Appendix G BAT MONITORING DATA – LATE SPRING/EARLY SUMMER 2017

KENT HILLS 3: KENT HILLS WIND FARM EXPANSION PHASE 3

Appendix G Bat monitoring Data – Late Spring/early Summer 2017

INTRODUCTION

The Kent Hills 3 Wind Project requires registration under the New Brunswick *Environmental Impact Assessment (EIA) Regulation* under the *Clean Environment Act*. Following consultation with the New Brunswick Department of Environment and Local Government (NBDELG), Environmental Assessment Section, TransAlta was requested to complete bat monitoring surveys in the summer breeding season (June) and in the fall migration season (mid-August to mid-September) in support of their EIA Registration. The following provides information on the methods and results of bat monitoring during the month of June, 2017. The Pre-Construction Bat Survey Plan for the project s included at the end of this appendix.

METHODS

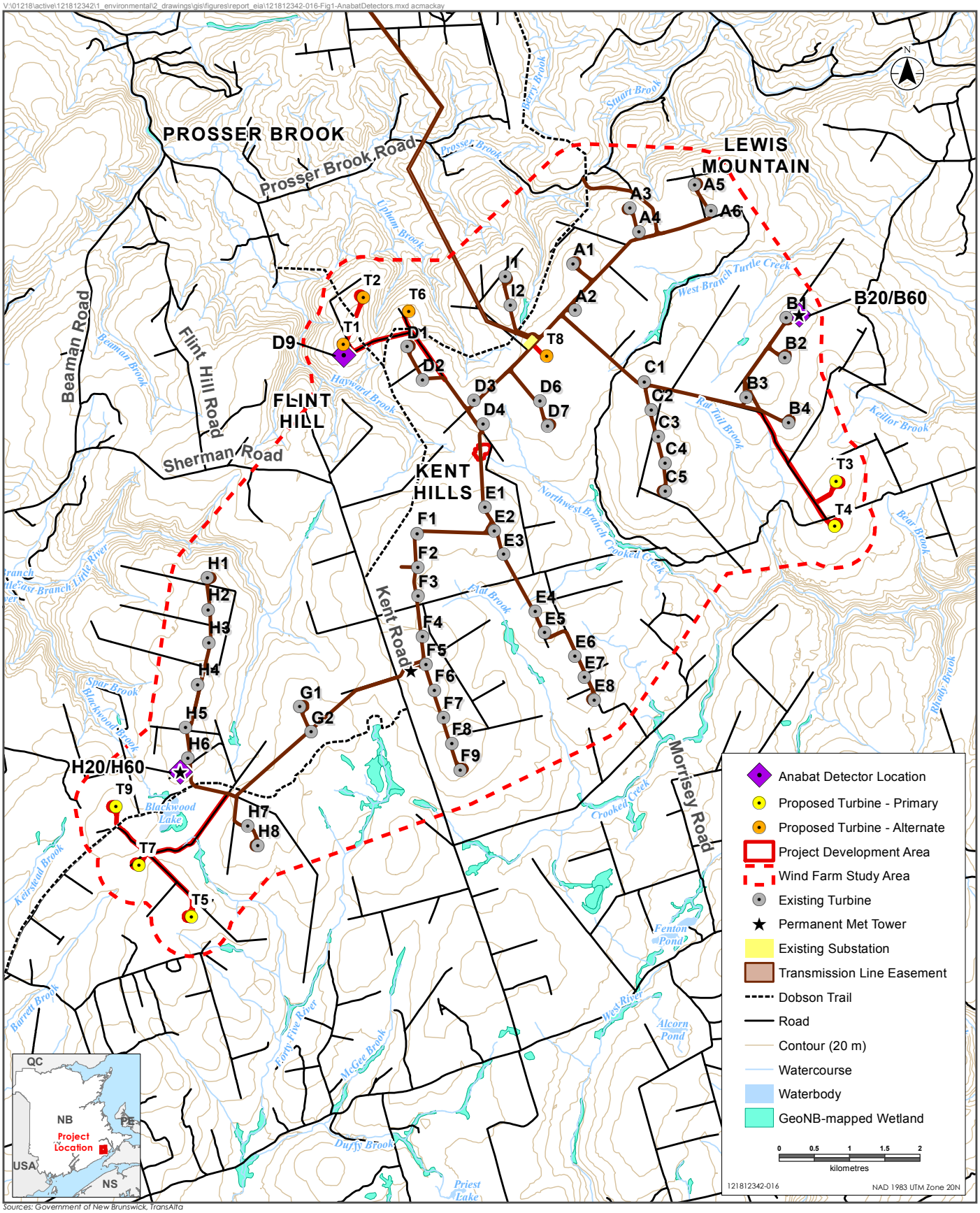
DATA COLLECTION

Stantec biologists deployed 5 Anabat (Titley Scientific ©) bat detectors at the Project on 30 May 2017. For this survey, data recorded by detectors from 30 May to 30 June were collected and analyzed. Anabat detectors are frequency division detectors, which divide the frequency of echolocation sounds made by bats by a factor of 16, and then record these sounds onto removable compact flash cards for subsequent analysis. Detectors were programmed to begin monitoring at 21:00 hours each night and set to monitor for 5 to 6.75 hours. Sunset at the Project occurred after 21:00 each night of survey, thus each survey night encompassed the survey period from one half hour after sunset to 4 hours after one half hour after sunset. The audio sensitivity setting of each Anabat was set between approximately 6 and 7.5 (on a scale of 1–10) to maximize sensitivity while limiting ambient background noise and interference.

Two detectors were deployed in 2 available on-site meteorological (met) towers. One met tower was located in the western portion of the Project area adjacent to the "H" turbine string and one met tower was located in the eastern portion of the Project area adjacent to the "B" turbine string (Figure 1). On each met tower, one detector was deployed at 60 m above ground level (agl; detectors "B60" and "H60") and one at 20 m agl (detectors "B20" and "H20") (Figure G.2). The fifth detector was deployed in a tree approximately 9 m agl, near the "D" turbine string (detector "D9"), located centrally within the Project area (Figure G.3).

