

Fall 2023: Pre-Construction Eagle Use and Raptor Migration Survey Report

Twin Energy Project - Oxford County, Maine



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INTRODUCTION

PROJECT DESCRIPTION

The Twin Energy Project (Project) is a proposed wind electric generation facility located on South Twin Mountain in Rumford and Roxbury, Maine. Twin Energy LLC (Twin Energy) is proposing to install three wind energy turbines, each with a nameplate capacity of approximately six-megawatts. The access road and collector line are proposed to extend from the existing RoxWind project in Roxbury southerly to South Twin Mountain in Rumford.

The proposed Project includes three turbines that are aligned from west to east, with elevations ranging between 1,950 and 2,155 feet, along the northern ridge of South Twin Mountain. The proposed turbines will each have a hub height of approximately 384-feet (117 meters), blade tip height of approximately 645-feet (196 meters), and total blade swing diameter of approximately 490-feet (149 meters). The access road and collector line are proposed to extend from the existing RoxWind project in Roxbury southerly to South Twin Mountain in Rumford.

Flycatcher LLC (Flycatcher) was contracted by Twin Energy to complete eagle use and raptor migration surveys to aid in Project siting and to support permitting requirements for the Project. Flycatcher biologists consulted with the Maine Department of Inland Fisheries and Wildlife (MDIFW), and the United States Fish and Wildlife Service (USFWS) to develop a site-specific survey plan that will collect sufficient data to support these two agencies in making a determination about the Project during their respective review processes.

SURVEY BACKGROUND

During pre-survey consultations, MDIFW and USFWS recommended that eagle and raptor surveys be completed to support their review and meet the Project's obligations for permitting under the Maine Department of Environmental Protection (MDEP) Site Location of Development Act (Site Law: MDEP, 2019), and the US Army Corps of Engineers (USACE) Maine General Permits (GP: USACE, 2020).

Flycatcher developed a draft survey plan that was provided to both MDIFW and USFWS for comment and review during the winter of 2022. Following this review, slight modifications were made to the survey plan to collect data that could be used in USFWS's collision risk model. The survey plan was approved by both MDIFW and USFWS in early February 2022. The first round of twice weekly surveys (Spring 2022) commenced on February 15 and extended through June 15, 2022. The second round of surveys (Fall 2022) began on August 3 and extended through December 15, 2022. The third round of surveys (Spring 2023) was completed between March 1 and June 15. The fourth and final round of surveys (Fall 2023) was completed between August 1 and December 14, 2023. Figures 1 and 2, depict the Project area and raptor survey location.

In addition to direct consultation with the MDIFW and USFWS, Flycatcher's survey methods were informed by the protocols detailed in the MDIFW 2018 Maine Wind Power Preconstruction Recommendations and Turbine Curtailment Recommendations to Avoid/Minimize Bat Mortality (2018 Recommendations: MDIFW, 2018), and the USFWS Eagle Conservation Plan Guidance (ECPG), Module 1 – Land-based Wind Energy, Version 2, 2013 (ECPG: USFWS, 2013).

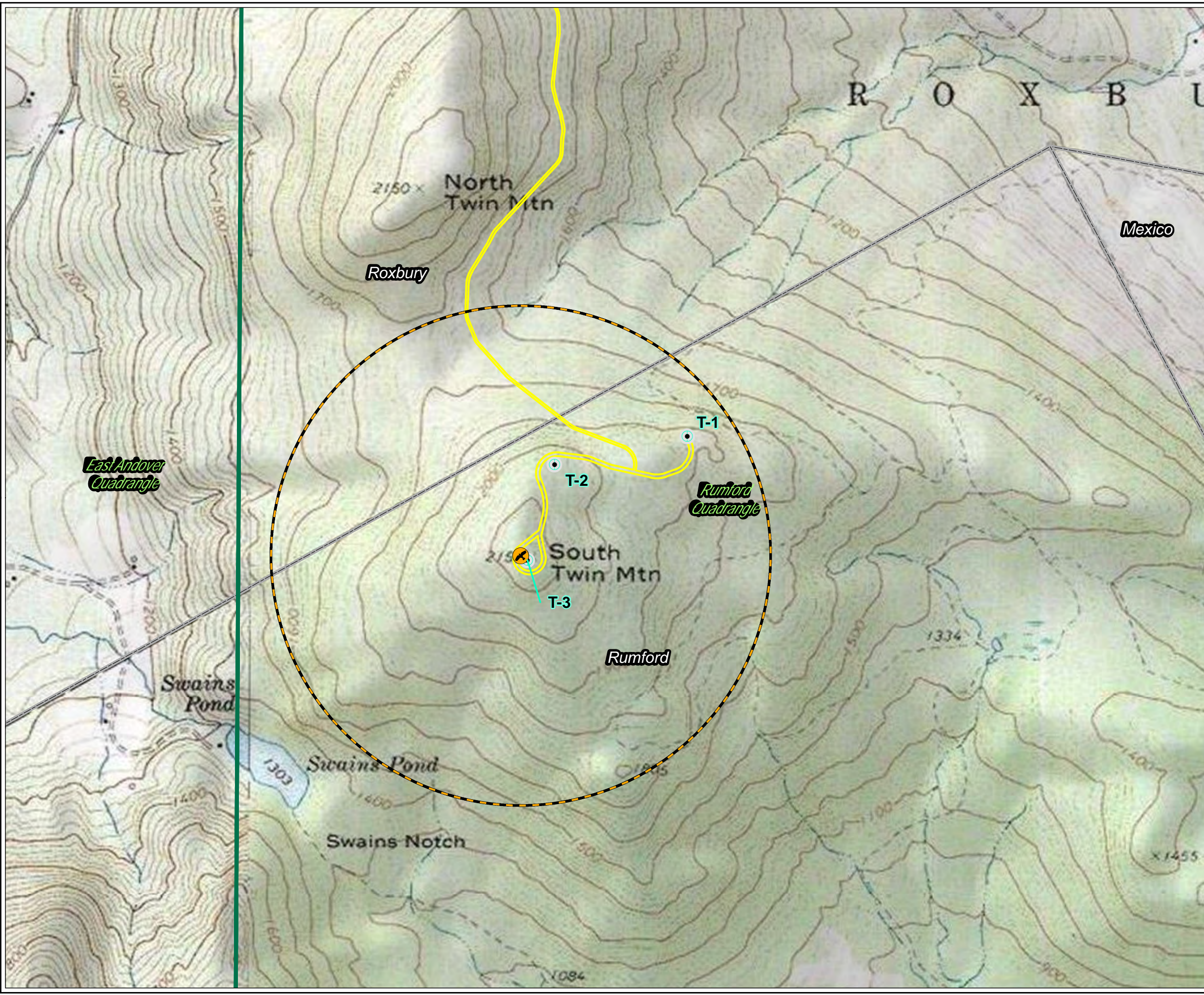
SURVEY OBJECTIVES

Eagle and raptor migration data collected during the fall 2023 survey are presented in this report to provide developers and reviewing agencies with site-specific data to inform decision making during the planning and permitting processes, including review by MDIFW and USFWS. The information presented in this report is intended to support avoidance and minimization of potential Project impacts to eagles and migrating raptor species. Gaining an understanding of how eagles and raptors use the proposed Project site and surrounding area supports turbine siting, operational practices, and the development of best practices to protect species.

Surveys were completed to collect site-specific information typically necessary for MDIFW to make a determination on the Projects' potential impacts to raptors. Additionally, data was collected in a way that will allow USFWS to use their collision-risk model to determine the potential risk the proposed Project has to negatively impact eagles. This model supports decision making regarding the potential need for a wind project to apply for a take permit. Evaluating the data collected from this survey is a key part of the take permitting process.

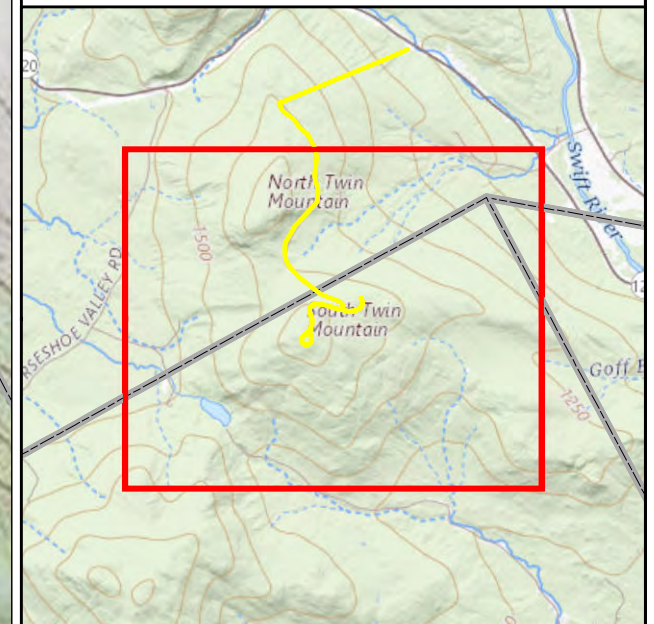
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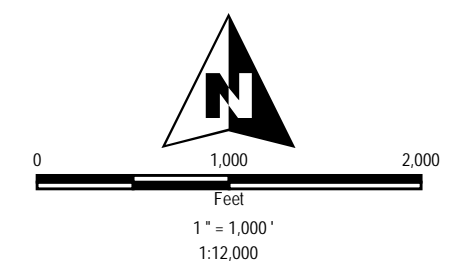
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- PROPOSED PROJECT BOUNDARY
- PROPOSED TURBINE LOCATION
- RAPTOR SURVEY LOCATION
- 800M RADIUS SAMPLE AREA
- USGS 7.5-MINUTE QUADRANGLE BOUNDARY
- TOWN BOUNDARY



NOTES:

- BASEMAP IMAGERY FROM USGS 7.5' QUADRANGLE SERIES.



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 OXFORD COUNTY, MAINE**

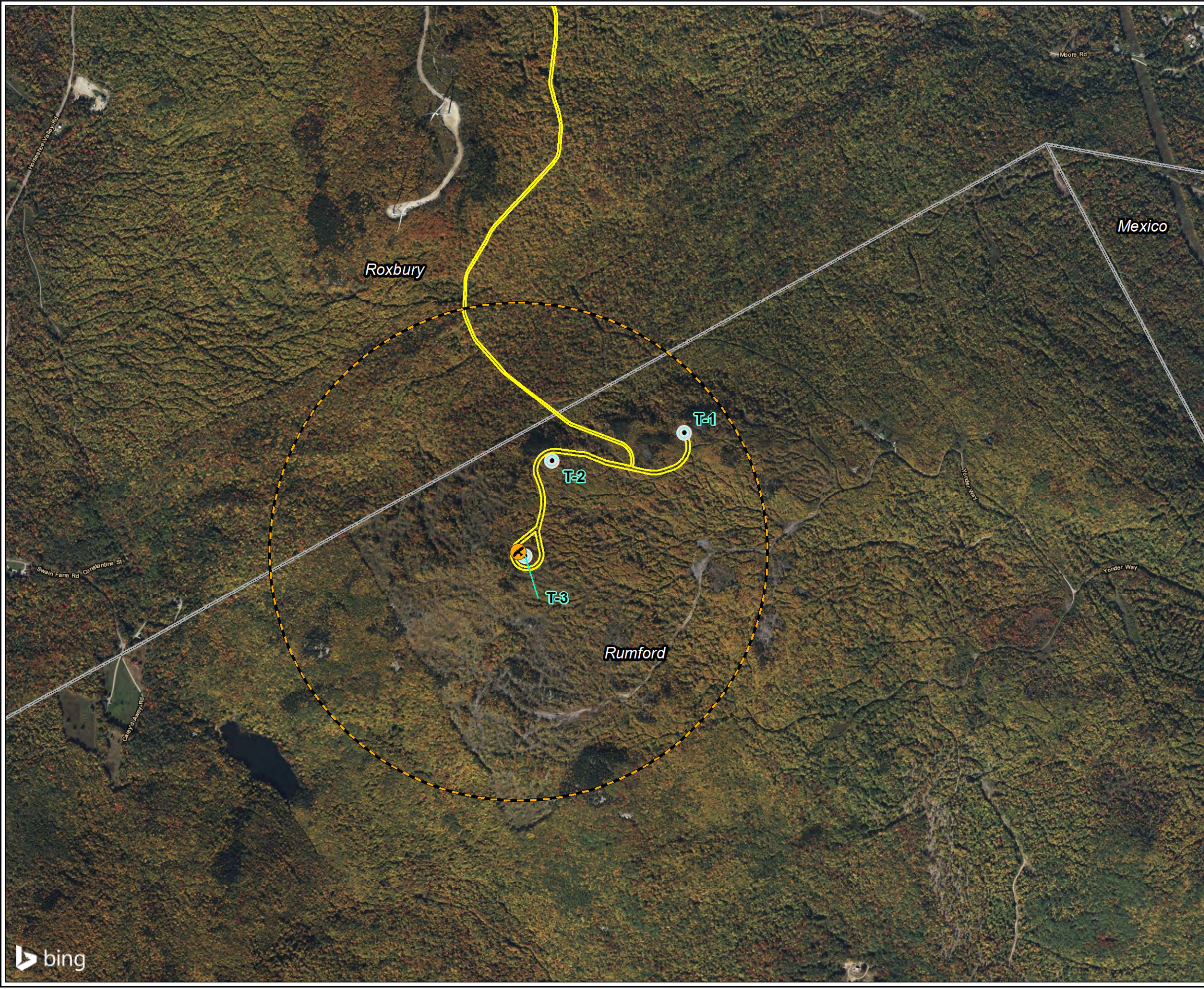
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CHECKED BY: R. KELSHAW	FIGURE 1
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YEAR: 2022	

