Stantec

Memo

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Reference: Analysis of Potential Habitat Fragmentation Impacts to Songbirds and Bats Associated with the Baron Winds Project, New York

INTRODUCTION

Forest habitat fragmentation occurs when large blocks of contiguous forest are divided or broken into smaller patches as a result of clearing or canopy removal. Similarly, grassland habitat fragmentation typically occurs when a larger, contiguous patch of grassland is divided into smaller patches by development or land-use changes. In either case, fragmentation may affect the movement, breeding, roosting, or nesting behavior of birds and bats across the landscape, which could degrade overall habitat suitability and reduce reproductive success. Fragmentation can occur at a variety of scales and patterns, and may affect species differently depending on their habitat requirements. The potential effects of habitat fragmentation depend in part on previous land use, the original extent of intact forested or grassland habitat, how much habitat will be impacted during and after construction, and the behavioral sensitivity of potentially affected species or species groups which may include both residents and migrants. The relative impacts of forest or grassland habitat removal or conversion also depend on the configuration of impacted areas, the current level of habitat degradation or disturbance, and types and levels of activity (e.g., traffic volume, noise levels, visual disturbances) expected to occur in the affected areas. Impacts to species as a result of habitat fragmentation may also vary temporally, and may have short-term or long-term effects depending on the species.

This memo assesses the potential for habitat fragmentation impacts to breeding birds and bats from construction of the proposed Baron Winds Project (Project), and has been prepared as an appendix to the Project's Article 10 certificate application.

OVERVIEW OF FRAGMENTATION EFFECTS ON BIRDS

The categorization of bird species as "forest-interior specialists", "interior-edge generalists", "edge species," or "field-edge species," as outlined by Whitcomb et al. (1981) and modified by Freemark and Collins (1992) can be useful in the conceptual understanding of potential impacts of habitat fragmentation (Villard 1998). Forest-interior habitat located deep within woodlands is sheltered from influences of forest edges and open habitats. Bird species that utilize forest interior habitat ('forest-interior species') prefer these sheltered conditions due to availability of certain types of food, less nest disruption, and fewer predators. Conversely, forest edge habitat is typically sunnier, warmer, drier, windier, and prone to more disturbance, and supports a higher density of predators than interior habitat. Bird species that utilize forest edge ('edge species') are often generalists in terms of habitat needs, are well-adapted to these conditions, and can successfully occupy such transitional habitats (LandOwner Resource Centre 2000). While such categorizations are useful in evaluating theoretical impacts of habitat fragmentation, bird species do not always conform to distinct categorizations as "edge" or "interior" specialists. Also, continued presence of a species in an area affected by habitat removal or conversion does not necessarily indicate that the reproductive success of that species has been unaffected by fragmentation.

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Native grassland ecosystems are rare in North America due to human-induced influences, primarily agriculture and development. The surrogate grasslands that exist today, particularly in the northeast, are typically associated with agriculture, and largely composed of hayfields, pastures, old fields, and idle croplands. Obligate grassland birds generally are considered to be species that are adapted to and dependent upon open, grassy habitats (ideally uncultivated) for successful nesting and food resources. Habitat requirements vary greatly among species. "Area-sensitive" obligate grassland species are habitat specialists that require certain amounts of contiguous patches or unbroken blocks of grassland to attract the birds and support nesting. For the purpose of this report, the assessment of potential effects of grassland fragmentation is focused only on the obligate grassland bird species, and not the wide range of generalist bird species that utilize edge habitats (including grasslands).

FRAGMENTATION ANALYSIS METHODS

Land cover within the Project area was primarily mapped by Stantec in GIS using the National Land Cover Database (NLCD, Homer et al. 2012). Potential forest fragmentation effects were determined by overlaying the proposed Project footprint on the NLCD polygon data and observing where development and/or clearing would occur within existing forest or grassland blocks.

To determine the amount of area that would be affected by project activities and development, the project footprint for portions of the project occurring in forested areas was assumed to be the area encompassing a 300-foot buffer surrounding the project infrastructure, including wind turbines, and work spaces, access roads, and buried or overhead collector lines. The intention of the 300-foot buffer in forested areas is to account for fragmentation effects related to clearing of trees on forest birds[1].

For portions of the project to be sited within open habitats where no tree clearing is proposed, the project footprint was assumed to be the total area of soil disturbance, which is made up of:

- 200-foot radius for each turbine and work space;
- 60-foot wide access road corridors;
- 40-foot wide linear path for buried electrical collection lines;
- 15-foot wide linear path for overhead electrical collection lines;
- The spatial extents of construction laydown yards; and
- The spatial extents of the operations & maintenance building.

Because the scale of NLCD data was not suitable for determining the extents or types of potential grassland habitats, Stantec used aerial photography to identify and digitize grasslands in the Project area, and a subset of these grassland areas were field verified by biologists from Environmental Design & Research. Stantec then determined potential grassland fragmentation effects by

[1] The 300-foot buffer was recommended by the New York Department of Environmental Conservation (NYSDEC) during a January 2016 phone meeting with Project developers in regard to another wind energy project.

overlaying the proposed Project footprint on the digitized grassland polygons and observing where turbine pads, access roads, and other development would occur within these areas.

