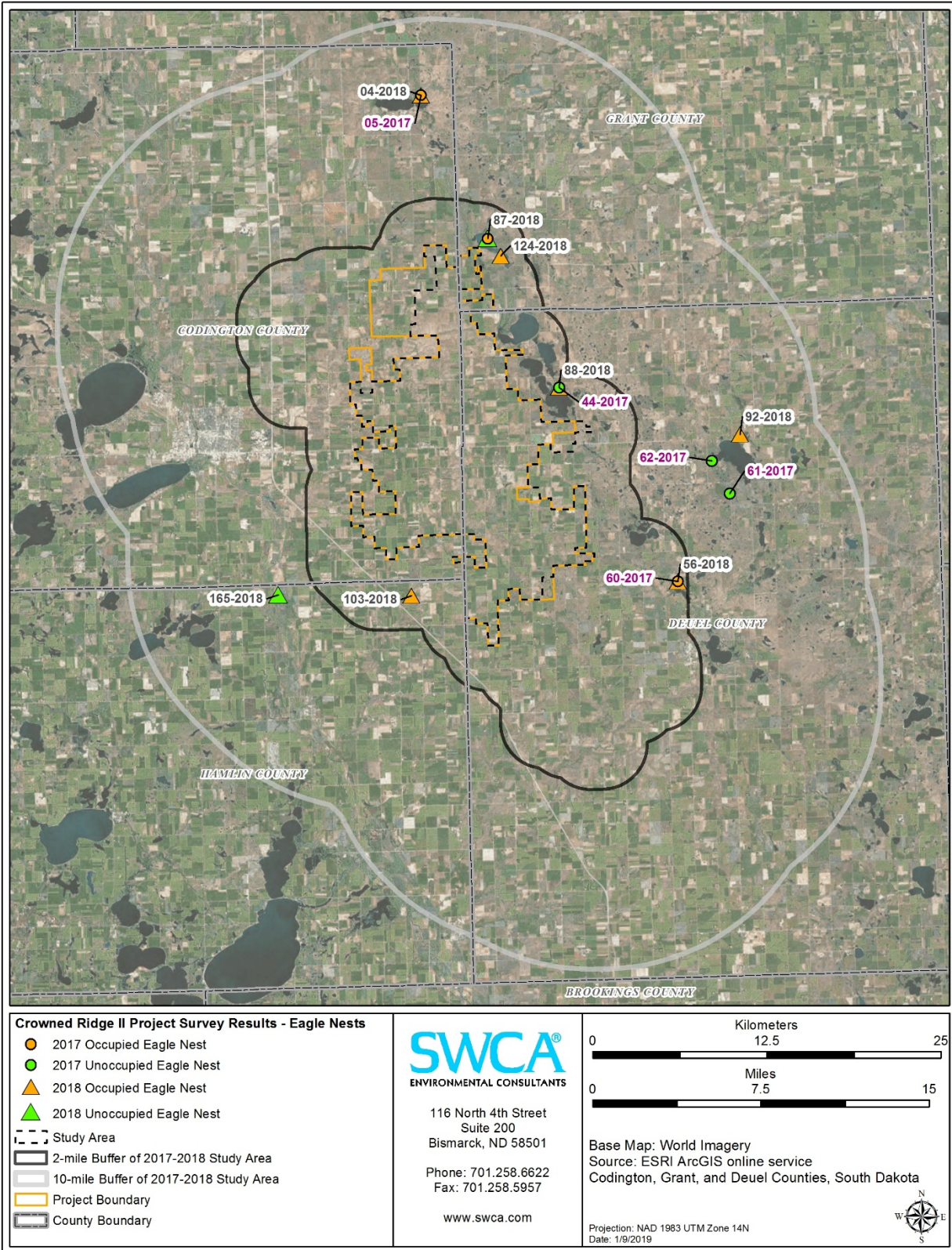


Figure 6. Survey results: eagle nests.