KENT HILLS 3: KENT HILLS WIND FARM EXPANSION PHASE 3

Appendix G Bat monitoring Data – Late Spring/early Summer 2017



Location of Anabat Detectors at Kent Hills Wind Farm

KENT HILLS 3: KENT HILLS WIND FARM EXPANSION PHASE 3

Appendix G Bat monitoring Data – Late Spring/early Summer 2017

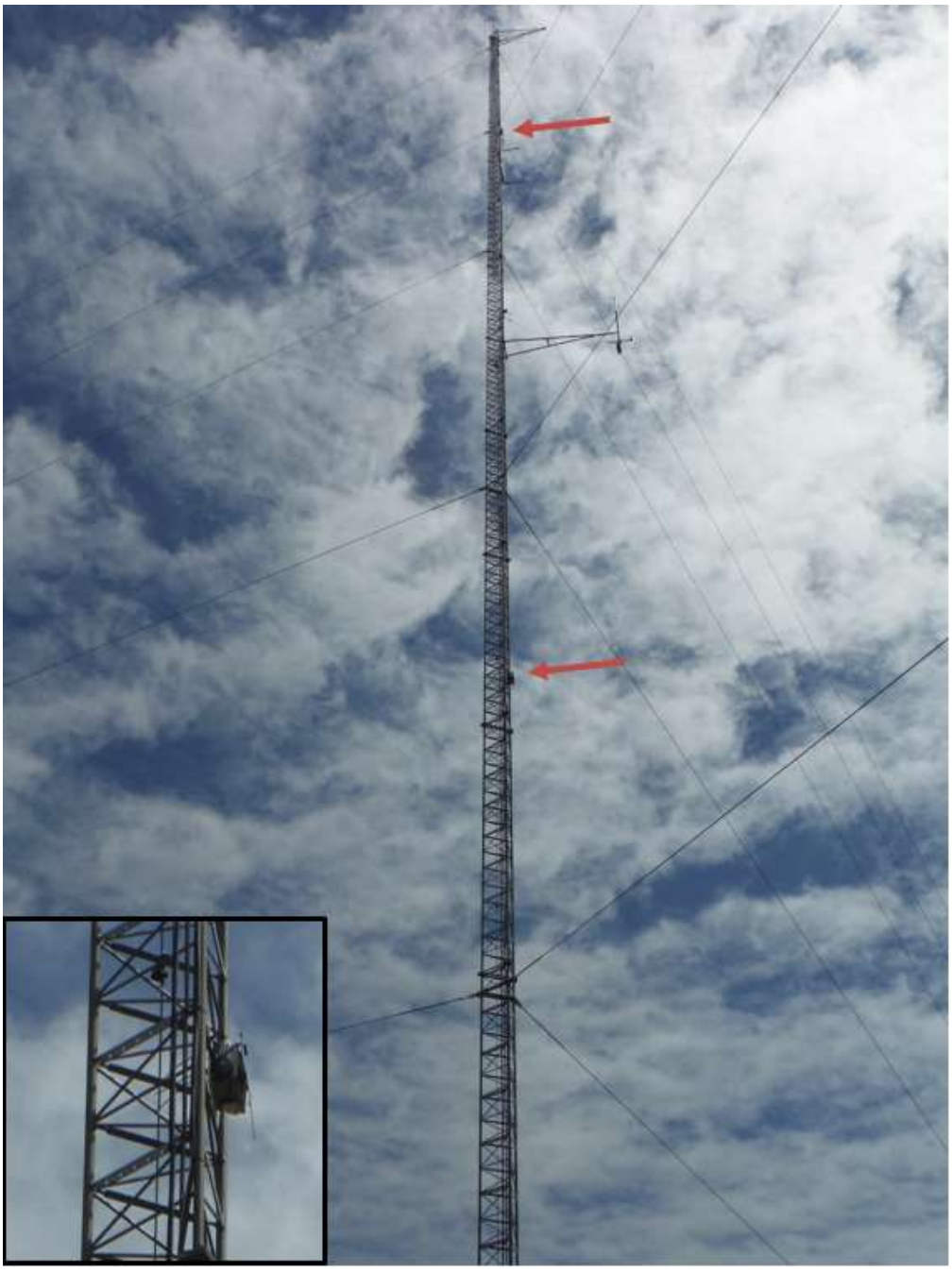


Figure G.2. Representative photo of Anabat detectors deployed in met tower at Kent Hills Wind Farm, spring 2017. Arrows indicate where Anabat detectors are attached to the met tower. Inset is a closeup of Anabat detector within waterproof housing.

Figure G.3. Anabat detector deployed in tree near proposed turbine T1, north of "D" turbine string at Kent Hills Wind Farm, spring 2017.

Each Anabat detector was powered by 12-volt batteries charged by solar panels. Each solar-powered Anabat system was deployed in a waterproof housing enabling the detector to record while unattended for the duration of the survey. The housing suspended the Anabat microphone downward to give maximum protection from precipitation. To compensate for the

downward position, a curved plastic joint was used to funnel sound into the downward-facing microphone, allowing the microphone to record the airspace horizontally surrounding the detector.

DATA ANALYSIS

Ultrasound recordings of bat echolocation may be broken into recordings of a single bat call or recordings of bat call sequences. A call is a single pulse of sound produced by a bat, while a call sequence is a combination of two or more pulses recorded in an Anabat file. Recordings containing less than two calls were eliminated from analysis as has been done in similar studies (Arnett et al. 2006). Call sequences typically include a series of calls characteristic of normal flight or prey location ("search phase") and capture periods (feeding "buzzes").

Potential call files were extracted from data files using CFCread® software. The default settings for CFCread® were used during this file extraction process. This software screens all data recorded by the detector and extracts bat call files using a filter. Settings used by the filter include a maximum time between calls of 5 seconds, a minimum line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to whether or not adjacent pixels can be connected with a smooth line. The higher the smoothing factor, the less restrictive the filter and the more noise files and poor quality call sequences that are retained within the dataset.

Following the extraction of call files, each file was visually inspected for species identification and to determine that only bat calls were included in the data set. Call sequences are easily differentiated from other recordings, which typically form a diffuse band of dots at either a constant frequency or widely varying frequency.