Importantly, the majority of grassland habitats identified in the Project area for this fragmentation analysis are agricultural lands under various types or stages of management. The land cover types assumed to provide potential habitat for grassland-obligate bird species, e.g., bobolinks (*Dolichonyx oryzivorus*), eastern meadowlark (*Sturnella magna*), and grasshopper sparrow (*Ammodramus savannarum*), included primarily hayfields, pastures, and successional old fields. Hayfields are croplands that are actively harvested one or more times each season, and some may be tilled and replanted each year. Pastures are fenced-in open habitats where horses or cattle can roam and graze. Successional old fields are former hayfields, cropland, or pastures that presumably have not been actively managed (other than occasional mowing, for example) for a number of years and have naturally reverted to an open habitat dominated by a combination of graminoid and forb species, sometimes with a minor component of shrub species.

A review of historical aerial imagery on Google Earth® showed that the grasslands we identified are typically not actively managed as grasslands (e.g., for the benefit of obligate grassland wildlife). Land use on many of the grasslands we identified appeared to change regularly due to changes in the agricultural practices on actively managed fields, or due to longer term successional changes on abandoned fields (i.e., increasing shrub growth). Previously abandoned fields may sometimes become active croplands, pastures, or hayfields again, and previously active lands may be temporarily or permanently abandoned. Stantec believes this dynamic aspect of land use change in the Project area should be an important factor when considering grassland fragmentation effects. In many cases, the status or value of any particular grassland is more likely to be influenced by the agricultural practice than the potential effects of a wind generation project. The temporal scope of this grassland fragmentation analysis reflects the habitats observed on the 2015 aerial imagery (the most recent data available) supplemented with spot field-verifications from summer 2017, and we recognize that the extent and suitability of available grassland habitat and the abundance of grassland-obligate is likely to change year to year.

EXPECTED PROJECT EFFECTS ON EXISTING HABITATS

The Project area consists of 17,527 acres, of which 8,880 acres (50%) are forested (Figures 1–3). Existing land uses in and around the Project area include agriculture and low-density residential and road development. Existing forested habitat within the Project area is relatively fragmented in the southern portion of the Project, and less fragmented in the northeast. Seven out of the proposed 76 turbines, including T17 and T15 in the north, T64 and T75 in the central portion, and T70, T71, and T82 in the south, are located in the interior portions of relatively unfragmented forest blocks that are approximately 800 acres or larger (Figures 1–3). Based on a coarse and conservative estimate that considers the 300-ft buffer around all infrastructure in forested areas, clearing for all components associated with the Project (service roads, collector lines, turbine pads, and laydown areas) may affect approximately 827 forested acres, or 9% of the existing forested habitat in the Project area.

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Based on the relatively coarse NLCD data[2], vegetated, non-forest habitat comprises 43% the Project area (7,586 acres). This includes 3,434 acres of agricultural cropland, 4,114 acres of pasture/hayfield, 13 acres of grassland/herbaceous, and 25 acres of emergent wetland or wet meadow. Stantec's more refined mapping assessment based on aerial photo interpretation indicates that grassland habitats in the Project area (Figures 1–3) comprise approximately 820 acres, and appear to be made up of active hayfields (260 acres), pastures (38 acres), successional old fields (510 acres), and emergent marsh or wetland meadow (12 acres). Grasslands that are not actively managed or used by livestock on an annual basis would present the most valuable habitat for breeding grassland bird species (assuming sufficient size), primarily because breeding pairs and nests would not be disturbed by mowing or livestock. These more functional grassland areas would most likely be associated with the successional old fields, assuming they were dominated by grasses/graminoids as opposed to forbs or shrubs. Some hayfields and pastures may also provide suitable habitat for grassland birds, though the risk of disturbance (e.g., mowing or trampling by livestock) during nesting would diminish the value of these habitat types.

Regardless of the landcover type, it is inherently difficult to assess existing and expected grassland fragmentation in agriculturally-managed areas because management methods and levels of activity often change from year to year. Approximately 319 acres of the Project footprint (including the soil disturbance extents associated with each type of infrastructure) will be located within open, non-developed habitats mapped by the NLCD, representing approximately 4.2% of these non-forested vegetated habitats in the Project area. Based on Stantec's interpretation of the 2015 aerial imagery, it is estimated that only 18.6 acres of likely grassland habitat types will be within the Project footprint (Figures 1–3), representing approximately 0.2% of the vegetated, non-forest habitat in the Project area.

Of the 87 separate grassland polygons Stantec identified within the Project area, only 13 will be affected by proposed Project infrastructure. Of the 76 proposed turbines, 7 are located along the edges[3] of existing grassland habitat and none are located in the interior of the habitat polygons. Seven of the polygons are crossed by collector lines, three of which are co-located with access roads. Collector lines will be both overhead and underground. Table 1 summarizes the types of Project infrastructure to be located within mapped grassland habitats.

[2] Landcover types for this assessment are based on publicly-available 2011 National Land Cover Data (NLCD), which were identified using satellite remote sensing methods. Land cover mapped in this way is relatively coarse and represents what was present at the time of data collection. Because habitats can change from year to year based on land use changes, 2011 NLCD mapping may not accurately reflect current landcover.
[3] Proposed turbines T9, T13, T18, T46, T47, T62, and T88 will be located on the edge of current grassland habitats identified on aerial photography.

