

4.0 ENVIRONMENTAL CHARACTERISTICS

The general and specific environmental characteristics of the WFSA and RSA are described in this section.

4.1 GEOPHYSICAL ENVIRONMENT

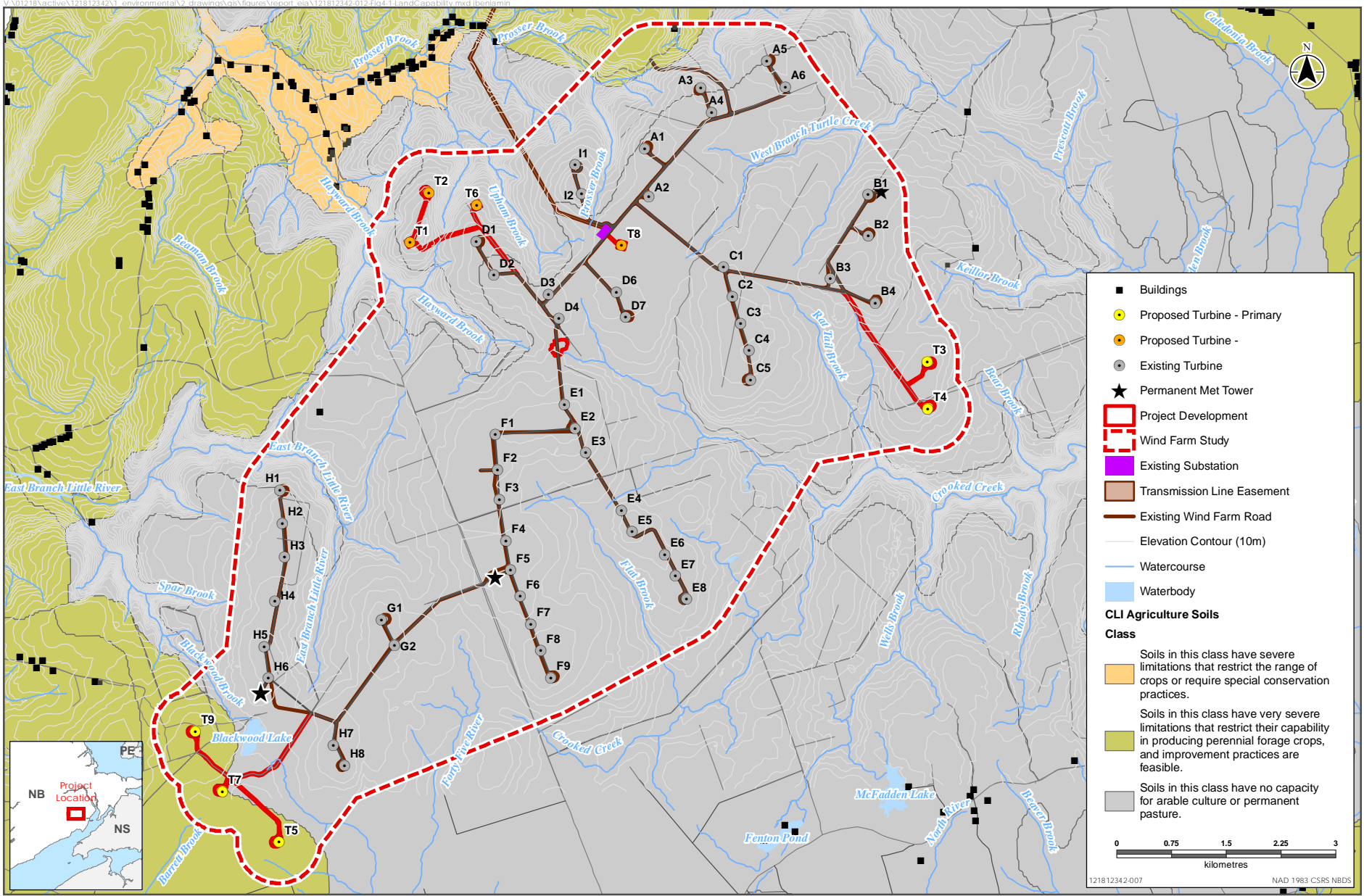
The following sections outline the geophysical environment of the WFSA including the physiography and topography, soil quality, geology, seismicity, and hydrogeology of the area.

4.1.1 Physiography and Topography

The WFSA is located within the Caledonian Highlands Physiographic Region. The land surface is a plateau, cut transversely by short fast moving streams running in deep, narrow valleys. Rock outcrops and ledges are numerous and the drainage is therefore restricted locally so that soggy, swampy land is common. This region has an average elevation of more than 300 m with some points as high as 415 m in the Kent Hills. The WFSA has elevations which range from 320 to 415 m (Aalund et al. 1950; Service New Brunswick 2006).

4.1.2 Soil Quality

Albert County is host to a wide variety of soils. Those of the highlands, encompassing the WFSA include colluviums of Quaternary origins, consisting of gravel, silt, sand and clay; glacial tills of varying thickness (0.5-3 m) of upper and mid Wisconsinian origin; and sandy moraine deposits of Wisconsinian origin (Environment Canada 2006). The topography is moderately undulating, with areas surrounding the WFSA being quite hilly. The soil capacity for agriculture in and around the WFSA is Class 4, 5, and 7, meaning they have severe limitations to, very severe limitations to, or no capacity for agriculture, respectively (Figure 4.1). Accordingly, predominant crops in the area are forage crops such as hay.



Sources: Base Data - provided by the Government of New Brunswick.

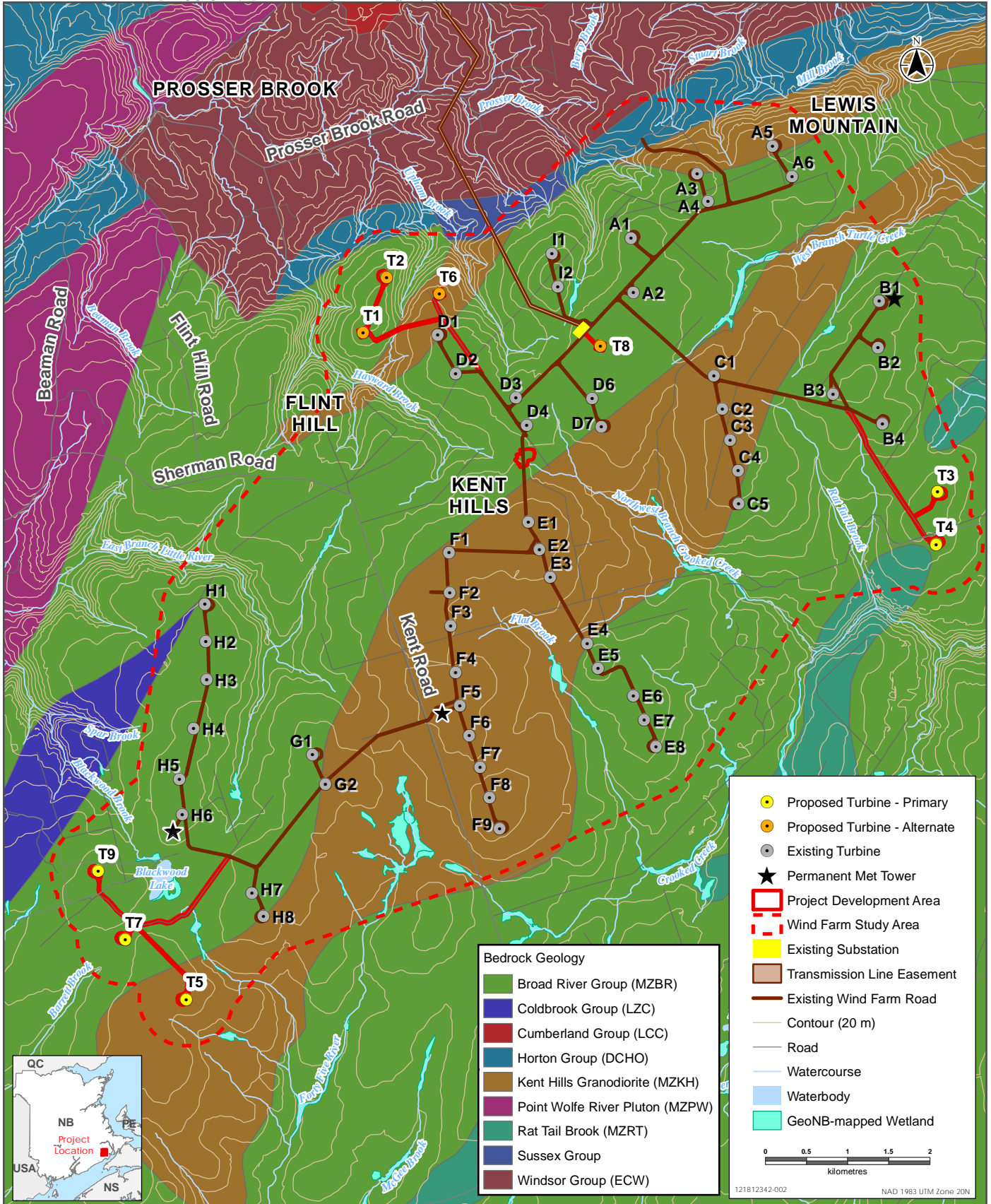
Land Capability for Agriculture

4.1.3 Geology

The WFSa is wholly underlain by bedrock of Neoproterozoic age which includes bedrock of the Coldbrook Group, the Broad River Group and the Kent Hills pluton (Figure 4.2). The Coldbrook Group in this area includes only the Hosford Brook Formation which is comprised of amygdaloidal to massive basalt with less abundant mafic tuff. The bedrock of the Broad River Group underlying the WFSa includes the Pine Brook, Teahans Corner and Crooked Creek Formations. The Pine Brook Formation includes siltstone, sandstone and pebble arkosic conglomerate; the Teahans Corner Formation includes tuffaceous phyllite, chlorite schist, slate, felsites, arkosic sandstone and conglomerate; and the Crooked Creek Formation contains metasilstone (locally hornfels), dacitic crystal and lithic crystal tuff, mafic tuff, minor chert or felsites (Barr et al. 2004). The Kent Hills pluton contains various igneous intrusive rocks including granodiorite, quartz diorite, diorite, syenite, and alkali granitoids (St. Peter et al. 1997).

