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## Technical Memorandum

**To:** Crowned Ridge Wind I, LLC  
**From:** SWCA Environmental Consultants  
**Date:** November 28, 2018  
**Re:** **Crowned Ridge I Raptor Nest Aerial Surveys / SWCA Project No. 44511**

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### INTRODUCTION

Crowned Ridge Wind, LLC, an indirect, wholly owned subsidiary of NextEra Energy Resources, LLC (NEER), plans to develop an approximately 300-megawatt wind facility known as the Crowned Ridge I Wind Energy Facility (the project) in 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 69,433 acres (ac) (28,099 hectares [ha]) (Figure 1). At the time of the 2018 survey, the study area as provided to SWCA on March 20, 2018, included approximately 57,126 ac (23,118 ha) (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, 2018. All raptor nests were surveyed within the study areas and a 2-mile (mi) (3.2-kilometer [km]) buffer. The study areas plus a 10-mi (16-km) 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 Guidelines<sup>1</sup> and Eagle Conservation Plan Guidance.<sup>2</sup>

### 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 to better determine status during a single survey period and avoid visibility issues due to canopy closure encountered during 2017. SWCA documented all raptor nests identified within the study area and associated 2-mi (3.2-km) buffer and all eagle nests identified within the study area and associated 10-mi (16-km) buffer. The study

<sup>1</sup> 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.

<sup>2</sup> 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.

area and 2-mi (3.2-km) buffer survey were conducted by flying pre-established linear north–south transects at 0.5-mi (800-m) intervals at an altitude of 300 to 700 feet (ft) (91–213 meters [m]) above ground level, depending on terrain and flight safety issues. Transects within the 2-mi 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-mi (16-km) buffer survey were conducted by flying roaming, east–west transects at 1.0- to 3.5-mi (1.6–5.6-km) intervals across the entire survey area at an altitude of 300 to 700 ft 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 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-mi (3.2-km) and 10-mi (16-km) 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 raptor nest aerial survey are presented in Attachments 1 and 2. See Figure 5 for detected raptor nest locations in the 2-mi buffer during each survey year, and Figure 6 for eagle nest locations detected in the 10-mi 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 aerial raptor nest surveys identified 22 non-eagle raptor nest structures within the 2-mi buffer (Figure 5). Eight of these nests were considered occupied due to the presence of an adult in incubation position; five of these 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 one great-horned owl (*Bubo virginianus*), three red-tailed hawks (*Buteo jamaicensis*), and one Swainson's hawk (*Buteo swainsoni*). The sixteen unoccupied nests were consistent in size and composition to those made by a *Buteo* species.

Visibility of the raptor nests was extremely restricted due to 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 2017 nest 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 47 non-eagle raptor nest structures within the 2-mi buffer (Figure 5). Sixteen nests were considered occupied due to the presence of an adult in incubation position; eight of these nests were located within the study area (Table 1). Thirty-one nests were considered unoccupied due to a lack of an attending/incubating adult, nestlings, or eggs at the time of the survey. Of the 16 active non-eagle raptor nests, one (No. 122-2018, red-tailed hawk nest) was located within the 2-mi buffer of *both* the Crowned Ridge I and Crowned Ridge II study areas. 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 three great-horned owl nests and nine red-tailed hawk nests. The 31 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-mi Buffer**

Nest No.	Nesting Species	Nest Condition	Nest Contents	Location	Coordinates
<b>2017 Nest Surveys</b>					
52-2017	Red-tailed hawk	Good	Incubating adult	Within study area	45.1365 N, -96.9746 W
34-2017	Great-horned owl	Good	Incubating adult	Within study area	45.0240 N, -96.9853 W
47-2017	Red-tailed hawk	Good	Incubating adult	Within study area	45.0598 N, -96.9681 W
48-2017	Red-tailed hawk	Good	Incubating adult	Within study area	45.0788 N, -97.0094 W
49-2017	Red-tailed hawk	Good	Incubating adult	Within study area	45.0637 N, -97.0019 W
06-2017	Red-tailed hawk	Good	Incubating adult	2-mi buffer	45.1178 N, -96.7304 W
50-2017	Red-tailed hawk	Good	Incubating adult	2-mi buffer	45.1745 N, -97.0048 W
51-2017	Swainson's hawk	Good	Incubating adult	2-mi buffer	45.1749 N, -96.9806 W
<b>2018 Nest Surveys</b>					
33-2018	Red-tailed hawk	Good	Incubating adult	Within study area	45.0446 N, -96.9510 W
34-2018	Red-tailed hawk	Good	Incubating adult	Within study area	45.0562 N, -96.9345 W
134-2018	Great-horned owl	Good	Incubating adult	Within study area	45.1063 N, -96.8274 W
137-2018	Red-tailed hawk	Good	Incubating adult	Within study area	45.0447 N, -96.8213 W
139-2018	Great-horned owl	Good	Incubating adult	Within study area	45.1427 N, -96.8053 W
142-2018	Red-tailed hawk	Good	Incubating adult	Within study area	45.1419 N, -96.7969 W
145-2018	Red-tailed hawk	Good	Incubating adult	Within study area	45.0948 N, -96.7877 W
152-2018	Red-tailed hawk	Good	Incubating adult	Within study area	45.1682 N, -96.7754 W
80-2018	Red-tailed hawk	Good	Incubating adult	2-mi buffer	45.0225 N, -97.0363 W
82-2018	Great-horned owl	Good	Incubating adult	2-mi buffer	45.1032 N, -96.9498 W
96-2018	Red-tailed hawk	Good	Incubating adult	2-mi buffer	45.0874 N, -97.0615 W
97-2018	Red-tailed hawk	Good	Incubating adult	2-mi buffer	45.0335 N, -97.0145 W
122-2018	Red-tailed hawk	Good	Incubating adult	2-mi buffer	45.0032 N, -96.8694 W
141-2018	Great-horned owl	Good	Incubating adult	2-mi buffer	45.0195 N, -96.8057 W
158-2018	Red-tailed hawk	Good	Incubating adult	2-mi buffer	45.1538 N, -96.7554 W
160-2018	Red-tailed hawk	Good	Incubating adult	2-mi buffer	45.1030 N, -96.7440 W