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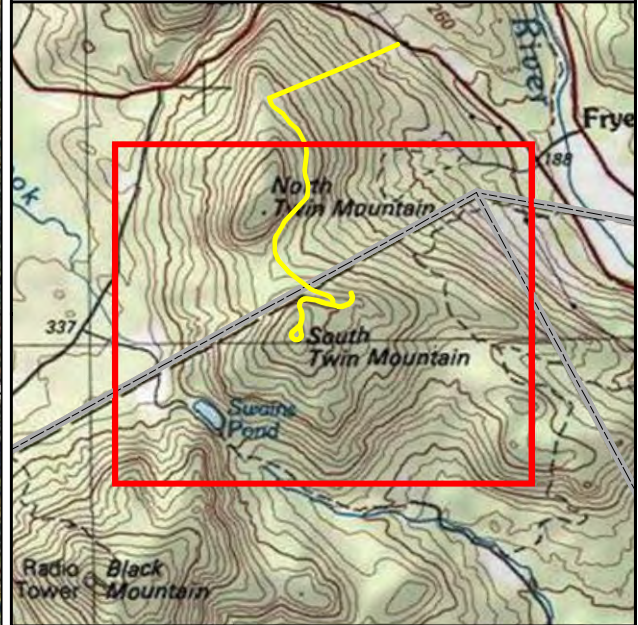
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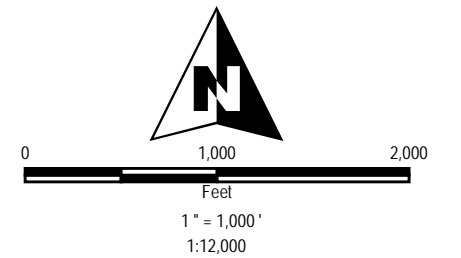
LEGEND

- PROPOSED PROJECT BOUNDARY
- PROPOSED TURBINE LOCATION
- RAPTOR SURVEY LOCATION
- 800M RADIUS SAMPLE AREA
- TOWN BOUNDARY



NOTES:

- 1 BASEMAP IMAGERY FROM BING AERIAL IMAGERY.



PROJECT: **TWIN ENERGY LLC
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 OXFORD COUNTY, MAINE**

TITLE: **AERIAL RAPTOR SURVEY LOCATION MAP**

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EAGLE USE AND RAPTOR MIGRATION SURVEYS

SURVEY SUMMARY

In this summary, the term “raptor” includes eagle and raptor species. A total of 100 raptors were observed during the fall 2023 surveys; 94 raptors were observed during raptor surveys (August 1 – November 30) and six (6) raptors were observed while travelling from the parking area at the intersection of Swift River Road and Yonder Way located in Mexico, Maine, to the raptor survey location at the top of South Twin Mountain in Rumford, Maine (the Survey Location). No additional raptors were observed during eagle use surveys that extended to December 14, 2023.

Of the 94 raptors observed during Fall 2023 surveys, 67 (71%) occurred within the 800-meter plot of the Survey Area and 54 (57%) occurred both within the 800-meter plot and at flight heights below the Survey Area height (221 meters) for at least a portion of their flight. The fall seasonal observation rate for raptors observed during raptor surveys was 0.40 raptors/hour. The seasonal observation rate for raptors seen within 800 meters of the Survey Location during raptor surveys was 0.28 raptors/hour.

A total of four (4) bald eagles (*Haliaeetus leucocephalus*) were documented resulting in an observation rate of 0.02 eagles/hour (Table 4). One (1) out of four (4) (25%) of these eagle observations occurred within 800 meters of the Survey Location. The one eagle that was within the 800 m plot did not dip below the survey height of 221 meters (Table 4). The observation rate for eagles within 800 meters of the Survey Location was 0.004 eagles/ hour.

SURVEY METHODS

Survey Description and Location

The Survey Area encompasses a three-dimensional cylindrical plot with a radius of 2,625-feet (800 meters) from the Survey Location (Figures 1 and 2), and a distance above the ground of 725-feet (221-meters), which is 82-feet (25 meters) above maximum turbine blade height of 196 meters. The Survey Location was selected during a site visit in early February 2022 and is situated on a prominent location at the top of South Twin Mountain, near proposed Turbine 3. A recent clearing for the installation of a temporary metrological tower created an ideal location for viewing raptor movements within the proposed turbine array (Figures 1 and 2). The viewshed from this point has nearly unobstructed views to the northwest beyond Ellis Pond and the RoxWind project, and to the east beyond Swift River and Roxbury Mountain. The viewshed encompasses the entire proposed Project area. There is also a view south toward the mill in Rumford and Black Mountain and unobstructed overhead views. Photos of the Survey Location are included in Appendix A.

The Survey Location and Survey Area meet the standards described in the ECPG (USFWS 2013). For this survey, the Project footprint, or the minimum convex polygon around the turbines, is a one-kilometer radius from the three proposed turbine locations (4.58 square kilometers). The 800-meter radius (2.01 square kilometers) Survey Area covers 44% of the total Project footprint (USFWS 2013). This exceeds the recommendation outlined in the ECPG (USFWS 2013) to cover a minimum of 30% of the area within one kilometer of proposed turbines. Additionally, this encompasses 100% of the three proposed turbine locations (Figures 1 and 2).

Surveys consisted of point-based recordings of raptor and eagle flight activity (minutes and direction of flight) in proximity to the three-dimensional cylindrical sample plot or Survey Area. The buffer of 25 meters above the maximum blade reach

was included in the Survey Area based on guidance from USFWS and per recommendations outlined in Title 50 of the Code of Federal Regulations (50 CFR 22.80(d)(3)(ii)(A)).

Note that in the following “Survey Area” references the entire cylindrical plot, “800-meter plot” references the horizontal limit of the Survey Area, which is 800 meters from the central Survey Location, and “Survey Area height” references the area 221 meters above the ground, which is a buffer of 25 meters beyond the proposed turbine height of 196 meters.

Data Collection

Flycatcher conducted eagle use surveys from August 1 to December 14, 2023, for a total of 254 hours. Raptor migration surveys were conducted from August 1 to November 30, 2023, for a total of 237 hours. Survey days were scheduled on days with forecasted good visibility and fair weather, however, as weather changes rapidly in mountainous regions, surveys included days with variable weather conditions. Surveys were conducted from 0900 hours to 2-hours before sunset to target peak hours of raptor movement unless conditions impeded access or hazardous weather dictated ending surveys early.

Stationed at the survey location, observers scanned the surrounding area using binoculars and a spotting scope. Data collected included the observer’s name, the date of the survey, the survey start and end time, and hourly weather details including temperature, wind speed and direction, visibility, sky conditions, and cloud type. Observed raptors were recorded on the data sheet and the flight path was sketched on a map. The following was recorded for each observation:

1. Time of observation;
2. Total observation time seen;
3. Species;
4. Number of individuals;
5. Sex (when possible);
6. Age (when possible);
7. If the bird occurred within 800-meter plot and if they were observed below the Survey Area height (221 meters);
8. Time above and below Survey Area height;
9. If the bird crossed a ridge and if they crossed a ridge within the 800-meter plot;
10. The flight height above ground level inside and outside the 800-meter plot, and flight height if crossed a ridge;
11. Flight azimuth or direction; and
12. Description of general flight behavior and activity.

Non-raptor avian species were also documented as incidental wildlife observations during surveys.

Data Summary and Analysis

Raptor observation data were evaluated by the following metrics:

1. Seasonal observation rates (number of raptor observations per hour);
2. Number of species and individuals;
3. Hourly observation totals (and survey hour totals);
4. Percentage of birds observed within 800-meter plot;
5. The percentage of birds seen within 800-meter plot and below Survey Area height (221 meters);
6. Percentage of birds observed crossing ridges inside 800-meter plot; and
7. Mean minimal and mean overall flight height of birds inside, and crossing a ridge inside, the 800-meter plot.

SURVEY RESULTS

Survey Effort and Weather

Eagle use surveys were conducted for a total of 38 days and 254 survey hours, and raptor surveys were conducted concurrently, for a total of 34 days and 237 hours.

Wind direction was variable throughout the survey period; however, winds most often blew from the northwest. Wind speeds ranged from calm, zero (0) miles per hour (mph), to strong, 19-24 mph. Sky conditions ranged from clear, to cloudy and overcast, and were most frequently partly cloudy or variable. Seasonal temperatures ranged from a high of 87°F on September 5 to a low of 13°F on December 14. Table 1 summarizes the weather conditions throughout the survey period.

Table 1. Daily Weather Conditions, Twin Wind Energy Project, Fall 2023.

<i>Date</i>	<i>Daily min temp °F</i>	<i>Daily max temp °F</i>	<i>Mean daily cloud cover %</i>	<i>Mean wind code</i>	<i>Daily wind direction</i>	<i>Range of daily sky conditions</i>
1-Aug	63	70	55	2	NW	Partly cloudy or variable sky
3-Aug	60	70	86	3	S, SW	Partly cloudy or variable sky, cloudy or overcast
9-Aug	60	68	77	4	NW	Partly cloudy or variable sky, cloudy or overcast
10-Aug	72	80	60	1	SW, W	Partly cloudy or variable sky, cloudy or overcast
14-Aug	66	73	84	3	NW, W	Partly cloudy or variable sky, cloudy or overcast
17-Aug	62	65	100	1	S	Fog or mist
22-Aug	69	74	14	4	N, NW	Clear or few clouds, partly cloudy or variable sky
23-Aug	68	77	26	2	NW	Clear or few clouds, partly cloudy or variable sky
28-Aug	74	80	58	0	E, NE, S, SE, SW, W	Clear or few clouds, partly cloudy or variable sky, cloudy overcast
29-Aug	72	79	60	2	S	Partly cloudy or variable sky, cloudy overcast, fog or mist
5-Sep	77	87	30	1	N, NW	Clear or few clouds, partly cloudy or variable sky
7-Sep	78	86	30	1	SW, W	Clear or few clouds, partly cloudy or variable sky
12-Sep	64	67	100	1	E	Fog or mist, drizzle
15-Sep	50	61	94	2	N	Cloudy overcast
20-Sep	57	62	90	2	NW	Partly cloudy or variable sky, cloudy or overcast
22-Sep	64	72	8	1	S, SW	Clear or few clouds
27-Sep	59	68	22	1	E, N, NE	Partly cloudy or variable sky
30-Sep	60	72	100	1	N, NE, S, SE	Fog or mist
3-Oct	64	77	35	3	NW	Partly cloudy or variable sky
4-Oct	71	86	20	1	NW, SW	Clear or few clouds, partly cloudy or variable sky
10-Oct	49	51	98	2	SW, W	Partly cloudy or variable sky, cloudy or overcast
13-Oct	43	49	93	4	NW, SW	Cloudy overcast, drizzle
18-Oct	47	56	88	1	NW, W	Cloudy overcast, drizzle
20-Oct	50	55	99	1	SW, W	Cloudy overcast
25-Oct	58	64	81	1	NW, W	Partly cloudy or variable sky, cloudy or overcast
31-Oct	27	32	61	1	NW	Partly cloudy or variable sky, cloudy or overcast
2-Nov	28	42	14	1	NW, W	Clear or few clouds, partly cloudy or variable sky
9-Nov	27	30	100	1	SE	Fog or mist, snow
10-Nov	33	40	70	2	NW	Partly cloudy or variable sky, cloudy or overcast
14-Nov	27	32	94	2	N, NW	Cloudy overcast
16-Nov	43	49	10	1	NW	Clear or few clouds
20-Nov	25	28	33	3	NW	Partly cloudy or variable sky
29-Nov	19	22	62	3	W	Partly cloudy or variable sky, cloudy or overcast
30-Nov	30	37	59	1	S, SW	Partly cloudy or variable sky, cloudy or overcast
8-Dec	22	30	2	2	NW	Partly cloudy or variable sky
9-Dec	27	30	100	1	SE	Fog or mist
12-Dec	25	33	34	2	SW, W	Partly cloudy or variable sky
14-Dec	13	26	23	1	NW	Clear or few clouds, partly cloudy or variable sky

Wind Speed codes 1 = 1-3 mph; 2 = 4-8 mph; 3 = 9-12 mph; 4 = 13-18 mph; 5 = 19-24 mph

Raptor Migration Survey Results

Raptor surveys were conducted over a total of 34 days and 237 survey hours. Raptor survey results include eagles observed during this period. Incidental raptors were documented during eagle surveys and while traveling to and from the survey location, however these data are not included in the following analysis. A total of 94 raptors were observed during the survey period from August 1 to November 30, 2023, Table 2.