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Table 1. Estimated areas of proposed Project infrastructure in grassland habitat, based on Stantec's interpretation of 2015 aerial imagery.

Grassland Type	Grassland Area Affected by Project Infrastructure (Acres)					
	Access Road Only	Collector Co-located with Access Road	Overhead Collector	Underground Collector Only	Turbine and Workspace	Totals
Emergent Marsh	0.00	0.00	0.03	0.00	0.00	0.03
Hayfield	0.53	0.87	0.19	2.31	5.12	9.04
Pasture	1.03	0.00	0.06	0.00	0.00	9.06
Successional Old Field	1.16	1.84	0.32	1.88	3.27	8.47
Totals:	2.72	2.71	0.60	4.20	8.39	18.63

Bird Survey Results

Pre-construction bird surveys were conducted in the Project area in accordance with a work plan developed in consultation with the NYSDEC and the U.S. Fish and Wildlife Service (Service). Pre-construction breeding bird survey results and point counts conducted during fall migration provide baseline data and an opportunity to assess species use of habitats and the potential habitat fragmentation impacts to resident and migrant bird species from development and operation of the Project. Stantec documented forest-interior, edge, and grassland species during spring breeding and fall migration surveys at the Project. From the standpoint of potential fragmentation effects, this assessment is focused on forest-interior and obligate grassland bird species.

Forest-Interior Bird Species

During spring breeding bird surveys, forest-interior species were observed in forested habitats, but most individuals of these species were observed in non-forested habitat (agricultural, forest edge, and overgrown field; n=89, 64%; Table 2). Similarly, non-interior species were also observed in forested habitats, indicating variation in utilization among different habitats in the Project area during spring breeding season. Breeding bird surveys were not designed to quantify reproductive success rates, so that information is unavailable.

Observations of forest-interior species during fall (Table 3) were infrequent, partly due to the few forest points (n=4) relative to non-forest points (n=16), and since songbirds are more difficult to identify during fall due to drab plumage and minimal singing. Observations during fall migration surveys included one red-eyed vireo (*Vireo olivaceus*) in hardwood forest habitat, one veery (*Catharus fuscescens*) and one northern cardinal (*Cardinalis cardinalis*) in forest edge habitats, and one winter wren (*Troglodytes hiemalis*) in a crop field (Stantec 2016).

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Table 2. Locations of forest-interior species observed during breeding bird surveys at the Baron Winds Project, Spring 2015.

Forest-Interior Bird Species	Scientific Name	Non-forest total (52 points)	Forest total (9 points)	All points total (61 points)	% Observed in Forested Habitat
Acadian flycatcher	*Empidonax virescens*	3	0	3	0%
black-and-white warbler	*Mniotilta varia*	1	0	1	0%
black-throated green warbler	*Setophaga virens*	10	7	17	41%
blue-headed vireo	*Vireo solitarius*	0	2	2	100%
chestnut-sided warbler	*Setophaga pensylvanica*	1	5	6	83%
dark-eyed junco	*Junco hyemalis*	0	7	7	100%
eastern towhee	*Pipilo erythrophthalmus*	7	1	8	13%
eastern wood-pewee	*Contopus virens*	2	3	5	60%
hermit thrush	*Catharus guttatus*	3	1	4	25%
indigo bunting	*Passerina cyanea*	6	0	6	0%
northern cardinal	*Cardinalis cardinalis*	0	1	1	100%
ovenbird	*Seiurus aurocapilla*	45	17	62	27%
red-eyed vireo	*Vireo olivaceus*	8	2	10	20%
scarlet tanager	*Piranga olivacea*	3	1	4	25%
veery	*Catharus fuscescens*	0	2	2	100%
wood thrush	*Hylocichla mustelina*	0	1	1	100%
Totals		**89**	**50**	**139**	**36%**

Despite being partially fragmented, the Project area appears to support a diversity of songbirds that is typical of similar habitats in the region, including a variety of fragmentation-sensitive interior species. Forest-interior species such as Acadian flycatcher (*Empidonax virescens*), indigo bunting (*Passerina cyanea*), ovenbird (*Seiurus aurocapilla*), red-eyed vireo (*Vireo olivaceus*), scarlet tanager (*Piranga olivacea*), and wood thrush (*Hylocichla mustelina*) (all observed during breeding bird surveys) are known to be sensitive to fragmentation (Donovan and Flather 2002) and therefore could experience reproductive dysfunction associated with additional forest fragmentation. Ground or open-nesting species would typically be most sensitive to fragmentation, and may experience reduced success due to increased nest predation and nest parasitism (Lampila et al. 2005). Species in this category include black-and-white warbler (*Mniotilta varia*), ovenbird, and veery (Cornell University 2015). Ovenbirds were frequently observed in the Project area, with individuals utilizing interior forest, forest-edge, and agricultural habitats. Somewhat surprisingly, agricultural habitat had the greatest number of bird observations, the greatest species richness, and the greatest Shannon Diversity Index during breeding bird surveys (Stantec 2016). The forest interior species observed in the Project area are regionally common and none is federally or state-listed (NYSDEC 2017a). Two species, scarlet tanager and wood thrush, are New York Species of Greatest Conservation Need (SGCN) considered to be experiencing some level of population decline (NYSDEC 2017b).