## 2017 Bald Eagle Nests

No bald eagle nests were observed within the study area during 2017 surveys. Two occupied bald eagle (*Haliaeetus leucocephalus*) nests were observed within the 2-mi buffer (Table 2; Figure 6). The two

occupied bald eagle nests were identified as such due to the presence of an adult in incubation position. The detected eagle nests within the 2-mi buffer were found in medium- to large-sized eastern cottonwood (*Populus deltoides*) trees approximately 0.10 mi (0.16 km), and approximately 1.6 mi (2.6 km) outside of the study area. No bald eagle nests were identified within the 10-mi buffer (outside of the 2-mi buffer [Figure 6]) except those identified within the 2-mi buffer of the Crowned Ridge II study area.

No new nests not already documented during April surveys were discovered during the June 2017 survey. Of the two active bald eagle nests observed in April, both were still active and contained one eaglet each and observations of a nearby adult were recorded.

### **2018 Bald Eagle Nests**

No bald eagle nests were observed within the study area during 2018 surveys. Two occupied bald eagle nests and one (likely) unoccupied eagle nest were observed within the 2-mi buffer (Table 2 and Figure 6). The two occupied bald eagle nests were identified as such due to the presence of an adult in incubation position. Unoccupied Nest No. 87-2018 was the same as occupied Nest No. 42-2017 identified during 2017 surveys. Occupied Nest No. 04-2018 was the same as occupied Nest No. 05-2017 identified during 2017 surveys. Eagle Nest No. 124-2018 and Nest No. 87-2018 were in the 2-mi buffer of both the Crowned Ridge I and Crowned Ridge II study areas.

Three occupied bald eagle nests were identified within the 10-mi buffer (outside the 2-mi buffer) (Figure 6, Table 3). Occupied Nest No. 89-2018 appears to be in the same territory as unoccupied (destroyed) Nests No. 43-2017 and No. 45-2017 identified during 2017 surveys. The remaining two nests identified within the 10-mi buffer during the 2018 survey were previously undetected and/or new nest structures. Given that the nest survey was conducted just prior to leaf-out, it was difficult to determine the exact species of a nest tree. Bald eagle nests located within the 10-mi buffer of the Crowned Ridge I study area and within the 2-mi buffer of Crowned Ridge II were not included in this analysis (see *Crowned Ridge II Aerial Raptor Nest Surveys Technical Memorandum*).

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

<b>Nest No.</b>	<b>Survey Year</b>	<b>Status</b>	<b>Nest Condition</b>	<b>Nest Contents</b>	<b>Nest Coordinates</b>
05-2017*	2017	Occupied	Sticks – intact	1 nestling	45.1172 N, -96.9126 W
42-2017†	2017	Occupied	Sticks – intact	1 nestling	45.0236 N, -96.8553 W
04-2018*	2018	Occupied	Sticks – excellent	Incubating adult	45.1172 N, -96.9126 W
87-2018†	2018	Unoccupied	Excellent	Empty	45.0238 N, -96.8553 W
124-2018	2018	Occupied	Sticks – excellent	Incubating adult	44.7947 N, -96.9330 W

\* Indicates same nest site between years

† Indicates same nest site between years

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

<b>Nest No.</b>	<b>Survey Year</b>	<b>Status</b>	<b>Nest Condition</b>	<b>Nest Contents</b>	<b>Nest Coordinates</b>
89-2018	2018	Occupied	Excellent	1 nestling	45.2750 N, -97.0030 W
93-2018*	2018	Occupied	Excellent	Incubating adult	45.2710 N, -96.5420 W
163-2018*	2018	Occupied	Excellent	Incubating adult	45.0313 N, -97.2456 W

\* Located 1.3 to 5.8 kilometers outside of 10-mi (16-km) buffer but on waterways that cross the study area 10-mi buffer