Table 2. Raptor Survey Species List, Twin Wind Energy Project, Fall 2023.

<i>Raptor species observed</i>	<i>Scientific name</i>	<i>Total number of observations</i>
American Kestrel	<i>Falco sparverius</i>	2
Bald Eagle	<i>Haliaeetus leucocephalus</i>	4
Broad-winged Hawk	<i>Buteo platypterus</i>	11
Cooper’s Hawk	<i>Accipiter cooperii</i>	4
Merlin	<i>Falco columbarius</i>	1
Northern Harrier	<i>Circus hudsonius</i>	1
Red-shouldered Hawk	<i>Buteo lineatus</i>	1
Red-tailed Hawk	<i>Buteo jamaicensis</i>	13
Sharp-shinned Hawk	<i>Accipiter striatus</i>	3
Turkey Vulture	<i>Cathartes aura</i>	50
Unknown Raptor	<i>unknown</i>	4
Total raptors observed during fall raptor surveys		94

Total Number of Raptors Observed

Of the 94 raptors observed during raptor surveys (Table 2), the species most frequently observed were turkey vulture (n=50) and red-tailed hawk (n=13); the most infrequently observed included merlin, red-shoulder hawk (n=1), and northern harrier (n=1) (Figure 3).

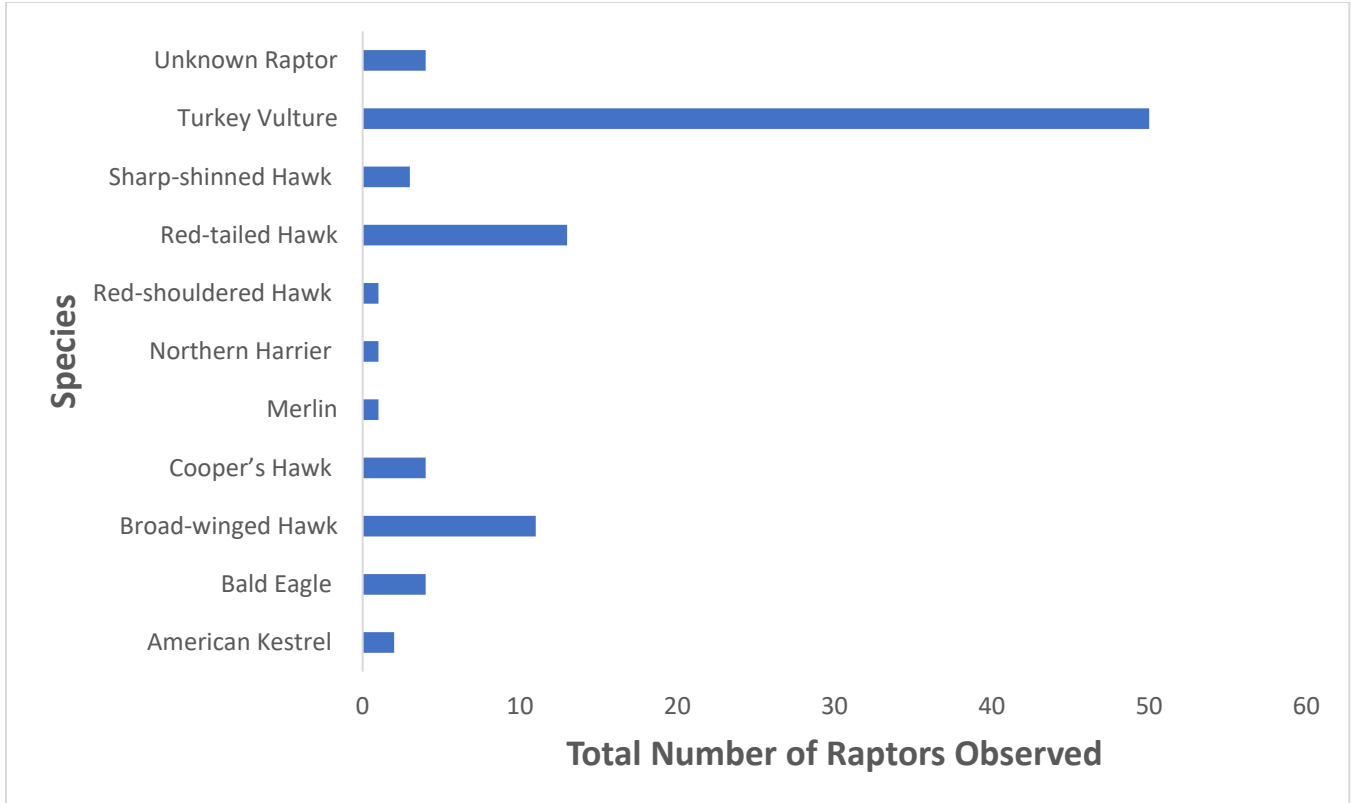


Figure 3. Number of Raptor Observations by Species, Twin Wind Energy, Fall 2023.

Daily Observations

During fall raptor surveys, daily observation rates ranged from 0 raptors/day (13 of the 34 days) to 18 raptors/day (August 29) and from 0 raptors/hour to 2.14 raptors/hour (Figure 4; Appendix C). The fall observation rate for raptors seen during raptor surveys was 0.40 raptors/hour.

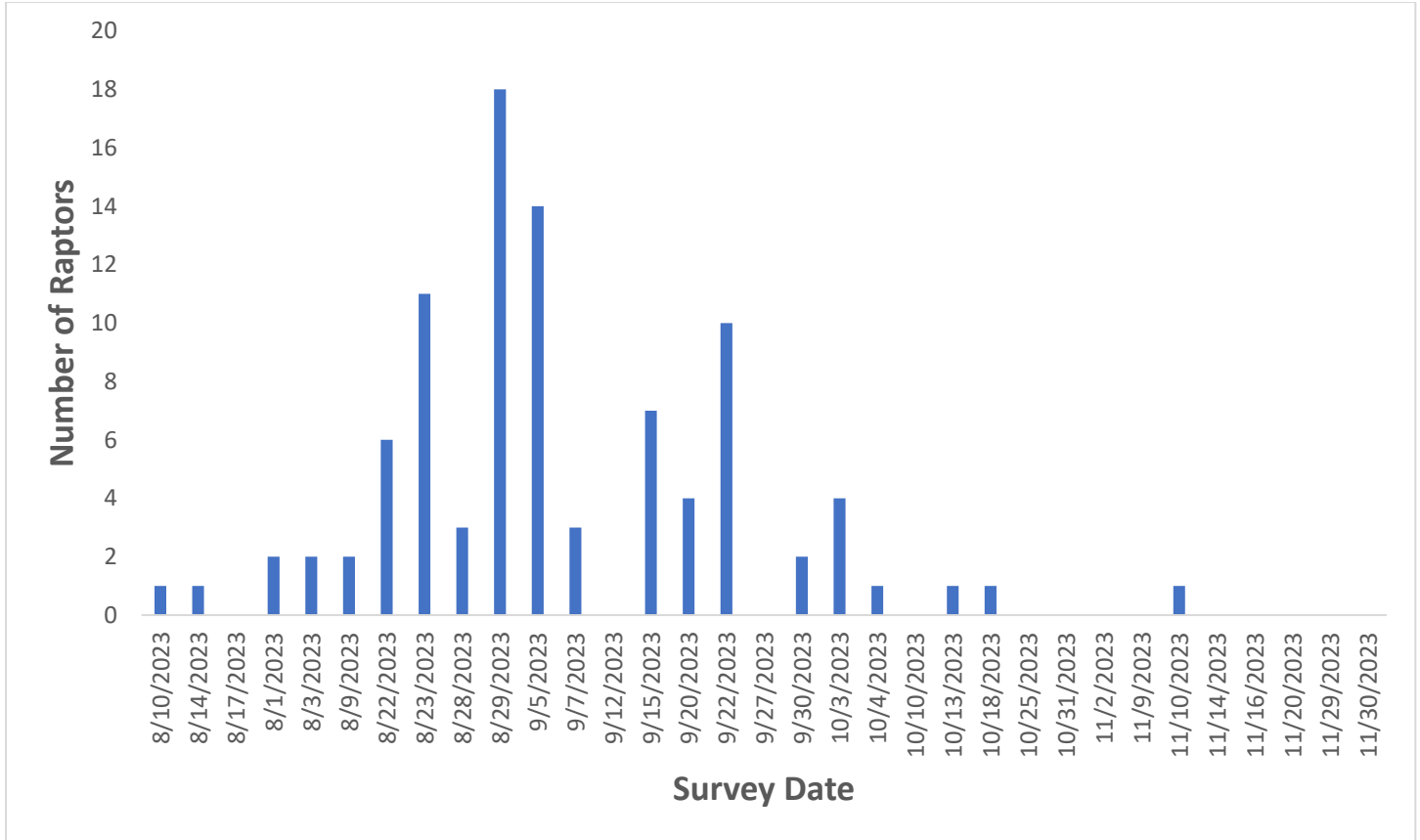


Figure 4. Daily Raptor Observations, Twin Wind Energy Project, Fall 2023.

Peak Hourly Observations

Peak hourly raptor observations occurred from 1500 to 1600 hours (16 raptors) and 1600 to 1700 hours (16 raptors), followed closely by 1100 to 1200 hours (15 raptors) and 1300 to 1400 hours (14 raptors) (Figure 5; Appendix C). Note, hourly survey effort varied daily as surveys started daily at 0900 hours and ended daily 2 hours before sunset, unless delayed by trail or weather conditions. As such, there is a lower hourly survey effort for hour blocks later in the day, and slightly lower hourly survey effort for 900 to 1000, as shown in Figure 5.

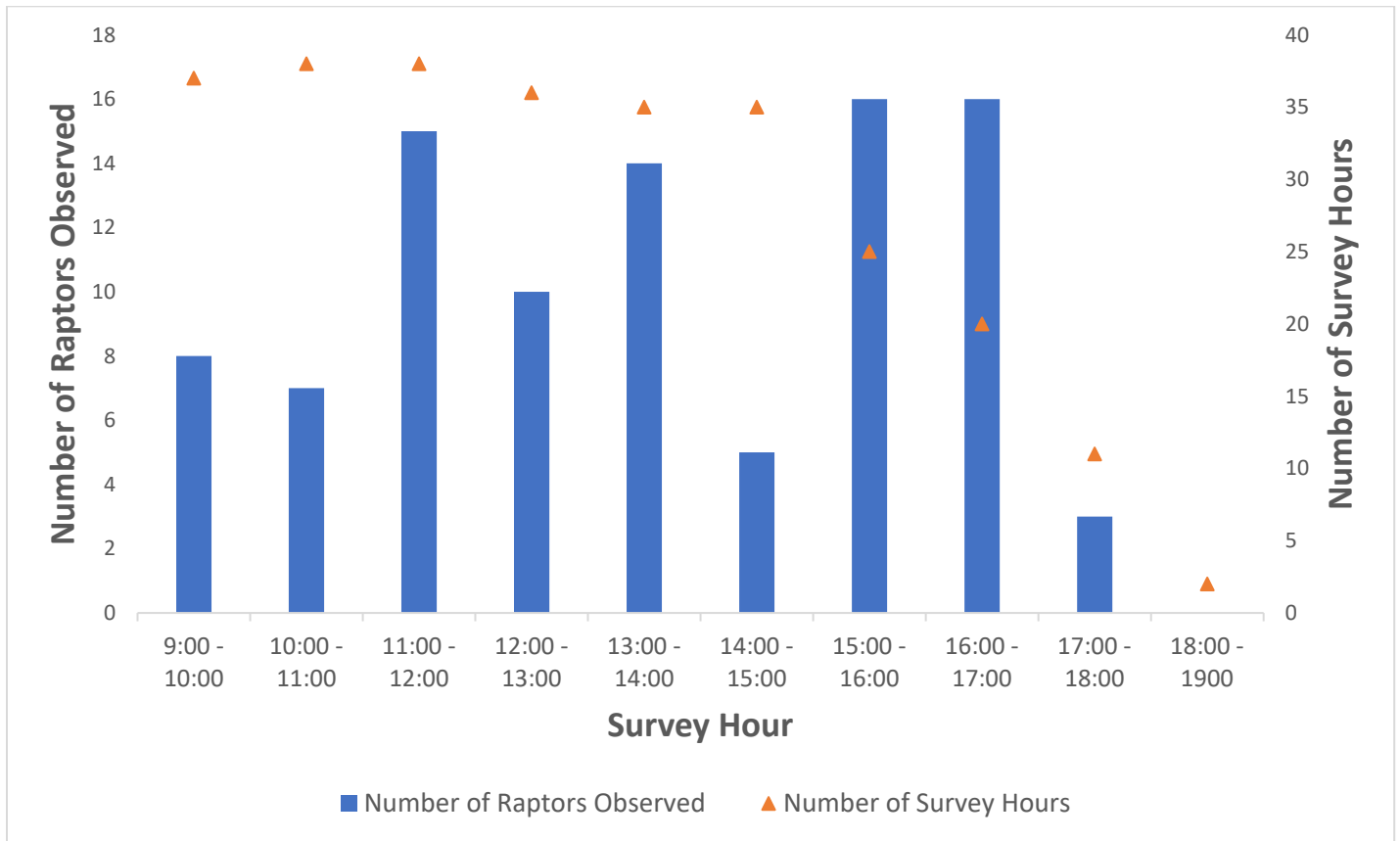


Figure 5. Number of Observations of Raptors per Survey Hour, Twin Wind Energy Project, Fall 2023.