The most northern portion of the WFSa includes Devonian to Carboniferous age Horton Group and Carboniferous age Windsor Group bedrock. The Horton Group can contain fossils and is made up of the Albert and the Memramcook Formations. The Albert Formation is characterized by grey and minor red locally calcareous mudstone, shale and fine to coarse grained sandstone with plant debris; granule to boulder polymictic conglomerate; minor kerogenous mudstone and kerogenous shale commonly containing fish fossils; minor fossiliferous limestone; dolostone; and evaporates. The Memramcook Formation is red to grey, granule to boulder, polymictic conglomerate and fine grained to pebbly sandstone with sparse plant material, red mudstone, and minor calcrete. The Windsor Group in the vicinity of the WFSa contains the Hillsborough Formation which is characterized by red to grey, granule to cobble, polymictic conglomerate and lithic sandstone, and minor red mudstone (Barr et al. 2004).

Although there are some formations within the WFSa which are known to contain fossils, the presence of these fossiliferous units are not expected to be negatively affected by the Project since the only planned construction within these units is the upgrade of an existing road which contains a stretch of approximately 125 m over the Albert Formation. According to Provincial Department of Natural Resource Development Bedrock Geologist Susan Johnson (pers. comm. 2007 in Jacques Whitford 2007a), the Project should not be a concern with regards to paleontological sites. A report was requested and received from Randall Miller of the MB Museum, which has verified this assumption for the current PDA (see Section 4.6.3.3). While cuts are not planned through the bedrock in this area, if a road cut is necessary, the potential loss of a small number of fossils during construction is balanced by the palaeontological study potential of a fresh cut face.



Sources: Government of New Brunswick

Bedrock Geology

Environmental Characteristics

None of the bedrock units underlying the WFSAs are considered to be specifically problematic with regards to acid rock drainage (ARD). However, even though the specific probability of ARD in the rock units as a whole is low, it is always possible that sulfide mineralized zones could be present. If sulfides are present in bedrock to be disturbed by the Project, these areas could be at a higher risk for ARD. Known mineralized zones do exist in the Crooked Creek Formation within the WFSAs (Barr et al. 2004); but none are within 1 km of a proposed wind turbine or road location. As a precaution against ARD, during the geotechnical investigation to be completed prior to the construction phase of the Project, any bedrock to be disturbed (e.g., blasted or exposed) which is found or suspected to contain high levels of sulfide minerals will be tested for acid generating potential. If bedrock to be disturbed is found to be potentially acid producing, additional site specific precautions, procedures and/or mitigation measures will be developed and implemented in consultation with the NBDELG or the Project will be altered to avoid these areas. However, where quantities of bedrock requiring disposal are relatively small (i.e., <50 m³, or <500 m³ for the entire project), which is expected for this Project, special disposal measures are not likely warranted, other than depositing more than 100 m from a watercourse or wetland. In the absence of New Brunswick guidelines or regulations, the amount of 500 m³ is derived from the Nova Scotia *Sulphide Bearing Material Disposal Regulations*, which identify amounts of rock less than this to be exempt from the regulations.

4.1.4 Seismicity

Eastern Canada is in a relatively tectonically stable region of the North American Plate. However, earthquakes can, and do, occasionally occur in Eastern Canada, although the causes of these earthquakes are not well understood. On average, Eastern Canada receives approximately 450 detectable earthquakes annually, of which approximately four will exceed a magnitude of 4 on the Richter scale. In a decade, Eastern Canada will receive approximately three events greater than magnitude 5. While a magnitude 3 earthquake is strong enough to be felt in the immediate area, a magnitude 5 earthquake is generally the threshold for potential damage to structures (NRCan 2016a).

The Project is in the North Appalachians Seismic Zone, which includes parts of southern and western Nova Scotia, most of New Brunswick and extends into New England down to Boston. Historically, this zone has experienced earthquakes with epicenters of intensities greater than magnitude 5. For example, the largest earthquake to affect the Maritime Provinces since 1929 occurred in an unpopulated region of the Miramichi watershed, north of Highway 108 and about midway between New Castle and Plaster Rock, New Brunswick. That earthquake was a magnitude 5.7, with aftershocks measured at up to magnitude 5.1. That earthquake occurred in an unpopulated area, so damage was only very slight (e.g., a few hairline cracks) but no structural damage in buildings up to 100 km away from the epicenter (NRCan 2016b). If that earthquake had occurred closer to a developed area, more damage would have likely occurred.

4.1.5 Hydrogeology

No municipal potable water well fields are in the WFSAs. A query of the NBDELG Online Well Logs System (OWLS) database (NBDELG 2017a) did not identify any private well log and groundwater chemistry data within 800 m of the WFSAs.



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The OWLS database identified 15 domestic drinking water wells within 5 km of the new and existing turbines. A summary of the pertinent well properties included in these logs is provided in Table 4.1.

The Riverside-Albert Wellfield is located to the east of the proposed site. This wellfield is protected under the *Wellfield Protection Area Designation Order – Clean Water Act*. However, this area, and the wells noted in Table 4.1, are located well outside the WFSA, and will not be affected by Project construction activity.

Table 4.1 Summary of Water Wells Records within 5 km of New and Existing Turbines

Statistic	Well Depth (m)	Casing Length (m)	Casing Diameter (cm)	Estimated Yield (L/min)	Water Level (m)	Overburden Thickness (m)
Minimum	16.8	5.8	15.2	4.6	4.6	0.6
Maximum	68.6	26.8	15.2	364	53.3	12.2
Average	39.5	10.8	15.2	66.4	13.9	4.2
Median	35.8	9.1	15.2	36.4	9.1	3.4
Number of wells*	14	14	14	12	10	14
Note: *One of the wells identified in the OWLS database did not include information on these characteristics and has not been included.						

The groundwater quality was characterized from chemistry results obtained from the Online Well Log System for wells located within 5 km of the WFSA. Summary statistics from 11 sample results from the database are presented in Figure 4.3. Groundwater quality is generally good with general chemistry parameters meeting the Guidelines for Canadian Drinking Water Quality (GCDWQ, Health Canada 2017) except for slightly elevated concentrations of iron in two of the samples, one of which also had a slightly elevated concentration of fluoride, and an elevated concentration of arsenic in the other sample. Similar results to these 11 wells would be expected for wells if they were installed within the WFSA.

