Adelaide Wind Power Project, Raptor Monitoring 2020

FINAL REPORT

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1.0 INTRODUCTION

1.1 BACKGROUND

Suncor Adelaide Wind Limited Partnership (Suncor) is operating the 18 turbine Adelaide Wind Power Project (the "Project") north of Strathroy, Ontario, in Middlesex County, Municipality of Adelaide Metcalfe (**Figure 1, Appendix A**). Post-construction mortality monitoring, in accordance with the Project's Environmental Effects Monitoring Plan (EEMP), took place from 2015 through 2017.

Results of the annual monitoring programs exceeded provincial raptor thresholds set out in Condition I5 (3) of the Renewable Energy Approve (REA) in 2015-2017. This exceedance triggered Condition I8 in 2015 and I10 in 2016, which included:

- Two years of subsequent scoped mortality and cause and effect monitoring for raptors (undertaken in 2016 and 2017).
- Following the scoped monitoring, implementation of mitigation for the life of the facility (2018).
- Effectiveness monitoring at individual turbines for three years, following implementation of mitigation (2018).
- Increased reporting frequency to identify potential threshold exceedance (implemented in 2017).
- Additional behavioural studies (implemented in 2017).

A mitigation plan was created in 2016 and updated in 2018 (Stantec 2018) to detail mitigation measures and guide the additional monitoring programs.

Through consultation with the Ministry of the Environment, Conservation and Parks (MECP) and Ministry of Natural Resources and Forestry (MNRF) in 2019, an Enhanced Raptor Monitoring Plan (**Appendix B)** was developed and agreed upon. The intent of this Enhanced Raptor Monitoring Plan was to build upon the conclusions of the 2016 through 2018 monitoring, with the goal of providing insight into where and when operation mitigation would be effective for raptors.

The Enhance Raptor Monitoring Plan was to be implemented until mortality and behavioural correlations could be confirmed so as to inform an effective and efficient Operational Mitigation Strategy for the Project.

1.2 PURPOSE

The purpose of this report is to provide details on the results of the second year of monitoring under the Enhanced Raptor Monitoring Plan with analysis of risk to raptors under various conditions (e.g., weather conditions, time of year, time of day, etc.).

2.0 EXISTING OPERATIONAL MITIGATION

2.1 OPERATIONAL MITIGATION

Currently, in Ontario, there is no guidance or established protocols on implementation of operational mitigation for raptors. This is likely due, in part, to a lack of empirical evidence that risk of raptor mortality is elevated during specific conditions (e.g., weather or seasonal; Allison et al. 2017). For this reason and as discussed with the MECP and MNRF after submission of the 2018 Enhanced Monitoring Plan report, operational mitigation was not undertaken at the Adelaide facility in 2019 or 2020 but instead efforts were directed to collision risk abatement and enhanced monitoring, discussed below.

2.2 COLLISION RISK ABATEMENT

As both Turkey Vultures (Kirk and Mossman 2020), and to a lesser extent Red-tailed Hawks (Preston and Beane 2020), forage on carrion, an increase in carrion in the environment may lead to an increased risk of turbine collision. To address this risk, Suncor contacted a subset of Project landowners to discuss management of their deadstock to reduce attraction of vultures and raptors in both 2019 and 2020. In addition to landowner discussions, Suncor staff routinely observe local deadstock bins to assess vulture and raptor activity. In 2019, Turkey Vultures were observed on August 28, 2019 at a deadstock bin in proximity to turbine 18 (see **Figure 1, Appendix A**). In 2020, Suncor's onsite presence was diminished by approximately 30% due to work-from-home protocols set in place as part of the COVID-19 pandemic response. However, similar to 2019, a single observation of Turkey Vultures at a deadstock bin was made within the eastern portion of the Adelaide facility, this time in proximity to turbine 14 (see **Figure 1, Appendix A**).

2.3 ADAPTIVE MANAGEMENT

An adaptive management approach to mitigation, consisting of a plan subject to adjustment or refinement during effectiveness monitoring, is in place at the Adelaide facility. If strong trends become evident during the monitoring program, Suncor will contact the MNRF and MECP immediately to discuss potential mitigation options. Based on those discussions, if appropriate, mitigation may be implemented mid-year depending on the observed trend and seasonality. Furthermore, if evident trends are identified and/or successful mitigation techniques are identified by the MNRF and MECP through other facilities, these results will be used to inform appropriate operational mitigation measures for the Project.

3.0 METHODS

The Enhanced Raptor Monitoring Plan (**Appendix B**) was intended to build upon the analysis and conclusions of mortality and behavioural trends from previous years, with the goal of providing insight into where, when and how operation mitigation would be effective for raptors. 2020 was the second year the enhanced raptor monitoring program was implemented but the first year that the increased survey frequency requested by the MECP and the MNRF in their September 10, 2019 email was implemented for the full monitoring period (May-November).

The 2020 monitoring program included:

- Mortality monitoring at all turbines, once weekly from May through November
- Breeding territorial monitoring
  - One driving survey end of April to document nests within the Raptor Study Area (**Figure 1, Appendix A**)
  - Five behavioural surveys early-May – mid-June at identified nests
- Fall migration monitoring, ten surveys late-August – early-November at identified nests.

3.1 MORTALITY MONITORING

Raptor mortality monitoring was conducted at all 18 turbines, comprised of approximately 10-minute surveys, targeted to be focused on large-bodied birds (i.e., raptors), which is consistent with the non-subset searches conducted 2015-2017. Searches were conducted within 50 m of turbines and involved walking in concentric circles. Each vegetation class within the 50 m radius were searched and each turbine was searched weekly from May 5 – November 24, 2020 where weather, safety, and site-specific conditions allowed.

Weather parameters (temperature, wind speed and precipitation) were recorded on each day surveys were conducted. If a carcass was discovered, the following information was recorded:

- Searcher identification
- Species
- Turbine number
- Date and time it was found
- Sex (if possible to determine)
- Universal Transverse Mercator (UTM) coordinates
- State of decomposition

- Estimated days since death
- Injury sustained (if applicable)
- Distance and direction from the nearest turbine
- Substrate upon which the carcass was found
- Visibility class

Carcasses found in the field were photographed and then moved to the edge of the search area to avoid double-counting. To address agency comments and in accordance with the Enhanced Raptor Monitoring Plan (**Appendix B**), recovered raptor carcasses in suitable condition were left out to confirm if any scavenger removal of raptor carcasses was occurring. Monitoring occurred as part of the weekly mortality program for a period of two weeks.

For comparison purposes, an estimate of mortality based on MNRF's mortality estimator (MNR 2011) was calculated, assuming a searcher efficiency rate of 1.0, as these values are known to be much higher for large-bodied versus small-bodied birds (i.e., Erickson et al., 2003; Johnson et al., 2003). Full searches of the 50 metre (m) radius around the turbine were completed and therefore percent area searched was also 1.0.

Survey dates, times and weather conditions are provided below in **Table C1, Appendix C**.

3.2 BREEDING TERRITORIAL MONITORING

3.2.1 Nest Search

To determine potential nesting raptor locations, a search within 1 km of each turbine located within the facility (i.e., Raptor Study Area, **Figure 1, Appendix A**) was conducted. The survey took place on April 28, 2020 and included driving municipal and access roads in the Study Area looking for bulky stick nests for Red-tailed Hawks and evidence of Turkey Vulture use of barns and abandoned buildings. Active Red-tailed Hawk nests from previous years were also examined for signs of reuse.

3.2.2 Behavioural Surveys

Five surveys of identified nests were completed between May 6 and June 4, 2020 to assess territory size, observe interactions between raptors, and to monitor nest activity through the breeding season. Each survey consisted of two-hours at various times of day at each nest.

Details recorded during each survey included:

- Survey date and time
- Weather conditions
- Field personnel

- Species and age (if determined)
- Flight paths (including height)
- Raptor behaviour (soaring, flapping, gliding, hovering, or perched, including duration) and associated habitat

Incidental observations of raptor species were also recorded, including details on location, species, number of individuals, behaviour and flight height.

Individual flight paths were mapped in the field and consolidated using ArcGIS Online where flight paths overlapped in direction, location, and proximity to nearby turbines and natural features.

Survey dates, times and weather conditions are provided below in **Table C2, Appendix C**.

3.3 FALL MIGRATION BEHAVIOURAL MONITORING

The focus of the fall migration monitoring was on the known active territories, mapping how migrant individuals move through or around these territories and examining interactions between resident and migrants, with specific emphasis on recording high-risk behaviour (i.e., flying within 50 m of a turbine). Ten surveys were conducted between August 25 and November 9, 2020 at nesting territories associated with identified nests.

Data recorded was identical to that of the summer behavioural surveys outlined above, including:

- Survey date and time
- Weather conditions
- Field personnel
- Species and age (if determined)
- Flight paths (including height)
- Raptor behaviour (soaring, flapping, gliding, hovering, or perched, including duration) and associated habitat

Incidental observations of raptor species were also recorded, including details on location, species, number of individuals, behaviour and flight height.

Survey dates, times and weather conditions are provided below in **Table C2, Appendix C**.

4.0 RESULTS

4.1 MORTALITY MONITORING

Two (2) raptor mortalities were recovered during the 2020 mortality monitoring surveys conducted by Stantec. An additional raptor mortality was recovered by operations staff, with species subsequently confirmed by Stantec staff. Raptor mortalities included a Red-tailed Hawk at turbine 8 on May 5, 2020; Turkey Vulture at turbine 18 on May 20, and Red-tailed Hawk on August 13 at turbine 7. The May 5, 2020 Red-tailed Hawk carcass was severely scavenged with only feathers remaining, indicating that it had potentially been in place since earlier in the spring or over the winter. The remaining two carcasses (one Red-tailed Hawk and one Turkey Vulture) were in relative fresh condition and expected to be recent mortalities at the time of discovery.

The two raptor carcasses in good condition were included in two separate scavenger trials. Results of the scavenger trials did not document scavenging with both carcasses persisting for the full two-week monitoring period. Raptor mortalities documented in 2020, along with those previously reported for 2016-2019, are provided in **Table C3, Appendix C** and shown in **Figure 3** (**Appendix A**).

As the incidental mortality was recovered on the same day that Stantec was onsite conducting mortality searches, but prior to completing turbine 18, this mortality has been included in the adjusted mortality calculations. Based on the documented scavenger rate of 1.0, percent area searched of 1.0, and an assumed searcher efficiency rate of 1.0, the calculated mortality rate for raptors at the Adelaide facility in 2020 was 0.17 raptors/turbine.

Four additional mortalities were recovered during the mortality monitoring program in 2020, which included three birds (Horned Lark, flycatcher species, and an unidentifiable bird) and one bat (Hoary Bat), as summarized in **Table C4, Appendix C**.

4.2 BREEDING TERRITORIAL MONITORING

4.2.1 Nest Search

Four candidate stick nests were identified within the Raptor Study Area during the nest survey conducted on April 28, 2020. Nests were located near turbines 8, 12, 20, and 27, with confirmed Red-tailed Hawk activity at the nests associated with turbines 8 and 12. The remaining two nests, at turbines 20 and 27, were concluded to be inactive during a follow up visit conducted on May 5, 2020. The nest identified at turbine 12 was concluded to be the same nest site as documented in 2019. Active Red-tailed Hawk nests identified in 2020 are shown on **Figure 2.1** and **Figure 2.2, Appendix A**. For comparison purposes, a summary of nest locations by year is provided in **Table C5** (**Appendix C**).

Candidate nesting habitat for Turkey Vultures occurs throughout the Project with numerous barns documented, although confirmation of nesting was not possible due to a lack of access to these private structures.

4.2.2 Behavioural Surveys

Observed behaviours of Red-tailed Hawks and Turkey Vultures during the breeding season is summarized in **Tables C6** and **C7**, respectively, **Appendix C**, with flight paths of each raptor shown on **Figure 2.1** and **Figure 2.2, Appendix A**.

4.2.2.1 Red-tailed Hawks

Red-tailed Hawks were observed on nest (incubating or brooding) at each of the two monitored nests during the first (May 6) and second visits (May 12). Red-tailed Hawk activity continued at both turbines until the end of May with a combination of visits to the nest, perching in nearby features (hedgerow), or soaring behaviour (likely associated with foraging or patrolling); behaviours characteristic of resident birds associated with the observed nesting territories.