Table 3. Locations of forest-interior species observed during fall migration bird surveys at the Baron Winds Project, September 2013.

Forest-Interior Bird Species	Scientific Name	Crop Land (5 points)	Old Field (2 points)	Forest Edge (5 points)	Interior Forest (4 points)	All points total (16 points)	% Observed in Interior Forest
dark-eyed junco	*Junco hyemalis*	0	0	2	1	3	33%
eastern towhee	*Pipilo erythrophthalmus*	1	0	0	1	2	50%
northern cardinal	*Cardinalis cardinalis*	0	0	1	0	1	0%
red-eyed vireo	*Vireo olivaceus*	0	0	0	1	1	100%
veery	*Catharus fuscescens*	0	0	1	0	1	0%
winter wren	*Troglodytes hiemalis*	1	0	0	0	1	0%
yellow-rumped warbler	*Setophaga coronata*	0	0	1	1	2	50%
	Totals	2	0	5	4	11	36%

Construction and use of service roads generally represent less of a threat to bird communities than highways and other major roads, due to smaller clearing sizes and widths, lower levels of traffic, and lower vehicle speeds (Jacobson 2005). The primary habitat-related impacts to forest-interior songbirds that could be anticipated as a result of construction and operation of the Project may be increased predator activity and brood parasitism along edges of new clearings, which could either reduce reproductive success or remove viable habitat for certain vulnerable species (e.g., ground nesting songbirds) (Herkert et al 2003). Certain species that are least tolerant of edges, or more susceptible to nest predation, may suffer reduced reproductive success over the long-term, based on the potential for cumulative landscape conversion in the Project area and surrounding region.

Empirical studies of the effects of constructing wind projects on breeding bird populations with similar forested landscapes elsewhere in New York have not documented substantial shifts in species presence or distribution before and after construction. For example, a breeding bird study was conducted after construction of the Howard Wind Project in Steuben County, New York, to assess the potential bird avoidance of, and/or habituation to, turbines in a fragmented landscape. Surveys did not document systematic shifts in species composition or abundance based on proximity to turbines, nor did they document behavioral avoidance of turbines. Only the passerine subtype creepers and nuthatches exhibited statistically significant patterns of avoidance across the 2-year study (West 2014).

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Grassland Bird Species

During spring breeding bird surveys, grassland obligate bird species were observed in both non-forest and forested habitats, though most (95%, n = 323) were observed in non-forested habitat (agricultural, forest edge, and successional old field; Table 4). These data suggest that grassland obligate birds appear to have greater affinity to their preferred habitat during spring than do the forest-interior species (see Table 2). By contrast, the fall migration survey showed that only 40% of grassland birds were observed in their preferred habitat (Table 5), though the sample size (n = 15) was relatively small for that survey period.

Table 4. Locations of grassland species observed during breeding bird surveys at the Baron Winds Project, Spring 2015.

Area-Sensitive Grassland Bird Species	Scientific Name	Crop Land (50 points)	Old Field (6 points)	Forest Edge (25 points)	Forest (11 points)	All points total (92 points)	% Observed in Open Habitat
bobolink	*Dolichonyx oryzivorus*	86	30	2	0	118	98%
eastern bluebird	*Sialia sialis*	0	1	0	0	1	100%
eastern meadowlark	*Sturnella magna*	4	0	0	0	4	100%
grasshopper sparrow	*Ammodramus savannarum*	1	0	0	0	1	100%
red-winged blackbird	*Agelaius phoeniceus*	70	49	6	5	130	92%
Savannah sparrow	*Passerculus sandwichensis*	72	10	4	0	86	95%
	Totals	**233**	**90**	**12**	**5**	**340**	**95%**

Table 5. Locations of grassland species observed during fall migration bird surveys at the Baron Winds Project, September 2013.

Area-Sensitive Grassland Species	Scientific Name	Crop Land (5 points)	Old Field (2 points)	Forest Edge (5 points)	Interior Forest (4 points)	All points total (16 points)	% Observed in Open Habitat
northern harrier[1]	*Circus cyaneus*	4	0	1	1	6	67%
red-winged blackbird	*Agelaius phoeniceus*	1	0	0	0	1	100%
Savannah sparrow	*Passerculus sandwichensis*	0	1	6	1	8	13%
	Totals	**5**	**1**	**7**	**2**	**15**	**40%**

1. A grassland-dependent raptor species.

Reference: **Analysis of Potential Habitat Fragmentation Impacts to Songbirds and Bats Associated with the Baron Winds Project, New York**

Sources of grassland habitat fragmentation from a wind energy project would primarily include construction of permanent access roads, turbine pads, and other infrastructure within the interior portions of grassland patches. Displacement of some grassland species as a result of construction and operation of wind energy projects has been documented (Pearce-Higgins et al. 2009, 2012). New roads into grasslands may create new edges that encourage increased nest predation or brood parasitism (e.g., by brown-headed cowbird [*Molothrus ater*]). Unlike the clearing impacts in interior forests, the installation of electrical collector lines in grasslands would not be expected to cause habitat fragmentation due to the small amount of permanent ground disturbance as it relates to use by grassland birds for feeding and nesting (assuming the grassland habitat is allowed to persist in electrical transmission rights of way). While overhead lines may potentially provide perching habitat for raptors, buried lines would eliminate this risk of depredation or disturbance to songbirds. Conversion of grassland, fallow land/old field, or hayfield to cropland would be considered a fragmentation effect, and indeed is one of the primary sources of grassland fragmentation in North America (Herkert 1994, Herkert et al. 2003, Johnson 2001).