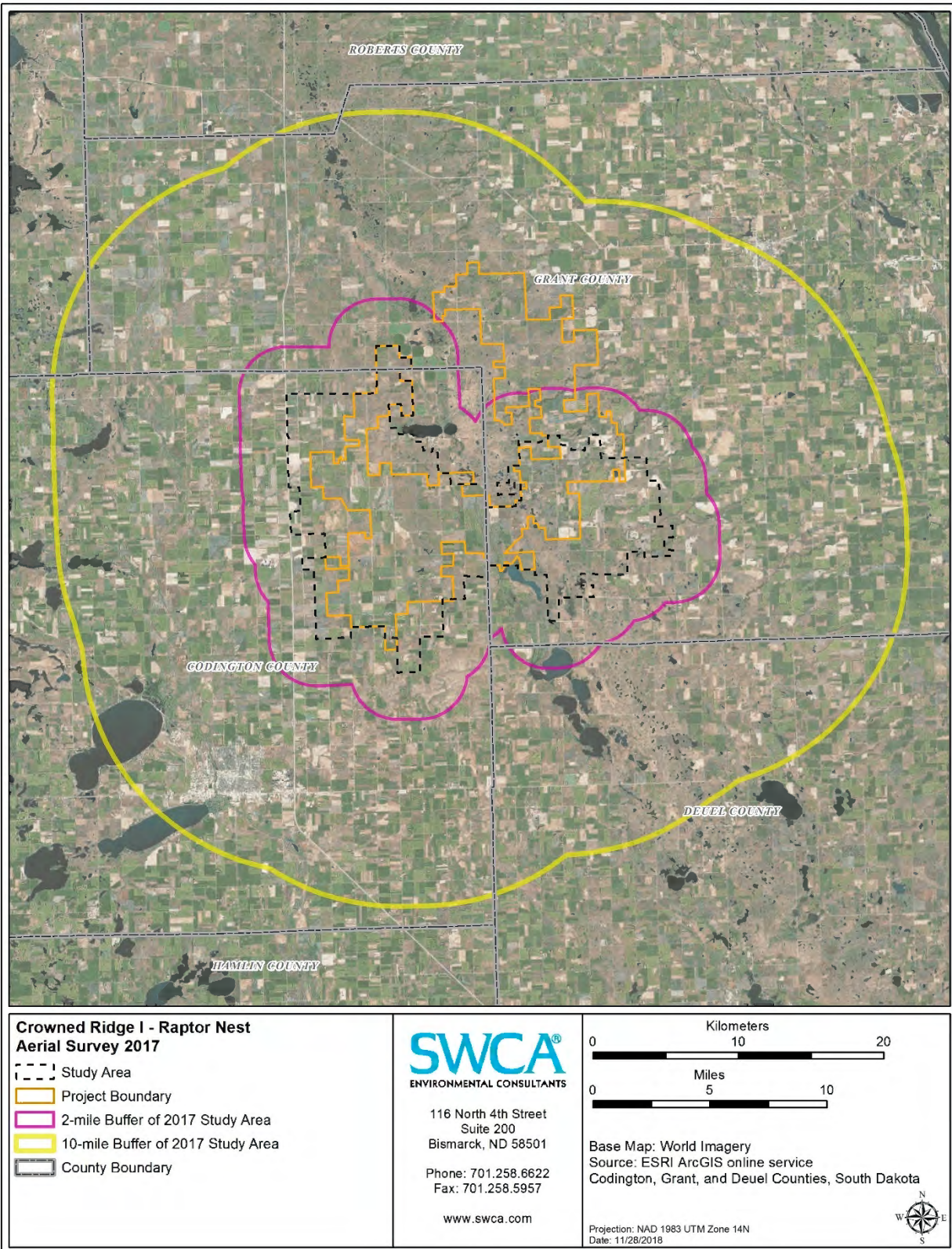


Figure 1. Study areas, 2017.