Environmental Characteristics

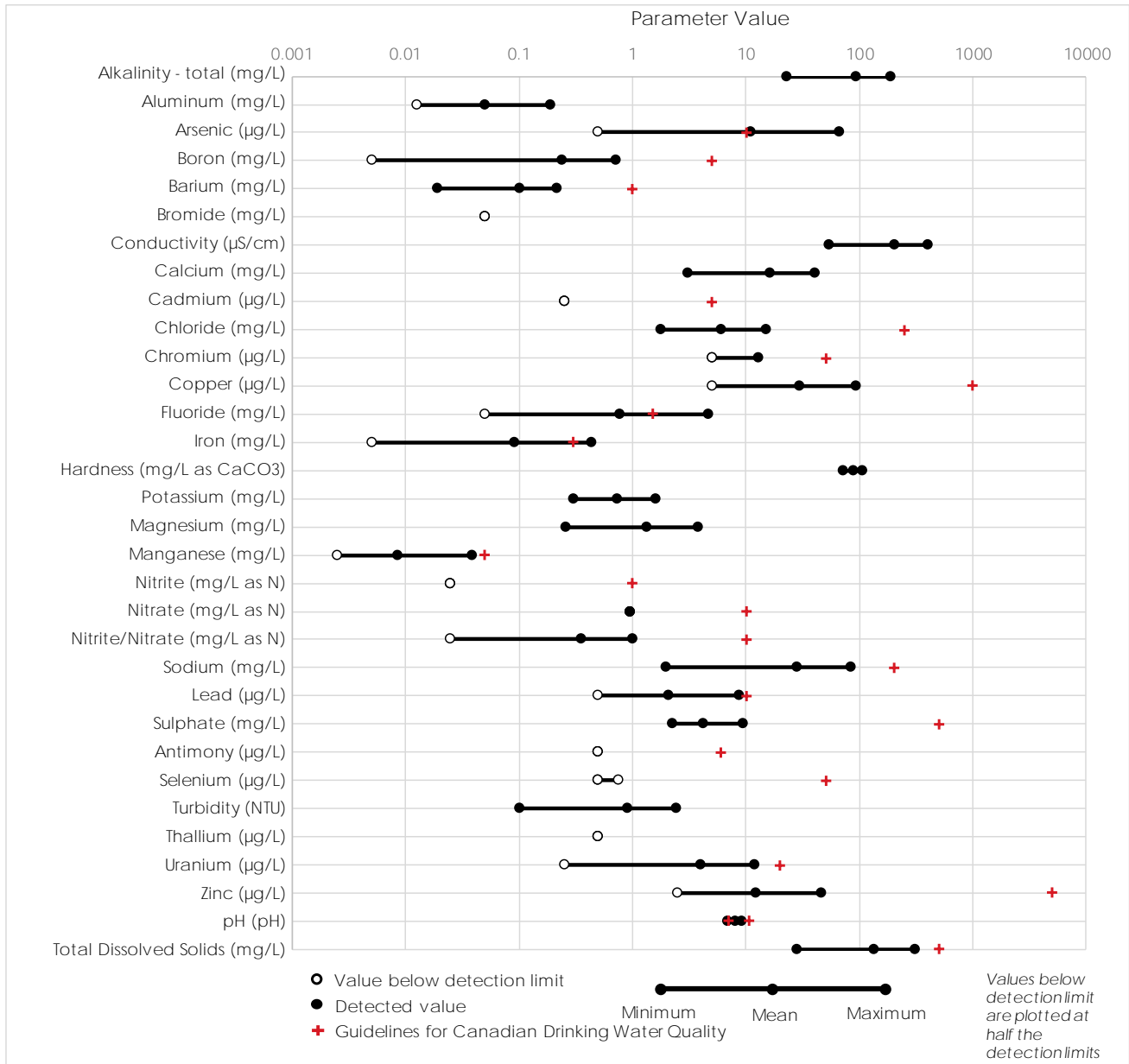


Figure 4.3. Groundwater Chemistry Results from 11 Wells in the OWLS Database

4.2 AQUATIC ENVIRONMENT

This section describes the aquatic environment within the PDA including the aquatic habitats, fauna, vegetation, surface hydrology, surface water quality and sediment quality. Included are aquatic Species at Risk (SAR) or Species of Conservation Concern (SOCC) that may be present in the PDA or larger WFSA. Species listed as endangered, threatened, or special concern under the federal *Species at Risk Act*, the New Brunswick *Species at Risk Act*, or the Committee on the Status of Wildlife in Canada (COSEWIC) are here considered to be SAR. Species which are considered rare in New Brunswick, but are not protected or listed by any legislation are considered herein to be SOCC. Species which have populations in New Brunswick, but may not be considered sustainable are also included as SOCC. SOCC are here defined to include species which are not SAR, but are ranked S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) in New Brunswick by the AC CDC (AC CDC 2017a).

4.2.1 Aquatic Habitats

The Kent Hills Wind Farm is located on a hydrological divide, splitting two watersheds: the Upper Salmon River watershed, and the Petitcodiac River watershed, each with several subwatersheds. The PDA is located within the East Branch Little River, Forty Five River and Crooked Creek sub-watersheds. All the watercourses within the PDA are first-order streams, which is the smallest tributary type in a watershed.

4.2.1.1 Methods

Two mapped watercourses and five potential unmapped watercourses were surveyed within the PDA in June 2017 (Figure 4.4).

For each watercourse, fish habitat surveys were conducted 100 m upstream and 100 m downstream of the proposed centreline for the potential crossing location. Aquatic habitat information was collected as per guidelines jointly issued by New Brunswick Department of Natural Resources and Fisheries and Oceans Canada, including habitat type (riffle, run, pool) and other habitat characteristics (cover, substrate, bank characteristics). The *in-situ* water quality parameters measured included: water temperature, dissolved oxygen, and conductivity (all measured using YSI ProPlus meter); pH (measured using a Hanna Instruments 98127 pH meter); and turbidity (measured using a Hach 2100Q turbidimeter). Water quality instrumentation was calibrated daily.

Of the seven sites that were surveyed, water was flowing in two (KHWf-04, KHWf-05) and an electrofishing survey was conducted in 2017 at one location, the unnamed tributary to Forty Five River (site identifier KHWf-05) to determine species present and community composition. Electrofishing surveys were conducted in areas most likely to possess fish, within the surveyed area and a minimum of 400 electrofishing shocking seconds were applied. All fish were anesthetized using a 1:10 clove oil/ethanol solution to water. Fish captured were identified to species, and weight and length measurements were collected. Fish were released at the same location as they were collected. No electrofishing was conducted in KHWf-04 due to low flow and silty substrate; KHWf-04 is connected hydrologically to KHWf-05 and brook trout were observed.

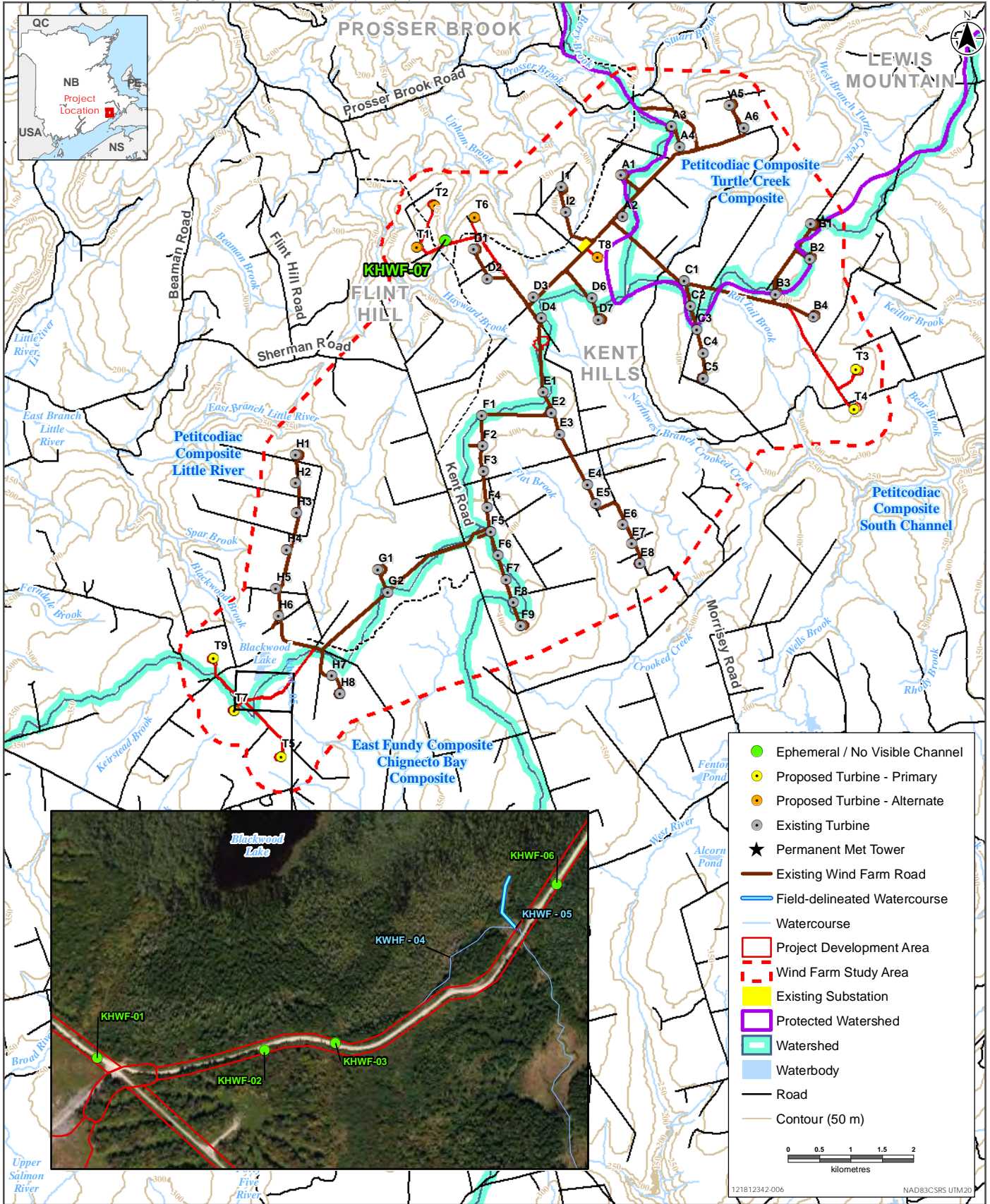
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4.2.1.2 Results

Of the two mapped watercourses, KHWF-07 had no visible channel and KHWF-05 was a permanent watercourse (Table 4.2; Figure 4.4). Only one of the unmapped potential watercourses (KHWF-04) was truly a watercourse; the rest of the potential watercourses surveyed were ephemeral or intermittent channels within the PDA (Table 4.2).

Table 4.2 Results of Survey of Mapped and Potential Unmapped Watercourses

Potential Watercourse Identifier	GPS Coordinates (UTM Zone 20T)	Comments
KHWF-01	347718, 5068461	Road drainage, not connected to watercourse
KHWF-02	348004, 5068462	No flow, not connected to a watercourse
KHWF-03	348122, 5068464	Ephemeral channel within PDA, connects to watercourse outside of PDA
KHWF-04	348278, 5068514	Watercourse
KHWF-05	348446, 5068632	Watercourse
KHWF-06	348513, 5068722	Ephemeral channel within PDA
KHWF-07	350993, 5075759	No visible channel



Sources: Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Watersheds and Watercourses

Environmental Characteristics

At the time of the surveys water temperature for both watercourses was suitable for cold water fish species such as brook trout and Atlantic salmon. Dissolved oxygen concentrations for both watercourses crossed by the Project exceeded the Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life (CEQG; CCME 1999) recommended lower limit of 6.5 mg/L for all life stages of fish (Table 4.3). The pH was below the accepted range (6.5 to 9.0) for the protection of freshwater aquatic life, but within the suitable range for species such as brook trout (Raleigh 1982). Turbidity was low (<10 NTU) at both watercourses sampled.

Table 4.3 *In Situ* Water Quality Parameters of Surveyed Watercourses

Watercourse Identifier	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µS/cm)	Turbidity (NTU)
KHWF-04	14.1	8.8	6.1	33	4.03
KHWF-05	15.5	8.8	6.3	34	1.42

Site KHWF-04, an unnamed tributary to Forty Five River, is a first-order stream which flows into Forty Five River Brook and is located within the Upper Salmon River watershed. Within the PDA the watercourse changes from ephemeral to a flowing stream approximately 5 m from the existing road crossing. Average bankfull width is 2.5 m, with a wetted width of 1.5 m. Riparian vegetation was predominately a mix of grass (40%) and shrubs (45%), and banks were stable (100%). Instream cover is provided by aquatic plants. Substrate in unnamed tributary to Forty Five River is dominated by organics and fines (100%). A representative photo of the habitat present in unnamed tributary to Forty Five River (KHWF-04) can be found in Photo 1.