An example of an operating wind energy facility with extensive, high quality grassland habitat with a high abundance and diversity of grassland breeding birds (Ontario Partners in Flight, 2006 as cited in Stantec 2011) is the 86-turbine Wolfe Island Wind Facility in the Province of Ontario, on the northeast corner of Lake Ontario. In 3 years, 2009, 2010, and 2011, biologists conducted disturbance effects monitoring for multiple bird groups including grassland birds at Wolfe Island. Monitoring involved area searches, pre/post construction point counts, and paired point counts, which allowed for mapping bird occurrences in 100-m bands from the base of turbines. Results did not suggest avoidance of the most common grassland breeding birds around the wind turbines (Stantec 2011). Bobolink, savannah sparrow, and song sparrow showed little or no change in recorded breeding densities between pre-construction and post-construction point count surveys. Horned lark, eastern meadowlark, and red-winged blackbird were recorded at lower densities in post-construction years than during pre-construction surveys. However these abundance changes were not reflected in the area search results, which surveyed the same tracts of habitat pre- and post-construction.

Summary of Expected Habitat Fragmentation on Birds

Forest-Interior Bird Species

Given that conservatively, only 9% of forested habitat at the Project is expected to be affected, that access roads will have low levels of vehicle use, and that the Project area already consists of a patchwork of forested and non-forested habitats, it is unlikely that this Project poses a significant risk of habitat fragmentation impacts to forest-interior bird communities. The forest-interior species observed in the Project area will likely continue to persist after the forest clearing associated with the Project. Habitat-related impacts associated with wind projects are expected to be less than those associated with activities requiring greater percentages of deforestation, larger-scale construction activities, and greater human presence, such as large-scale agriculture, logging, transportation, and urban/residential development. Species sensitive to fragmentation are currently present in partially fragmented areas of the Project, and utilize forested and non-forested habitats. Given the persistence of these species, and the fact that Project-related activities will result in minimal amounts of additional habitat fragmentation, it is likely that these species will continue to persist after small amounts of additional fragmentation.

Grassland Bird Species

Similarly, project infrastructure will largely avoid the potential grassland habitats identified on aerial imagery. The 7 turbines to be located in or near grasslands are located at the edges of the habitat polygons, and are thus not likely to cause fragmentation effects to grassland birds using those habitats. Narrow access roads and buried or overhead collector lines crossing grasslands are not expected to result in significant or measurable habitat fragmentation effects. Buried lines would have minimal, short-term, temporary impacts to habitat and are not likely to result in fragmentation effects. Overhead lines would likely have little to no fragmentation effects to habitat for common grassland obligates species with the possible exception of some area-sensitive species. The presence of overhead lines could increase the potential for depredation or disturbance by raptors. Maximizing the use of buried lines and minimizing the use of overhead collector lines will likely reduce potential impacts to grassland birds and their habitat. Proximate suitable habitat exists for birds that may be displaced during Project construction.

POTENTIAL EFFECTS OF FOREST FRAGMENTATION ON BATS

Potential effects of forest habitat fragmentation on bats are not well understood. Potential mechanisms of impact may vary among species but could include increased parasitism and/or predation, narrowed niche breadth, or shifts in home ranges (Segers and Broders 2014). Forest structure plays an important role in determining the suitability of foraging habitat, with different bat species selecting foraging habitat according to their prey preferences and flight morphology. Large bats such as migratory hoary bats (*Lasiurus cinereus*), eastern red bats (*Lasiurus borealis*), and silver-haired bats (*Lasionycteris noctivagans*) tend to be less maneuverable and prey on larger insects (Aldridge and Rautenbach 1987; Fenton 1990). As a result, these species tend to forage in open habitats or above the forest canopy. Small, highly maneuverable bats such as northern long-eared bats (*Myotis septentrionalis*) and eastern small-footed bats (*Myotis leibii*) typically forage closer to the ground, often beneath the forest canopy. Many bat species forage along forest edges, riparian corridors, and other gaps in the forest. Accordingly, a matrix of forest types and structural elements including gaps, edges, and corridors likely increases the overall diversity of bats in an area, provided there is a sufficient amount of roost opportunities and access to water (Krusic et al. 1996).

The clearing of linear corridors (e.g., access roads) and patches (e.g., turbine clearings) in an otherwise forested landscape will increase the amount of edge habitat present and reduce the amount of forest interior habitat. Accordingly, bat species that forage along forest edges and within open areas are likely to benefit from these activities whereas available habitat will be reduced for species preferring to forage within forest interior. Indeed, bat species appear to respond differently to forest thinning or clearing, probably due to a combination of prey availability, foraging behavior, or influence of forest structure on factors such as wind speed (Patriquin and Barclay 2003; Segers and Broders 2014). Forest interior specialists, such as northern long-eared bats, have shown a positive association with forest patch size, although effects differed among males and females (Henderson et al. 2008). However, forest fragmentation typically does not negatively impact bat diversity or abundance in a forested landscape unless remnant forest patches are very small or widely isolated (e.g., Lesinski et al. 2007; Medelin et al. 2010). Further, impacts to wetland resources, which provide preferred foraging habitat for many bat species in the region, will be avoided.