Perching locations (RT-P3, RT-P2, and RT-P5; **Figure 2.1** and **Figure 2.2, Appendix A**) and identified flight paths (RT1-RT3, RT9; **Figure 2.1** and **Figure 2.2, Appendix A**) used by Red-tailed Hawks during the breeding territorial mapping were relatively unique. Each flight path was used once and RT3 used twice, as depicted on **Figure 4** (**Appendix A**).

At turbine 8, on May 26, high-risk behaviour was documented by a soaring Red-tailed Hawk moving to forage directly above the turbine for approximately 2 minutes (see flight path RT9; **Figure 2.2**, **Appendix A**). No obvious changes in behaviour were noted during the turbine approach, although subtle height adjustments may have occurred to reduce turbine collision risk.

Interactions between territorial birds and other raptors was not observed in 2020.

4.2.2.2 Turkey Vultures

A total of six observations of individual Turkey Vultures soaring in proximity to the monitored nests were made on two of the five survey dates (May 6 and May 12) conducted during the breeding territorial mapping. Flight path use during the breeding territorial mapping was relatively unique, with one or two birds distributed between TV6, TV13, TV16, TV21, TV22 (**Figure 2.1** and **Figure 2.2, Appendix A**), and tallied on **Figure 5** (**Appendix A**).

High risk behaviour and interactions between Turkey Vultures and Red-tailed Hawks (or other raptors) were not noted in 2020.

4.3 FALL MIGRATION MONITORING

Observed behaviours of Red-tailed Hawks and Turkey Vultures during the fall migration period is summarized in **Table C8** and **Table C9**, respectively (**Appendix C**), with flight paths of each raptor shown on **Figure 2.1** and **Figure 2.2, Appendix A**.

4.3.1 Red-tailed Hawks

Red-tailed Hawk observations remained relatively consistent (1-3 birds) during the fall migration monitoring between end of August and mid-November. Red-tailed Hawks were only observed on warm (≥15°C) windy (Beaufort 2-4) days, although wind direction did not appear to influence the number of birds observed. The highest number of Red-tailed Hawks was observed on August 25, early in the migration period, with perching behaviour documented by 2 of the 3 birds observed. Documented fall flight paths (**Figure 4, Appendix A**) were unique (RT5-RT8) and tended to use flight paths that avoided turbines.

Although RT5 (**Figure 2.2, Appendix A**) does not appear to avoid turbine 8, behaviour observed on September 29, 2020 indicates otherwise. A juvenile Red-tailed Hawk was observed soaring upwards in a circle heading northeast towards turbine 8, going into a stoop (gliding rapidly downwards without wing beats) once it was within proximity to the turbine to decrease altitude until below turbine blade height, passes within 50 m of the turbine during the stoop, then resumes soaring in a circle and begins to increase in altitude once safely beyond the turbine to the northeast.

Considering time of day (combined summer and fall to increase sample size) most Red-tailed Hawk observations were made mid-day, between 11:30 am and 2:00 pm (**Figure 6, Appendix A**).

4.3.2 Turkey Vultures

Turkey Vulture observations were highest through September – October, approximately 20-40 birds per survey, with the highest count on September 29 at 113 birds. Temperatures during these surveys were warm in September and cool in October with observations associated with predominantly medium wind speeds, except for one low (September 1) and one high (October 24) record. Flight path number TV14 experienced the most activity with 88 uses by Turkey Vultures, followed by TV13 (50 uses), and TV17 (45 uses), and TV21 (47; **Figure 5, Appendix A**). Considering time of day, most Turkey Vulture observations were made between mid-morning and mid-day (combined summer and fall, **Figure 7, Appendix A**).

Turkey Vultures tended to use flight paths that avoided turbines, except for TV21 (**Figure 2.2, Appendix A**). On September 29, 2020, a group of approximately 15 Turkey Vultures were observed thermal soaring southwest of turbine 8. Two of the Turkey Vultures broke off from the group and headed directly towards turbine 8 such that one individual continued to soar closer to the turbine. At one point the Turkey Vulture got within 20 m before rapidly readjust its flight path to avoid the turbine.

4.3.3 Other Raptors

The Enhanced Raptor Monitoring Plan focused on Red-tailed Hawk and Turkey Vulture, as they were the predominant species observed during the mortality monitoring. However, observations of other species of raptors within the Study Area were recorded. Species include Bald Eagle, Northern Harrier and one *Accipiter* unknown raptor species, either a Cooper's Hawk or Sharp-shinned Hawk as these two species

are quite difficult to distinguish. A summary of these incidental observations is provided in **Table C10, Appendix C**.

A total of 3 Bald Eagle observations, 4 Northern Harrier observations, and 1 Cooper's/Sharp-shinned Hawk were made across the wind farm. Their flight paths are also shown on **Figure 2.1** and **Figure 2.2, Appendix A**.

4.4 HAWK WATCH DATA

Data from the Hawk Migration Association of North America's Raptor Migration Database (Hawk Count 2020) was obtained to compare to observations within the Adelaide Project. The Holiday Beach Hawk Watch station was selected for comparison, as it is the closest Ontario station that would be "downstream" (i.e., to the south) of the Project during fall migration. The Holiday Beach Hawk Watch station is approximate 150km to the southwest of the Project. It is expected that raptors passing through the Project during fall migration would subsequently pass-through Holiday Beach a day or two later.

Daily numbers of Red-tailed Hawk and Turkey Vultures at Holiday Beach in 2020 are provided in **Table C11** and **Table C12, Appendix C**, respectively. Red highlighting (add by Stantec) indicated the timing of peak migration of each species based on results of the fall migration monitoring conducted at the Adelaide facility. As timing of migration can be dependent on weather conditions and variable from year to year, the long-term migration data was also obtained for Holiday Beach, which is shown on **Figure 8** and **Figure 9, Appendix A**.

5.0 DISCUSSION

5.1 MORTALITY MONITORING

Results of multi-year mortality monitoring program at the Project has recorded a total of twenty raptor mortalities (including incidental finds) between 2016 and 2020, as shown in **Figure 3, Appendix A**. To date, Red-tailed Hawks and Turkey Vultures (45%; 9 of 20, each) comprise most of the raptor mortalities at the Project, which is consistent with results across Ontario. Red-tailed Hawk comprises 5.27% and Turkey Vulture 6.07% of all wind facility bird mortalities in Ontario (BSC et al. 2018). The mortality of Red-tailed Hawks and Turkey Vultures in Ontario can likely be attributed to, at least in part, the abundance of these species in the province. The remaining two raptor mortalities at the Adelaide facility between 2016 and 2020 were Osprey (10%; 2 of 20), unexpected due to a lack of habitat in the Project area. It is expected that both individuals were in transit through the area when they collided with the turbines.

In 2020, the calculated mortality rate for raptors at the Adelaide facility in 2020 was 0.17 raptors/turbine. With the understanding that the mortality monitoring program differs from those completed at the Adelaide facility in 2016-2018, this calculate rate is below the provincial threshold detailed in the REA of 0.2 raptors/turbine.

5.2 BREEDING TERRITORIAL MONITORING

5.2.1 Evidence of Active Territories

Two Red-tailed Hawk nest locations were identified within the Study Area, as shown on **Figure 2.1** and **Figure 2.2, Appendix A**. The Red-tailed Hawk territory in proximity to turbine 12 has been active for several years, with evidence of nesting from 2016-2020 (**Table C5**, **Appendix C**). Although the location of the nest moved westward in 2018. It is believed the nest in the original location was damaged by a high-wind weather event as some sticks were noted on the ground in the approximate vicinity of the previous 2016/2017 nest. The nest in its new location continued to be active in 2019 and 2020. Activity at turbine 12 in 2020 began with an observation of an adult on the nest on May 6, followed by an adult in proximity to the nest throughout the month of May.

The Red-tailed Hawk territory in proximity to turbine 8 was not documented in 2019, however; an active nest was identified in 2018 within the same woodlot farther to the west. In 2020, Red-tailed Hawks were observed incubating on the nest during the first survey date (May 6, 2020) with activity at the nest noted throughout May until visibility obscured the view of the nest. A juvenile Red-tailed Hawk, potentially a fledgling from the documented nest, was observed within proximity to the nest on both September 8 and 29. Red-tailed Hawks were regularly seen patrolling and hunting in the area from May through November (excluding October), suggesting the territory likely remained active throughout the monitoring period.

5.2.2 Wind Turbine Collision Risk

The risk of turbine collision may be affected by many factors, including behaviour, flight path, abundance, landscape, morphology, weather, vision, and whether the individual is a resident or breeding bird (Marques et al. 2014). Raptors, in particular Red-tailed Hawks, may be more susceptible to collisions when compared with other birds, potentially attributable to their foraging and flight behaviour (Hoover and Morrison 2005). However, Garvin et al. (2010) found some signs of turbine avoidance, where resident Red-tailed Hawks and Turkey Vultures changed flight height or direction within 100 m of a turbine. This suggests that resident birds may experience a lower risk of wind turbine collision, as they are familiar with the landscape and avoid the turbines (Drewitt and Landston 2008). The results of the territorial monitoring in 2020 and previous years, support this conclusion, as flight paths (**Figure 2.1** and **Figure 2.2, Appendix A**) avoided turbines, in some cases showing a change in direction as raptors approach turbines (e.g., RT1).

During previous years of cause and effect monitoring at the Adelaide Wind Power Project it has been observed that raptor mortality was higher in proximity to an active Red-tailed Hawk nest. It was hypothesized that increased mortality associated with active territories may be attributable to interactions between resident Red-tailed Hawks and migrating raptors passing through their territory. Such interactions may result in distracted flight and increase risk of collision. During such interaction, the migratory birds, unfamiliar with the territory, may be at higher risk of turbine collision. Results of the 2020 behavioural surveys did not document direct interactions between resident Red-tailed Hawks and other raptors, although such behaviour had been recorded during previous cause and effect monitoring at the Adelaide facility.

In 2020, a single Red-tailed Hawk mortality was recorded during the breeding season; at turbine 8 (recovered May 5) in proximity to an active nest. This mortality was likely of a Red-tailed Hawk passing through the territory as the nest at turbine 8 remained active throughout May. This supports the conclusion of previous years of monitoring, that non-resident raptors may be a higher risk of turbine collision.

5.3 FALL MIGRATION MONITORING

5.3.1 Fall Migration Patterns

Red-tailed Hawk observations remained relatively consistent (1-3 birds) during the fall migration monitoring between end of August and mid-November. The 2020 Holiday Beach Hawk Watch data (**Table C11, Appendix C**) is consistent with the long-term trend (**Figure 8, Appendix A**), showing peak Red-tailed Hawk migration in mid-October through mid-November.

The fall migration monitoring surveys observed daily counts of Turkey Vultures that were generally consistent through September and October (approximately 20-40 birds per survey) with the highest count on September 29 at 113 birds. No Turkey Vultures were observed during the single survey conducted in November, consistent with Holiday Beach Hawk Watch data (**Table C12, Appendix C**), which shows peak migration of Turkey Vultures in October, dropping off in November (**Figure 9, Appendix A**).

Both Red-tailed Hawk (**Figure 6, Appendix A**) and Turkey Vultures (**Figure 7, Appendix A**) had an observed trend of higher flight activity during mid-day. This result agrees with the literature which finds raptor flight activity, in particular migratory flights, to be concentrated mid-day when temperatures are higher and thermals, which support raptors flight, are well developed (Newton 2007).

It is known that weather can affect raptor migration activity, in particular wind direction. At hawk watch stations in southern Ontario, increased fall migration activity typically occurs during prevailing winds from the north or northwest (Hawk Count 2020). Winds blowing in the same direction of the raptor's migration decreases flight effort. As discussed above, temperature can also affect raptor migration, with warmer days providing strong thermals to help lift the raptors.

Results of the 2020 fall migration monitoring identified three days with prevailing winds from the north, August 25, October 8, October 24, and October 30. Red-tailed Hawk activity was highest on August 25, which may have been contributed to wind direction, although that was early in the migration period. Red-tailed Hawks were not recorded on October 8, 24, or 30. Turkey Vulture activity was moderate throughout the fall migration period, including on three of the four days with prevailing north winds. The highest observed total on September 29 did not appear to correspond to prevailing winds. There was no evident trend in raptor activity with other weather conditions (wind speed and temperature). Overall, strong correlations between weather conditions and raptor activity were not observed.