ATTACHMENT 1. 2017 Crowned Ridge II Raptor Nest Aerial Survey Data

Nest No.	Status	Species	Study Area	Study Area Proximity	Latitude	Longitude
60-2017	Active	Bald Eagle	CRII	10-mile	44.7992	-96.6910
02-2017	Active	Red-tailed Hawk	CRII	10-mile	44.6899	-96.7643
16-2017	Active	Red-tailed Hawk	CRII	10-mile	44.8065	-96.6852
54-2017	Active	Red-tailed Hawk	CRII	10-mile	44.6392	-96.7256
56-2017	Active	Red-tailed Hawk	CRII	10-mile	44.6993	-96.7710
57-2017	Active	Red-tailed Hawk	CRII	10-mile	44.7201	-96.7562
58-2017	Active	Red-tailed Hawk	CRII	10-mile	44.7138	-96.8028
55-2017	Active	Swainson's Hawk	CRII	10-mile	44.6238	-96.7020
61-2017	Destroyed	Bald Eagle	CRII	10-mile	44.8550	-96.6420
62-2017	Destroyed	Bald Eagle	CRII	10-mile	44.8764	-96.6573
29-2017	Inactive	Red-tailed Hawk	CRII	10-mile	44.6937	-96.7629
08-2017	Inactive	Unoccupied Stick Nest	CRII	10-mile	44.7058	-96.8502
10-2017	Inactive	Unoccupied Stick Nest	CRII	10-mile	44.6904	-96.7979
42-2017	Active	Bald Eagle	CRI & II	2-mile	45.0236	-96.8553
00-2017	Active	Bald Eagle	CRI & II	2-mile	45.0229	-96.8541
21-2017	Active	Red-tailed Hawk	CRII	2-mile	44.8304	-96.9920
19-2017	Active	Swainson's Hawk	CRII	2-mile	44.8157	-96.9676
27-2017	Active	Swainson's Hawk	CRII	2-mile	44.7776	-96.7903
13-2017	Inactive	Unoccupied Stick Nest	CRI & II	2-mile	44.9500	-96.9480
09-2017	Inactive	Unoccupied Stick Nest	CRII	2-mile	44.8795	-97.0079
12-2017	Inactive	Unoccupied Stick Nest	CRII	2-mile	44.8024	-96.7679
18-2017	Inactive	Unoccupied Stick Nest	CRII	2-mile	44.7854	-96.9328
24-2017	Inactive	Unoccupied Stick Nest	CRII	2-mile	44.8715	-96.7825
26-2017	Inactive	Unoccupied Stick Nest	CRII	2-mile	44.9103	-96.7596
44-2017	Inactive	Unoccupied Stick Nest	CRII	2-mile	44.9263	-96.7942
04-2017	Active	Red-tailed Hawk	CRII	Within	44.8416	-96.9405
28-2017	Active	Red-tailed Hawk	CRII	Within	44.7796	-96.8459
59-2017	Active	Swainson's Hawk	CRII	Within	44.9577	-96.8694
30-2017	Inactive	Red-tailed Hawk	CRII	Within	44.7995	-96.8279
32-2017	Inactive	Red-tailed Hawk	CRII	Within	44.9425	-96.9000
33-2017	Inactive	Red-tailed Hawk	CRII	Within	44.9455	-96.8524
31-2017	Inactive	Swainson's Hawk	CRII	Within	44.9209	-96.8777
07-2017	Inactive	Unoccupied Stick Nest	CRII	Within	44.8918	-96.8844
11-2017	Inactive	Unoccupied Stick Nest	CRII	Within	44.9217	-96.9466
17-2017	Inactive	Unoccupied Stick Nest	CRII	Within	44.8339	-96.7677