Site KHWF-05, an unnamed tributary to Forty Five River, is a first-order stream which flows into Forty Five River Brook and is located within the Upper Salmon River watershed. Average bankfull width is 2.0 m, with a wetted width of 1.4 m. Riparian vegetation was predominately a mix of grass (43%) and shrubs (40%), and banks were generally stable (88%). Instream cover is provided primarily by aquatic plants. Substrate in unnamed tributary to Forty Five River is dominated by organics and fines (49%), with some coarse substrate, including gravel (25%), cobble (11%) and boulder (14%). A representative photo of the habitat present in unnamed tributary to Forty Five River (KHWF-05) can be found in Photo 2.



Photo 1. Representative Fish Habitat In KHWF-04 Facing Downstream



Photo 2. Representative Fish Habitat In KHWF-05 Facing Upstream at a Location Downstream of the Road Crossing

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While there are very little published data readily available for the fish in the waterways within and around the Kent Hills site, unpublished data has found that the following fish species are present in the larger watercourses in the area (Connell, C. unpublished data, pers. comm. 2017): American eel (*Anguilla rostrata*), blacknose dace (*Rhinichthys atratulus*), brook trout (*Salvelinus fontinalis*), common shiner (*Luxilus cornutus*), and slimy sculpin (*Cottus cognatus*). The presence of brook trout was confirmed in one of the unmapped tributaries to West Branch Turtle Creek in 2007 (Jacques Whitford 2007a). Brook trout were also confirmed to be present in the unnamed tributaries to Forty Five River (KHWF-04 and KHWF-05) during habitat and fish surveys in June 2017. Brook trout at KHWF-05 ranged in size from 34 to 99 mm and represented young of the year to adults. Catch per unit effort was 14 fish per 100 shocking seconds. Brook trout were observed at KHWF-04. The watercourses in the area likely represent year-round habitat for various life stages of brook trout.

Historically, sea-run Atlantic salmon (*Salmo salar*) were prevalent throughout the inner Bay of Fundy (IBoF) rivers. In 2004, IBoF Atlantic salmon were listed under Schedule 1 of the federal *Species at Risk Act*. Populations have not recovered and many rivers no longer contain salmon or are at critically low levels (COSEWIC 2006a). The PDA does not contain critical habitat for IBoF Atlantic salmon (Government of Canada 2010), and freshwater habitat is currently not limiting the recovery of IBoF Atlantic salmon (COSEWIC 2006a).

Atlantic salmon is known to have occurred in Flat Brook, a stream within the Kent Hills area (Jacques Whitford 2007a), and in the Upper Salmon River and Petitcodiac River at very low abundances (DFO 2008). No Atlantic salmon were captured during electrofishing surveys in 2017.

The streams surveyed (KHWF-04 and KHWF-05) are not thought to represent potential Atlantic Salmon habitat, as this species prefers habitat with larger substrates (e.g., gravel and cobble), higher velocity, and higher stream orders (Stanley and Trial 1995). There is an abundance of higher quality habitat in other areas of the watershed.

American eel is listed as *threatened* by COSEWIC and is listed as a SAR under the *New Brunswick Species at Risk Act*. It currently has no status under the federal *Species at Risk Act*. It is widely distributed in New Brunswick and inhabits a variety of marine and freshwater habitats during its life cycle. The American eel has been observed in the larger watercourses downstream of the WFSA (e.g., Prosser Brook; Connell, C. unpublished data, pers. comm. 2017); however, based on the small size and headwater nature of streams in the WFSA American eel is considered unlikely to be present.

Based on a review of the other freshwater fish species occurring in southern New Brunswick, and the available habitat found in the WFSA, it is unlikely that any other SAR or SOCC occur in the PDA. The only known commercial fish species found near the Project is American eel.

4.2.2 Surface Hydrology

The WFSA is located on a hydrological divide, splitting two watersheds (the Upper Salmon River watershed and the Petitcodiac River watershed), and several subwatersheds (Figure 4.4). The PDA crosses the headwaters of several streams, including East Branch Little River, Prosser Brook, Forty Five

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River and Crooked Creek, and/or their associated tributaries. Within the WFSA, all of these streams are first-order, with gradual slopes (~1%). The proposed new facilities are located outside of the limits of the Turtle Creek Protected Watershed.

4.2.3 Water Quality

Water quality of Turtle Creek, Little River, and Prosser Creek were monitored as part of a study, completed in 2001, which was undertaken for the Petitcodiac Watershed Monitoring Group (St-Hilaire et al. 2001). The study indicated that the water quality for these watercourses generally meets the Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life (CEQG; CCME 1999) and that Turtle Creek occasionally contains ammonia concentrations above these guidelines (St-Hilaire et al. 2001). Although Crooked Creek and Forty Five River were not included in the Petitcodiac Watershed Monitoring Group study (St-Hilaire et al. 2001), they would be expected to have generally good water quality meeting the CEQG, given the similarities with the assessed streams (i.e., similar bedrock geology and land use in the catchment area - lack of urbanization and agricultural activities).

4.3 TERRESTRIAL ENVIRONMENT

This section describes the flora and fauna, including any terrestrial SAR or SOCC that may be present in the PDA or larger WFSA. It also describes managed or other special areas that may provide important habitat for various wildlife species.

4.3.1 Terrestrial Vegetation

New Brunswick is divided into seven ecoregions which differ in physical characteristics such as climate, soils, and forest composition. The Project is located in the Caledonia Ecodistrict of the Central Uplands Ecoregion (NBDNR 2007). This ecodistrict is isolated from other ecodistricts in the Central Uplands Ecoregion, which are all located in the northwestern portion of New Brunswick.

The Caledonia Ecodistrict is an upland plateau, reaching its highest elevation at approximately 400 m asl (above sea level) in the Kent Hills area (NBDNR 2007). In the area of the Project is underlain by a number of different rock types, including felsic volcanic, magic volcanic, and granites and granodiorites. Soils frequently have low fertility, with some areas of moderately fertile soils. The WFSA is made up of forested land in various stages of succession resulting from past and ongoing forest management in the area, though much of the forest surrounding the WFSA is in a mature developmental stage (Figures 4.5-4.8). Overall, the forests are primarily tolerant hardwood, dominated by sugar maple (*Acer saccharum*) with lesser amounts of red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), and yellow birch (*Betula alleghaniensis*), though stands dominated by black spruce (*Picea mariana*) and red spruce (*P. rubens*) are also common in the WFSA. Although there is only one wetland mapped by NBDLEG, there are additional field-identified wetlands within the PDA, discussed in Section 4.4.

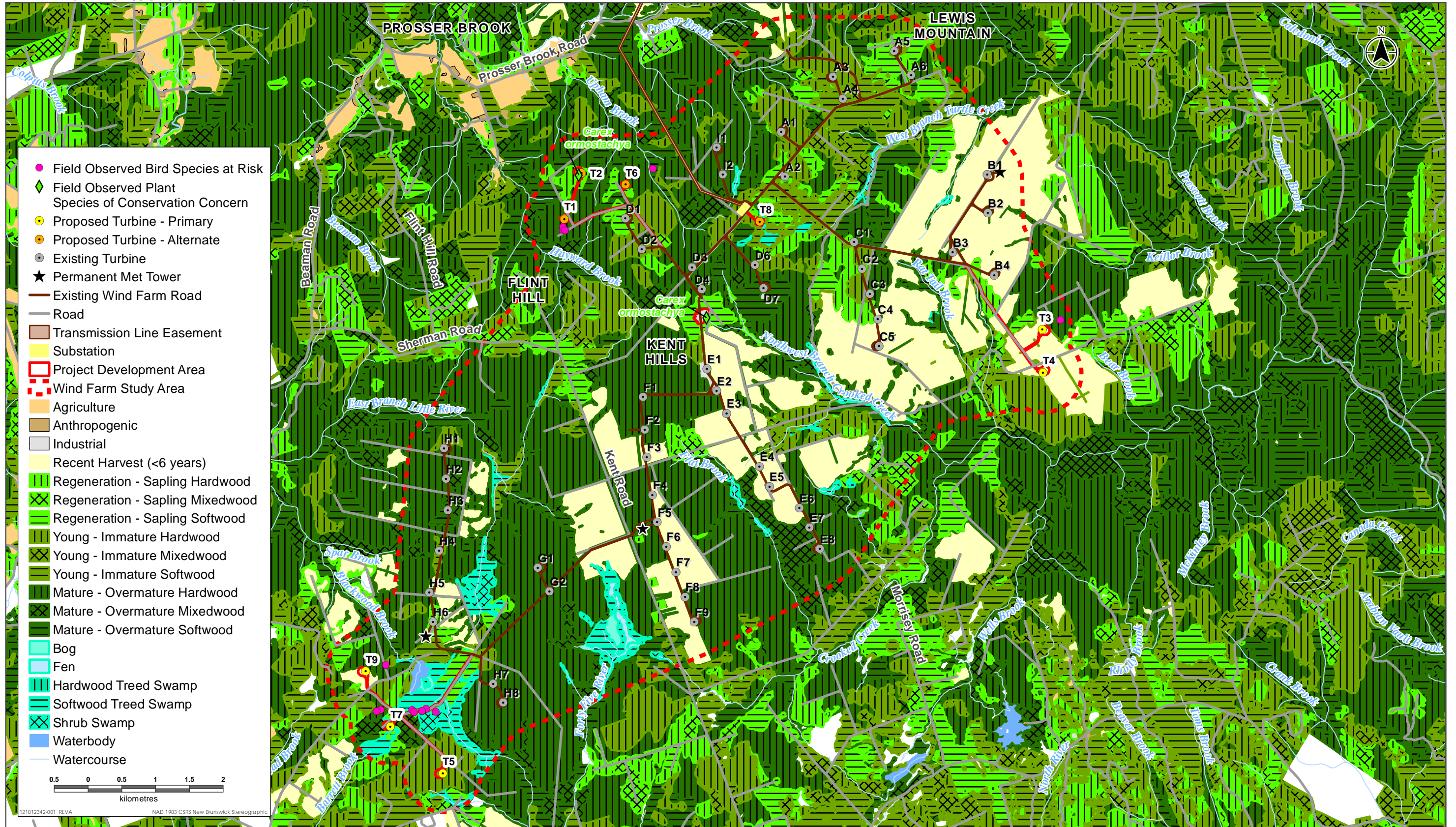
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Land classifications within the PDA and WFSA were determined using NBDERD forest and non-forest data and GeoNB and New Brunswick Hydrological Network wetlands. Wetlands within the PDA were updated with the results of field surveys. Land classification values (ha and %) within the PDA and WFSA are listed in Table 4.4.