5.3.2 Wind Turbine Collision Risk

One raptor mortality was observed early in the fall migration period in 2020: an adult Red-tailed Hawk on August 13, 2020 at turbine 7. The mortality was located approximately 1.3 m away from the Red-tailed Hawk nest at turbine 8; within the known territory size of Red-tailed Hawks (average of 2.3 km^2; Preston and Beane, 2020). Although two adults were not documented together after the August 13 mortality, the territory at turbine 8 remained active as documented by a patrolling adult on August 25. A single adult or juvenile Red-tailed Hawk continued to patrol the territory for the rest of the survey period, observed on September 8, 29, and November 9. Therefore, as with the breeding territorial monitoring, the mortality was likely of a Red-tailed Hawk passing through the territory, supporting the theory that non-resident raptors may be a higher risk of turbine collision.

Most flight paths shown on **Figure 2.1** and **Figure 2.2** (**Appendix A**) occurred during the fall migration (see **Figure 4** and **Figure 5, Appendix A**) and generally appeared to avoid turbines. Furthermore, two recorded behaviours during fall 2020 directly documented turbine-avoidance behaviour, that of a resident juvenile Red-tailed Hawk and high-risk behaviour of a migratory Turkey Vulture, detailed below.

An observation on September 29, 2020 documented a juvenile Red-tailed Hawk altering its altitude through a change in behaviour, from circling upwards to a stoop, was presumably to avoid risk of collision with turbine 8. As this juvenile bird is expected to be a resident, potentially a fledgling of the nearby nest, this behaviour supports the theory that resident birds are at lower risk of turbine collision due to familiarity with the landscape.

A second observation, on the same day (September 29, 2020), in which a single Turkey Vulture left the group it was with and headed towards turbine 8 until the bird rapidly readjust its flight to avoid turbine collision. Because of the grouping of the birds and time of year, these birds were expected to be migrant and not resident birds, again, supporting the theory that non-resident birds may be at higher risk of collision.

Although the observed numbers of Red-tailed Hawks (1-3 birds observed) and Turkey Vultures (16-38; 113 outlier) during the 2020 fall monitoring period were generally consistent, data from the Holiday Beach Hawk Watch station show peak Turkey Vulture migration in October and peak Red-tailed Hawk migration from mid-October through mid-November. This October to mid-November timing window would be the expected period of increased Turkey Vulture and Red-tailed Hawk migration through the Study Area. However, this period does not align with observed raptor mortality at the Project. Considering the mortality monitoring results from 2015 through 2020, 40% (8 of 20) recorded mortalities occurred during the fall monitoring period (August - October). This suggests that volume of migrating raptors alone is not an indicator of mortality risk.

Results of the 2020 fall migration monitoring show limited evidence of correlation between weather conditions and raptor activity. However, it is known from the literature that raptor migration is highest during prevailing winds from the north or northwest and at mid-day.

6.0 SUMMARY AND RECOMMENDATIONS

The goal of the Enhanced Raptor Monitoring Plan was to provide insight into where, when and how operation mitigation could be effective for raptors. Based on the results of the first and second year of enhanced monitoring under the Plan, mortality risk appears to be higher within active Red-tailed Hawk territories, but not specifically to nesting Red-tailed Hawks. The single observed raptor mortality in the 2019 program (a Red-tailed Hawk in June) was observed in proximity to one of the potential breeding territories. Two of the mortalities observed in 2020, 2 Red-tailed Hawks (May 5 and May 20) were also in proximity to a confirmed Red-tailed Hawk breeding territory at turbine 8. Monitoring results suggest these mortalities were of individuals passing through the territory, consistent with previous years' results that suggest risk of collision may be elevated within active Red-tailed Hawk territories.

Results of the behavioural monitoring conducted in the fall of 2020 documented evidence of turbine avoidance by a resident Red-tailed Hawk as well as high-risk behaviour by a migrating Turkey Vulture, indicating that non-resident birds may be at higher risk of turbine collision.

With regard to time of year, data from the Holiday Beach Hawk Watch station provides insight into when raptor activity is expected to be elevated in the Study Area; specifically in October to mid-November and during conditions with prevailing winds from the north or northwest. However, results of the Project's post-construction monitoring program completed to-date (2015 to 2020) have not found elevated raptor mortality during this period, accounting for only40% (8 of 20) recorded mortalities during the fall monitoring period (August - October).

Currently, in Ontario, there is no guidance or established protocols on implementation of operational mitigation for raptors. This is likely due, in part, to a lack of empirical evidence that risk of raptor mortality is elevated during specific conditions (e.g., weather or seasonal; Allison et al. 2017). Furthermore, the scientific literature and best available science suggest that turbine curtailment, in particular curtailment linked to seasonal or weather variables, is unlikely to affect raptor mortality and that mitigation for the impacts to raptors can be more achievable through off sets or abatement of other sources of raptor mortality.

It is also our understanding that a precedent for operational mitigation in response to an exceedance of the raptor threshold has not been established in Ontario. Specific to the Adelaide facility, raptor mortalities from 2015-2020 do not show a strong seasonal trend and it is therefore unlikely that an effective operational mitigation program could be implemented. Based on the limited conclusions of the raptor monitoring program, absence of empirical evidence, and lack of precedent in Ontario to inform mitigation measures, consultation with MECP and MNRF is recommended to determine appropriate mitigation measures for the Adelaide facility. In the meantime, Suncor is planning to replicate the raptor monitoring program in 2021 to further and continue to study raptor behaviour and mortality patterns at the Adelaide facility, as well as inform adaptive mitigation measures, as required. The Enhanced Raptor Mortality Plan monitoring and this report are intended to meet the requirements of the REA triggered by the exceedance of the raptor mortality provincial threshold at the Adelaide facility recorded in 2015 through 2017.

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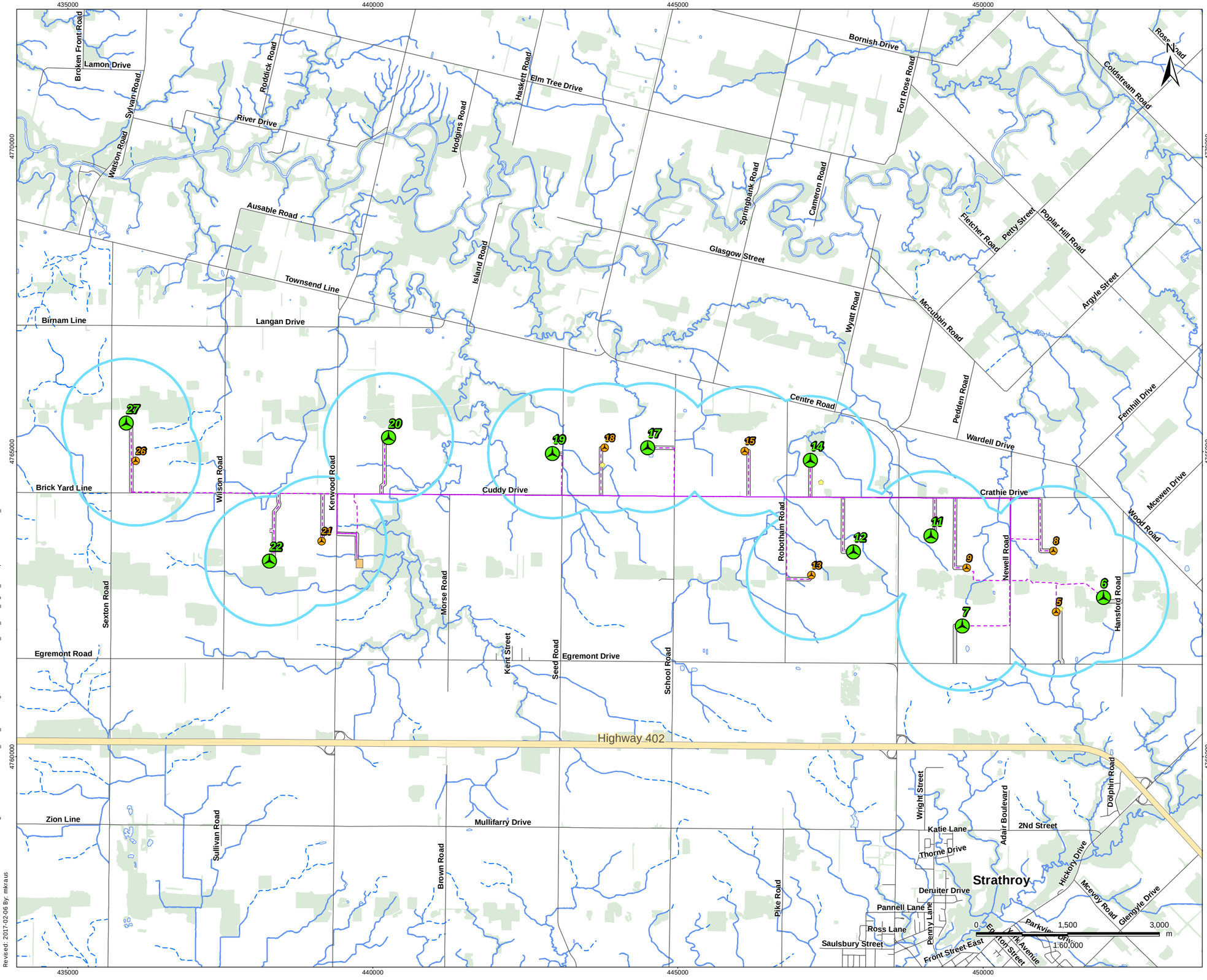
APPENDIX A
FIGURES



Legend

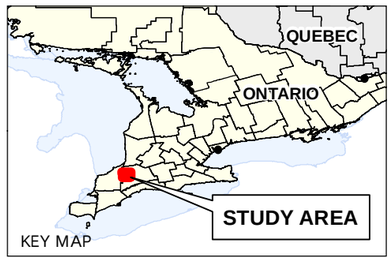
- Raptor Study Area

Project Components

- MET Tower
- Turbine Location
- Turbine Subset
- Access Road
- Collector Line
- Substation Constructible Area

Existing Features

- Expressway / Highway
- Road
- Watercourse
- Constructed Drain
- Waterbody



Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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February 2017
160961067

Client/Project

Suncor Energy
Adelaide Wind Project

Figure No.