ATTACHMENT 2. 2018 Crowned Ridge II Raptor Nest Aerial Survey Data

Nest No.	Status	Species	Study Area	Study Area Proximity	Latitude	Longitude
56-2018	Active	Bald Eagle	CRII	10-mile	44.7992	-96.6910
92-2018	Active	Bald Eagle	CRII	10-mile	44.8931	-96.6309
98-2018	Active	Red-tailed Hawk	CRI & II	10-mile	44.9343	-97.0264
15-2018	Active	Red-tailed Hawk	CRII	10-mile	44.8065	-96.6852
95-2018	Active	Red-tailed Hawk	CRII	10-mile	44.6890	-96.7054
07-2018	Active	UNK	CRII	10-mile	44.7058	-96.8502
99-2018	Inactive	UNK	CRI & II	10-mile	44.8972	-97.0215
151-2018	Inactive	UNK	CRI & II	10-mile	44.9789	-96.7835
09-2018	Inactive	UNK	CRII	10-mile	44.6904	-96.7979
17-2018	Inactive	UNK	CRII	10-mile	44.7854	-96.9328
124-2018	Active	Bald Eagle	CRI & II	2-mile	45.0123	-96.8440
88-2018	Active	Bald Eagle	CRII	2-mile	44.9263	-96.7942
103-2018	Active	Bald Eagle	CRII	2-mile	44.7947	-96.9330
122-2018	Active	Red-tailed Hawk	CRI & II	2-mile	45.0032	-96.8694
105-2018	Active	Red-tailed Hawk	CRII	2-mile	44.8284	-96.9221
136-2018	Active	Red-tailed Hawk	CRII	2-mile	44.9737	-96.8154
149-2018	Active	Red-tailed Hawk	CRII	2-mile	44.9273	-96.7908
148-2018	Active	UNK	CRII	2-mile	44.9288	-96.7893
127-2018	Inactive	UNK	CRI & II	2-mile	45.0279	-96.8495
128-2018	Inactive	UNK	CRI & II	2-mile	45.0399	-96.8418
26-2018	Inactive	UNK	CRII	2-mile	44.7776	-96.7903
100-2018	Inactive	UNK	CRII	2-mile	44.8115	-96.9603
106-2018	Inactive	UNK	CRII	2-mile	44.7994	-96.9161
107-2018	Inactive	UNK	CRII	2-mile	44.8171	-96.9194
115-2018	Inactive	UNK	CRII	2-mile	44.7975	-96.8947
126-2018	Inactive	UNK	CRII	2-mile	44.9686	-96.8512
129-2018	Inactive	UNK	CRII	2-mile	44.7620	-96.8466
135-2018	Inactive	UNK	CRII	2-mile	44.7634	-96.8316
150-2018	Inactive	UNK	CRII	2-mile	44.9160	-96.7828
155-2018	Inactive	UNK	CRII	2-mile	44.8217	-96.7629
156-2018	Inactive	UNK	CRII	2-mile	44.8373	-96.7650
157-2018	Inactive	UNK	CRII	2-mile	44.9186	-96.7582
30-2018	Active	Great-horned Owl	CRII	Within	44.9425	-96.9000
114-2018	Active	Great-horned Owl	CRII	Within	44.8697	-96.8952
113-2018	Active	Red-tailed Hawk	CRII	Within	44.8698	-96.8987
119-2018	Active	Red-tailed Hawk	CRII	Within	44.8339	-96.8733
131-2018	Active	Red-tailed Hawk	CRII	Within	44.7950	-96.8428
154-2018	Active	Red-tailed Hawk	CRII	Within	44.9074	-96.7769
116-2018	Inactive	UNK	CRI & II	Within	45.0122	-96.8862
03-2018	Inactive	UNK	CRII	Within	44.8416	-96.9405

Nest No.	Status	Species	Study Area	Study Area Proximity	Latitude	Longitude
16-2018	Inactive	UNK	CRII	Within	44.8339	-96.7677
29-2018	Inactive	UNK	CRII	Within	44.9209	-96.8777
53-2018	Inactive	UNK	CRII	Within	44.9210	-96.8759
85-2018	Inactive	UNK	CRII	Within	44.9154	-96.8060
120-2018	Inactive	UNK	CRII	Within	44.8784	-96.8755
121-2018	Inactive	UNK	CRII	Within	44.8830	-96.8748
125-2018	Inactive	UNK	CRII	Within	44.8405	-96.8550
130-2018	Inactive	UNK	CRII	Within	44.7886	-96.8460
132-2018	Inactive	UNK	CRII	Within	44.8154	-96.8450
133-2018	Inactive	UNK	CRII	Within	44.8945	-96.8474
87-2018	Inactive	Prob BAEA	CRI & II	Within	45.0238	-96.8553
165-2018	Inactive	Prob BAEA	CRII	10-mile	44.7973	-97.0538