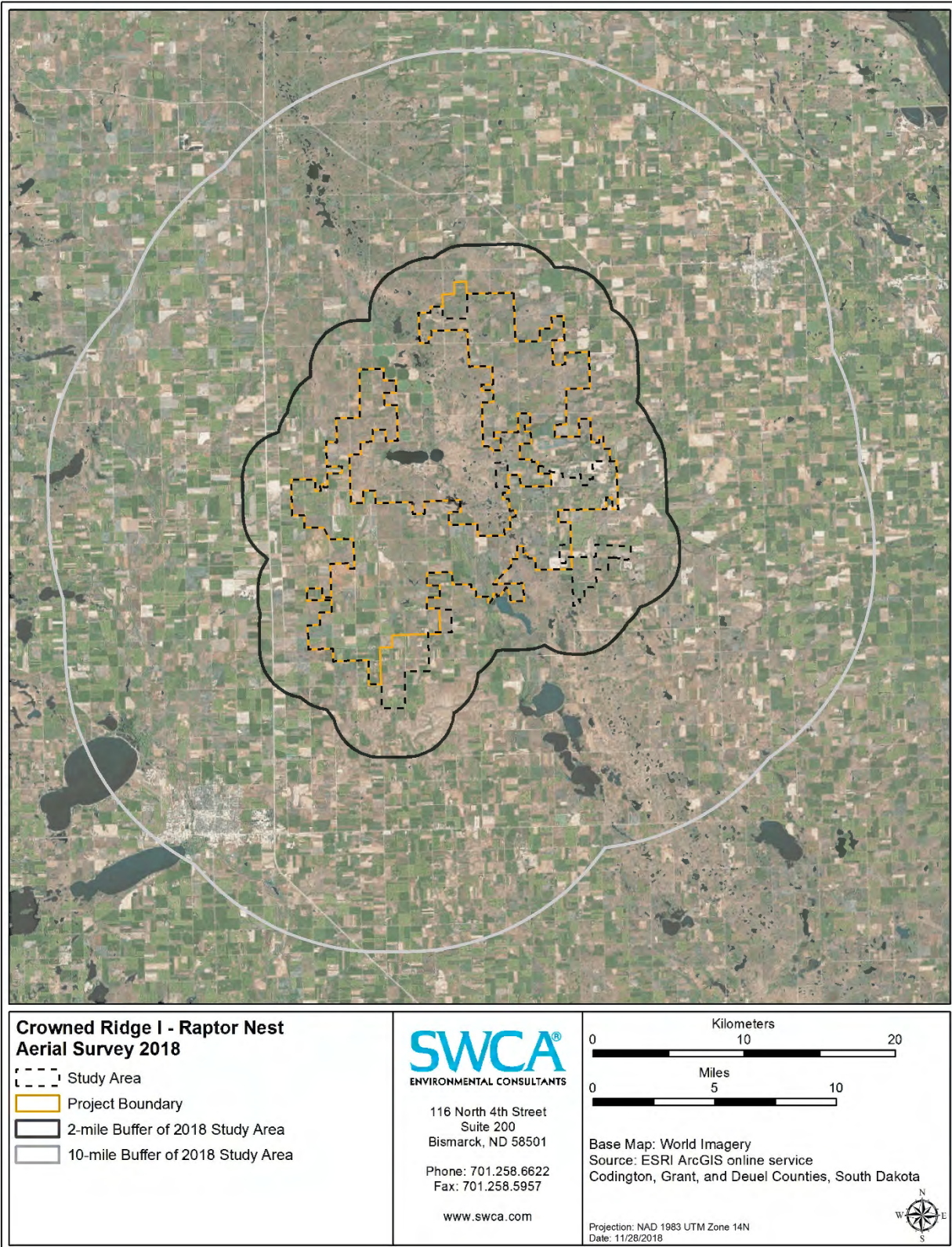


Figure 2. Study areas, 2018.



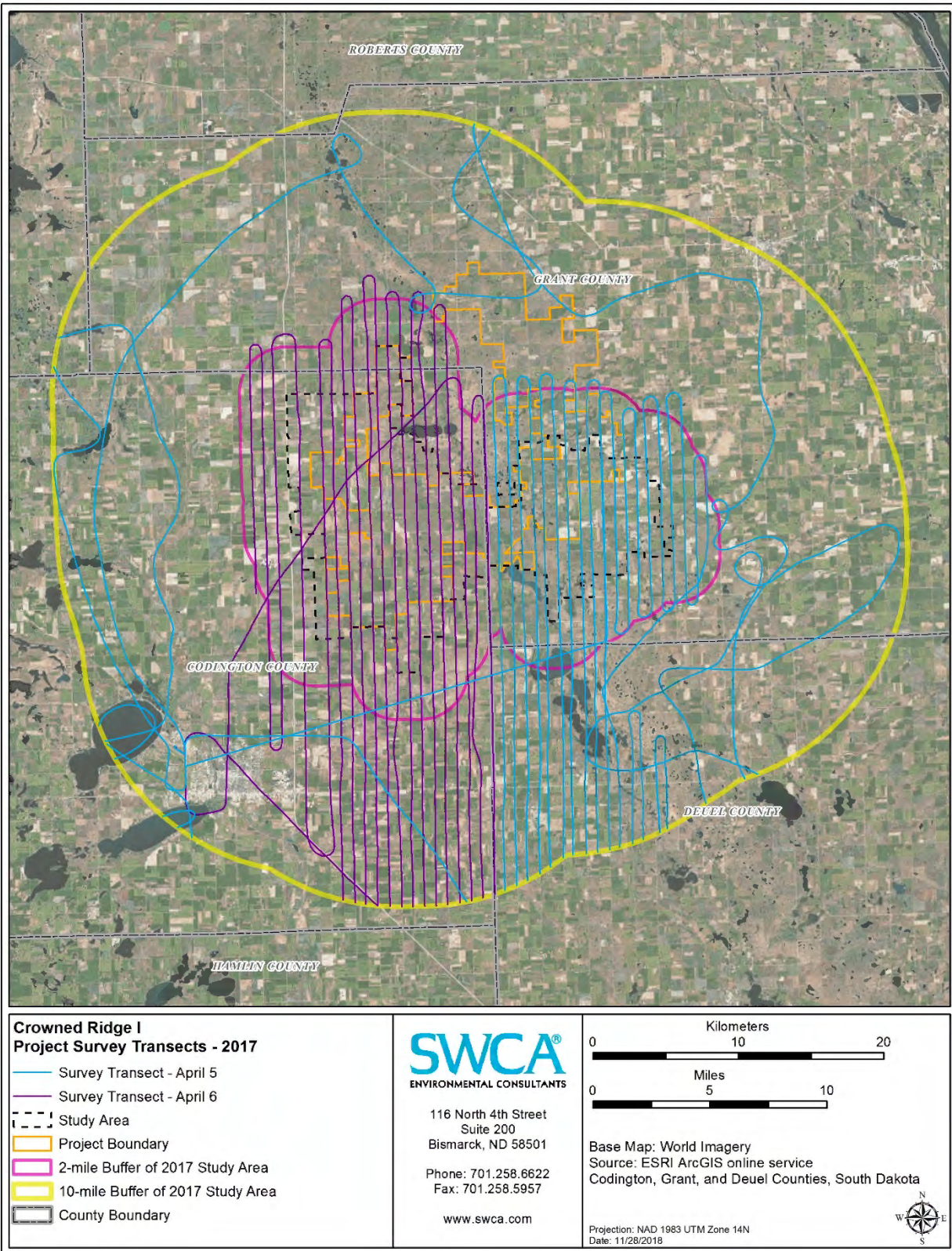


Figure 3. Survey transects, 2017.