As described above, a small percent of forested habitats within the Project area will be potentially affected, and remaining forest habitat should provide ample roosting opportunity for bats. Roost trees may be maternity roosts or day/temporary roosts with one or few individuals. Loss of maternity roost trees as a result of forest clearing, if occupied at the time of clearing, could impact a local bat population. Tree clearing during winter would eliminate the risk of impacting occupied roosts. Loss of day roost trees could also occur as a result of forest clearing, though most bat species that reproduce in New York are not thought to be limited by day roost availability. Specifically, roost habitat is not considered a limiting factor for the federally threatened northern long-eared bat, which could occur in the Project area (USFWS 2016).

Summary of Expected Habitat Fragmentation Effects on Bats

Construction of the Project is not expected to negatively impact the suitability of foraging or roosting habitat for bats. The distribution of species across the Project area may shift somewhat as a result of creating additional edge habitat and cleared corridors, although sufficient intact forest patches will remain for species that forage within the forest interior habitats as well as those that prefer open habitats and edges.

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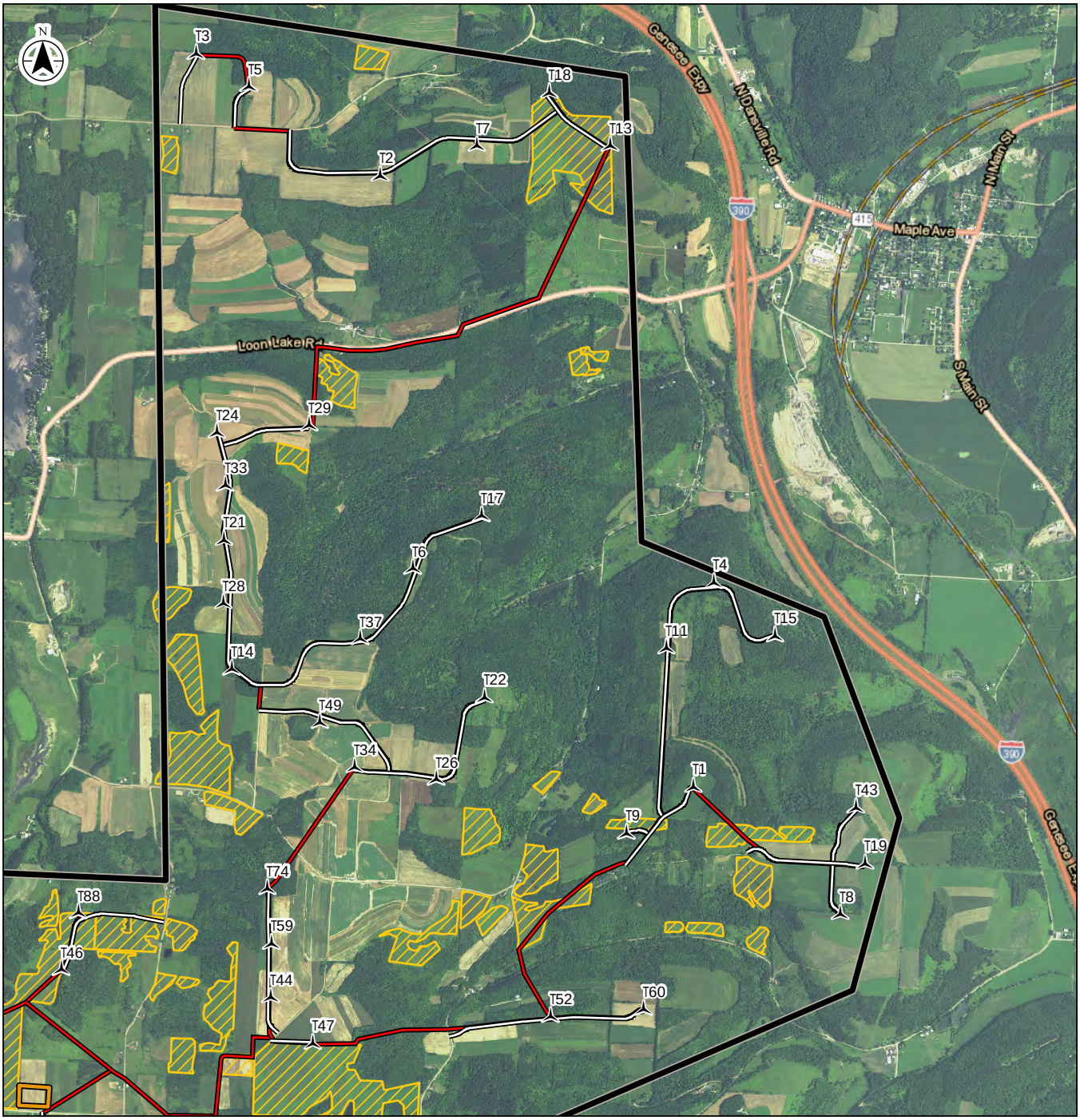
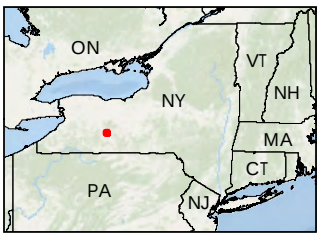
Attachment: Figures 1 – 3. Forest and Grassland Habitat Fragmentation Assessment.