1

Title

Raptor Study Area

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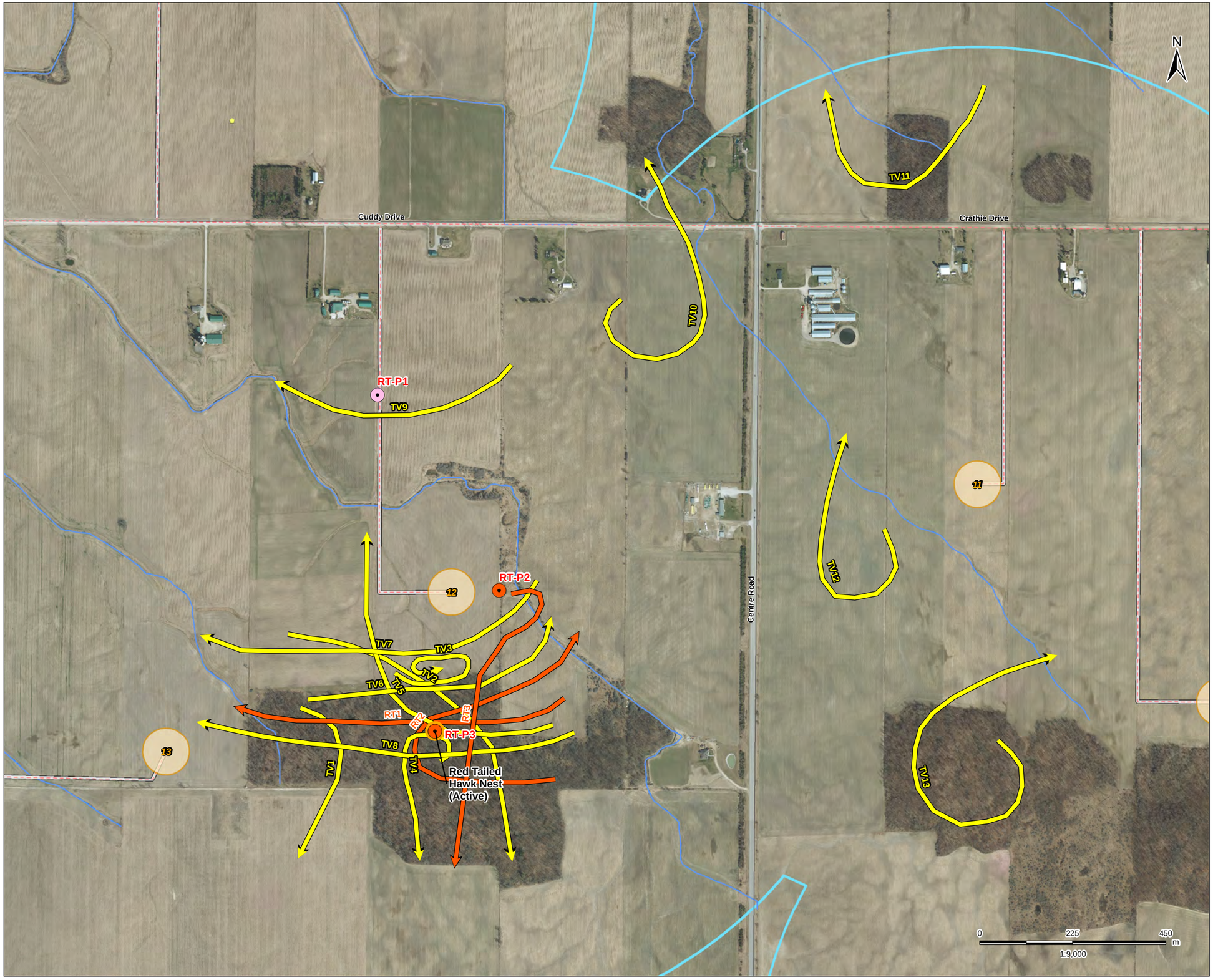
Revised: 2017-02-06 By: mkraus



Stantec

Legend

- Project Boundary
- Raptor Study Area

Project Components

- MET Tower
- Turbine Location
- Access Road
- Collector Line

Existing Features

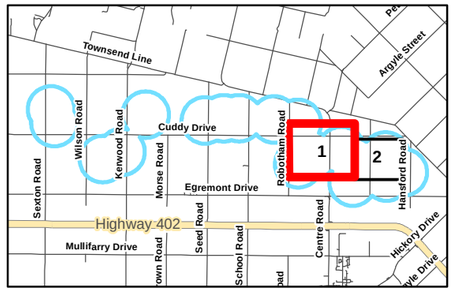
- Road
- Watercourse
- Constructed Drain
- Red Tailed Hawk Nest (Active)

Perch Location

- Coopers / Sharp-shinned
- Red Tailed Hawk (RTHA)

Flight Paths (2020)

- Red Tailed Hawk (RTHA)
- Turkey Vulture (TUVU)



Notes

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3. Orthographic Imagery provided by Suncore, 2011. Imagery taken in Spring 2010.

February 2021
160961067

Client/Project

Suncor Energy
Adelaide Wind Project

Figure No.
2.1

Title

Raptor Monitoring Flight Paths 2020

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Revised: 2021-02-09 By: BCowper

450000

N

Newell Road

RT6
NH2
TV23
BE3
RT5
NH1
RT9
8
RT-P4
BE2
TV19
TV22
NH3
BE1
TV21
TV20
TV15
TV16
RT8
RT-P5
RT-P6
TV18
RT7
TV17
RT4
Red Tailed Hawk Nest (Active)
TV24
9
TV14
5

0 175 350 m

1:7,000

450000

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Revised: 2021-02-12 By: BCowper

Stantec

Legend

- Project Boundary
- Raptor Study Area

Project Components

- MET Tower
- Turbine Location
- Access Road
- Collector Line

Existing Features

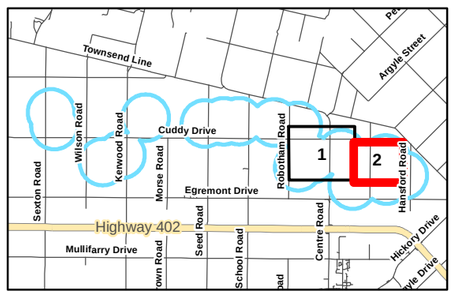
- Road
- Watercourse
- Constructed Drain
- Waterbody
- Red Tailed Hawk Nest (Active)

Perch Location

- Red Tailed Hawk (RTHA)

Flight Paths (2020)

- Bald Eagle (BAEA)
- Northern Harrier (NOHA)
- Red Tailed Hawk (RTHA)
- Turkey Vulture (TUVU)



Notes

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February 2021
160961067

Client/Project

Suncor Energy
Adelaide Wind Project

Figure No.

2.2

Title

Raptor Monitoring Flight Paths 2020

Figure 3: Raptor Mortalities by Year, Adelaide Wind Power Project

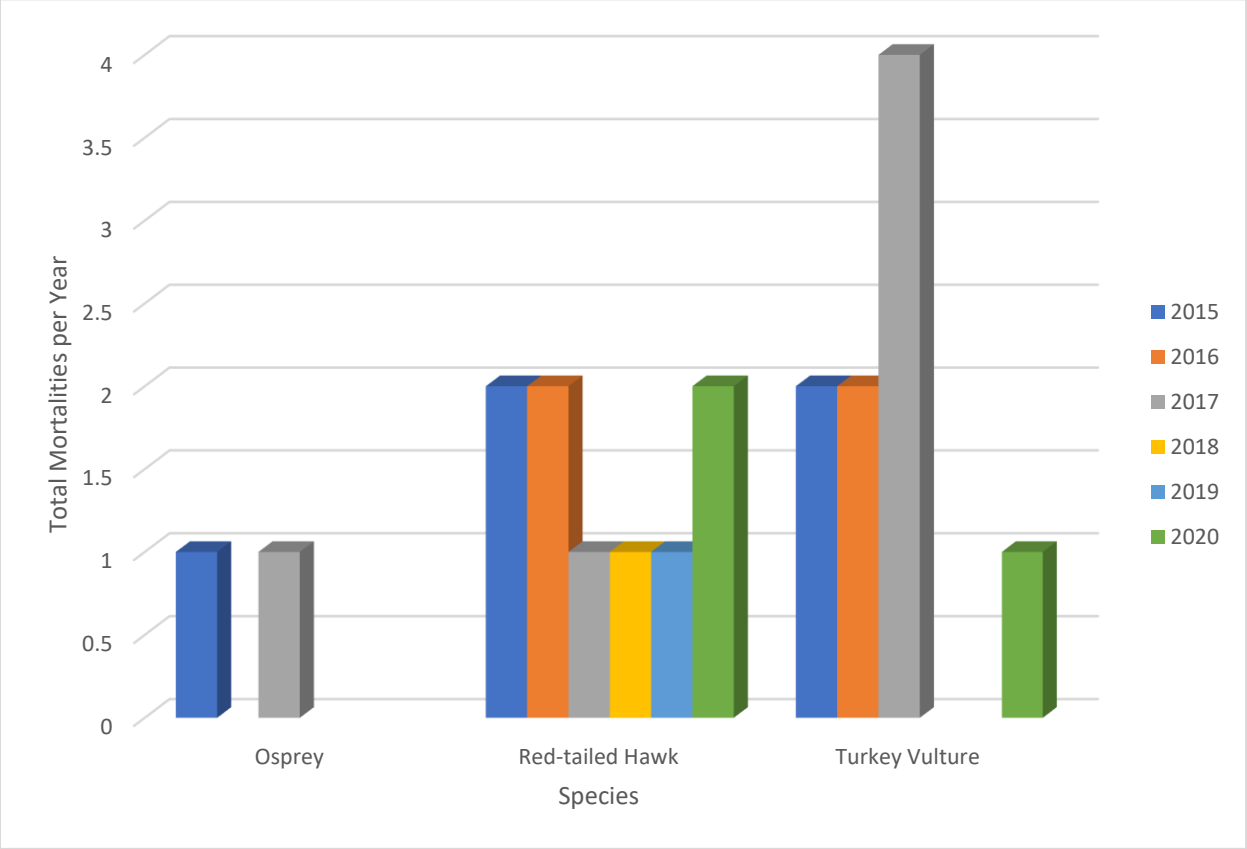


Figure 4: Red-tailed Hawk Observations by Flight Path, Breeding Territory and Fall Migration, 2020

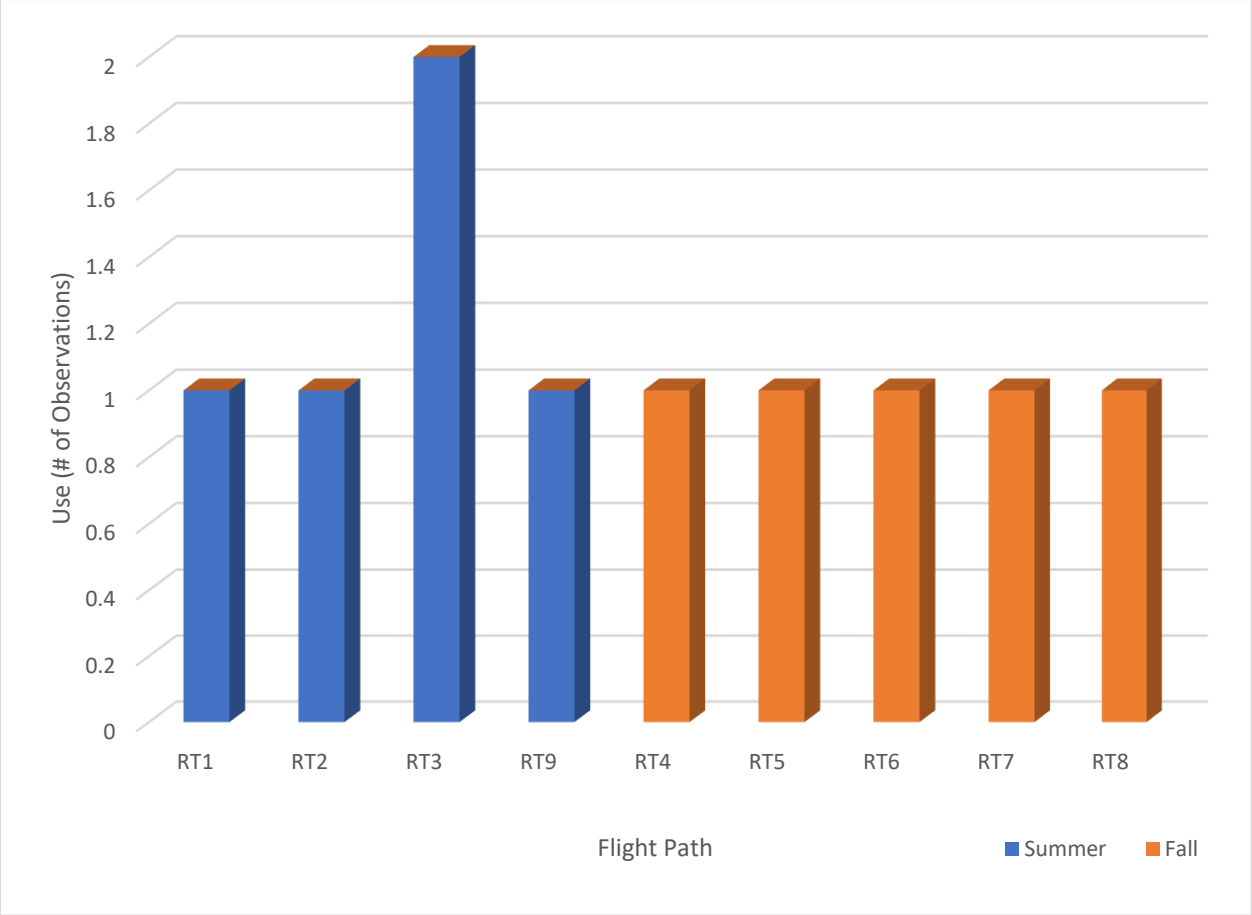


Figure 5: Turkey Vulture Observations by Flight Plan, Breeding Territory and Fall Migration, 2020