Bat calls were individually marked and categorized by species group, or "guild," based on visual comparison to reference calls. Eight species of bats occur in New Brunswick, based upon their normal geographical range (BCI 2017), including:

- little brown myotis (Myotis lucifugus)
- northern myotis (M. septentrionalis)
- eastern small-footed bat (M. leibii)
- silver-haired bat (Lasionycteris noctivagans)
- tri-colored bat (Perimyotis subflavus)
- big brown bat (Eptesicus fuscus)
- eastern red bat (Lasiurus borealis)
- hoary bat (Lasiurus cinereus)

The little brown myotis, northern myotis, and tri-colored bat are listed as *endangered* in New Brunswick under the *Species at Risk Act*.

Each bat species is capable of expressing characteristic call types; however, overlap in certain call patterns is common in some species that call within the same frequency range. Additionally, calls from any species may lack sufficient detail needed for species level identification because of background noise, distance of the bat from the microphone, weather, or other environmental

factors. To compensate for these limitations in the analysis process, the following guilds were created to account for ambiguous calls that could not be confidently identified to species:

Myotis (MYSP) – All bats of the genus *Myotis*. While there are some general characteristics believed to be distinctive for several of the species in this genus, these characteristics do not occur consistently enough for any one species to be relied upon at all times when using Anabat recordings.

Eastern red bat/tri-colored bat (RBTB) – Eastern red bats (LABO) and tri-colored bats (PESU). These two species produce calls distinctive to each species. However, significant overlap in the call pulse shape, frequency range, and slope can occur.

Big brown bat/silver-haired bat (BBSH) – Big brown (EPFU) and silver-haired bats (LANO). These species' call signatures are often difficult to distinguish and have therefore been included as one guild in this report.

Hoary bat (HB) – Hoary bats. Calls of hoary bats can usually be distinguished from those of big brown and silver-haired bats by minimum frequency extending below 20 kHz or by calls varying widely in minimum frequency across a sequence.

Unknown (UNKN) – All call sequences with less than 5 pulses, or poor quality sequences (those with indistinct call characteristics or overwhelming background static). These unknown sequences were further identified as either:

"High frequency unknown" **(HFUN)** for sequences with a minimum frequency above 30 to 35 kilohertz (kHz) (for this region, HFUN most likely represents eastern red bats, tri-colored bats, and *Myotis* species since these species typically produce ultrasound sequences of more than 30 kHz); or

"Low frequency unknown" **(LFUN)** for sequences with a minimum frequency below 30 to 35 kHz (big brown, silver-haired, and hoary bats would be the species in this region typically producing ultrasound sequences of less than 30 kHz).

This method of guild level identification represents a conservative approach to bat data analysis. Because some species occasionally produce calls unique only to that species, all calls were identified to the lowest possible taxonomic level as possible.

WEATHER DATA

Weather data were retrieved from weather sensors located approximately 80 m agl on the B1 and H6 Project turbines. Additionally, weather data were retrieved from the INBCOLPI2 weather station in Colpitts Settlement located approximately 18 kilometers (km) northwest of the Project (accessed via wunderundergound.com). Temperature, wind speed, and precipitation data were used to determine If survey nights occurred on suitable weather nights, as described in the *Bats pre-construction survey guidelines for wind farm project proposals for New Brunswick* (Survey Guidelines) dated June 2009. Nights with suitable weather conditions include seasonal temperatures with no precipitation and low winds (<20 km per hour [km/h]).

RESULTS

Detectors surveyed from 30 May to 30 June. Due to detector malfunction, the D9 detector operated for 11 of the 32 nights surveyed. Weather data collected at the B1 and H6 turbines indicate that during every night from 30 May to 30 June, either precipitation or wind speeds greater than 20 km/h occurred. Weather data retrieved from the Colpitts Settlement weather station indicate that 24 of the 32 nights surveyed consisted of suitable weather conditions for survey (Table G.1).