V:\1956\active\195600885_a\drawing\mxd\Land_Cover\00885_01_Grassland.mxd Revised: 2017-10-11 By: gcarpentier





Legend

- Potential Grassland Habitat
- Turbine Layout (9/19/2017)
- Access Roads (9/19/2017)
- Collector (9/19/2017)
- Laydown Yard (9/19/2017)
- Project Area (4/20/2017)

0 3,000 Feet

1" = 3,000' (At page size of 8.5"x11")

Notes

1. Potential grassland habitat polygons were identified and digitized by Stantec from 2015 NAIP aerial photography.
2. Base map: NAIP 2015

Stantec

Project Location
Steuben County, New York

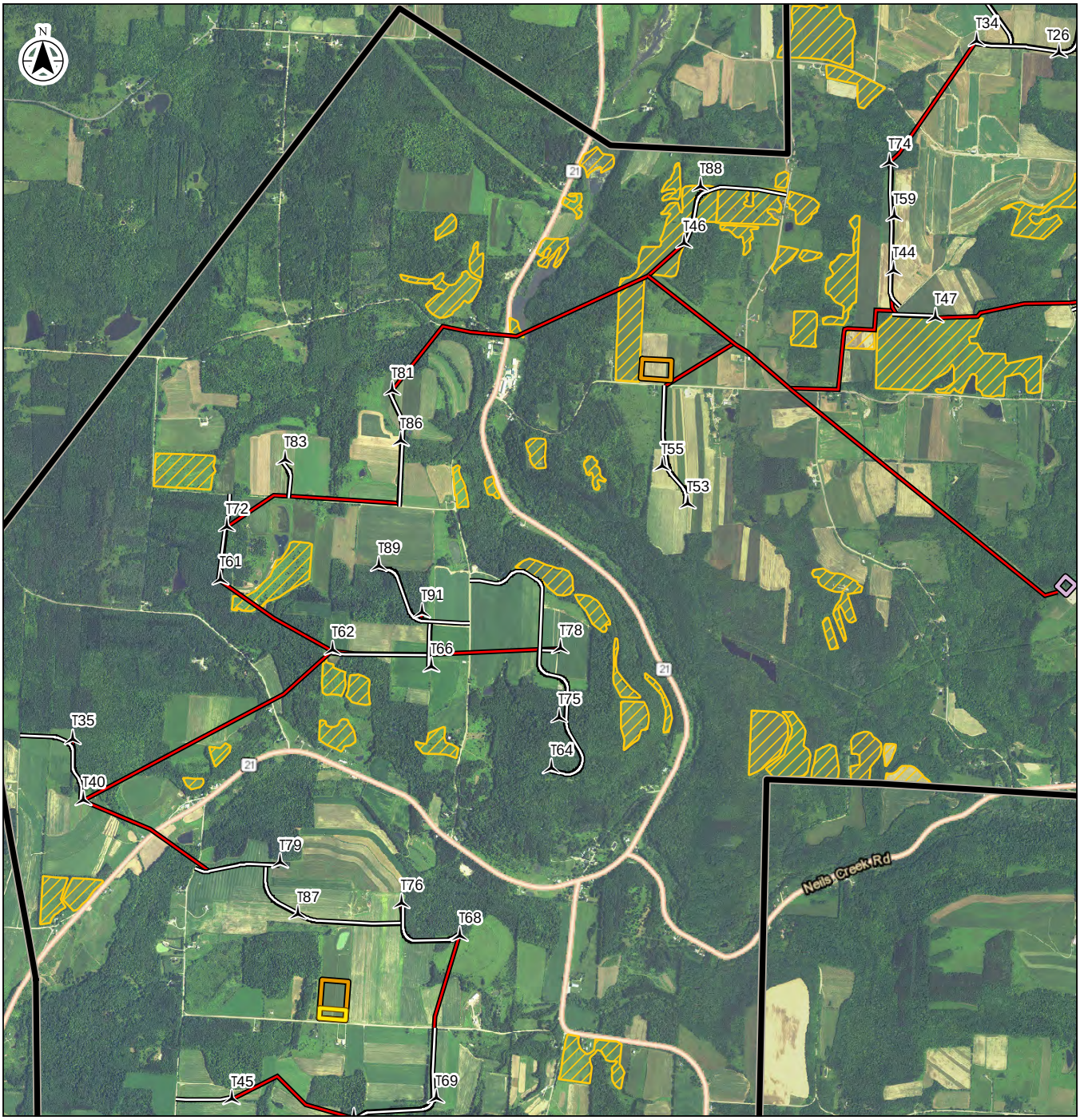
195600885
Prepared by GAC on 2017-10-03
Reviewed by FJD on 2017-10-04

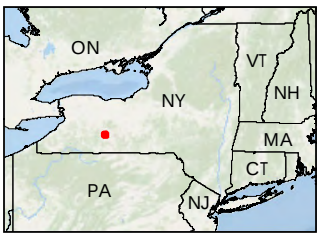
Client/Project
EverPower Wind Holdings, Inc.
Baron Winds Project