Fall Flight Paths and Flight Heights

Of the 94 raptors observed during Fall 2023 surveys, 67 (71%) occurred within the 800-meter plot of the Survey Area and 54 (57%) occurred both within the 800-meter plot and at flight heights below the Survey Area height (221 meters) for at least a portion of their flight (Table 3; Figure 6; Appendix C). The seasonal observation rate for raptors within the 800-meter plot was 0.28 raptors/hour. The mean minimum flight height of those raptors observed within the 800-meter plot was 108 meters (354 feet). Of the 94 raptors observed, 43 (46%) crossed a ridge and 35 (37%) crossed a ridge within the 800-meter plot (Table 3). The mean minimum flight height of raptors that crossed a ridge within the 800-m plot was 82 meters (269 feet).

Table 3. Summary of Raptor Locations and Mean Flight Heights, Twin Wind Energy Project, Fall 2023.

<i>Raptor species</i>	<i>Number inside 800m plot</i>	<i>Number outside 800m plot¹</i>	<i>Number crossed a ridge²</i>	<i>Number inside Survey Area³</i>	<i>Total</i>
American Kestrel*	2		2	2	2
Bald Eagle*	1	3			4
Broad-winged Hawk	10	1	8	8	11
Cooper's Hawk	4		1	3	4
Merlin	1			1	1
Northern Harrier*	1			1	1
Red-shouldered Hawk	1				1
Red-tailed Hawk	8	5	4	8	13
Sharp-shinned Hawk	3		2	3	3
Turkey Vulture	32	18	17	24	50
Unknown Raptor	4		1	4	4
Total	67	27	35	54	94

1. Observations outside 800-meter plot only.
 2. Ridges inside 800-meter plot only.
 3. Survey Area as defined (within 800-meter plot and below the Survey Area height of 221 meters).
 *Listed as a species of special concern by MDIFW (2023).

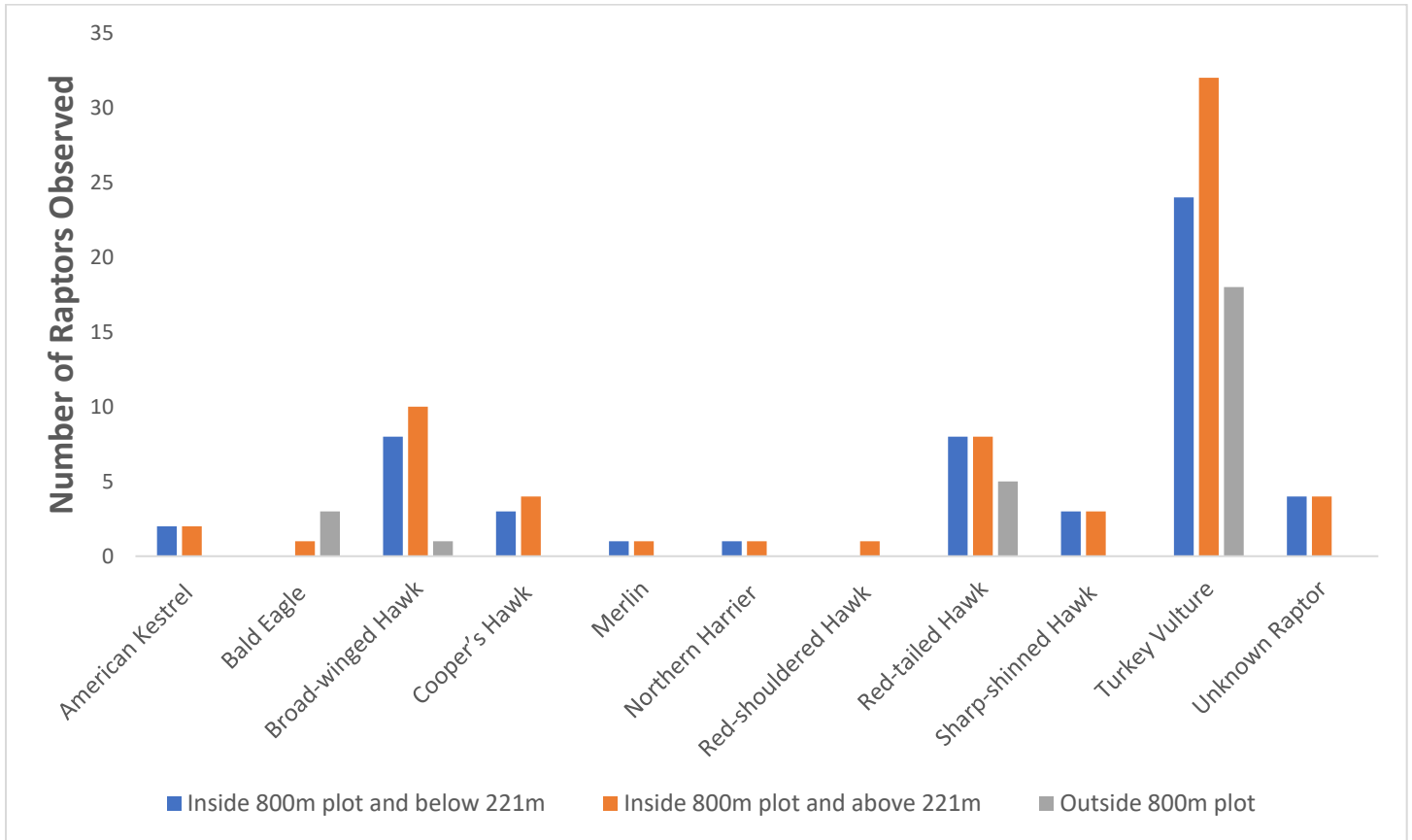


Figure 6. Number of Raptor Observations Within 800-meter Radius Plot at Heights Below and Above 221 Meters, and Outside 800-meter Radius Plot, Twin Wind Energy Project, Fall 2023.

Eagle Use Survey Results

Eagle use surveys were conducted from August 1 to December 14 for a total of 38 days and 254 survey hours. During eagle use surveys, there were four (4) bald eagle observations, resulting in an observation rate of 0.02 eagles/hour. Of the four eagle observations, one (1) occurred within the 800-meter plot (25%). This individual did not dip below the Survey Area height of 221 meters within the 800-m plot (Table 4). The observation rate for eagles within the 800-meter plot was 0.004 eagles/hour. No observed eagles crossed a ridge within the 800m plot. Out of the four (4) eagles observed during surveys, two (2) were adults and two (2) were juvenile. Table 5 provides details regarding each eagle observed during the fall 2023 eagle use surveys.

Table 4. Summary of Eagle Locations and Mean Flight Heights, Twin Wind Energy Project, Fall 2023.

<i>Observation</i>	<i>Inside 800m plot</i>	<i>Outside 800m plot¹</i>	<i>Crossed a ridge²</i>	<i>Number inside survey area³</i>
Bald eagle	1	3	0	0
Percent of total observations	25%	75%	NA	NA
Mean minimum flight height (meters)	300	313	NA	NA
Mean flight height (meters)	450	438	NA	NA
<ol style="list-style-type: none"> 1. Observations outside 800-meter plot only. 2. Ridges inside 800-meter plot only. 3. Survey Area as defined (within 800-meter plot and below the Survey Area height of 221 meters). 				

Table 5. Eagle Use Observations, Twin Wind Energy Project, Fall 2023.

Date	Time First Seen	Time Last Seen	Species	No. Indiv	Age (A, J, UNK)	INSIDE 800m Plot (Y/N)	Inside Height Min (m)	Inside Height Max (m)	Outside Height Min (m)	Outside Height Max (m)	Crossed a Ridge (Y/N)	Behavior Code Inside	Behavior Code Outside	Flight Azimuth (general)	Time Above Turbine Height (221m) w/in Array (sec)	Time Below Turbine Height (221m) w/in Array (sec)	Notes
9/5/2023	15:45:00	15:50:00	Bald Eagle	1	A	Y	300	600	600	1000	N	SO; FG	SO; FG	S	120	NA	BAEA circling over S Twin soaring higher and higher, heading S until disappeared.
9/5/2023	10:38:00	10:38:00	Bald Eagle	1	A	N	NA	NA	290	350	N	NA	SO	N	NA	NA	BAEA appeared above tree line for ten seconds E of N Twin then disappeared below tree line.
9/30/2023	11:21:00	11:24:00	Bald Eagle	2	J	N	NA	NA	50	340	N	NA	SO; FG; SB	W	NA	NA	BAEA (2) rose above tree line between N & S Twin soaring higher and higher in circles. Then flew W out of sight.

*Flight Behavior Codes: SO: soaring, PE: perched, FG: flap or glide, KH: kiting or hovering, MB: being mobbed, UT: undulating, territorial flight< SB: stooping or diving in response to another bird, SP: stooping or diving on prey, FO: foraging.

Incidental Non-Raptor Species Fall 2023

In the fall of 2023, 51 non-raptor avian species were recorded during surveys or while travelling to or from the parking area to the survey location (Table 6). Of the incidental songbird species observed, the blackpoll warbler (*Setophaga striata*) is a State Listed Threatened Species under the Maine Endangered Species Act (MDIFW 2023). Three (3) blackpoll warblers were observed during raptor surveys. There were six (6) species listed as Species of Special Concern by the State of Maine: the bay-breasted warbler (*Setophaga castaridea*), the Cape May warbler (*Setophaga tigrine*), the eastern kingbird (*Tyrannus tyrannus*), the eastern wood-pewee (*Contopus virens*), the olive-sided flycatcher (*Empidonax minimus*), and the white-throated sparrow (*Zonotrichia albicollis*) (MDIFW 2023).

Table 6. Incidental Observations of Non-Raptor Avian Species, Twin Wind Energy Project, Fall 2023.

Common Name	Scientific Name
American Crow	<i>Corvus brachyrhynchos</i>
American Goldfinch	<i>Spinus tristis</i>
American Redstart	<i>Setophaga ruticilla</i>
American Robin	<i>Turdus migratorius</i>
Bay-breasted Warbler*	<i>Setophaga castaridea</i>
Black and white warbler	<i>Mniotilta varia</i>
Black-capped Chickadee	<i>Poecile atricapillus</i>
Blackpoll Warbler**	<i>Setophaga striata</i>
Black-throated Green Warbler	<i>Setophaga virens</i>
Blue Jay	<i>Cyanocitta cristata</i>
Blue-headed Vireo	<i>Vireo solitarius</i>
Boreal Chickadee	<i>Poecile hudsonicus</i>
Brown Creeper	<i>Certhia americana</i>
Cape May Warbler*	<i>Setophaga tigrine</i>
Cedar Waxwing	<i>Bombycilla cedrorum</i>
Common Raven	<i>Corvus corax</i>
Common Redpoll	<i>Acanthis flammea</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Downy Woodpecker	<i>Picoides pubescens</i>
Eastern Kingbird*	<i>Tyrannus tyrannus</i>
Eastern Wood-Pewee*	<i>Contopus virens</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>
Gray Catbird	<i>Dumetella carolinensis</i>
Hairy Woodpecker	<i>Picoides villosus</i>
Least Flycatcher	<i>Empidonax minimus</i>
Magnolia Warbler	<i>Setophaga magnolia</i>
Mourning Dove	<i>Zenaida macroura</i>
Nashville Warbler	<i>Leiostyris alpestris</i>
Northern Flicker	<i>Colaptes auratus</i>
Olive-sided Flycatcher*	<i>Empidonax minimus</i>
Palm Warbler	<i>Setophaga palmarum</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
Pine Siskin	<i>Spinus pinus</i>
Purple Finch	<i>Haemorhous purpureus</i>
Red Crossbill	<i>Loxia curvirostra</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>
Ruby-crowned Kinglet	<i>Corthylio calendula</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>
Ruffed Grouse	<i>Bonasa umbellus</i>
Song Sparrow	<i>Melospiza melodia</i>
Tufted Titmouse	<i>Baeolophus bicolor</i>
White-breasted Nuthatch	<i>Sitta carolinensis</i>
White-throated Sparrow*	<i>Zonotrichia albicollis</i>
White-winged Crossbill	<i>Loxia leucoptera</i>
Winter Wren	<i>Troglodytes hiemalis</i>
Yellow Warbler	<i>Setophaga petechia</i>
Yellow-rumped warbler	<i>Setophaga coronata</i>
Yellow-throated Vireo	<i>Vireo flavifrons</i>

*Listed Species of Special Concern, ** listed as threatened by MDIFW (2023).