Table 4.4 Land Classification in the PDA and WFSA

Land Classification	PDA		WFSA	
	ha	%	ha	%
Anthropogenic	3.16	9.26	10.34	0.15
Industrial	3.47	10.18	74.45	1.07
Forest	26.66	78.16	6,648.32	95.22
Recent harvest (≤ 6 years)	6.86	20.12	1,405.11	20.13
Regeneration - sapling hardwood	3.34	9.79	204.54	2.93
Regeneration - sapling mixedwood	0.17	0.50	94.24	1.35
Regeneration - sapling softwood	2.90	8.50	301.26	4.31
Young - immature hardwood	4.31	12.64	575.06	8.24
Young - immature mixedwood	0	0	49.70	0.71
Young - immature softwood	0.30	0.88	273.77	3.92
Mature - overmature hardwood	4.89	14.35	2,780.94	39.83
Mature - overmature mixedwood	2.73	8.01	388.56	5.57
Mature - overmature softwood	1.15	3.38	575.14	8.24
Wetland	0.82	2.40	239.33	3.43
Bog	0	0	14.04	0.20
Fen	0	0	10.68	0.15
Hardwood treed swamp	0.02	0.06	0.06	0.00
Softwood treed swamp	0.54	1.60	149.77	2.15
Shrub swamp	0.25	0.74	64.79	0.93
Waterbody	0	0	9.34	0.13
Grand Total	34.11	100.00	6,981.78	100.00

Vegetation surveys were conducted for Kent Hills 1 and Kent Hills 2, and were conducted for the Kent Hills 3 PDA in June 2017. During the vegetation surveys conducted in support of the Kent Hills 3 Wind Project, 197 vascular plant species were observed (Appendix C), including one SOCC, discussed below.



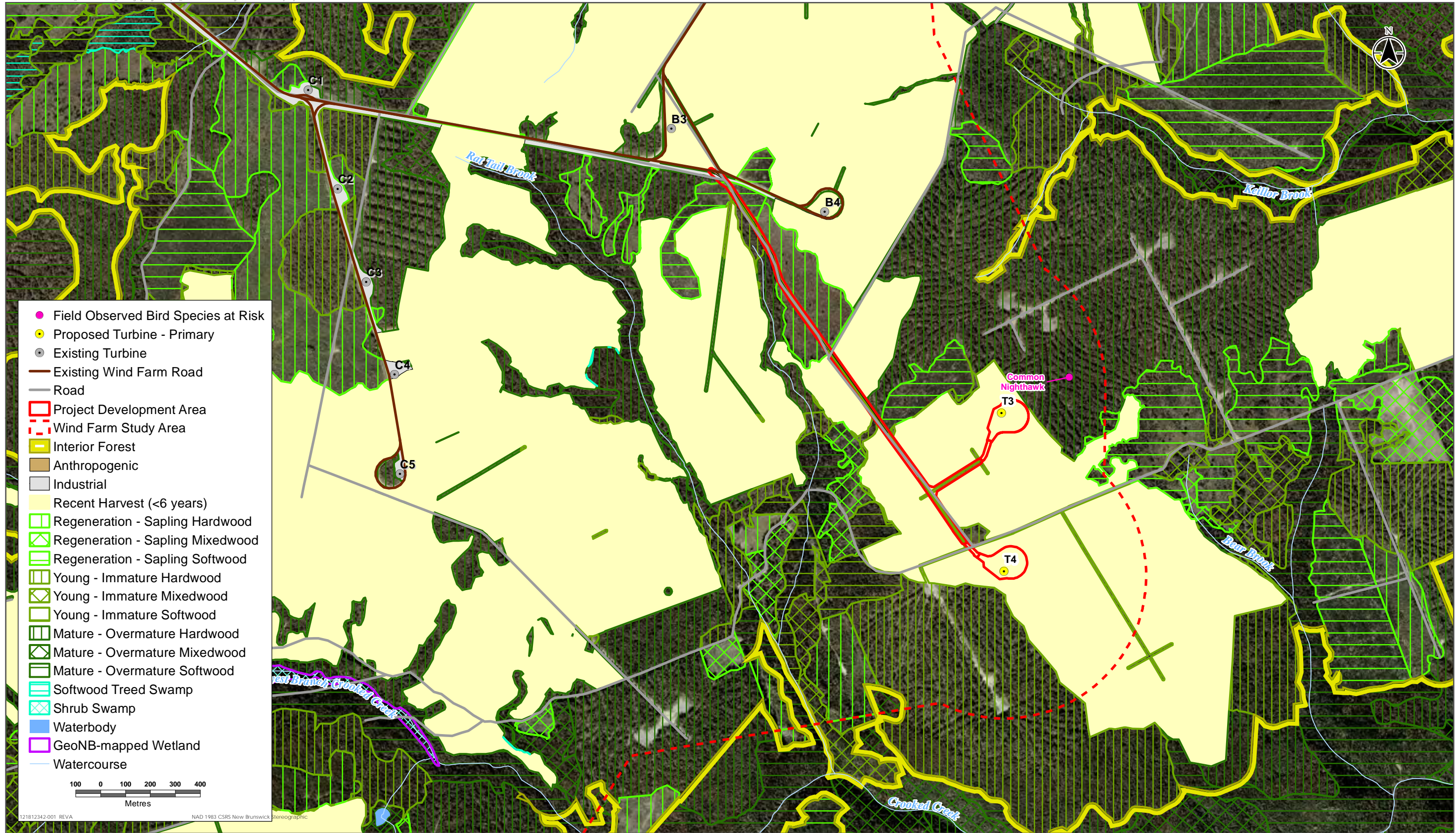
Sources: Government of New Brunswick
Service Layer Credits:

Habitat Overview

Figure 4.5 Habitat Overview

KENT HILLS 3: KENT HILLS WIND FARM EXPANSION PHASE 3

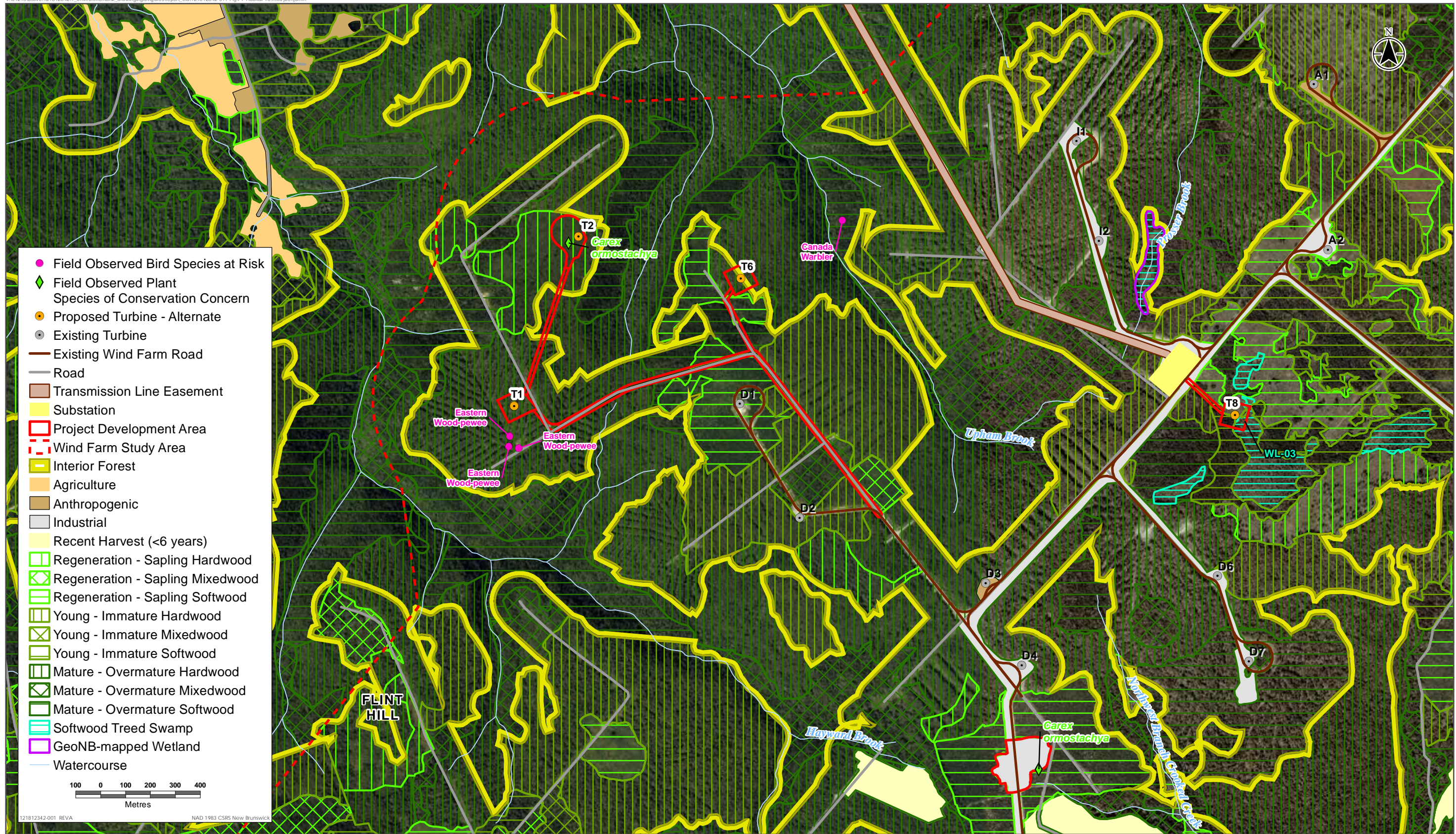
Environmental Characteristics



Sources: Government of New Brunswick

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Habitat Map - T3,T4



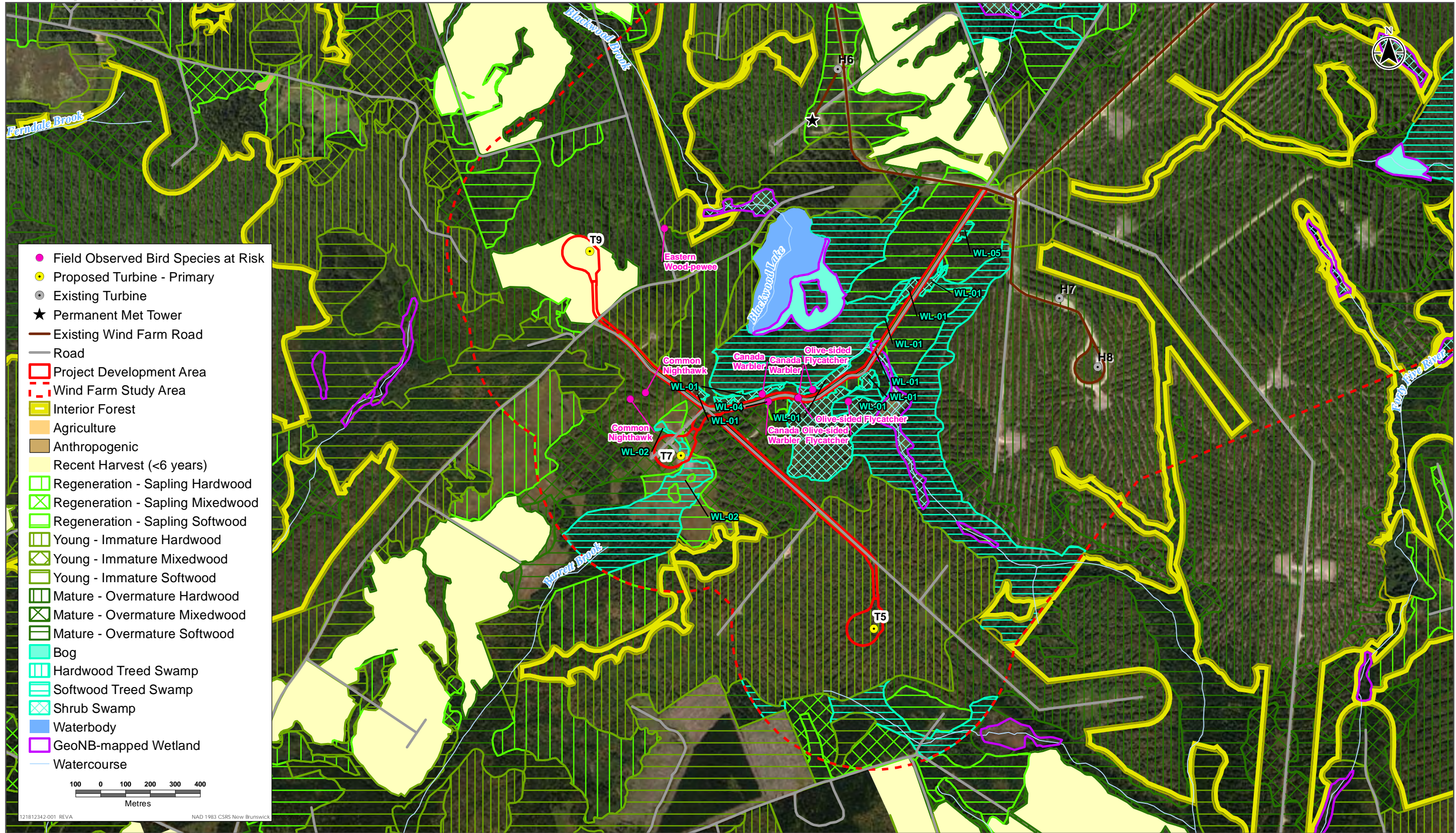
Sources: Government of New Brunswick

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Habitat Map - T1,T2,T6

KENT HILLS 3: KENT HILLS WIND FARM EXPANSION PHASE 3

Environmental Characteristics



Sources: Government of New Brunswick

Service Layer Credits: Service New Brunswick/Service Nouveau Brunswick

Habitat Map - T5, T7, T9



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4.3.1.1 Plant Species of Conservation Concern

During vascular plant surveys conducted in 2017 a single SOCC, necklace spike sedge (*Carex omostachya*, S3), was observed within the PDA. This species typically grows in rich hardwood stands (Hinds 2000) and was observed in two locations: near the southeastern edge of the cleared planned laydown area between existing turbines D4 and E1, and within the footprint of T2, in a young birch (*Betula* spp.) and poplar (*Populus* spp.) stand (Figure 4.7). Neither of these habitats are ideal for this species, indicating it may have a broader habitat affinity than previously reported.

Data obtained from the AC CDC (2017b; Appendix D) indicate there are no known SAR or SOCC within the PDA; but 20 plant SOCC have been identified as occurring within 5 km of the WFSA, including two non-vascular plants, and 18 vascular plants (Table 4.5). This list includes those species with a provincial ranking of S3 or rarer. There are 33 plant SOCC records in total, as some species have been recorded from the area multiple times. Of the 33 total records, 21 occur within Mount Zackie Jonah Environmentally Significant Area (ESA) on a slope west of Little River, nearly 5 km west of the WFSA. Three occur within the Caledonia Gorge Protected Natural Area (PNA). Only two records, bristle-leaved sedge (*Carex eburnea*, S3) and long-bracted frog orchid (*Coeloglossum viride* var. *virescens*, S2) are within the WFSA; however, these species were not observed within the PDA during the vegetation survey conducted in 2017.

Table 4.5 Terrestrial SOCC Reported by AC CDC Within the WFSA or Surrounding 5 km (AC CDC 2017b)

Taxon	Scientific Name	Common Name	AC CDC S-Rank ¹	Location ²
Non-vascular Plant	<i>Tayloria serrata</i>	serrate trumpet moss	S2	WFSA ³
Non-vascular Plant	<i>Thamnobryum alleghaniense</i>	a moss	S2	RSA
Vascular plant	<i>Arabis drummondii</i>	Drummond's rockcress	S2	RSA
Vascular plant	<i>Arabis hirsuta</i> var. <i>pycnocarpa</i>	western hairy rockcress	S3	RSA
Vascular plant	<i>Asplenium trichomanes</i>	maidenhair spleenwort	S2	RSA
Vascular plant	<i>Asplenium trichomanes-ramosum</i>	green spleenwort	S3	RSA
Vascular plant	<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>	lance-leaf grape-fern	S3	RSA
Vascular plant	<i>Carex arcta</i>	northern clustered sedge	S3	RSA
Vascular plant	<i>Carex backii</i>	rocky mountain sedge	S1	RSA
Vascular plant	<i>Carex eburnea</i>	bristle-leaved sedge	S3	WFSA ² , RSA
Vascular plant	<i>Carex merritt-fernaldii</i>	Merritt Fernald's sedge	S1	RSA
Vascular plant	<i>Chenopodium simplex</i>	maple-leaved goosefoot	S1	RSA
Vascular plant	<i>Clematis occidentalis</i>	purple clematis	S3	RSA
Vascular plant	<i>Coeloglossum viride</i> var. <i>virescens</i>	long-bracted frog orchid	S2	WFSA, RSA

Table 4.6 Managed and Special Areas Within 5 km of the WFSA

Name	Area Type	Description
Berryton Cave	ESA	One of the longest caves in the province (302m), this site was a major roosting/hibernation location in NB for bats prior to 2011 when the lethal white-nose syndrome was determined to be present (Vanderwolf et al. 2012).
Crooked Creek Valley	ESA	This is the only known location for long-tailed shrew (<i>Sorex dispar</i>) in New Brunswick. Located east of the WFSA, within the Caledonia Gorge PNA.
Mount Zackie Jonah	ESA	A steep sloped mountain home to several rare species of plants, located west of the WFSA.
Wiener's Marsh Ducks Unlimited	Managed Area	Ducks Unlimited managed freshwater marsh located west of the WFSA.
Note: PNA = Protected Natural Area; NWA = National Wildlife Area; ESA = Environmentally Significant Area		

Fundy National Park is located approximately 3.5 km southwest of the WFSA. As one of the largest intact natural areas of Acadian forest in New Brunswick, this park attracts visitors to its more than 100 km of hiking and biking trails, as well as front-country campgrounds and backcountry sites, and a nine-hole golf course.