Table G.1 Summary of bat detector field survey effort at Kent Hills Wind Farm, spring 2017

Detector	Dates Surveyed	Calendar Nights	Total Detector-Nights[1]	Total Hours Surveyed	Detector-Nights with Suitable Weather[2]	Total Hours Surveyed with Suitable Weather[2]
D9	30 May–30 June	32	11	62	11	56
B60	30 May–30 June	32	32	179	24	135
B20	30 May–30 June	32	32	193	24	146
H60	30 May–30 June	32	32	179	24	135
H20	30 May–30 June	32	32	179	24	135
		Totals:	139	792	107	607
[1]One detector-night is equal to one detector successfully operating throughout the night.						
[2]According to weather data collected from the INBCOLPI2 weather station in Colpitts Settlement.						

Five bat call sequences were recorded during the survey period. Table 2 shows the species identification and the weather conditions that occurred at the time each call sequence was recorded. The 2 hoary bat calls sequences recorded on 22 June were within 16 seconds of each other and were likely produced by the same bat (Table G.2).

Table G.2 Bat call sequences recorded during surveys in spring, 2017.

Date and Time Call Sequence was Recorded	Species or Guild	Detector	Weather data collected by nearest turbine (B1 or H6) at at 80 m agl at time call sequence was recorded			Weather collected by Colpitts Settlement weather station at time call sequence was recorded		
			Temperature (°C)	Wind Speed (km/h)	Precipitation?	Temperature (°C)	Wind Speed (km/h)	Precipitation?
5/31/2017 01:44:41	LFUN	B20	15	53.5	No	8.3	6.4	No
6/11/2017 23:48:02	LANO	H20	22.9	46.1	No	19.5	0.0	No
6/22/2017 22:21:07	HB	B60	21*	38.6	No	17.3	11.3	No
6/22/2017 22:21:23	HB	B60	21*	38.6	No	17.3	11.3	No
6/30/2017 22:24:55	HB	H20	18.1	7.1	No	15.4	0.0	No
NA = Not Available. * from H6; temperature NA from B1								

DISCUSSION

Regardless of weather conditions, every night during the spring inventory dates required by Survey Guidelines (1–30 June) were surveyed, with an additional 2 nights in late May. Each detector surveyed more than 4 hours after one half hour after sunset totaling more than 40 hours, across more than 10 nights consisting of suitable weather conditions according to the nearby Colpitts Plantation weather station. Overall, few bat call sequences were recorded during the survey period and none were produced by a listed species.

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Pre-construction Bat Survey Plan - 2017
Kent Hills III Expansion

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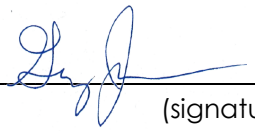
May 23, 2017

Sign-off Sheet

This document entitled Pre-construction Bat Survey Plan - 2017 - Kent Hills III Expansion was prepared by Stantec Consulting Ltd. ("Stantec") for the account of TransAlta Corporation (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Reviewed by 
(signature)

Greg Johnson

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

TransAlta is proposing an expansion of the existing Kent Hills Wind Farm (the site), in the southeastern section of Elgin Parish, in Albert County, New Brunswick (Figure 1). The proposed expansion would involve the installation of up to five new turbines (T1 to T5) and associated access roads, on Crown land. Currently, nine potential locations (including four alternate sites – T6 to T9) have been identified, and will be included in the bat monitoring study for 2017. The turbines proposed for addition are Vestas 126 turbines (3.45 MW), with a 117 m hub height and 60 m blades. While short interconnections between new turbines and the existing electrical collection system are required, no new transmission lines will be required.

The expansion requires registration under the New Brunswick Environmental Impact Assessment (EIA) Regulation under the Clean Environment Act. Following consultation with the New Brunswick Department of Environment and Local Government (NBDELG) Environmental Assessment Section, TransAlta was requested to complete bat monitoring surveys in the summer breeding season (June) and in the fall migration season (mid-August to mid-September) in support of their EIA Registration. The purpose of this document is to provide the bat monitoring plan to NBDELG to fulfil this request and for approval by the New Brunswick Department of Energy and Resource Development.