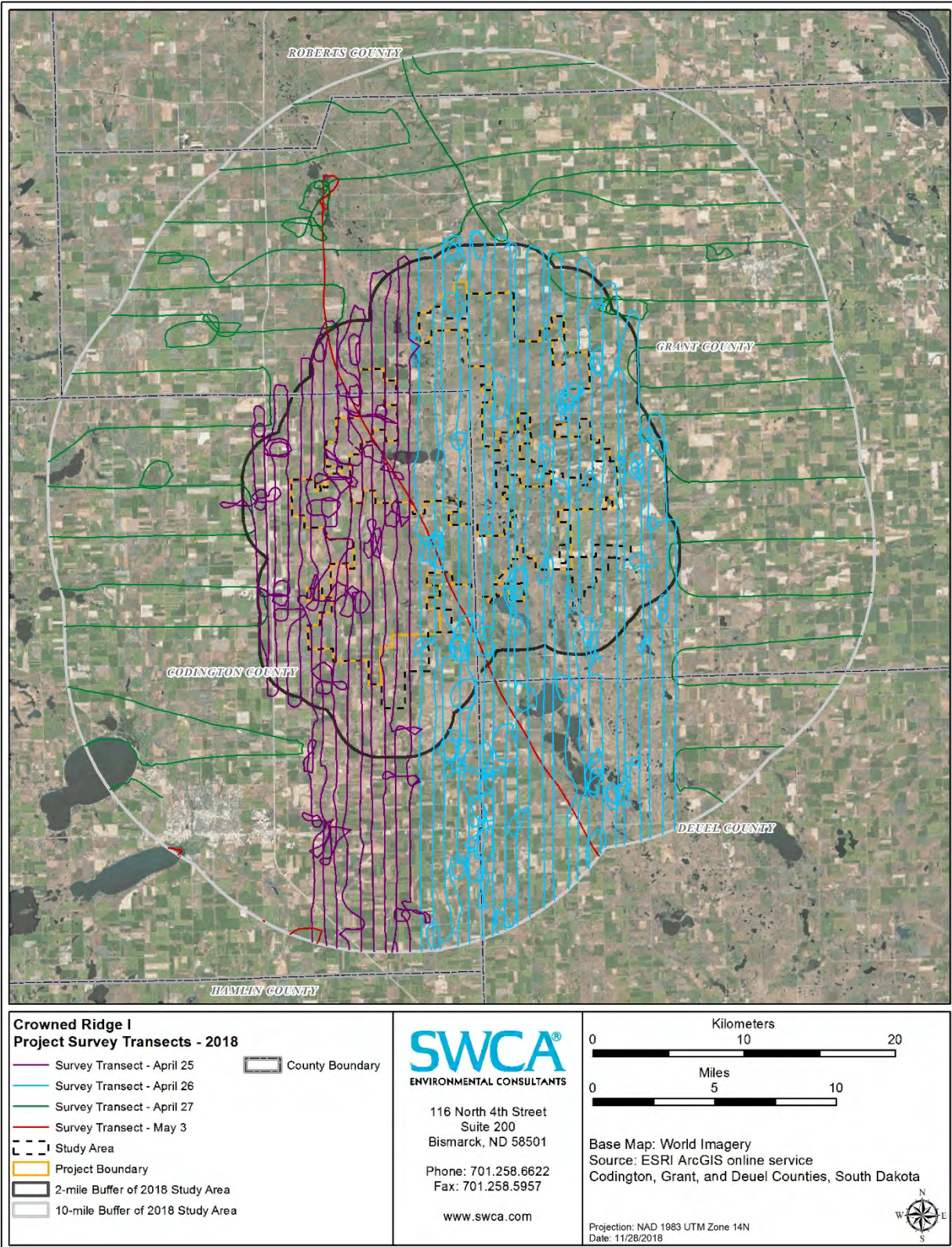


Figure 4. Survey transects, 2018.