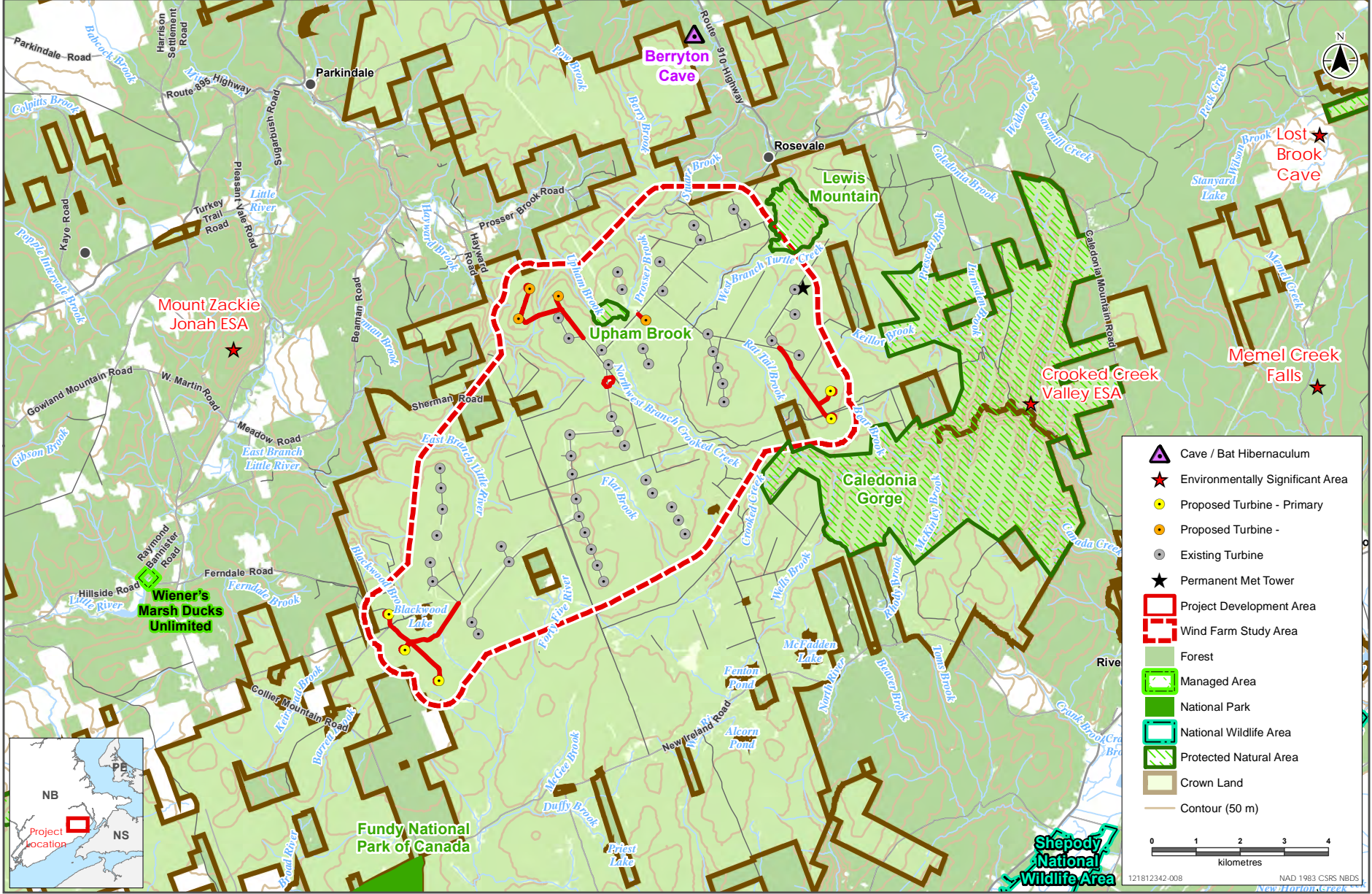
The Caledonia Gorge PNA, a 29 km² protected natural area, is located just south of the WFSA (approximately 750 m) near Turbine T4. It contains the steeply sloping Crooked Creek Gorge and nearby brooks, which are dominated by large, old hardwood forests and old-growth red spruce. This protected area contains rare species of lichens and mosses. In addition, the Crooked Creek Valley ESA within the Caledonia Gorge PNA is one of only two known locations within New Brunswick for long-tailed shrew (*Sorex dispar*), a rare insectivore that lives on boulder slopes and is discussed further in 4.3.3.3 (COSEWIC 2006b). It is unlikely that the Project will have an adverse impact on this area.

The Upham Brook PNA, a 26.9 ha protected natural area, is located within the WFSA, and the Lewis Mountain PNA, a 1.3 km² protected natural area is located within and northeast of the WFSA. These areas are ranked as Class II under the *Protected Natural Areas Act*, which prohibits construction activities within these areas.

Berryton Cave ESA is a known hibernaculum located 3.5 km north of the WFSA, used by several species of bats, including several SAR, and discussed further in Section 4.3.3.4 and 4.3.3.5.

Mount Zackie Jonah ESA is a mature sugar maple and beech-dominated slope located 4.6 km west of the WFSA. There are 10 recorded vascular plant SOCC in this area.

Wiener's Marsh, a Ducks Unlimited freshwater marsh wetland, is located 5 km west of the WFSA. Given its location, this wetland is not likely to interact with the Project.



Sources: Base Data - provided by the Government of New Brunswick.

4.3.3 Wildlife

The WFSA supports animals that are typical of forests in Albert County and across much of southern New Brunswick. Details on the fauna of the WFSA, including information on the birds, mammals, reptiles and amphibians, are presented below.

4.3.3.1 Birds

Based on a review of available information, including past and current on-site surveys, the WFSA hosts few bird SAR or SOCC; the same sources indicate that the WFSA does not host large concentrations of staging or wintering birds, is not likely located on a major migration route and is not near any nesting bird colonies, such as a heronry. The WFSA forest habitat supports a breeding population of forest species that are typical of the variety of habitats of this and the surrounding areas, including birds considered SAR and SOCC. The most notable potential migration route is the movement of scoter species during spring migration more than 10 km east of the WFSA, along the Bay of Fundy.

Breeding, migration and wintering bird surveys were conducted over multiple seasons between 2006 and 2010 in support of the assessments of Kent Hills 1 and Kent Hills 2. Post-construction casualty studies (2009-2012) and breeding bird surveys (2009 and 2011) were also conducted, following commissioning of each phase (Table 4.5).

Table 4.5 Bird Monitoring Studies Completed at Kent Hills Wind Farm

Bird Monitoring Studies	Years Completed
Wintering Birds	2007, 2017
Breeding Birds	2006, 2009, 2011, 2017
Bird Migration	2006, 2007, 2008 (fall only), 2009 (spring only), 2017
Diurnal Raptor Passage Migration	2006, 2007, 2008, 2017
Post-construction Breeding Bird Monitoring and Casualty Searches	2009, 2010, 2011, 2012

A field program was initiated in 2017 to collect data on birds in the WFSA, with emphasis on migrating and breeding birds. A migration monitoring program was undertaken in the spring (April-May) of 2017 and is also planned for the fall (August-October). Breeding bird surveys were conducted within the WFSA in June 2017.

Breeding Birds

The WFSA interacts with four Maritime Breeding Bird Atlas (MBBA) map squares: 20LR46, 20LR47, 20LR56 and 20LR57. The most recent breeding bird atlas (2006-2010) identified 90 avian species possibly, probably, or confirmed breeding within these four map squares. The squares that overlap the WFSA include portions adjacent to the Bay of Fundy coastline, including wetland habitats not found in the WFSA. Some coastal species found breeding in these map squares are therefore not likely to be found in the WFSA.

Environmental Characteristics

Kent Hills 1 Breeding Surveys

For Kent Hills 1, Stantec conducted breeding surveys in 2006, consisting of point counts at 20 locations, and atlassing surveys between count locations over two days in mid-June, and again in late June in support of the original wind development. These surveys were repeated in 2009 following construction of the first phase of the wind farm. A cumulative total of 55 species of birds were detected over the two years, including one SAR (rusty blackbird). Most resident breeding birds were heard or observed foraging at or below tree height (<40 m).

Raptors recorded in or near the WFSA during the breeding season included American kestrel (*Falco sparverius*) and red-tailed hawk (*Buteo jamaicensis*). No raptor nests were found in the WFSA, though both species recorded are known to breed in the region.

Kent Hills 2 Breeding Surveys

For Kent Hills 2, an additional 20 point count location were surveyed in the vicinity of the new proposed turbine locations (E-Row, G-Row and H-Row turbines) in 2009 (pre-construction) and surveyed again one and two years following construction (2011 and 2012). Including incidental observations, 41 species were recorded in 2009, 34 in 2011 and 37 in 2012, for a cumulative total of 57 species over the three years with 24 species recorded in all three years. Only one SAR species was recorded on two occasions during these surveys (eastern wood-pewee, COSEWIC-listed as *threatened*); however, it was not considered SAR at the time of the surveys. Olive-sided flycatcher and Canada warbler (listed under the SARA as *threatened*) were recorded once each during area searches in 2009. There was also an incidental observation of a single common nighthawk (listed under SARA as *threatened*) in 2009.

Kent Hills 3 Breeding Surveys (2017)

The protocol and results of the 2017 breeding bird surveys are presented in Appendix E. June 2017 breeding bird surveys, consisting of 10-minute, fixed-radius point counts, were conducted at 36 stations over three mornings near the proposed turbine locations during June 2017 (Appendix E). These surveys identified a total of 58 species (including species observed incidentally between surveys and during other terrestrial surveys in June). The surveys identified the presence of four SAR (common nighthawk, eastern wood-pewee, olive-sided flycatcher and Canada warbler) and one SOCC (red crossbill). Species observed during the point count surveys, and their highest breeding evidence (available as collected in the field or from the MBBA), including species observed incidentally are presented in Table 4.7. A nightjar survey consisting of 10-minute auditory surveys (i.e. 5 minutes of silent listening followed by 5 minutes with playbacks) at six point counts was also completed on June 27, 2017; a single common nighthawk was recorded.