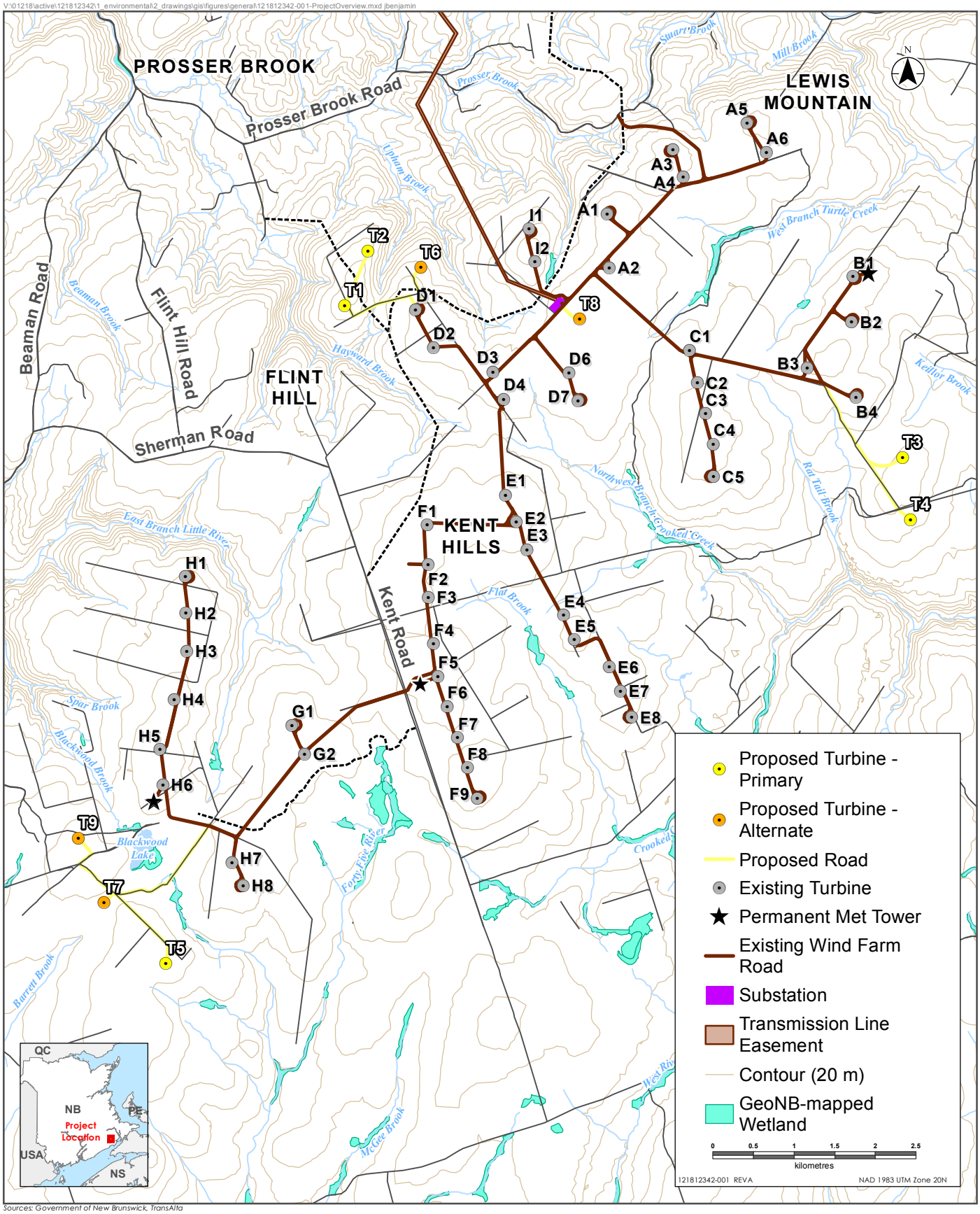
2.0 BACKGROUND

The proposed Project is located on Crown land in the Southern New Brunswick Uplands Ecoregion, within the Atlantic Maritime Ecozone (Environment Canada 2006). The terrestrial habitat within the site boundaries consists predominantly of mixedwood and hardwood stands, with some nursery/plantation areas. Overall, the area is dominated by tolerant hardwood forest. The forest stands are in various states of succession due to forestry practices in the area.