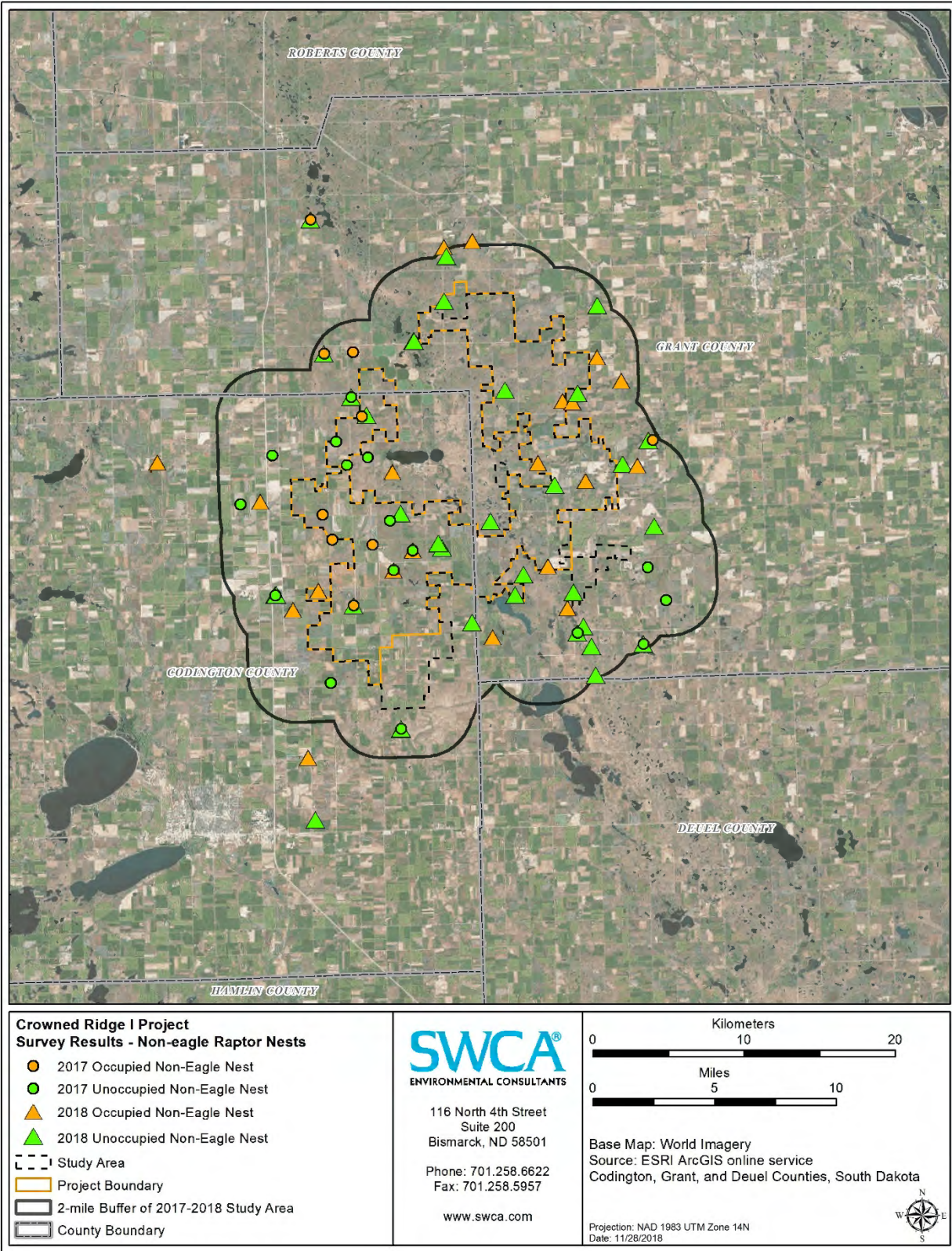


Figure 5. Survey results: non-eagle raptor nests.



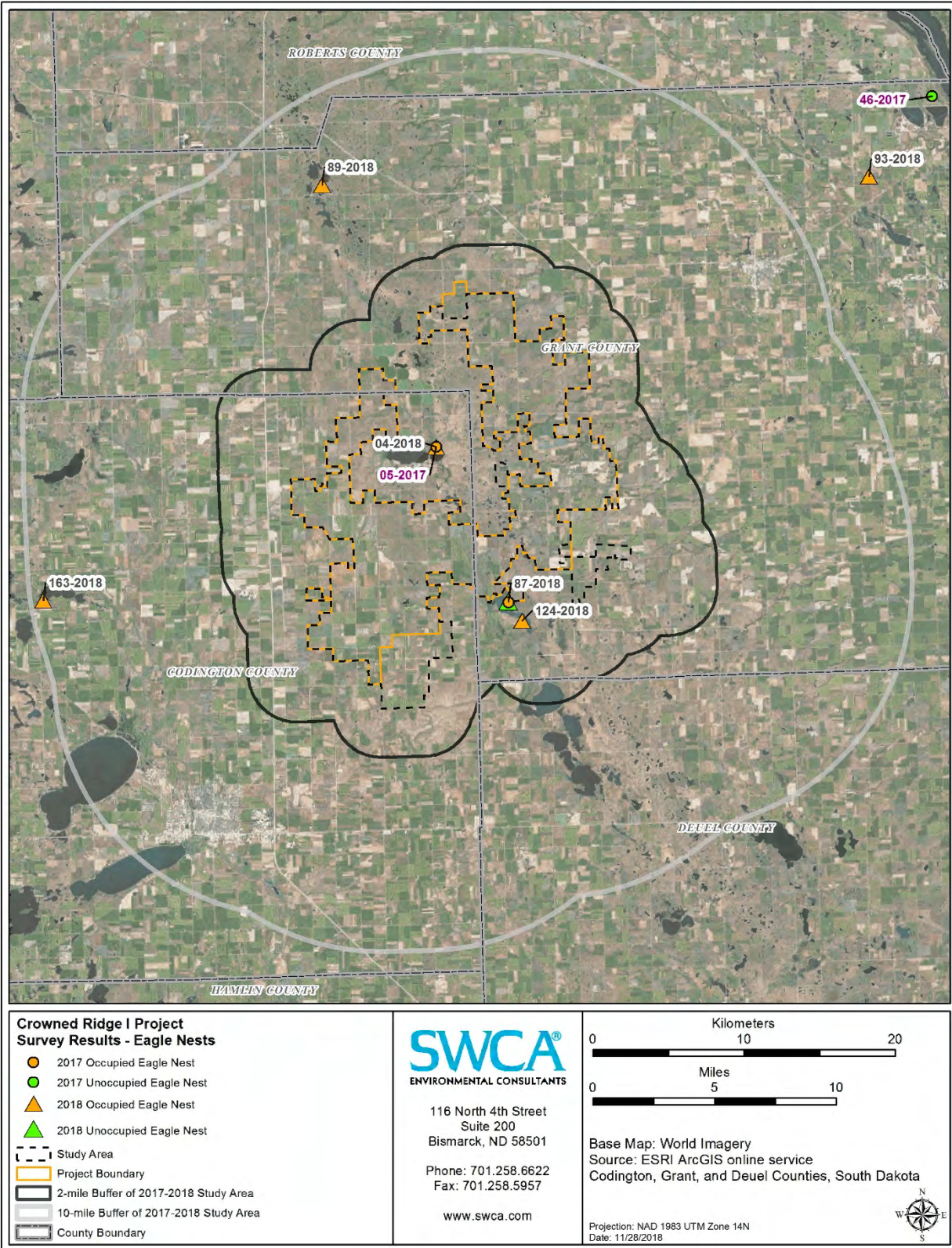


Figure 6. Survey results: eagle nests.