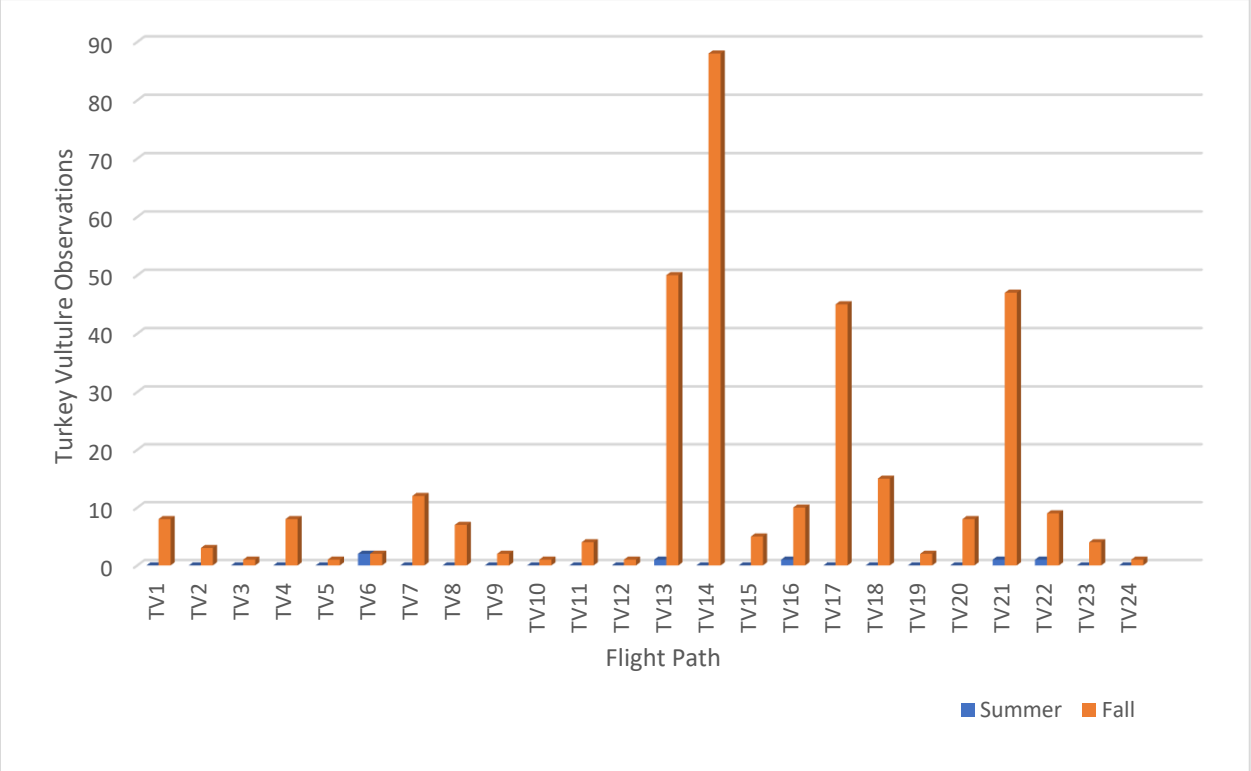


Figure 6: Summary of Red-tailed Hawk Observation by Time of Day, Breeding Territory and Fall Migration, 2020

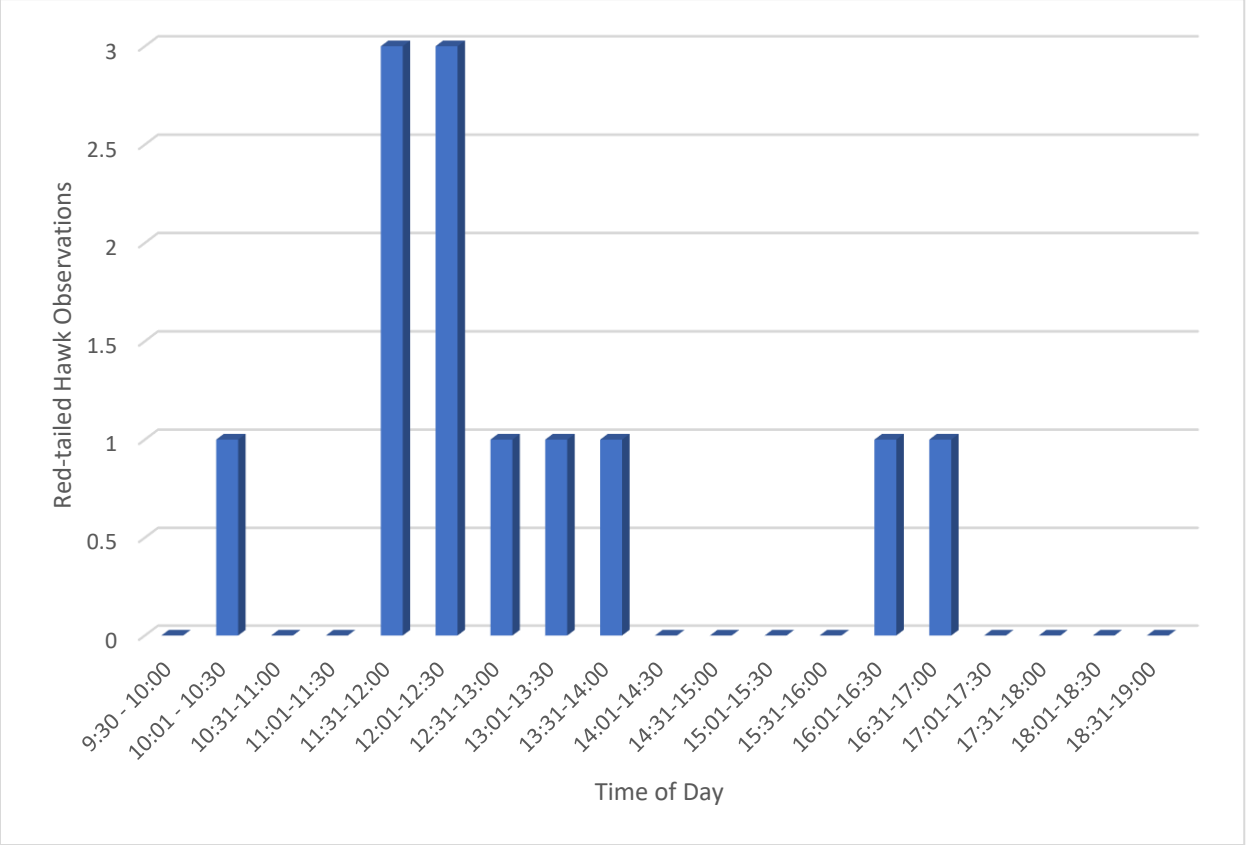


Figure 7: Summary of Turkey Vultures Observation by Time of Day, Breeding Territory and Fall Migration, 2020

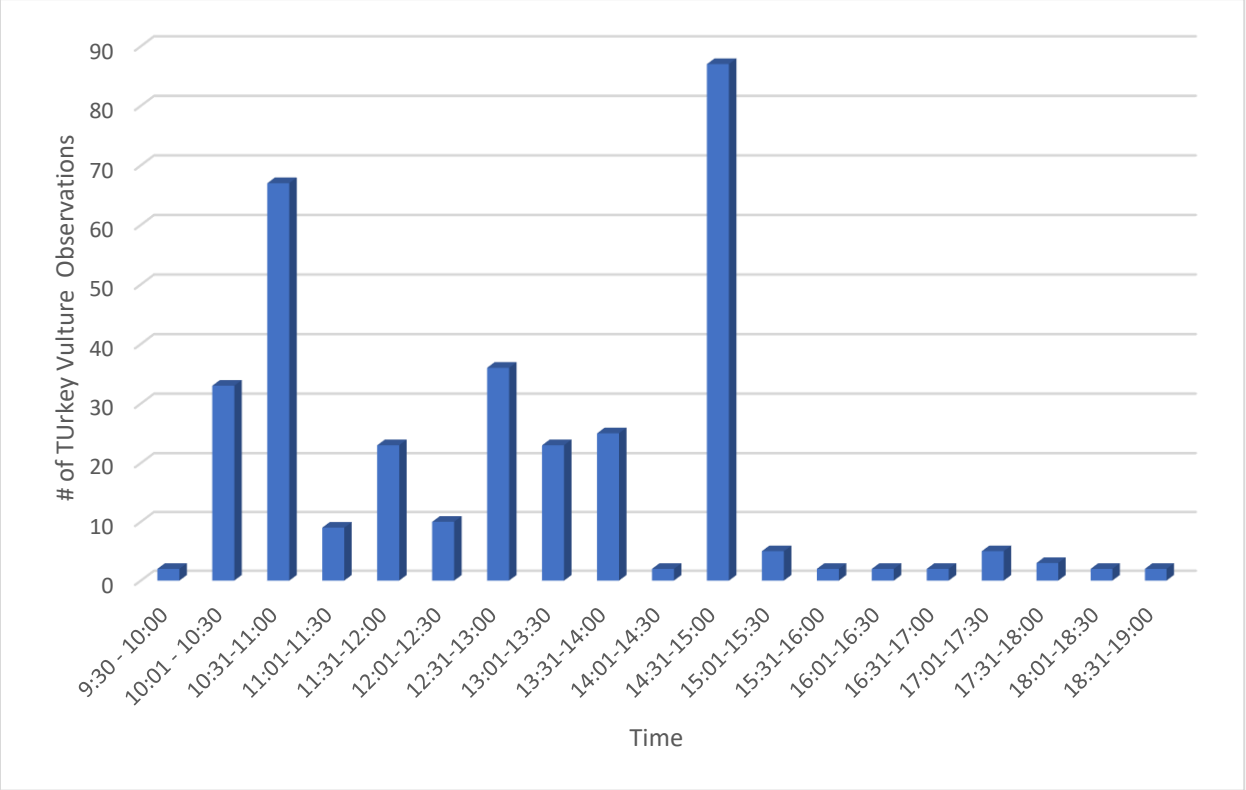


Figure 8: Summary of Red-tailed Hawk migration timing using long-term data from the Holiday Beach Hawk Watch station (1974-2020). Source: Hawk Count 2020

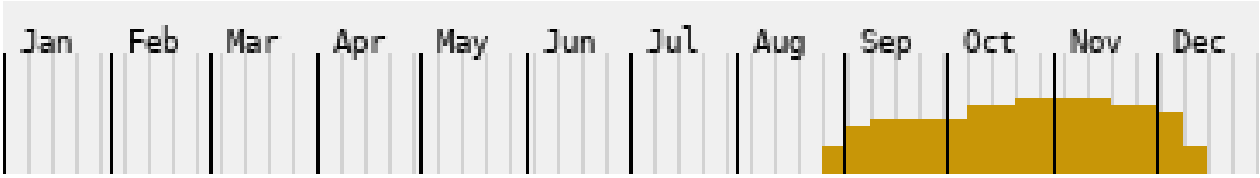
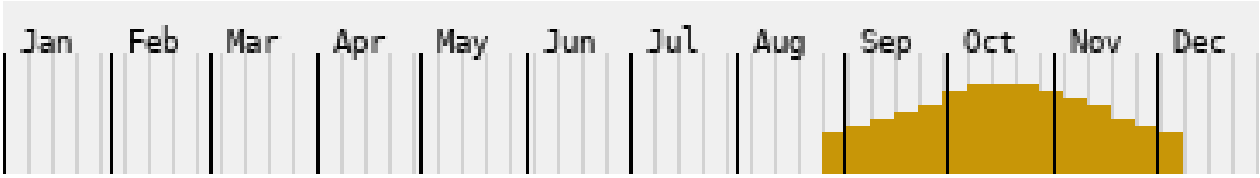


Figure 9: Summary of Turkey Vulture migration timing using long-term data from the Holiday Beach Hawk Watch station (1974-2020). Source: Hawk Count 2020



APPENDIX B: ENHANCED RAPTOR MONITORING PLAN

Stantec Consulting Ltd.
1-70 Southgate Drive, Guelph ON N1G 4P5

August 28, 2019
File: 160961067

Attention: John McGlynn, Senior Environmental Officer
Ontario Ministry of the Environment, Conservation and Parks
Southwest Region, London District Office
733 Exeter Road, London, Ontario

Dear Mr. McGlynn,

Reference: Adelaide Wind Power Project
Monitoring Plan for Raptors

Stantec Consulting Ltd. has been retained by Suncor Energy Inc. to conduct the ongoing post-construction monitoring of the Adelaide Wind Power Project. The Environmental Effects Monitoring Plan (EEMP) monitoring was completed in 2015 through 2017, with continued, ongoing post-construction raptor monitoring to address the raptor threshold exceedance.