DISCUSSION

During the fall 2023 survey season, the majority (71%) of raptors observed were within the 800-meter plot for at least part of their flight. Additionally, 57% were observed both within the 800-meter plot and below the Survey Area height of 221 meters. The mean minimum flight height within the 800-meter plot was 108 meters, 13 meters below the Survey Area height.

Of the bald eagles observed, only one individual (25%) flew within the 800-meter plot for part at least a portion of their flight during surveys. Additionally, no bald eagles were observed both within the 800-meter plot and below the Survey Area height of 221 meters, or crossing a ridge within the 800-meter plot. The minimum flight height for the one eagle that flew within the 800-meter plot was 300 meters, 79 meters above the Survey Area height.

Of the raptors observed, the American kestrel, the bald eagle, and the northern harrier are listed by the State of Maine as a Species of Special Concern (MDIFW 2023). Of the incidental songbirds observed, one (1) species is listed as a Threatened Species: the blackpoll warbler; and six (6) species are listed as Species of Special Concern: the bay-breasted warbler, the Cape May warbler, the eastern kingbird, the eastern wood-pewee, the olive-sided flycatcher, and the white-throated sparrow (MDIFW 2023).

Considering the potential risk of the proposed Project to raptors and eagles is an important step in the permitting and development process. Migration corridors provide important travel and forage areas for raptors and eagles during a time when these species are moving over long distances and are vulnerable. The data presented in this document was collected with the intent to support USFWS in using their collision risk model to determine the potential risk the proposed Project has to negatively impacting eagles, and aid in decision making regarding the need for take permits. Data collected from this survey are also intended to inform Twin Energy in project planning to avoid or minimize adverse impacts to migrating eagle and raptor species as well as MDEP and MDIFW in their review of the permit application for this Project.

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- US Army Corps of Engineers (USACE). (2020). Maine General Permits. <https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Maine-General-Permit/>

Appendix A. Photographs of the Survey Location



View north from Location 1, June 14, 2022.



View northeast from Location 1, June 14, 2022.



View east from Location 1, June 14, 2022.



View southeast from Location 1, June 14, 2022.



View south from Location 1, June 14, 2022.



View southwest from Location 1, June 14, 2022.



View west from Location 1, June 14, 2022.



View northwest from Location 1, June 14, 2022.

Appendix B. Twin Energy Spring 2022 Raptor and Eagle Survey Plan

SURVEY PLAN

Date:	February 9, 2022(Revised February 12, 2022)
To:	Bob Stratton (Maine Department of Inland Fisheries and Wildlife)
From:	Katelin Nickerson – Flycatcher LLC
CC:	Lindsay Deane-Mayer & Sumul Shah (Twin Energy LLC) Rodney Kelshaw, Rich Jordan (Flycatcher)
Subject:	Proposed Twin Energy Wind Electric Power Generation Facility – Spring 2022 Raptor and Eagle Survey Plan (Rev 1)

Dear Bob,

On behalf of Twin Energy LLC, Flycatcher is submitting this Revised Spring 2022 eagle and raptor migration survey plan for your approval. This survey plan was developed based on our recent conversations with you, protocols detailed in the Maine Department of Inland Fisheries and Wildlife (MDIFW) 2018 Maine Wind Power Preconstruction Recommendations and Turbine Curtailment Recommendations to Avoid/Minimize Bat Mortality (2018 Recommendations), and U.S. Fish and Wildlife Service Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy, Version 2, 2013 (ECPG 2013). The revisions are based on feedback from the USFWS (via email, February 11, 2022). Effectively the methods described herein are the same methods as described in the Survey Plan submitted on February 9, with minor changes to collect data to support input into USFWS’s collision risk model.

GENERAL PROJECT DESCRIPTION

The proposed Twin Energy Project (Project) is a small wind electric generation facility located on South Twin Mountain in Rumford and Roxbury, Maine. The current plan is to erect three turbines with a six-megawatt capacity each, that have a hub height of approximately 384-feet (117-meters), blade tip height of approximately 645-feet (196-meters), and total blade swing diameter of approximately 490-feet (149-meters). The proposed access road and collector line will extend from the existing RoxWind project southerly to South Twin Mountain in Rumford. The proposed turbine locations are in close proximity to each other, clustered on the northern edge of South Twin Mountain.

Turbine 3 is proposed to be located near the summit of South Twin Mountain, at an elevation of 2,155-feet. Turbines 1 and 2 are located to the north and east of turbine 3 at lower elevations; around 2,050-feet and 1,950-feet respectively (figures 1 and 2, attached).

METHODS AND SURVEY LOCATION DESCRIPTION

In accordance with the 2018 Recommendations, Flycatcher plans to begin surveys the week of February 15, 2022. We understand that one golden eagle was (*Aquila chrysaetos*) observed in the fall of 2016, at the Record Hill project site (approximately 2.5-miles north), during the four-year post construction monitoring effort. The spring raptor and eagle survey will occur from February 15 through June 15, 2022. We will conduct two surveys per week during weather that is conducive to observe migratory activity. Surveys will start at 9 a.m. and last until 2 hours before sunset (or later if birds are moving through the area during the completion of the “normal survey window”).

The number of standard survey locations (point counts) was determined using the standards described in the ECPG 2013. For this survey, the Project footprint, or the minimum convex polygon around the turbines, is a 1-kilometer radius from the three proposed turbine locations (4.58 square kilometers). Using one 800-meter

radius (2.01 square kilometers) point count survey plot size, 44 percent of the total Project footprint is covered. This also encompasses 100 percent of the three proposed turbine locations (figures 1 and 2, attached).

Surveys will consist of point-based recordings of raptor, bald eagle (*Haliaeetus leucocephalus*) and golden eagle flight activity (minutes of flight) within a three-dimensional cylindrical plot (the sample plot). The radius of the sample plot is 2,625 feet (800-meters), and the height above ground level of 82-feet (25-meters) above the maximum blade reach, which is 725-feet (221-meters).

Data will be collected on the attached “*Raptor Pre-construction Datasheet*” and will include the observed raptor/eagle behavior inside and outside the proposed turbine area. Observers will sketch the raptor/eagle path either on aerial photographs or using a web-based GIS mapping service.

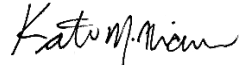
The survey effort will be completed substantially in accordance with the 2018 Recommendations and ECPG 2013. Surveys will be conducted during suitable weather conditions; surveys will not be conducted when visibility is less than 800-meters horizontally and 200-meters vertically. However, there may be factors including weather and road conditions that limit access to this remote site. This will be assessed weekly, and efforts will be made to complete the surveys if practicable and safe.

RAPTOR SURVEY POINT LOCATION

The survey point is located on the summit of South Twin Mountain, in the same location as proposed turbine 3. This location was selected because it provides a vantage point that has clear views across the Project area. The viewshed from the point has excellent views to the northwest beyond Ellis Pond and the RoxWind project, and to the east beyond Swift River and Roxbury Mountain. This viewshed encompasses the entire proposed Project area. Good views are also available to the south to the mill in Rumford and Black Mountain; with unobstructed view overhead. The attached photographs taken on February 7, 2022 show current views from the proposed survey location. If additional photographs are required, Flycatcher will save them to our file share folder for external access.

We are seeking your feedback and approval of this Survey Plan.

Respectfully,

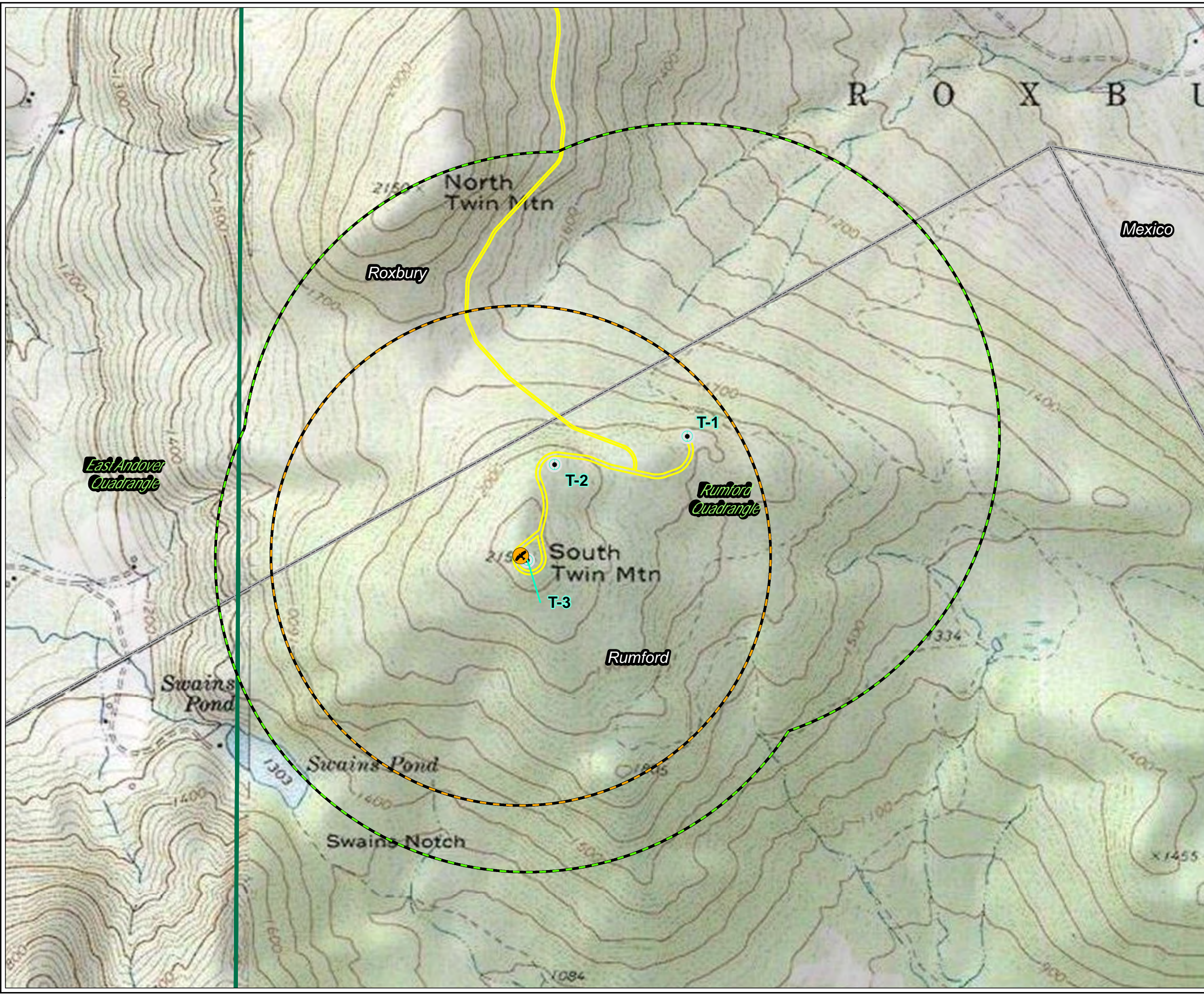


Katelin Nickerson
Project Director
Flycatcher, LLC
207.233.6175








Att (4): Figure 1.(revised)
Figure 2. (revised)
Raptor Pre-construction Datasheet (revised)
Photographs

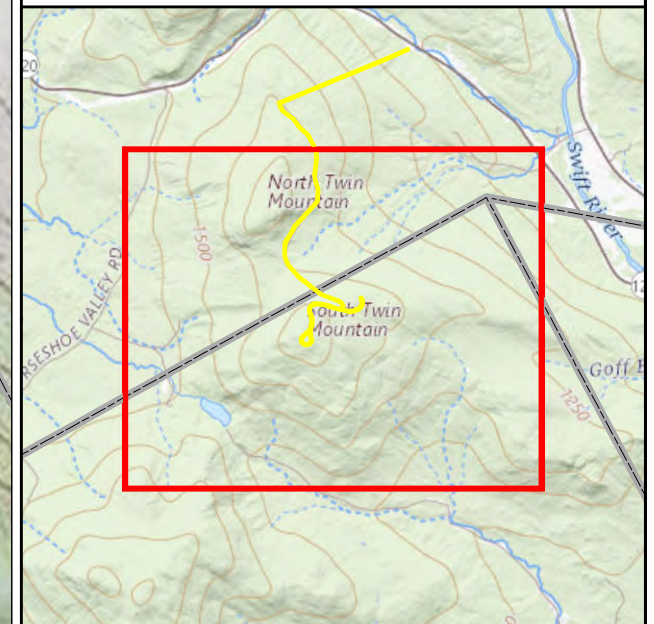
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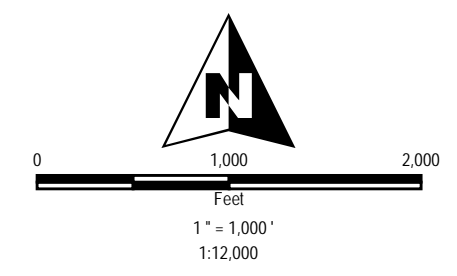
LEGEND

-  PROPOSED PROJECT BOUNDARY
-  PROPOSED TURBINE LOCATION
-  RAPTOR SURVEY LOCATION POINT
-  USFWS EAGLE SURVEY AREA
-  800M DIAMETER SAMPLE AREA
-  USGS 7.5-MINUTE QUADRANGLE BOUNDARY
-  TOWN BOUNDARY



NOTES:

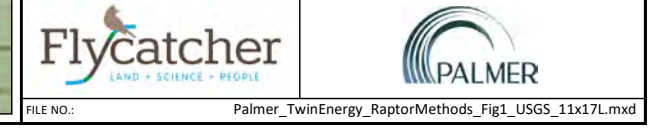
- 1 BASEMAP IMAGERY FROM USGS 7.5' QUADRANGLE SERIES.