An environmental assessment (EA) for the original 32 wind turbines and ancillary facilities was completed in 2007 (Jacques Whitford 2007), and a supplemental EA was completed in 2009 for an expansion with an additional 18 turbines (Stantec 2009). Pre-construction monitoring of bat migration was conducted in 2007, and post-construction casualty studies (2009-2012) were conducted following commissioning of each phase of turbine installation (Stantec 2010, 2011, 2012, 2013).

The Kent Hills Wind Farm site is not known to host large concentrations of bats and is not likely to be located on a major migration route. Bats in New Brunswick require overwintering habitat that provides protection from temperature fluctuations and wind. Such conditions are typically found underground, in either natural caves and crevices, or artificial structures such as mineshafts. The nearest known overwintering site for bats is located more than 4 km north of the existing Kent Hills Wind Farm turbine A5.

Prior to the spread of white-nose syndrome (WNS) to bats in New Brunswick, the cave north of the wind farm hosted the largest known overwintering population of bats in the province (Vanderwolf et al. 2012). Within a few months, approximately 80-90% of bats in the cave had died (GNB 2017), and no longer supports an overwintering population (Parks Canada 2015). The overwintering population of bats in New Brunswick has now been essentially extirpated due to WNS, with less than 0.05% estimated to remain (Parks Canada 2015).



Sources: Government of New Brunswick, TransAlta

Service Layer Credits:

Project Overview

2.1 OVERVIEW OF PREVIOUS SURVEY RESULTS

Results of previous surveys conducted for the wind farm, both pre- and post-construction, are described in Stantec (2013) and summarized below.

Prior to construction of the initial phase of the wind farm, on-site monitoring of bat activity was conducted in 2007 using Anabat™ bat detectors. Only 17 individual bat passes were noted at a height of 30 m above ground level (agl) over a total of 103 nights sampled. Most of the bat passes were *Myotis* species (either little brown myotis (*M. lucifugus*) or northern myotis (*M. septentrionalis*)), and other species included hoary bat (*Lasiurus cinereus*), either big brown bat (*Eptesicus fuscus*) or silver-haired bat (*Lasionycteris noctivagans*), and an unidentified species.

Two years of post-construction monitoring were conducted for the initial phase in 2009 and 2010, and for the expansion phase in 2011 and 2012. Post-construction monitoring was designed to assess direct effects measured as mortality (casualty) rate to bats from operating wind turbines using weekly casualty searches conducted in spring, summer, and fall. Casualty searches were not conducted in winter because bat activity drops to zero during winter months in New Brunswick.

Mortality (casualty) rates across the four post-construction years (2009-2012) are summarized in Table 2.1 and derived from Stantec (2013).

Table 2.1 Mortality Rates for Bats for Post-Construction Years at Kent Hills Wind Farm

Development Phase	Survey Year	Estimated Total Bat Fatalities per Turbine per Year[1]	Estimated Total Bat Fatalities per Megawatt per Year[1]
Initial Phase	2009	0.41	0.14
	2010	0.13	0.03
Expansion I	2011	0.95	0.32
	2012	0.25	0.08

Impacts to migrating bats from operating turbines were expected to be low following the results of pre-construction monitoring at the Kent Hills Wind Farm. Monitoring results supported this prediction, with an estimated bat mortality rate of between 0.03 to 0.32 per megawatt (MW) per year across the four years of post-construction monitoring (Table 2.1), which is at the low end for wind farms across North America. In a study conducted by Strickland et al. (2011), 66 wind farms provided estimates of bat casualties and most of them (54) reported fewer than ten casualties per megawatt (MW) per year and the range was from 0.07 to 39.7 per MW.

3.0 METHODOLOGY

3.1 SURVEY APPROACH

According to the Pre-Construction Bat Survey Guidelines for Wind Farm Development in NB (NBDNR 2009), pre-construction site surveys are conducted to determine the following.

- Species (or species group) occurrence;
- Bat activity levels and use rates; and,
- Presence (or probable presence) of significant bat habitat in the area of the proposed development.