On July 25, 2019, Suncor provided the Ontario Ministry of Environment, Conservation and Parks (MECP) with Stantec's proposed Enhanced Raptor Monitoring Plan. Comments from MECP and the Ministry of Natural Resources and Forestry (MNRF) were received August 26, 2019. The purpose of this letter is to respond to MECP and MNRF comments and to provide a revised Enhanced Raptor Monitoring Plan that addresses those comments.

1. *It has not been demonstrated that the proposed plan was developed by a qualified professional. Please identify the person(s) responsible for the development of the plan.*

The proposed plan was developed by Andrew Taylor from Stantec. Andrew has over 10 years of post-construction monitoring experience of wind power facilities, including studies specific to raptors mortality and behavioral impacts. Andrew's CV is attached.

2. *The intent of the additional monitoring option (i.e. option 2) is to provide more focused monitoring that would allow for an enhanced understanding of possible causes and/or trends related to the mortality occurring at the turbines to inform appropriate and effective mitigative actions.*

    a. *As such, please outline and include rationale as to how the proposed methodology would enhance or improve upon previous post-construction monitoring (i.e. mortality monitoring and scoped cause and effect monitoring).*

Based on the post-construction monitoring completed to-date (2015 through 2018) the following conclusions have been drawn, regarding trends in raptor mortality:

- In two years of monitoring (2016 and 2017), there appeared to be a potential correlation between the location of active raptor nests and the location of raptor mortality.

- Most raptor mortality has occurred during the breeding and fall migration; with variability from year to year.

- Otherwise, there has been a lack of identifiable trends in raptor mortality that would inform mitigatable conditions (e.g. timing or weather).

The Enhanced Raptor Monitoring Plan is intended to build upon these conclusions, with the goal of providing insight into where and when operation mitigation would be effective for raptors. Monitoring is proposed for May through November with an emphasis during the breeding and fall migration seasons, which corresponds to the timing of observed mortality during previous years of monitoring at this facility. Rational for each component of the Enhanced Raptor Monitoring Plan is provided below.

MORTALITY MONITORING

- The ongoing mortality monitoring is intended to provide additional information on mortality trends, beyond what has been collected from the previous years of studies.

- In addition, having mortality data in the same year of behavior studies is required to allow for a correlation between potentially high-risk behaviors and observed mortalities.

- Monitoring will be revised to occur at all 18 turbines on a weekly basis instead of only a subset, to allow a more comprehensive assessment of spatial mortality across the Project.

- We continue to propose once a week monitoring, as the monitoring is typically for larger-bodied raptors with high carcass persistence. The monitoring does not include searches for small-bodied birds or bats (which have shorter carcass persistence). As such, we believe the twice weekly monitoring typically of the full EEMP programs is not necessary to meet the goals of the enhanced raptor monitoring plan.

BEHAVIORAL STUDIES

Territorial Monitoring

- The territorial monitoring will be used to confirm the location of active nests and/or territories, which will allow:
    - An assessment of correlation between mortality data and proximity of active territories.
    - Conduct fall migration monitoring in proximity to active territories (see more details below).
- Territorial monitoring will look for interactions between territorial birds during the breeding season, with a focus on looking for potential high-risk behavior.

- In the event of a raptor mortality in proximity to an active territory, territorial monitoring may provide insight into whether the mortality was of the resident territorial pair, or an individual moving through the territory (i.e. determine if both individuals of the resident pair are still present).

- The initial spring, leave-off survey, will be used to determine the location of active nest in each year of monitoring. Rational for the additional five surveys, spread across the breeding season, is to confirm the territory remains active, provide additional survey effort to observe raptor interactions and to assess if observed mortalities are of the breeding pair.

Fall Migration Monitoring

- Resident birds typically remain on territory year-round and will interact with migratory raptors that pass through their territory.
- The Project site is not situated along a shoreline or major landscape formation (e.g. escarpment), as such, raptor migration is not expected to be concentrated in a particular area or along a specific feature.
- Focus of the fall migration monitoring will be on the active territories, mapping how migrant individuals move through or around active territories and examining interactions between resident and migration, with specific emphasis on recording high-risk behavior.
- Furthermore, the fall migration monitoring will be used to assess the hypotheses that there would not be distinct migration paths through the Project site, or if there are features that concentration movement (e.g. Ausable River valley to the north) are present and should be considered in a mitigation strategy.
- Survey effort has been increased to 10 surveys, spread throughout the fall migration period (i.e. late August through early November). This level of effort and survey period is based on consultation and advice from subject experts at Canadian Wildlife Services on other wind power projects in southern Ontario (e.g. Wolfe Island and Port Alma wind farms).

    b. Please describe and provide a rational as to how the enhanced monitoring intends to inform the development of an operational mitigation plan at the facility (i.e. what improved results will it yield to inform mitigative actions for raptors). See comments for consideration in red text in the original email below.

The goal of the Enhanced Raptor Monitoring Plan is to provide insight into where and when operation mitigation would be effective for raptors. Specific parameters that will be assessed using the Enhanced Raptor Monitoring Plan data including:

- Location
    - Results to-date suggest proximity to active nests may be a factor in raptor mortality and should be considered in a mitigation strategy.
    - Results of the fall migration monitoring will be assessed to determine if other spatial considerations (i.e. areas of concentrated raptor movement) should be used in developing a mitigation strategy.
- Time of year

  - The mortality monitoring results to-date have been somewhat variable on time of year (concentrated in the breeding season in some years and in the fall migration season in other years).
  - The addition of behavioral studies may help to refine when raptor activity is highest in the studies area, or when potentially high-risk behaviors are most frequent.

- Time of day
  - The monitoring completed to-date does not provide any insight into what time of day raptors may be a highest risk of mortality.
  - The additional behavior studies may help to determine what times of day raptor activity if highest or when high-risk behaviors are most frequent.

- Weather Conditions
  - It is difficult to correlate mortality monitoring results with weather conditions, as it is unknown exactly when a collision took place or the weather at the time.
  - However, through the additional behavioral monitoring, weather conditions can be recorded in real-time, when high-risk behaviors are identified.

PROPOSED WORK PLAN (REVISED)

The proposed Enhanced Raptor Monitoring Plan, which has been revised to address MECP and MNRF comments, is provided below. A reporting section has also been added to discuss how data will be analyzed to inform an operational mitigation strategy.

1. Mortality Monitoring
   - Weekly mortality monitoring
     - monitoring at all 18 turbines
     - weekly monitoring for raptors from the beginning of May to the end of November
     - Approx. 10 minute searches at each turbine (as the target are large-bodied, highly visible birds)
   - Correction factor trials:
     - searcher efficiency will be assumed to be 1.0 for large-bodied raptors, consistent with previous years of monitoring.
     - scavenger trials will be assumed to be 1.0 for large-bodied raptors, consistent with previous years of monitoring.
     - as previously requested by MNRF on this Project, raptor carcass, if available, will be set out to confirm if any removal of raptor carcasses is occurring.
     - percent area searched
2. Breeding territorial monitoring:
   - Initial April survey to identify and map location of active raptor nests within 1km of turbines.
   - Five additional surveys:
     - Identification of territory size around nests.

- Observation interactions between territorial raptors.
- Assume 2 hours of observations at each nest during each survey event.

3. Fall migration monitoring
    - 10 surveys from late August through early November.
    - Mapping migration flight paths in proximity to active territories and landscape features.
    - Observations of interactions between territorial raptors and migrant raptors.

4. Reporting
    - An annual report will be prepared summarizing the results, with a comparison to previous year's results at the Project.
    - The results will be compared to publicly available data from other sources (i.e. Hawk Watch) to assess trends in migration activity.
    - The results of behavioral studies (breeding and fall migration monitoring) will be compared to mortality data, to assess potential correlation between observed high-risk behavior and observed mortality.
    - Where possible, a determination of resident vs. migration will be made for observed raptor mortality.
    - Trends in observed high-risk behavior will be assessed against time of year, time of day and weather conditions.
    - The annual reports will provide conclusions on if and what trends in raptor mortality risk were identified, with recommendations for an operational mitigation strategy and/or additional study requirements.

Thank you for your attention to this letter and the ongoing consultation with Suncor and Stantec on this file. Should MECP or MNRF have additional comments or questions regarding the study design rational or the revised work plan above, please do not hesitate to contact the undersigned.

Regards,

Stantec Consulting Ltd.

Andrew Taylor
Senior Ecologist
Phone: 519 780 8122
Fax: 519 836 2493
andrew.taylor@stantec.com

Attachment: Andrew Taylor CV

c. Mark Kozak, Suncor Energy Inc.

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Andrew Taylor B.Sc.

Senior Ecologist

Andrew is a knowledgeable terrestrial ecologist and project manager. He has successfully managed a wide range of projects, including natural heritage assessments (NHA), environmental impact statements, constraint analyses, environmental implementation reports and natural heritage components of Environmental Assessments. These projects involve the implementation of natural heritage policies of the Renewable Energy Approval, Ontario Provincial Policy Statement, Greenbelt Plan and municipal policy documents. He is familiar with various Acts and their application to projects, including the Migratory Birds Convention Act, Endangered Species Act, Species at Risk Act and others.

Andrew is knowledgeable about the biology and life history of Ontario birds and bats. He also has strong technical skills at identification of vascular plants, breeding amphibians (calling frogs and toads), breeding salamanders (adult and egg studies), reptiles, butterflies and dragonflies.

Andrew has been involved in field studies, providing technical advice and/or reporting on over 30 wind energy projects in Ontario. Through these projects he has extensive experience conducting surveys for the diversity, abundance and behavior of breeding, migrating, staging and wintering birds. Andrew has experience analyzing the results of field surveys to assess potential impacts of local and migratory populations of birds. He has conducted pre-construction bat surveys on a number of projects in Ontario; including identification of candidate roost and hibernacula features and has experience surveying for bats using acoustic detectors to determine presence and species. Andrew has extensive experience with post-construction monitoring at wind energy projects, having coordinated studies at ten facilities in Ontario. These studies have assessed the direct impact of mortality on bird and bat populations and the indirect impacts of avoidance on birds.

He has extensive experience with policies, field studies and permitting requirements pertaining to species at risk. He is skilled at assessing wildlife habitat, applying Ecological Land Classification (ELC) and delineating wetland boundaries. Andrew is experienced at analyzing natural heritage features for the presence of Significant Woodlands or Significant Wildlife Habitat using applicable provincial guidance documents.

Andrew has provided terrestrial ecology expertise in a wide range of sectors, including urban lands, energy (including renewable energy), recreational development, infrastructure and aggregate extraction. He has appeared as an expert witness in front of Boards and Tribunals including the Environmental Review Tribunal.

EDUCATION

B.Sc. (Hons), University of Guelph / Environmental Toxicology, Guelph, Ontario, 2001

CERTIFICATIONS & TRAINING

Certificate #032, Ontario Ministry of Natural Resources / Butternut Health Assessor, Hamilton, Ontario, 2009

Certificate, Ontario Ministry of Natural Resources / Ecological Land Classification System for Southern Ontario, Turkey Point, Ontario, 2006

PROJECT EXPERIENCE

Renewable Energy

Renewable Energy Approval (REA) Natural Heritage Assessments (NHA) and Environmental Impact Studies (EIS), Multiple Projects, Various Sites, Ontario (Terrestrial Ecologist)

NHAs and EISs were prepared in accordance with O. Reg. 359/09 under the Environmental Protection Act with guidance obtained from the Draft Natural Heritage Assessment Guide for Renewable Energy Projects (MNR, 2010). NHAs included records review and site investigation, including but not limited to vascular plant surveys, Ecological Land Classification and wildlife surveys for avian species, amphibians, reptiles, mammals and invertebrates.