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**ATTACHMENT 1. 2017 Crowned Ridge I Raptor Nest Survey Data**

<b>Nest No.</b>	<b>Status</b>	<b>Species</b>	<b>Study Area</b>	<b>Study Area Proximity</b>	<b>Latitude</b>	<b>Longitude</b>
53-2017	Active	Swainson's Hawk	CRI	10-mi	45.2544	-97.0135
43-2017	Destroyed	Unoccupied Stick Nest	CRI	10-mi	45.2744	-97.0027
45-2017	Destroyed	Unoccupied Stick Nest	CRI	10-mi	45.2750	-97.0030
03-2017	Inactive	Unoccupied Stick Nest	CRI	10-mi	45.0223	-96.7234
15-2017	Inactive	Unoccupied Stick Nest	CRI	10-mi	44.9967	-96.7430
46-2017	Inactive	Unoccupied Stick Nest	CRI	10-mi	45.3176	-96.4869
05-2017	Active	Bald Eagle	CRI	2-mi	45.1172	-96.9126
42-2017	Active	Bald Eagle	CRI & CRII	2-mi	45.0236	-96.8553
06-2017	Active	Red-tailed Hawk	CRI	2-mi	45.1178	-96.7304
50-2017	Active	Red-tailed Hawk	CRI	2-mi	45.1745	-97.0048
51-2017	Active	Swainson's Hawk	CRI	2-mi	45.1749	-96.9806
01-2017	Inactive	Unoccupied Stick Nest	CRI	2-mi	45.0043	-96.7980
14-2017	Inactive	Unoccupied Stick Nest	CRI	2-mi	45.1149	-97.0505
20-2017	Inactive	Unoccupied Stick Nest	CRI	2-mi	45.0860	-97.0784
22-2017	Inactive	Unoccupied Stick Nest	CRI	2-mi	45.0424	-96.7376
23-2017	Inactive	Unoccupied Stick Nest	CRI	2-mi	44.9786	-97.0061
25-2017	Inactive	Unoccupied Stick Nest	CRI	2-mi	45.0315	-97.0508
13-2017	Inactive	Unoccupied Stick Nest	CRI & CRII	2-mi	44.9500	-96.9480
34-2017	Active	Great Horned Owl	CRI	Within	45.0240	-96.9853
47-2017	Active	Red-tailed Hawk	CRI	Within	45.0598	-96.9681
48-2017	Active	Red-tailed Hawk	CRI	Within	45.0788	-97.0094
49-2017	Active	Red-tailed Hawk	CRI	Within	45.0637	-97.0019
52-2017	Active	Red-tailed Hawk	CRI	Within	45.1365	-96.9746
35-2017	Inactive	Red-tailed Hawk	CRI	Within	45.0446	-96.9510
36-2017	Inactive	Red-tailed Hawk	CRI	Within	45.0562	-96.9345
37-2017	Inactive	Red-tailed Hawk	CRI	Within	45.0741	-96.9532
39-2017	Inactive	Red-tailed Hawk	CRI	Within	45.1075	-96.9878
40-2017	Inactive	Red-tailed Hawk	CRI	Within	45.1218	-96.9966
41-2017	Inactive	Red-tailed Hawk	CRI	Within	45.1482	-96.9829
38-2017	Inactive	Swainson's Hawk	CRI	Within	45.1120	-96.9703

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**ATTACHMENT 2. 2018 Crowned Ridge I Raptor Nest Survey Data**