To achieve this, the Province requires that early and late summer acoustic monitoring programs be conducted, each consisting of at least 40 hours over a minimum of ten suitable nights in June (breeding season for bats) and again in the period from mid-August to mid-September (fall migration for bats). The Province prefers that sampling be done within the vertical zone of blade sweep or as high as can be practically achieved in the absence of taller structures such as meteorological towers on the site. Additional surveys may be required where risk of interaction with bats is high.

Habitat features that the Province considers to be high risk for bat interactions are outlined in Table 3.1. along with comments to explain why high risk habitat is considered unlikely to be present for the new turbine locations.

Table 3.2 High Risk Habitat for Bat Interactions – New Brunswick

High Risk Habitat Feature[1]	Context for Proposed Turbine Expansion at Kent Hills Wind Farm
Within 5 km of a known hibernaculum or potential cave or abandoned mine - sensitive to disturbances and potential for high bat activity at particular times of the year	Unlikely to be high risk for bat interactions at the new proposed locations: Although an historic hibernaculum lies within 5 km of existing turbines A1 though A6, the bat population in the cave has been essentially extirpated due to WNS[2]. None of the proposed new turbines are within 5 km of the historic hibernaculum to the north.
Within 500 m of a coast line or other major water body (large lakes and rivers) – potential for concentration of foraging and migratory movement	Unlikely to be high risk for bat interactions: The proposed new turbine locations are more than 1 km from a coast line and other major water bodies.
On or near forested ridge habitat – known migratory routes for bats	Unlikely to be high risk for bat interactions: The site is elevated but not classified as a ridge and not known to be a migratory route for bats based on previous monitoring conducted for the Kent Hills Wind Farm.
Notes: [1] NBDNR (2009) [2] New Brunswick Museum (2017), Parks Canada (2015)	

3.2 SURVEY PLAN

Five turbines are proposed for the expansion, to be selected from nine candidate turbine locations shown on Figure 1. Following NBDNR (2009) guidelines, two to three bat survey stations are required to assess bat activity at the site. The candidate turbine locations are located in three general groupings: T5, T7, T9 to the west, T1, T2, T6, T8 to the north, and T3, T4 to the east of the Kent Hills Wind Farm.

We propose to place five Anabat™ bat detectors across the wind farm as follows.

- Paired (i.e. one at tree level, one hoisted on a met tower) bat detectors at the two met towers located near two of the three clusters of preferred (and alternate) turbine locations; and,
- One bat detector deployed at tree level at the third cluster without an available met tower on which to elevate to within the blade swept area.

We will make efforts to elevate the two detectors hoisted on the two met towers so that they occur within the blade swept area (>40 m). Based on the size of the planned expansion and existing data for this region (pre- and post-construction results from Kent Hills Phase 1 and Phase 2 projects), we feel that this sampling plan will be effective, and is reasonable given the safety considerations, logistical challenges, and equipment available.

Bat detectors will be deployed at these locations for the early summer (i.e., June) to capture migration during the bat breeding season and again in late summer (mid-August to mid-September) to capture fall bat migration. Choice of locations to place detectors within each grouping of proposed turbines will be made based on road accessibility and to represent a variety of forest regeneration habitat.

In accordance with NBDNR (2009), Anabat™ detectors (models SD1 and SD2; Titley Electronics) will be used. These detectors will be enclosed in waterproof cases with long-lasting batteries and supplemental solar panels to allow the detectors to run for extended periods. The detectors will be programmed to run for at least four hours each night, starting 30 minutes after sunset, corresponding to the period of highest bat activity. The number of suitable survey nights for bat detection, for both study periods (early and late summer), will depend on the weather.

3.3 REPORTING

Following the completion of the June bat surveys, the data recorded on the detectors will be reviewed by an experienced bat biologist to determine bat activity and species / species groups detected. A report will be completed within approximately four weeks for inclusion in the EIA Registration or submitted in a supplemental report. The report will include a description of methods and an indication of the species / species groups detected and amount of activity recorded. The report will also include a map of the Study Area showing the locations of surveys.

PRE-CONSTRUCTION BAT SURVEY PLAN - KENT HILLS III EXPANSION

May 23, 2017

Following the fall surveys, a supplementary report following the same format as the June survey report will be submitted as a standalone supplementary report.

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