Data obtained were used to identify and evaluate significant natural heritage features including wetlands, woodlands, valleylands and significant wildlife habitat. Outside the REA process, field surveys and habitat assessments were completed for species protected under the provincial Endangered Species Act. Andrew coordinated and conducted field studies, habitat assessments for species at risk, authored technical reports and engaged in public consultation for the following:
• Grand Renewable Energy Park (Haldimand County, 69 turbines & solar, total 253.1 MW)
• Port Dover and Nanticoke Wind Project (Norfolk and Haldimand Counties, 58 turbines)
• Ostrander Wind Energy Park (Prince Edward County, 9 turbines)
• Mica Bay (Algoma District, 12 turbines)
• Amherst Island (Lennox and Addington County, 37 turbines)
• Fairview Wind Farm (Simcoe County, 4 turbines)
• Whittington Wind Farm (Dufferin County, 3 turbines)
• Springwood Wind Farm (Wellington County, 4 turbines)
• Brooke-Alvinston Wind Farm (Lambton County, 4 turbines)
• Bow Lake (Algoma District, 36 turbines)
• Niagara Region Wind Farm (Niagara Region, 80 turbines)
• Adelaide Wind Power Project (Middlesex County; 28 turbines)
• Cedar Point Wind Power Project (Lambton County, 72 turbines)
• Grand Valley 3 (Dufferin County, 15 turbines)

Environmental Screening Report / Environmental Review Report, Multiple Projects, Various Sites, Ontario (Terrestrial Ecologist)
Environmental Screening Reports/Environmental Review Reports were prepared for various wind energy projects in compliance with the Ministry of the Environment's Guide to Environmental Assessment Requirements for Electricity Projects and the Canadian Environmental Assessment Act (CEAA). Andrew's involvement included pre-construction study design, coordinating and conducting monitoring for avian and other wildlife species, including targeted surveys for species at risk. Avian studies included breeding grassland and forest birds, wintering raptors and migratory surveys for waterfowl, raptors, passerines and shorebirds. Andrew conducted and coordinated acoustic bat surveys including data collection, species identification, data analysis and reporting, and co-authoring technical reports as part of the following projects in Ontario:
• Wolfe Island Wind Project (Wolfe Island, 86 turbines)
• Port Alma Wind Power Project (Municipality of Chatham-Kent, 44 turbines)
• Plateau Wind Project (Municipality of Grey Highlands & Melancthon Township, 18 turbines)
• Gosfield Comber Wind Energy Project (Essex County, 149 turbines)
• Kingsbridge II Wind Project (Huron County, 69 turbines)
• Chatham Wind Power Project (Municipality of Chatham-Kent, 44 turbines)
• Melancthon Wind Plant, Phases I & II (Melancthon and Amaranth Townships, 177 turbines)

Post-construction Monitoring Programs, Multiple Projects, Various Sites, Ontario (Terrestrial Ecologist)
Post-construction monitoring of renewable energy projects is performed to assess the direct impacts to birds and bats and indirect impacts to breeding, migrating and wintering wildlife. The purpose of post-construction monitoring programs is to verify predictions of the pre-construction assessment and, if necessary, implement appropriate measures to mitigate adverse effects. Andrew has coordinated and conducted monitoring field studies including assessment of disturbance to grassland, forest and wetland breeding birds, staging waterfowl and shorebirds, tundra swans and wintering raptors and co-authored or authored the post-construction monitoring reports for the following projects in Ontario:
• Wolfe Island Wind Project (Wolfe Island, 86 turbines)
• Melancthon Wind Plant, Phase I & II (Melancthon & Amaranth Townships, 177 turbines)
• Kingsbridge I Wind Plant (Huron County, 22 turbines)
• Port Alma Wind Power Project (Municipality of Chatham-Kent, 44 turbines)
• Gosfield Comber Wind Energy Project (Essex County, 149 turbines)
• Grand Valley Wind Farm (Dufferin County, 9 turbines)
• Enbridge Underwood and Cruickshank Wind Farms (Bruce County, 115 turbines)
• Gesner Wind Energy Project (Municipality of Chatham-Kent, 5 turbines)
• Port Dover and Nanticoke Wind Project (Counties of Norfolk and Haldimand, 58 turbines)

Oil & Gas

Energy East Pipeline, Various Sites, Ontario (Terrestrial Ecologist)
Senior ecologist and advisory role on impact assessment of wildlife habitat and species at risk for project spanning across Ontario through four ecoregions. Consultation with Ontario Ministry of Natural Resources regarding species at risk including, but not limited to, Woodland Caribou.

** denotes projects completed with other firms*

Andrew Taylor B.Sc.

Senior Ecologist

Genesis Pipeline Extension Project, Sarnia, Ontario (Terrestrial Ecologist)
Senior ecologist and advisory role on impact assessment of wildlife habitat and species at risk.

Hamilton to Milton Natural Gas Pipeline, Halton, Ontario (Terrestrial Ecologist)
Terrestrial surveys included vegetation community assessments and floral inventory, with emphasis on species at risk.

Parkway West Compressor Station, Halton, Ontario (Terrestrial Ecologist)
Senior ecologist and advisory role on impact assessment of wildlife habitat and species at risk.

Bickford to Dawn Pipeline Project, Chatham, Ontario (Terrestrial Ecologist)
Terrestrial surveys included vegetation community assessments, floral inventory and species at risk habitat assessments. Study design and development in conjunction with local Ontario Ministry of Natural Resources district for Eastern Foxsnake, including a SAR 17b permit application.

Brantford Take-off to Kirkwall Valve Site Pipeline Project, Hamilton, Ontario (Terrestrial Ecologist)
Senior ecologist and advisory role on impact assessment of wildlife habitat and species at risk.

Dow Moore, Corunna and Seckerton Pipeline Project, Lambton County, Ontario (Terrestrial Ecologist)
Species at risk habitat assessment and inventory. Study design and development in conjunction with local Ontario Ministry of Natural Resources district for several species protected under the Endangered Species Act.

Electrical Power Distribution

Bruce to Milton Transmission Reinforcement Project, Multiple Sites, Ontario (Terrestrial Ecologist)
Terrestrial surveys related for species at risk protected under the provincial Endangered Species Act (2007).

Coote's Paradise Transmission Reinforcement Project, Hamilton, Ontario (Terrestrial Ecologist)
Terrestrial surveys included vegetation community assessments, floral inventory, with emphasis on species at risk.

Clarington Transformer Station, Durham, Ontario (Terrestrial Ecologist)
Senior ecologist and advisory role on wildlife habitat and species at risk impact assessment.

Midtown Electricity Infrastructure Renewal Project, Toronto, Ontario (Terrestrial Ecologist)
Senior ecologist coordinating species at risk inventories and permitting requirements.

Huycke Island Electrical Distribution Submarine Cable Replacement, Trent Hills, Ontario (Terrestrial Ecologist)
Senior ecologist and advisory role on impact assessment of wildlife habitat and species at risk.

Bruce Creek x Sarnia Scott TS B3N Line Protection Project, Sarnia, Ontario (Terrestrial Ecologist)
Senior ecologist and technical advisory on species at risk and implementation of Species at Risk Act permit.

Stratford Distribution Station, Stratford, Ontario (Terrestrial Ecologist)
Coordination of tree management plan and species at risk assessment.

Transportation Planning

City of Toronto Fort York Pedestrian Footbridge, Toronto, Ontario (Terrestrial Ecologist)
Coordinated Natural Sciences component of project including assessment of potential impacts, with an emphasis on species at risk.

** denotes projects completed with other firms*

Andrew Taylor B.Sc.

Senior Ecologist

Natural Science Reports Related to MTO Highway Improvement Works, Various Sites, Ontario (Terrestrial Ecologist)
Produced numerous Natural Sciences reports related to highway improvement works. Where required, Fisheries Act authorization was obtained and Fish Habitat Compensation Plans were developed. Potential impacts to terrestrial vegetation, wetlands and wildlife were described for the following studies:
• Highway 3 (Essex County): Preliminary Design Study
• Highway 40 (Municipality of Chatham-Kent): Detail Design Study
• Highway 11 (Town of Bracebridge): Preliminary Design
• Highway 24 (Cambridge): Detailed Design
• Highway 8 (Perth County): Detailed Design
• Highway 401 (Kitchener): Post-construction Compliance Monitoring
• Highway 401 (Essex County, near Comber): Post-construction Compliance Monitoring
• Highway 26 (County of Grey): Post-construction Compliance Monitoring
• Highway 17 (Sudbury): Preliminary Design Study
• Highway 9 (Municipality of South Bruce): Post-construction Compliance Monitoring

Research

Rice Lake Plains Joint Initiative*, Northumberland County, Ontario (Ecologist)
Tallgrass prairie research program. Identification and detailed cataloging of remnant tallgrass prairie sites, landowner liaison and education, development of tallgrass prairie management plans, reporting of findings.

Alderville First Nations Black Oak Savannah*, Alderville, Ontario (Ecologist)
Tallgrass prairie and black oak savannah research program. Technical reporting. Vegetation monitoring, tallgrass prairie reconstruction, wildlife monitoring, Species at Risk reintroduction.

Aggregate Services

Proposed Bromberg Pit, Ayr, Ontario (Terrestrial Ecologist)
Natural environment field inventories with emphasis on Species at Risk (SAR).

Neubauer Pit, Town of Puslinch, Ontario (Terrestrial Ecologist)
Natural environment field inventories with emphasis on Species at Risk (SAR).

Dufferin Aggregates Acton Quarry Extension, Acton, Ontario (Terrestrial Ecologist)
The extension of the existing Acton Quarry is proposed to meet the need for additional close-to-market aggregate resources of high quality Amabel Dolostone. Andrew has conducted extensive ecological field surveys and habitat assessments for breeding birds, amphibians and mammals with specific emphasis on Species at Risk (SAR).

St. Marys Cement Flamborough Quarry License Environmental Impact Study and Level 2 Natural Environment Technical Report (Ecologist)
Identification and impact assessment of natural heritage features, compensation and management plan for Species at Risk (Butternut), water balance to maintain provincially significant wetland, salamander habitat and migration study, assessment of provincially significant woodland and significant wildlife habitat, environmental impacts of transportation.

Natural Sciences & Heritage Resources

Crates Marina, Keswick, Ontario (Project Manager / Ecologist)
Environmental policies, approvals and desgin. Identification of natural heritage features and sensitive species.

Kortright East Development, Guelph, Ontario (Project Manager / Ecologist)
Envrionmental Implementation Report. Vegetation buffers, wildlife corridor, tree conservation plan, planning and design of invasive species removal, design of compliance and performance monitoring program.

Southeast Sutton Development Area Plan, Sutton, Ontario (Project Manager / Ecologist)
Environmental policies, approval and design. Identification of natural heritage features and constraints for Development Area Plan. Plan of Subdivision forest buffers, mitigation of impacts to forest resources, sensitive vegetation and Species at Risk. Participation in Ontario Muncipal Board discussions.

** denotes projects completed with other firms*

Andrew Taylor B.Sc.

Senior Ecologist

Fourteen Mile Creek Development, Oakville, Ontario (Ecologist)
Natural Heritage Monitoring Program Director - directed monitoring program of vegetation communities, change in species composition, avian wildlife, aquatic Species at Risk, benthic invertebrate communities, hydrogeology, geomorphology and erosion.

Activa Waterloo East, Waterloo, Ontario (Ecologist)
Terrestrial and Aquatic Monitoring Program - monitoring of vegetation communties, changes in species composition and disturbance levels were undertaken, interpreted and reported. Directed monitoring of benthic invertebrate communities.

Sports, Recreation & Leisure
Sunnidale Park Master Plan, Barrie, Ontario (Ecologist)
Identification and delineation of ecological management units. Design of management plans for ecological units, wetland and forest habitat rehabilitation. Technical reporting.