<b>Nest No.</b>	<b>Status</b>	<b>Species</b>	<b>Study Area</b>	<b>Study Area Proximity</b>	<b>Latitude</b>	<b>Longitude</b>
111-2018	Active	Red-tailed Hawk	CR	10-mi	45.2362	-96.9019
117-2018	Active	Red-tailed Hawk	CR	10-mi	45.2394	-96.8778
89-2018	Active	Bald Eagle	CRI	10-mi	45.2750	-97.0030
93-2018	Active	Bald Eagle	CRI	10-mi	45.2710	-96.5420
163-2018	Active	Bald Eagle	CRI	10-mi	45.0313	-97.2456
164-2018	Active	Great-horned Owl	CRI	10-mi	45.1122	-97.1473
14-2018	Inactive	Unknown	CRI	10-mi	44.9967	-96.7430
72-2018	Inactive	Unknown	CRI	10-mi	45.2544	-97.0135
98-2018	Active	Red-tailed Hawk	CRI & II	10-mi	44.9343	-97.0264
99-2018	Inactive	Unknown	CRI & II	10-mi	44.8972	-97.0215
151-2018	Inactive	Unknown	CRI & II	10-mi	44.9789	-96.7835
158-2018	Active	Red-tailed Hawk	CR	2-mi	45.1538	-96.7554
102-2018	Inactive	Unknown	CR	2-mi	45.1807	-96.9294
104-2018	Inactive	Unknown	CR	2-mi	45.1807	-96.9287
110-2018	Inactive	Unknown	CR	2-mi	45.2040	-96.9026
112-2018	Inactive	Unknown	CR	2-mi	45.2307	-96.8996
162-2018	Inactive	Unknown	CR	2-mi	45.1178	-96.7338
05-2018	Gone		CR	2-mi	45.1178	-96.7304
04-2018	Active	Bald Eagle	CRI	2-mi	45.1172	-96.9126
82-2018	Active	Great-horned Owl	CRI	2-mi	45.1032	-96.9498
141-2018	Active	Great-horned Owl	CRI	2-mi	45.0195	-96.8057
80-2018	Active	Red-tailed Hawk	CRI	2-mi	45.0225	-97.0363
96-2018	Active	Red-tailed Hawk	CRI	2-mi	45.0874	-97.0615
97-2018	Active	Red-tailed Hawk	CRI	2-mi	45.0335	-97.0145
160-2018	Active	Red-tailed Hawk	CRI	2-mi	45.1030	-96.7440
21-2018	DNLO	Unknown	CRI	2-mi	45.0424	-96.7376
00-2018	Inactive	Unknown	CRI	2-mi	45.0043	-96.7980
12-2018	Inactive	Unknown	CRI	2-mi	44.9500	-96.9480
24-2018	Inactive	Unknown	CRI	2-mi	45.0315	-97.0508
39-2018	Inactive	Unknown	CRI	2-mi	45.1482	-96.9829
69-2018	Inactive	Unknown	CRI	2-mi	45.1745	-97.0048
94-2018	Inactive	Unknown	CRI	2-mi	45.0315	-97.0497
118-2018	Inactive	Unknown	CRI	2-mi	45.0723	-96.8683
140-2018	Inactive	Unknown	CRI	2-mi	45.0288	-96.8005
146-2018	Inactive	Unknown	CRI	2-mi	45.0083	-96.7928
147-2018	Inactive	Unknown	CRI	2-mi	44.9961	-96.7865
153-2018	Inactive	Unknown	CRI	2-mi	45.1041	-96.7562
161-2018	Inactive	Unknown	CRI	2-mi	45.0666	-96.7308
22-2018	Unknown	Unknown	CRI	2-mi	44.9786	-97.0061
36-2018	Gone	-	CRI	2-mi	45.1120	-96.9703

<b>Nest No.</b>	<b>Status</b>	<b>Species</b>	<b>Study Area</b>	<b>Study Area Proximity</b>	<b>Latitude</b>	<b>Longitude</b>
66-2018	Gone	-	CRI	2-mi	45.0637	-97.0019
67-2018	Gone	-	CRI	2-mi	45.0635	-96.9985
70-2018	Gone	-	CRI	2-mi	45.1749	-96.9806
77-2018	Gone	-	CRI	2-mi	45.1808	-96.9756
78-2018	Gone	-	CRI	2-mi	45.0277	-97.0096
124-2018	Active	Bald Eagle	CRI & II	2-mi	45.0123	-96.8440
122-2018	Active	Red-tailed Hawk	CRI & II	2-mi	45.0032	-96.8694
127-2018	Inactive	Unknown	CRI & II	2-mi	45.0279	-96.8495
128-2018	Inactive	Unknown	CRI & II	2-mi	45.0399	-96.8418
87-2018	Inactive	Prob. Bald Eagle	CRI & II	Within	45.0238	-96.8553
134-2018	Active	Great-horned Owl	CR	Within	45.1063	-96.8274
139-2018	Active	Great-horned Owl	CR	Within	45.1427	-96.8053
145-2018	Active	Great-horned Owl	CR	Within	45.0948	-96.7877
142-2018	Active	Red-tailed Hawk	CR	Within	45.1419	-96.7969
152-2018	Active	Red-tailed Hawk	CR	Within	45.1682	-96.7754
123-2018	Inactive	Unknown	CR	Within	45.1499	-96.8531
143-2018	Inactive	Unknown	CR	Within	45.1469	-96.7921
33-2018	Active	Red-tailed Hawk	CRI	Within	45.0446	-96.9510
34-2018	Active	Red-tailed Hawk	CRI	Within	45.0562	-96.9345
137-2018	Active	Red-tailed Hawk	CRI	Within	45.0447	-96.8213
32-2018	Inactive	Unknown	CRI	Within	45.0240	-96.9853
83-2018	Inactive	Unknown	CRI	Within	45.1373	-96.9703
101-2018	Inactive	Unknown	CRI	Within	45.0781	-96.9437
108-2018	Inactive	Unknown	CRI	Within	45.0571	-96.9095
109-2018	Inactive	Unknown	CRI	Within	45.0597	-96.9126
138-2018	Inactive	Unknown	CRI	Within	45.0926	-96.8139
38-2018	Gone		CRI	Within	45.1218	-96.9966
62-2018	Gone		CRI	Within	45.0611	-96.9243
63-2018	Gone		CRI	Within	45.0598	-96.9681
64-2018	Gone		CRI	Within	45.1000	-96.9943
65-2018	Gone		CRI	Within	45.0788	-97.0094
71-2018	Gone		CRI	Within	45.1365	-96.9746
116-2018	Inactive	Unknown	CRI & II	Within	45.0122	-96.8862
58-2018	Gone		CRI & II	Within	44.9729	-96.8838
60-2018	Gone		CRI & II	Within	45.0014	-96.9039