PROJECT: **TWIN ENERGY LLC
TWIN ENERGY PROJECT
OXFORD COUNTY, MAINE**

TITLE: **USGS RAPTOR SURVEY LOCATION MAP**

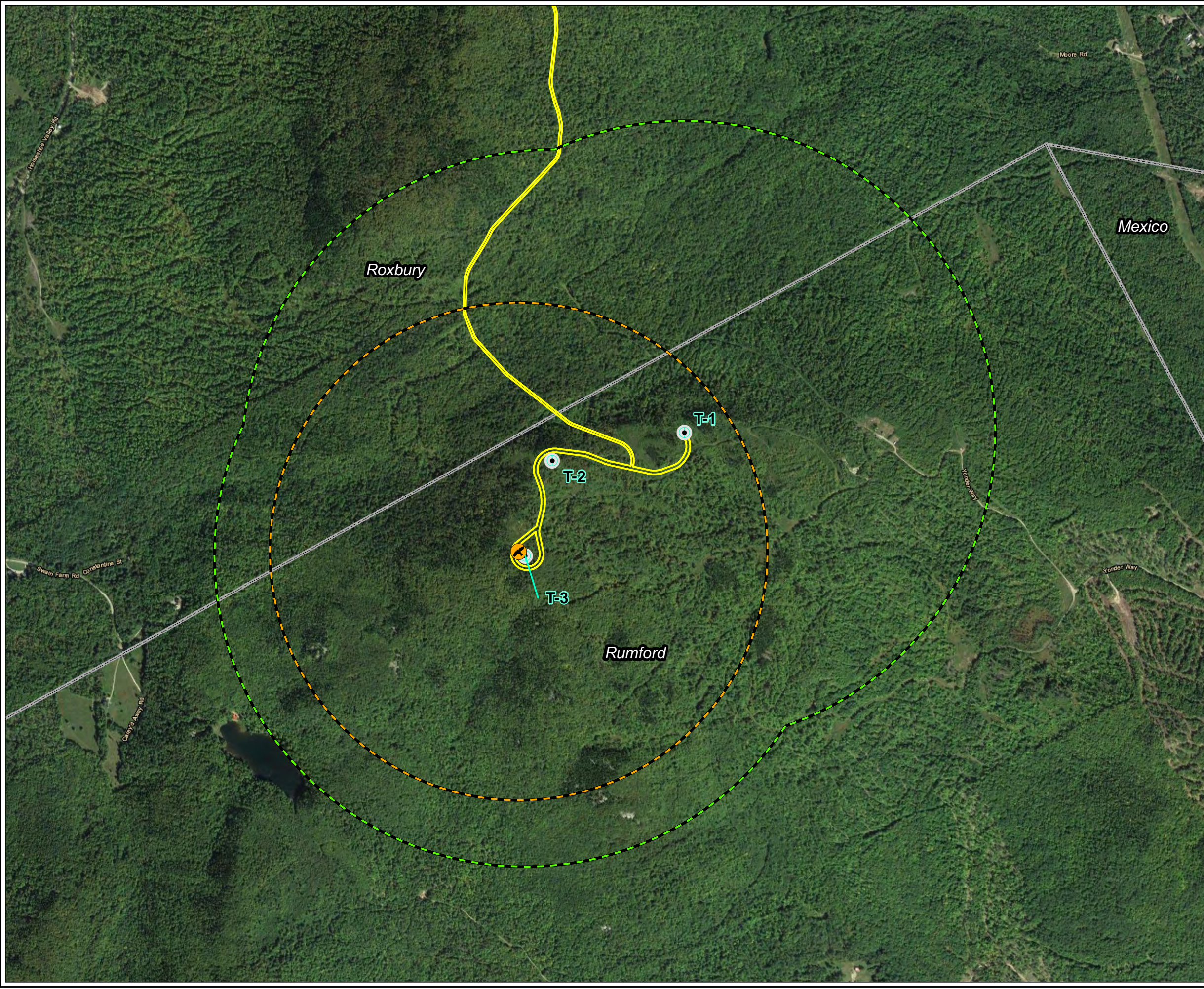
DRAWN BY:	D. KENWORTHY	PROJ NO.:	212P
CHECKED BY:	R. KELSHAW	FIGURE 1	
MONTH:	FEBRUARY		
YEAR:	2022		



FILE NO: Palmer_TwinEnergy_RaptorMethods_Fig1_USGS_11x17L.mxd

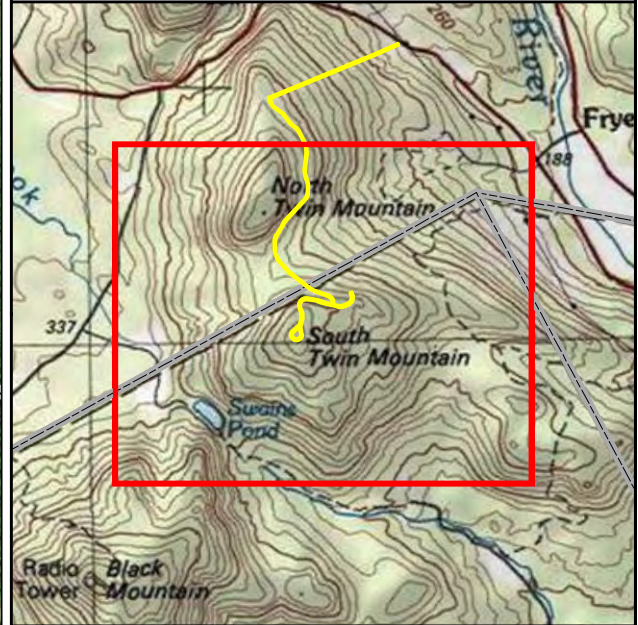
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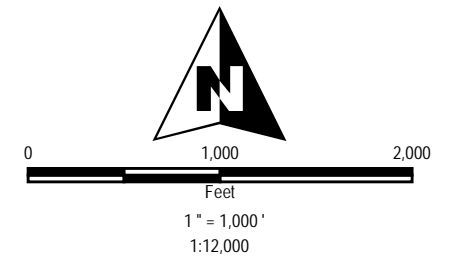
LEGEND

- PROPOSED PROJECT BOUNDARY
- PROPOSED TURBINE LOCATION
- RAPTOR SURVEY LOCATION POINT
- USFWS EAGLE SURVEY AREA
- 800M DIAMETER SAMPLE AREA
- TOWN BOUNDARY



NOTES:

- 1 BASEMAP IMAGERY FROM ESRI/NAIP "WORLD IMAGE" SERVICE LAYER.