** denotes projects completed with other firms*

APPENDIX C
TABLES

Table C1: Mortality Monitoring Dates, Times and Weather Conditions

Date	Time	Weather					Surveyors
		Temp	Wind (Beaufort Scale)	Wind Direction	Cloud	PPT / PPT last 24 hours	
May 5 2020	9:00-14:30	6	2	E	50%	None	Kim Zupfer
May 12 2020	9:10-15:00	7	3	SW	60%	None	Kim Zupfer
May 20 2020	8:55-14:00	17	4	SE	10%	None	Kim Zupfer
May 25 2020	9:30-14:35	32	1	S	15%	None	Kim Zupfer
June 2 2020	9:58-15:07	23	3	SW	30%	None / rain	Kim Zupfer
June 9 2020	9:30-14:09	32	3	SW	20%	None	Kim Zupfer
June 17 2020	8:50-13:40	29	1	NE	0%	None	Kim Zupfer
June 25 2020	9:15-13:45	24	3	SE	20%	None	Kim Zupfer
July 3 2020	9:00-14:15	35	3	NE	0%	None	Kim Zupfer
July 8 2020	9:10-14:00	38	2	SW	0%	None	Kim Zupfer
July 15 2020	8:35-13:20	31	3	S	20%	None	Kim Zupfer
July 21 2020	8:40-13:10	25	2	E	75%	None	Kim Zupfer
July 28 2020	8:30-13:30	27	3	W	50%	None / rain	Kim Zupfer
August 6 2020	8:40-13:30	24	2	NE	10%	None	Kim Zupfer
August 13 2020	8:37-13:35	29	2	E	10%	None	Kim Zupfer
August 18 2020	8:39-13:26	23	3	NW	50%	None / rain	Kim Zupfer
August 27 2020	8:27-12:15	22	2	W	100%	Heavy rain	Kim Zupfer
September 18 2020	9:00-14:00	10	2	N	0%	None	Jordan Brooks
September 22 2020	8:41-13:30	7	1	E	0%	None	Jordan Brooks
September 29 2020	9:00-13:30	12	2	SW	35%	None / rain	Jordan Brooks
October 7 2020	9:00-14:00	13	2	SW	90%	None / rain	Jordan Brooks
October 14 2020	8:40-12:52	7	1	SW	10%	None	Jordan Brooks
October 23 2020	8:45-16:00	16	3	S	40%	None / Rain	Kayla Ellis
October 29 2020	9:45-15:30	4	1	N	100%	None	Kayla Ellis
November 4 2020	8:30-13:00	11	3	S	0%	None / Light snow	Jordan Brooks
November 13 2020	9:25-16:00	4	2	W	100%	None / Light rain	Kayla Ellis
November 21 2020	9:45-16:00	4	3	NNW	100%	None	Kayla Ellis
November 24 2020	8:30-12:40	-2	0	E	70%	None / Light snow	Jordan Brooks

Table C2: Behaviour Survey Dates, Times, and Weather Conditions

Date	Time	Weather					Surveyors
		Temp	Wind (Beaufort Scale)	Wind Direction	Cloud	PPT / PPT last 24 hours	
April 28 2020 *(Driving Survey)*	11:00-17:00	16	1	South West	80%	None / Rain	Mitch Ellah
May 6 2020	8:00-17:30	12	3	North East	0%	None	Mitch Ellah
May 12 2020	8:00-15:40	9	2	West	5%	None	Mitch Ellah
May 19 2020	8:00-13:00	14	3	East	100%	None / light rain	Mitch Ellah
June 4 2020	9:30-13:45	23-27	1-2	NW	5%	None	Mitch Ellah
August 25 2020	14:30-18:45	25-26	4	NW	20%	None	Mitch Ellah
September 1 2020	9:20-17:36	21-25	3	South	40-60%	Drizzle	Mitch Ellah
September 8 2020	12:30-16:40	15-18	2-3	East	100%	Rain	Mitch Ellah
September 16 2020	9:15-13:27	14-18	2-3	South West	0%	None	Jordan Brooks
September 29 2020	11:40-16:00	15-17	2-3	South West	25-80%	Rain	Melissa Straus
October 8 2020	9:18-13:35	9-13	2-3	WNW	5-10%	Rain	Jordan Brooks
October 13 2020	9:00-13:06	8-12	2	West	0%	Rain	Jordan Brooks
October 24 2020	11:00-19:10	6-7	3	North	90%	Heavy rain	Melissa Straus
October 30 2020	12:00-16:10	2-3	2	North East / North West	95-100%	Rain	Mitch Ellah
November 11 2020	10:30-14:39	15-16	2-3	South East	5-10%	None	Mitch Ellah

Table C3: Raptor Mortalities Documented to Date at the Adelaide Wind Power Project (2015-2020)

Year	Date	Turbine #	Species
2015	June 18	27	Turkey Vulture
			Turkey Vulture
	June 21	9	Osprey
	June 22	6	Red-tailed Hawk
		11	Red-tailed Hawk
2016	May 2	12	Red-tailed Hawk
	Sept 19	11	Red-tailed Hawk
	Sept 26	20	Turkey Vulture
		22	Turkey Vulture
2017	May 1	12	Red-tailed Hawk
		27	Osprey
	May 2	15	Turkey Vulture
	Aug 10	5	Turkey Vulture
	Sept 27	14	Turkey Vulture
	Oct 27	21	Turkey Vulture
2018	Aug 21	22	Red-tailed Hawk
2019	June 25	9	Red-tailed Hawk
2020	May 5	8	Red-tailed Hawk
	May 20	18	Turkey Vulture
	Aug 13	7	Red-tailed Hawk

Table C4: Incidental Recovered Mortalities (2020)

Date	Turbine	Species
May 12 2020	6	Unidentified bird
May 25 2020	15	Flycatcher
July 3 2020	18	Hoary Bat
October 14 2020	19	Horned Lark

Table C5: Red-tailed Hawk Nests Monitored at the Adelaide Wind Power Project (2016-2020)

Year	Nearest Turbine	Reuse Details
2020	8	Same woodlot but farther east than 2018 nest
	12	Reuse of 2019 T12 Nest
2019	12	New nest, rebuilt close to 2016/2017 nest site
	17	New nest in 2019
	27	Use not confirmed in 2019.
2018	8	New nest in 2018
	11	New nest in 2018
	12	New nest, same woodlot as 2017, moved westward. 2017 nest blew down. Determined to be likely active but use not confirmed in 2018.
2017	12	Reuse of 2016
2016	12	First year of nest studies

Table C6: Red-tailed Hawk Observations, Breeding Territorial Surveys 2020

Nest Location	Flight Path	Date	Observed Behavior
Turbine 8	RT-P5	May 6	Red-tailed Hawk perched on nest.
		May 12	Red-tailed Hawk perched on nest.
	RT9	May 26	Circled ~30 over woodlot then flew north towards turbine and circled directly above turbine for 2 minutes. Flew higher towards the west and out of sight.
Turbine 12	RT-P3	May 6	RTHA perched on nest. Active RTHA nest on May 6, May 12 and May 19. After May 19, nest no longer visible.
		May 12	Red-tailed Hawk perched on nest.
	RT1	May 12	RTHA glided over nest and woodlot from east to west but did not land in nest. Landed at west end of woodlot
	RT2	May 19	Red-tailed Hawk visited the nest.
	RT3	May 26	Red-tailed Hawk perched at RT-P2 flew towards woodlot. Returned 20 minutes later soaring low above the agricultural field, coming up and flying into trees in the woodlot using generally same flight path.
	RT-P2	May 26	Perched on tree in hedgerow.

[1] – Flight path # corresponds to flight paths on **Figures 2.1 and 2.2**, Appendix A

Table C7: Turkey Vulture Observations, Breeding Territorial Surveys 2020

Nest Location	Flight Path	Date	Observed Behavior
Turbine 8	TV22	May 6 2020	Soaring
	TV13	May 6 2020	Soaring
Turbine 12	TV16	May 12 2020	Soaring
	TV21	May 12 2020	Soaring
	TV6	May 6 2020	Soaring
		May 12 2020	Soaring

[1] – Flight path # corresponds to flight paths on **Figures 2.1 and 2.2**, Appendix A

Table C8: Red-tailed Hawk Observations, Fall Migration 2020

Date	Total Observed	Nearest Turbine	Flight Path Observed	Flight Height	Wind	Temp
Aug 25	3	8	RT-P4	5	High, north west	Warm
		8	RT-P6	20		
		8	RT8	80		
Sept 8	2	8	RT4	50	Medium, East	Warm
		8	RT-P6	30		
Sept 29	1	8	RT5	40-50	Medium, south west	Warm
Nov 9	2	8	RT6	80	Medium, south east	Warm
		8	RT7	120		

[1] – Flight path # corresponds to flight paths on **Figures 2.1 and 2.2**, Appendix A

[2] – Wind is measured using the Beaufort Scale (1 = low, 2 = medium, 3-4 = high)

[3] – Temperature is measured in degrees Celsius (cold = ≤ 0°C, cool = 1°C - 14°C, warm = ≥ 15°C)

Table C9: Turkey Vulture Observations, Fall Migration 2020

Date	Total Observed	Nearest Turbine	Flight Path Observed1	Flight Height (m)	Wind	Temp
Aug 25	16	12	TV2	70	High, north west	Warm
		12	TV3	30		
		8	TV15	50-120		
		8	TV16	30-40		
		8	TV17	70		
		8	TV18	30-100		
		8	TV19	60		
Sept 1	35	13	TV1	50	Low, south	Warm
		9	TV14	70		
		8	TV16	50		
		8	TV18	60-120		
		8	TV19	60		
		12	TV2	40		
		12	TV2	50		
		8	TV20	70		
		12	TV4	50		
		12	TV4	50		
Sept 8	36	8	TV21	60-70	Medium, East	Warm
		8	TV22	60-100		
Sept 16	17	13	TV1	40	Medium, south west	Warm
		8	TV16	150		
		8	TV17	20-60		
		8	TV18	15		
		8	TV22	20		
		12	TV4	40		
		12	TV5	40		
		12	TV6	50		
Sept 29	133	12	TV10	50	Medium, south west	Warm
		11	TV11	75		
		11	TV12	60		
		9	TV13	50		
		9	TV14	30-40		
		8	TV17	30		
		8	TV20	40		
		8	TV21	80		
		8	TV22	20-40		
		8	TV23	Oct-40		
		12	TV7	40		
		12	TV9	20-30		
Oct 8	38	13	TV1	100	Medium, north west	Cool
		9	TV14	80		
		8	TV15	50		
		8	TV16	50		
		8	TV17	40		
		8	TV18	60		
		8	TV24	120		
		12	TV6	60		
		12	TV7	30-60		
		13	TV8	50-80		
Oct 13	24	13	TV1	60	Medium, west	Cool
		9	TV14	70		
		8	TV20	60-100		
		12	TV4	40		
		12	TV7	90		
Oct 24	35	8	TV17	100	High, north	Cool

[1] – Flight path # corresponds to flight paths on **Figures 2.1 and 2.2**, Appendix A

[2] – Wind is measured using the Beaufort Scale (1 = low, 2 = medium, 3-4 = high)

[3] – Temperature is measured in degrees Celsius (cold = ≤ 0°C, cool = 1°C - 14°C, warm = ≥ 15°C)

Table C10: Other Raptor Observations, 2020

Date	Species	Number Observed	Nearest Turbine
Sept 8	Bald Eagle	2	8
	Northern Harrier	1	8
Sept 29	Northern Harrier	1	8
Oct 8	Coopers/Sharp-shinned	1	12
Oct 13	Bald Eagle	1	8
Oct 30	Northern Harrier	1	8
Nov 9	Northern Harrier	1	8

Table C11: Summary of Red-tailed Hawk observations from Holiday Beach, fall migration 2020 (Hawk Count 2020)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Sept	1	0	0	0	0	0	1	3	11	3	37	4	0	20	1	0	43	41	11	7	1	0	0	0	0	0	0	0	0	0	N/A
Oct	4	21	9	1	9	2	16	17	9	3	118	48	32	14	8	77	131	5	14	303	5	4	1	124	333	447	31	129	345	263	23
Nov	4	29	41	30	4	23	35	64	82	54	159	819	99	49	0	18	116	58	9	58	371	0	51	11	0	3	5	29	6	0	N/A

Source: Hawk Count 2020

Table C12: Summary of Turkey Vulture observations from Holiday Beach, fall migration 2020 (Hawk Count 2020)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Sept	2	0	0	0	0	0	0	0	0	5	68	0	29	56	2	1	253	606	251	255	21	34	0	33	17	4	90	29	206	142	N/A
Oct	60	925	881	0	1503	2639	2616	1849	414	561	10967	1071	1627	376	270	3843	2655	1339	169	7128	352	30	170	1464	1957	2083	154	537	893	813	10
Nov	15	39	248	48	19	41	43	35	86	12	63	226	72	9	0	16	0	10	0	9	12	0	6	0	0	0	0	3	0	0	N/A

Source: Hawk Count 2020