Figure No.
1

Title
Forest and Grassland Habitat Fragmentation Assessment

V:\1956\active\195600885_a\drawing\mxd\Land_Cover\00885_01_Grassland.mxd Revised: 2017-10-11 By: gcarpentier





Legend

- Potential Grassland Habitat
- Turbine Layout (9/19/2017)
- Access Roads (9/19/2017)
- Collector (9/19/2017)
- Laydown Yard (9/19/2017)
- Collector Substation (9/19/2017)
- O&M Building
- Project Area (4/20/2017)

0 3,000 Feet

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195600885
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Client/Project
EverPower Wind Holdings, Inc.
Baron Winds Project

Figure No.
2

Title
Forest and Grassland Habitat Fragmentation Assessment

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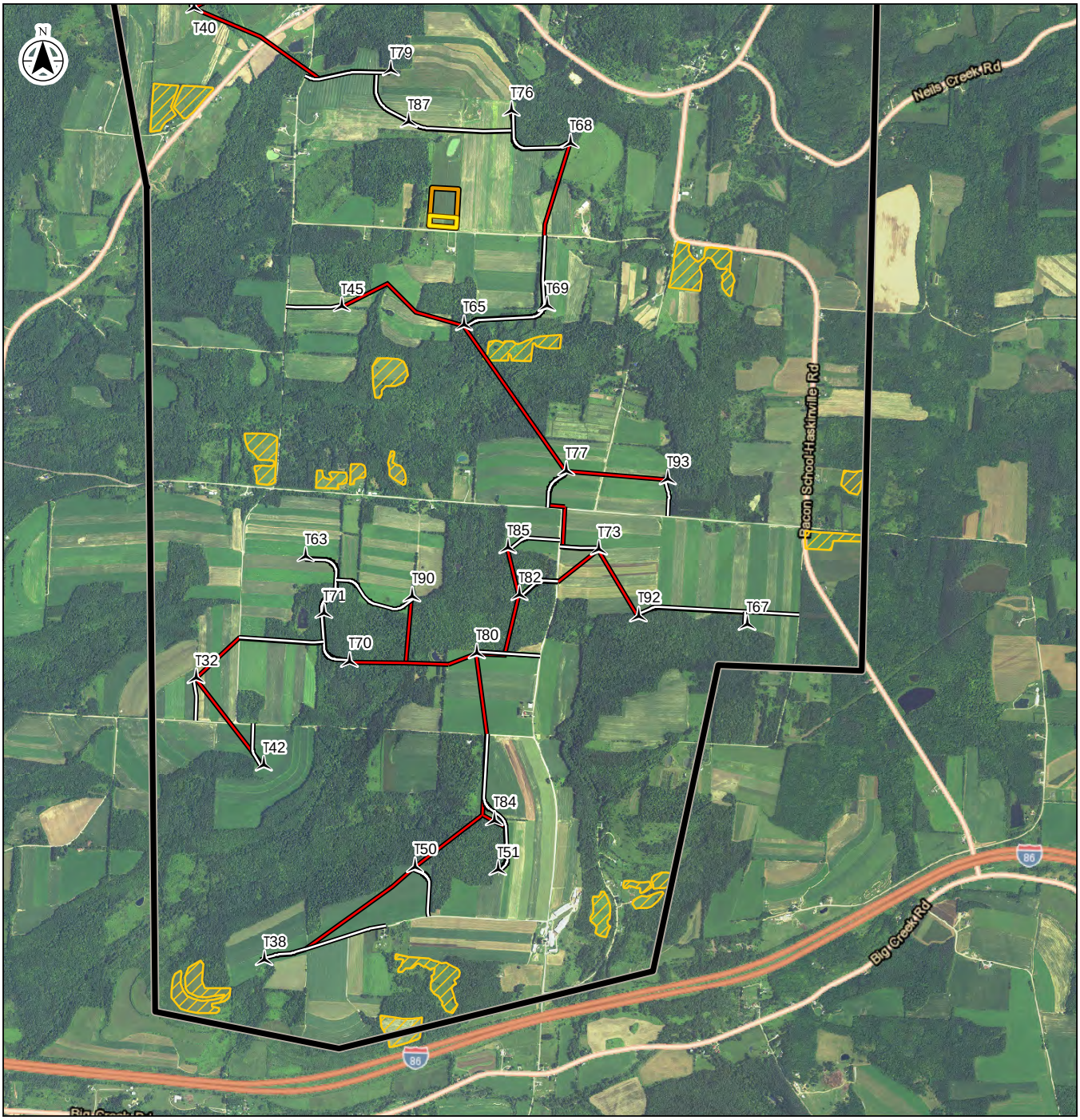

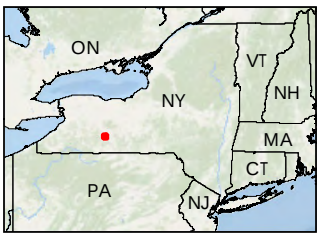

Legend

- Potential Grassland Habitat
- Turbine Layout (9/19/2017)
- Access Roads (9/19/2017)
- Collector (9/19/2017)
- Laydown Yard (9/19/2017)
- O&M Building
- Project Area (4/20/2017)

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Client/Project
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Baron Winds Project

Figure No.
3

Title
Forest and Grassland Habitat Fragmentation Assessment