PROJECT: **TWIN ENERGY LLC
 TWIN ENERGY PROJECT
 OXFORD COUNTY, MAINE**

TITLE: **AERIAL RAPTOR SURVEY LOCATION MAP**

DRAWN BY:	D. KENWORTHY	PROJ NO.:	212P
CHECKED BY:	R. KELSHAW	FIGURE 2	
MONTH:	FEBRUARY		
YEAR:	2022		

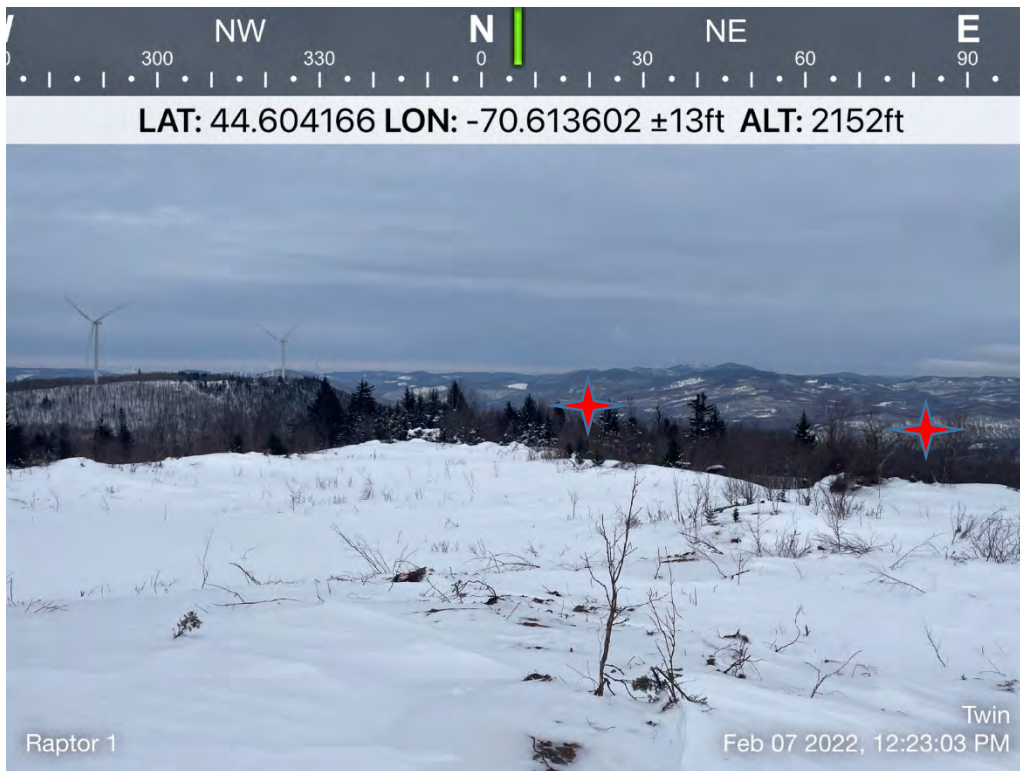
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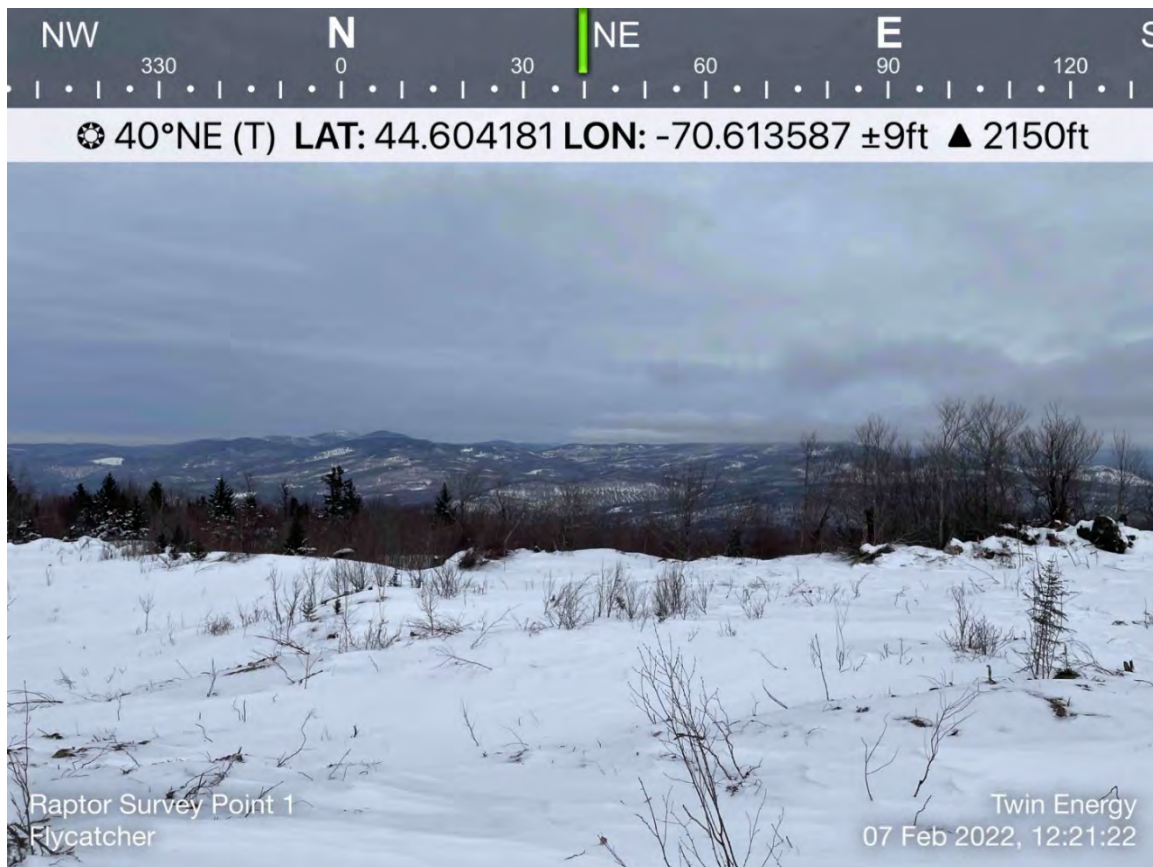
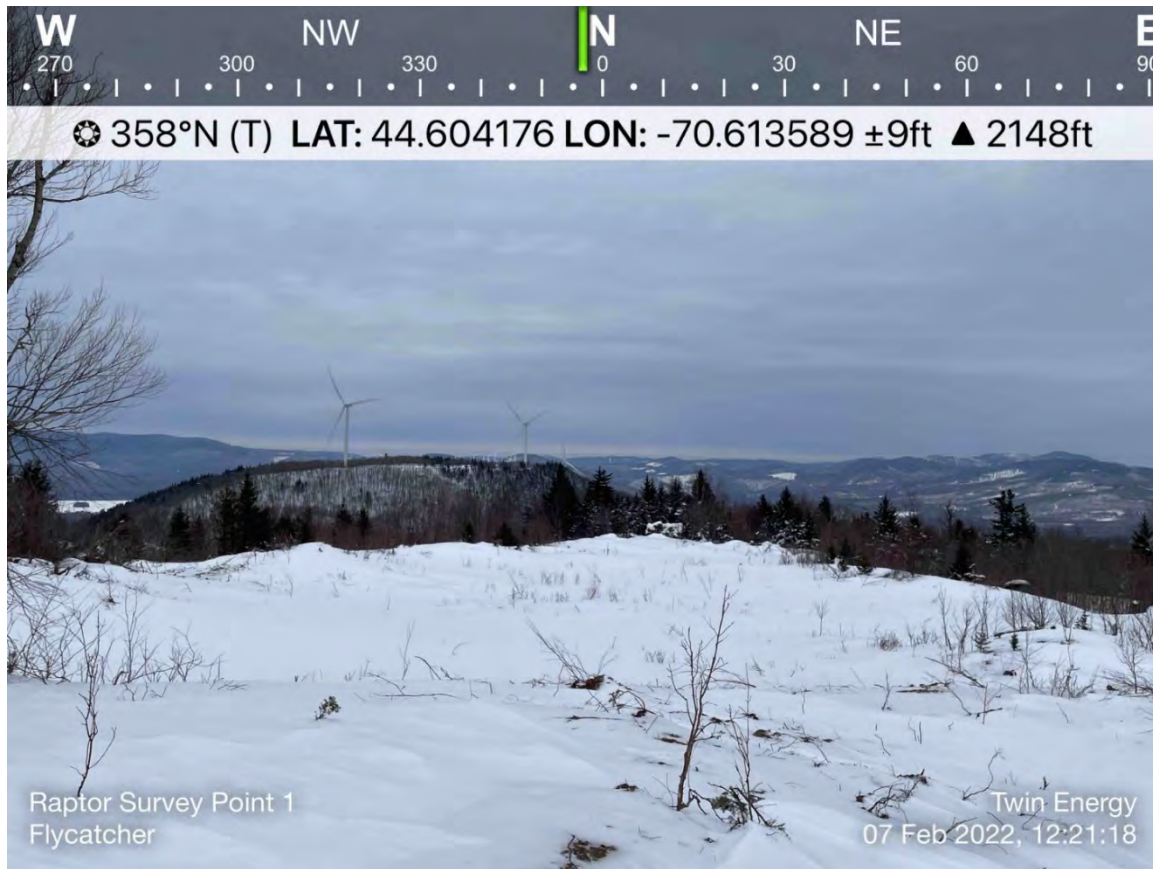
Panoramic from Raptor Survey Point Location across the northwest to northeast (left to right).



Panoramic from Raptor Survey Point Location across the northwest to northeast (left to right).



Red Stars denote approximate locations of Turbines 1 and 2.







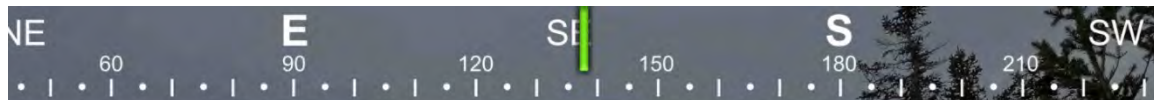


☉ 318°NW (T) LAT: 44.604161 LON: -70.613582 ±13ft ▲ 2151ft



Raptor Survey Point 1
Flycatcher

Twin Energy
07 Feb 2022, 12:21:48



☉ 137°SE (T) LAT: 44.603776 LON: -70.613203 ±13ft ▲ 2142ft



Raptor Survey Point 1
Flycatcher

Twin Energy
07 Feb 2022, 12:29:59

Appendix C. Raptor Observation Data

Date	Time First Seen	Time Last Seen	Species	No. Indiv	Sex (M, F, UNK)	Age (A, J, UNK)	INSIDE 800m Plot (Y/N)	Inside Height Min (m)	Inside Height Max (m)	Outside Height Min (m)	Outside Height Max (m)	Crossed a Ridge (Y/N)	Crossed Ridge Min Heights (m)	Crossed Ridge Max Heights (m)	Behavior Code Inside*	Behavior Code Outside*	Flight Azimuth (general)	Time Above Turbine Height (221m) w/in Array (sec)	Time Below Turbine Height (221m) w/in Array (sec)	Notes*
8/1/2023	17:52:40	17:54:10	Turkey Vulture	2	UNK	A	Y	130	150	80	200	Y	80	110	SO	SO	N	NA	10	Pair soaring N of N Twin.
8/3/2023	9:35:00	9:38:00	Sharp-shinned Hawk	2	UNK	A	Y	20	50	50	500	Y	20	50	SO; FG; PE	SO; FG	E	NA	60	2 SHSH circled to W of S Twin then circled over Survey location calling repeatedly then one flew E out of Survey Area and out of sight and one landed in tree in Survey Area. Then took off and circled E of Survey Area and then dove out of view.
8/9/2023	13:39:56	13:40:27	Red-tailed Hawk	1	UNK	A	Y	30	120	120	170	Y	30	80	KH; FG	SO	W	NA	22	Flap/glide and kiting into valley between Twins.
8/9/2023	13:46:42	13:47:06	Turkey Vulture	1	UNK	UNK	Y	40	100	NA	NA	Y	40	100	SO	NA	E	NA	24	Soaring above S Twin.
8/10/2023	13:01:56	13:02:08	Turkey Vulture	1	UNK	A	Y	30	40	NA	NA	N	NA	NA	SO	NA	E	NA	12	Soaring low S of S Twin.
8/14/2023	12:44:58	12:46:35	Broad-winged Hawk	1	UNK	A	Y	40	120	NA	NA	Y	40	120	KH; FG	NA	S	NA	97	Hovering and gliding between Twins, then flew S.
8/17/2023																				No raptors observed. Survey shorted due to dense fog and poor visibility.
8/22/2023	12:54:00	12:54:03	Merlin	1	UNK	A	Y	40	80	NA	NA	N	NA	NA	FG	FG	NE	NA	3	Dropped below view.
8/22/2023	13:39:00	13:39:04	Red-tailed Hawk	1	UNK	J	Y	60	175	175	240	N	NA	NA	FG	FG	W	NA	NA	Dropped below view.
8/22/2023	10:14:45	10:16:00	Red-tailed Hawk	1	UNK	J	Y	130	240	260	310	N	NA	NA	SO	SO	SW	NA	NA	
8/22/2023	16:53:00	16:53:06	Broad-winged Hawk	1	UNK	J	Y	120	265	270	380	Y	120	210	FG	FG	S	NA	4	
8/22/2023	13:39:00	13:40:10	Red-tailed Hawk	1	UNK	A	Y	150	160	180	240	Y	160	180	SO	SO	SW	NA	NA	Dropped below view.
8/22/2023	17:31:00	17:33:10	Turkey Vulture	1	UNK	UNK	N	NA	NA	200	275	Y	140	200	SO	SO	NW	NA	NA	Rose up above tree line.
8/23/2023	12:51:00	12:51:04	Broad-winged Hawk	1	UNK	J	N	NA	NA	120	295	N	NA	NA	NA	FG	SW	NA	NA	
8/23/2023	12:29:00	12:29:05	Red-tailed Hawk	1	UNK	J	Y	125	185	145	270	N	NA	NA	FG	FG	W	NA	NA	
8/23/2023	14:04:00	14:04:02	Unknown Raptor	1	UNK	UNK	Y	170	190	175	320	N	NA	NA	FG	FG	SW	NA	NA	
8/23/2023	14:27:00	14:28:50	Turkey Vulture	1	UNK	UNK	Y	70	100	25	230	Y	25	100	SO	SO	W; E	NA	NA	
8/23/2023	16:36:00	16:40:10	Turkey Vulture	1	UNK	UNK	Y	135	165	25	300	Y	25	100	SO	SO	S	NA	1	Convoluting flight through valley.
8/23/2023	14:16:00	14:16:45	Turkey Vulture	1	UNK	UNK	N	NA	NA	10	355	Y	10	155	NA	SO	E	NA	NA	
8/23/2023	16:39:00	16:41:55	Turkey Vulture	2	UNK	UNK	Y	165	170	25	240	Y	25	100	SO	SO	S	20	2	Convoluting flight through valley.
8/23/2023	16:52:00	16:52:06	Turkey Vulture	3	UNK	A, J	Y	85	165	NA	NA	Y	120	140	SO	NA	S	NA	5	Dropped below view.
8/28/2023	12:15:30	12:16:00	Red-tailed Hawk	1	UNK	J	N	NA	NA	145	310	N	NA	NA	NA	FG	SW	NA	NA	
8/28/2023	13:44:10	13:46:00	American Kestrel	1	UNK	A	Y	45	190	190	290	Y	45	160	PE	FG	W	NA	100	Landed in trees in Survey Area several times.
8/28/2023	11:17:00	11:18:10	Turkey Vulture	1	UNK	A	N	NA	NA	100	365	Y	100	200	NA	SO	W	NA	NA	
8/29/2023	15:45:00	15:45:00	Cooper's Hawk	1	UNK	UNK	Y	80	150	190	210	N	NA	NA	FG	FG	S	NA	2	
8/29/2023	10:31:00	10:31:02	Cooper's Hawk	1	UNK	UNK	Y	85	105	NA	NA	N	NA	NA	FG	NA	SE	NA	2	Popped up briefly above trees.
8/29/2023	11:40:00	11:40:15	Red-tailed Hawk	1	UNK	A	N	NA	NA	165	280	N	NA	NA	NA	SO; KH	S	NA	NA	
8/29/2023	12:14:00	12:14:05	Red-tailed Hawk	1	UNK	A	N	NA	NA	295	315	N	NA	NA	NA	SO	S	NA	NA	
8/29/2023	16:27:00	16:27:02	Sharp-shinned Hawk	1	UNK	UNK	Y	80	110	NA	NA	N	NA	NA	SP	NA	NA	NA	1	
8/29/2023	11:33:00	11:33:05	Turkey Vulture	1	UNK	J	N	NA	NA	220	335	N	NA	NA	NA	SO	S	NA	NA	
8/29/2023	15:22:10	15:23:00	Turkey Vulture	1	UNK	J	N	NA	NA	225	250	N	NA	NA	NA	SO	SW	NA	NA	Obs 11 to 14 were travelling together.
8/29/2023	15:22:10	15:23:00	Turkey Vulture	1	UNK	A	N	NA	NA	225	250	N	NA	NA	NA	SO	SW	NA	NA	Obs 11 to 14 were travelling together.
8/29/2023	15:22:10	15:23:00	Turkey Vulture	1	UNK	J	N	NA	NA	230	240	N	NA	NA	NA	SO	SW	NA	NA	Obs 11 to 14 were travelling together.
8/29/2023	15:22:10	15:23:00	Turkey Vulture	1	UNK	J	N	NA	NA	235	260	N	NA	NA	NA	SO	SW	NA	NA	Obs 11 to 14 were travelling together.
8/29/2023	11:48:00	11:48:02	Unknown Raptor	1	UNK	UNK	Y	90	90	NA	NA	N	NA	NA	FG	FG	SE	NA	2	
8/29/2023	11:18:00	11:18:03	Unknown Raptor	1	UNK	UNK	Y	190	190	190	230	N	NA	NA	FG	FG	SE	NA	6	Obscure view.
8/29/2023	11:39:00	11:39:15	Broad-winged Hawk	1	UNK	J	Y	70	190	155	330	Y	70	130	FG	FG; SB	SE	NA	5	Dove at RTHA.
8/29/2023	15:19:15	15:22:00	Turkey Vulture	1	UNK	J	Y	130	135	30	135	Y	130	140	SO	SO	SW	NA	NA	
8/29/2023	15:19:15	15:19:00	Turkey Vulture	1	UNK	A	Y	130	135	30	135	Y	130	140	SO	SO	SW	NA	NA	
8/29/2023	15:29:00	15:29:10	Turkey Vulture	1	UNK	UNK	Y	140	180	175	255	Y	180	190	FG	FG	NE	NA	NA	Potentially with obs 11 through 14.
8/29/2023	15:31:00	15:31:10	Turkey Vulture	1	UNK	UNK	Y	160	180	170	255	Y	185	195	FG	FG	NE	NA	NA	Potentially with obs 11 through 14.
8/29/2023	11:18:00	11:18:15	Unknown Raptor	1	UNK	UNK	Y	80	190	105	230	Y	80	160	FG	FG	S	NA	NA	Popped up briefly above trees.
9/5/2023	15:45:00	15:50:00	Bald Eagle	1	UNK	A	Y	300	600	600	1000	N	NA	NA	SO; FG	SO; FG	S	120	NA	BAEA circling over S Twin soaring higher and higher, heading S until disappeared.
9/5/2023	10:38:00	10:38:00	Bald Eagle	1	UNK	A	N	NA	NA	290	350	N	NA	NA	NA	SO	N	NA	NA	BAEA appeared above tree line for ten seconds E of N Twin then disappeared below tree line.
9/5/2023	15:45:00	15:48:00	Broad-winged Hawk	2	UNK	A	Y	300	600	600	800	N	NA	NA	SO; FG	SO; FG	S	120	NA	BWHA (w/ obs#4) circling over S Twin soaring higher and higher and heading S until too high/ out of view.

Date	Time First Seen	Time Last Seen	Species	No. Indiv	Sex (M, F, UNK)	Age (A, J, UNK)	INSIDE 800m Plot (Y/N)	Inside Height Min (m)	Inside Height Max (m)	Outside Height Min (m)	Outside Height Max (m)	Crossed a Ridge (Y/N)	Crossed Ridge Min Heights (m)	Crossed Ridge Max Heights (m)	Behavior Code Inside*	Behavior Code Outside*	Flight Azimuth (general)	Time Above Turbine Height (221m) w/in Array (sec)	Time Below Turbine Height (221m) w/in Array (sec)	Notes*
9/5/2023	11:15:00	11:15:00	Turkey Vulture	1	UNK	A	N	NA	NA	280	320	N	NA	NA	NA	SO	S	NA	NA	TUVU rose above tree line just E of ridge between N & S Twin, flew S and below tree line out of sight.
9/5/2023	16:00:00	16:01:00	Turkey Vulture	2	UNK	A	Y	250	350	350	600	N	NA	NA	SO; FG	SO; FG	S	10	NA	TUVU flew S overhead (slightly to E of N & S Twin).
9/5/2023	16:01:00	16:08:00	Turkey Vulture	6	UNK	A	Y	300	600	500	800	N	NA	NA	SO; FG	SO; FG	SE; NE	180	NA	6 TUVU soaring overhead higher and higher. Moving N. Then four broke off and flew SE and three flew N.
9/5/2023	13:20:00	13:20:00	Turkey Vulture	1	UNK	A	Y	190	259	250	400	Y	200	210	SO; FG	SO; FG	SE	5	5	TUVU rose above tree line circling E of N and S Twin then flew S then SE overhead and out of sight.
9/7/2023	15:07:48	15:09:14	Turkey Vulture	2	UNK	UNK	Y	25	160	25	160	N	NA	NA	SO	SO	S	NA	47	Soaring to the S of S Twin
9/7/2023	10:01:40	10:01:50	Broad-winged Hawk	1	UNK	J	Y	20	25	NA	NA	Y	20	25	FG	NA	W	NA	10	Flap/glide low over tree-line.
9/12/2023																				No raptors observed. Survey shorted due to dense fog and poor visibility.
9/15/2023	13:18:00	13:19:00	Red-tailed Hawk	1	UNK	A	N	NA	NA	300	1000	N	NA	NS	NA	SO; KH	N; SE	NA	NA	Soared N to the E of mtns on thermals gaining height. Then paused kiting. Then soared SE until out of sight.
9/15/2023	9:30:00	9:30:00	Broad-winged Hawk	1	UNK	UNK	Y	100	110	100	300	Y	100	110	SO	SO	W	NA	10	Bombed W btw Twins.
9/15/2023	9:08:00	9:15:00	Broad-winged Hawk	3	UNK	A; J;	Y	200	300	100	700	Y	100	200	SO; FG	SO; FG; MB	E; W	50	10	One BWHA flew W btw N & S Twin, joined two BWHA to W of Twins soaring and gaining altitude. All 3 flew E btw N & S Twin then soared gaining altitude to E of Twins. One grappled with another. Then all 3 flew W btw Twins and out of sight.
9/15/2023	9:51:00	9:51:00	Cooper's Hawk	1	UNK	UNK	Y	260	300	260	360	Y	260	300	SO	SO	W	NA	5	Flew w btw Twins.
9/15/2023	9:50:00	9:50:00	Turkey Vulture	1	UNK	UNK	N	NA	NA	100	600	Y	100	150	NA	SO	W	NA	NA	TUVU flew N to E of S Twin then banked W btw Twins.
9/20/2023	12:05:00	12:05:00	Turkey Vulture	1	UNK	UNK	N	NA	NA	200	250	N	NA	NA	NA	SO	NW	NA	NA	Circling over valley NW of N Twin.
9/20/2023	12:32:00	12:32:00	American Kestrel	1	UNK	UNK	Y	30	70	NA	NA	Y	30	50	FG; SP	NA	NE	NA	13	Flew over S Twin and then dove steeply as if hunting prey.
9/20/2023	10:03:00	10:04:00	Red-tailed Hawk	1	UNK	A	Y	100	180	80	100	Y	100	120	SO; KH	FG	N	NA	20	Kiting and soaring between Twins.
9/20/2023	10:08:00	10:09:00	Turkey Vulture	1	UNK	UNK	Y	80	130	130	150	Y	80	100	SO	SO	NE	NA	18	Soaring across valley between Twins.
9/22/2023	11:13:00	11:17:00	Red-shouldered Hawk	1	UNK	A	Y	250	300	200	460	N	NA	NA	FG	SO; FG	W	NA	NA	Obs 1 & 2 soared W of Spruce Mtn. Circling further and further W. Then TUVU flew NW to the E of N Twin and out of sight and RSHA flew W overhead and out of sight.
9/22/2023	11:13:00	11:17:00	Turkey Vulture	1	UNK	A	N	NA	NA	200	450	N	NA	NA	NA	SO; FG	NW	NA	NA	Obs 1 & 2 soared W of Spruce Mtn. Circling further and further W. Then TUVU flew NW to the E of N Twin and out of sight and RSHA flew W overhead and out of sight.
9/22/2023	11:17:00	11:17:00	Turkey Vulture	2	UNK	A	Y	5	20	NA	NA	N	NA	NA	PE; FG	NA	E	NA	20	Two TUVU landed in maples S of survey on S Twin. Took off flying E and disappeared below tree line.
9/22/2023	13:25:00	13:28:00	Turkey Vulture	4	UNK	UNK	N	NA	NA	100	200	N	NA	NA	NA	SO; FG	N	NA	NA	Flying and soaring NE of N Twin then flew N below tree line out of sight.
9/22/2023	11:58:00	23:58:00	Turkey Vulture	1	UNK	A	Y	30	50	50	60	Y	30	40	FG	FG	W	NA	5	TUVU popped above tree line btw two mtns flying W, then flew back down below tree line.
9/22/2023	13:35:00	13:35:00	Turkey Vulture	1	UNK	A	N	NA	NA	50	60	Y	50	60	NA	FG	E	NA	NA	TUVU popped above tree line btw Twins flying E, then flew back down below tree line.
9/27/2023																				No raptors observed.
9/30/2023	11:21:00	11:24:00	Bald Eagle	2	UNK	J	N	NA	NA	50	340	N	NA	NA	NA	SO; FG; SB	W	NA	NA	BAEA (2) rose above tree line between N & S Twin soaring higher and higher in circles. Then flew W out of sight.
10/3/2023	15:46:00	15:48:00	Cooper's Hawk	1	UNK	J	Y	30	200	200	250		NA	NA	SO; MB	SO; SB	SW	NA	97	Flying sw, mobbed by raven S of S Twin
10/3/2023	12:39:00	12:42:00	Red-tailed Hawk	1	UNK	A	Y	50	230	200	230	Y	50	100	SO; KH	SO	W	8	150	Kiting with obs 1 in valley and split to the W.
10/3/2023	12:39:00	12:41:00	Red-tailed Hawk	1	UNK	A	Y	100	250	100	250	Y	100	220	KH	SO; SP	N	8	10	Kiting with obs 2 in valley and split to the N, dove down below N Twin.
10/3/2023	13:54:00	13:55:00	Turkey Vulture	1	UNK	UNK	Y	20	40	NA	NA	Y	20	40	SO		E	NA	31	Soaring low S of S Twin.
10/4/2023	14:38:00	14:38:00	Northern Harrier	1	F	A	Y	5	20	NA	NA	N	NA	NA	FG; FO	FG	W	NA	20	NOHA rose above tree line and entered survey area from the E flying low, circled grassy area twice, hunting behavior, then continued W below tree line out of view.
10/10/2023																				No raptors observed.
10/13/2023	14:48:00	14:48:00	Turkey Vulture	1	UNK	J	Y	25	145	NA	NA	Y	25	145	SO	NA	E; W	NA	11	Entered survey area flying E then pivoted W and flew btw Twins and below tree line out of sight.
10/18/2023	15:05:00	15:09:00	Turkey Vulture	1	UNK	A	N	NA	NA	200	500	N	NA	NA	NA	SO	E; SE; S	NA	NA	Soaring over N Twin moving E then SE then soared S until no longer visible.
10/20/2023																				No raptors observed.
10/25/2023																				No raptors observed.
10/31/2023																				No raptors observed.
11/2/2023																				No raptors observed.
11/9/2023																				No raptors observed.
11/10/2023	10:37:00	10:37:00	Red-tailed Hawk	1	F	A	N	NA	NA	50	300	N	NA	NA	NA	SO	W	NA	NA	Popped above tree line SW of N Twin. Soared W out of sight.

Date	Time First Seen	Time Last Seen	Species	No. Indiv	Sex (M, F, UNK)	Age (A, J, UNK)	INSIDE 800m Plot (Y/N)	Inside Height Min (m)	Inside Height Max (m)	Outside Height Min (m)	Outside Height Max (m)	Crossed a Ridge (Y/N)	Crossed Ridge Min Heights (m)	Crossed Ridge Max Heights (m)	Behavior Code Inside*	Behavior Code Outside*	Flight Azimuth (general)	Time Above Turbine Height (221m) w/in Array (sec)	Time Below Turbine Height (221m) w/in Array (sec)	Notes*
11/14/2023																				No raptors observed.
11/16/2023																				No raptors observed.
11/20/2023																				No raptors observed.
11/29/2023																				No raptors observed.
11/30/2023																				No raptors observed.
12/8/2023																				No raptors observed.
12/9/2023																				Short survey due to poor visibility. No raptors observed.
12/12/2023																				No raptors observed.
12/14/2023																				No raptors observed.

*Flight Behavior Codes: SO: soaring, PE: perched, FG: flap or glide, KH: kiting or hovering, MB: being mobbed, UT: undulating, territorial flight< SB: stooping or diving in response to another bird, SP: stooping or diving on prey, FO: foraging.