Environmental Characteristics

Table 4.7 Bird Species Observed during 2017 Breeding Bird Surveys, Including Incidental Observations

Common Name	Scientific Name	SARA ¹	COSEWIC ²	NB SARA ³	AC CDC S-Rank ⁴	Highest Observed Breeding Status ⁵
ruffed grouse	<i>Bonasa umbellus</i>	-	-	-	S5	Confirmed
common nighthawk	<i>Chordeiles minor</i>	Schedule 1, threatened	threatened	threatened	S3B,S4M	Possible
sharp-shinned hawk	<i>Accipiter striatus</i>	-	not at risk	-	S4B,S5M	Possible
broad-winged hawk	<i>Buteo platypterus</i>	-	-	-	S5B,S5M	Possible
red-tailed hawk	<i>Buteo jamaicensis</i>	-	not at risk	-	S4	Confirmed
great horned owl	<i>Bubo virginianus</i>	-	-	-	S4	Possible
barred owl	<i>Strix varia</i>	-	-	-	S5	Possible
yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	-	-	-	S5B,S5M	Possible
downy woodpecker	<i>Picoides pubescens</i>	-	-	-	S5	Probable
hairy woodpecker	<i>Picoides villosus</i>	-	-	-	S5	Confirmed
northern flicker	<i>Colaptes auratus</i>	-	-	-	S5B,S5M	Confirmed
American kestrel	<i>Falco sparverius</i>	-	-	-	S4B,S4S5M	Probable
olive-sided flycatcher	<i>Contopus cooperi</i>	Schedule 1, threatened	threatened	threatened	S3B,S3M	Possible
eastern wood-pewee	<i>Contopus virens</i>	no schedule, no status	special concern	special concern	S4B,S4M	Possible
yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	-	-	-	S4S5B,S5M	Possible
alder flycatcher	<i>Empidonax alnorum</i>	-	-	-	S5B,S5M	Possible
least flycatcher	<i>Empidonax minimus</i>	-	-	-	S5B,S5M	Possible
blue-headed vireo	<i>Vireo solitarius</i>	-	-	-	S5B,S5M	Probable
red-eyed vireo	<i>Vireo olivaceus</i>	-	-	-	S5B,S5M	Confirmed
blue jay	<i>Cyanocitta cristata</i>	-	-	-	S5	Confirmed



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Table 4.7 Bird Species Observed during 2017 Breeding Bird Surveys, Including Incidental Observations

Common Name	Scientific Name	SARA ¹	COSEWIC ²	NB SARA ³	AC CDC S-Rank ⁴	Highest Observed Breeding Status ⁵
American crow	<i>Corvus brachyrhynchos</i>	-	-	-	S5	Possible
black-capped chickadee	<i>Poecile atricapillus</i>	-	-	-	S5	Confirmed
red-breasted nuthatch	<i>Sitta canadensis</i>	-	-	-	S5	Probable
brown creeper	<i>Certhia americana</i>	-	-	-	S5	Possible
winter wren	<i>Troglodytes hiemalis</i>	-	-	-	S5B,S5M	Possible
golden-crowned kinglet	<i>Regulus satrapa</i>	-	-	-	S5	Confirmed
ruby-crowned kinglet	<i>Regulus calendula</i>	-	-	-	S4B,S5M	Possible
eastern bluebird	<i>Sialia sialis</i>		Not at Risk		S4B,S4M	Confirmed
Swainson's thrush	<i>Catharus ustulatus</i>	-	-	-	S5B,S5M	Possible
hermit thrush	<i>Catharus guttatus</i>	-	-	-	S5B,S5M	Possible
American robin	<i>Turdus migratorius</i>	-	-	-	S5B,S5M	Confirmed
cedar waxwing	<i>Bombycilla cedrorum</i>	-	-	-	S5B,S5M	Probable
purple finch	<i>Haemorhous purpureus</i>	-	-	-	S4S5B,SUN,S5M	Probable
red crossbill	<i>Loxia curvirostra</i>	-	-	-	S3	Probable
American goldfinch	<i>Spinus tristis</i>	-	-	-	S5	Probable
ovenbird	<i>Seiurus aurocapilla</i>	-	-	-	S5B,S5M	Probable
black-and-white warbler	<i>Mniotilta varia</i>	-	-	-	S5B,S5M	Probable
Nashville warbler	<i>Oreothlypis ruficapilla</i>	-	-	-	S5B,S5M	Possible
mourning warbler	<i>Geothlypis philadelphia</i>	-	-	-	S4B,S5M	Possible
common yellowthroat	<i>Geothlypis trichas</i>	-	-	-	S5B,S5M	Confirmed



Environmental Characteristics

Table 4.7 Bird Species Observed during 2017 Breeding Bird Surveys, Including Incidental Observations

Common Name	Scientific Name	SARA ¹	COSEWIC ²	NB SARA ³	AC CDC S-Rank ⁴	Highest Observed Breeding Status ⁵
American redstart	<i>Setophaga ruticilla</i>	-	-	-	S5B,S5M	Probable
northern parula	<i>Setophaga americana</i>	-	-	-	S5B,S5M	Probable
magnolia warbler	<i>Setophaga magnolia</i>	-	-	-	S5B,S5M	Possible
bay-breasted warbler	<i>Setophaga castanea</i>	-	-	-	S4B,S4S5M	Possible
blackburnian warbler	<i>Setophaga fusca</i>	-	-	-	S5B,S5M	Confirmed
chestnut-sided warbler	<i>Setophaga pensylvanica</i>	-	-	-	S5B,S5M	Possible
black-throated blue warbler	<i>Setophaga caerulescens</i>	-	-	-	S5B,S5M	Confirmed
yellow-rumped warbler	<i>Setophaga coronata</i>	-	-	-	S5B,S5M	Confirmed
black-throated green warbler	<i>Setophaga virens</i>	-	-	-	S5B,S5M	Confirmed
Canada warbler	<i>Cardellina canadensis</i>	Schedule 1, threatened	threatened	threatened	S3B,S3M	Possible
chipping sparrow	<i>Spizella passerina</i>	-	-	-	S5B,S5M	Possible
clay-colored sparrow	<i>Spizella pallida</i>	-	-	-	SNA	Observed
song sparrow	<i>Melospiza melodia</i>	-	-	-	S5B,S5M	Probable
Lincoln's sparrow	<i>Melospiza lincolni</i>	-	-	-	S4B,S5M	Possible
swamp sparrow	<i>Melospiza georgiana</i>	-	-	-	S5B,S5M	Confirmed
white-throated sparrow	<i>Zonotrichia albicollis</i>	-	-	-	S5B,S5M	Confirmed
dark-eyed junco	<i>Junco hyemalis</i>	-	-	-	S5	Confirmed
rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	-	-	-	S4B,S4M	Probable



Environmental Characteristics

Table 4.7 Bird Species Observed during 2017 Breeding Bird Surveys, Including Incidental Observations

Common Name	Scientific Name	SARA ¹	COSEWIC ²	NB SARA ³	AC CDC S-Rank ⁴	Highest Observed Breeding Status ⁵
<p>Notes:</p> <p>Species at Risk are presented in bold text.</p> <p>1 SARA – Federal <i>Species At Risk Act</i></p> <p>2 COSEWIC - Committee on the Status of Endangered Wildlife in Canada</p> <p>3 New Brunswick <i>Species At Risk Act</i></p> <p>4 AC CDC – Atlantic Canada Conservation Data Centre S-Ranks: S1 = critically imperiled, S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, SNA = not applicable (typically exotic species) S#S# = a numeric range rank used to indicate any range of uncertainty about the status of the species or community B= Breeding, N = Nonbreeding, M = Migrant (AC CDC 2017a).</p> <p>5 From Maritime Breeding Bird Atlas or as collected in the field.</p>						

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Species richness, defined as the number of different species recorded within a habitat type, was determined for each of the habitat types sampled within the WFSAs (Table 4.8). Due to the highly-fragmented habitat within the WFSAs, it was not feasible to obtain a sufficient number of habitat replicate points to calculate density for each species.

Due to the highly-fragmented nature of the habitats within the WFSAs, birds were recorded in patches of habitat which differed from the habitat where the observer was performing a survey. Because of this, Table 4.8 presents species richness for habitat types in which no point counts were dedicated.

Table 4.8 Land Classifications Sampled During Point Count Surveys, and Species Richness

Land classification	Breeding Bird Point Counts Completed	Area within WFSAs (ha)	Breeding bird Observations (#)	Species Richness
Anthropogenic	3	10.34	1	1
Forest	61	6,648.32	412	55
Regenerating-sapling Hardwood	2	204.54	28	19
Regenerating-sapling Mixedwood	1	94.24	0	0
Regenerating-sapling Softwood	4	301.26	32	18
Young-immature Hardwood	9	575.06	38	15
Young-immature Mixedwood	0	49.7	0	0
Young-immature Softwood	2	273.77	15	12
Mature-overmature Hardwood	29	2780.94	213	38
Mature-overmature Mixedwood	5	388.56	10	8
Mature-overmature Softwood	3	575.14	33	19
Recent harvest (≤ 6 years)	6	1,405.11	43	19
Industrial	1	74.45	3	3
Wetland	0	239.33	10	8
Bog	0	14.04	0	0
Fen	0	10.68	0	0
Hardwood Treed Swamp	0	0.06	0	0
Shrub Swamp	0	64.79	0	0



Table 4.9 Wintering Birds within the WFSA – 2007

Common Name	Scientific Name	Number Observed by Survey Dates (2007)					
		Feb 1	Feb 17	Mar 2	Mar 14	Apr 2	Total
northern shrike	<i>Lanius excubitor</i>		1	1			2
gray jay	<i>Perisoreus canadensis</i>	2				2	4
blue jay	<i>Cyanocitta cristata</i>	2	2	10	1	7	22
common raven	<i>Corvus corax</i>	1	17	8	4	9	39
horned lark	<i>Eremophila alpestris</i>			1			1
black-capped chickadee	<i>Poecile atricapillus</i>	7	1	19	16	43	86
boreal chickadee	<i>Poecile hudsonica</i>		1	2		6	9
red-breasted nuthatch	<i>Sitta canadensis</i>					2	2
white-breasted nuthatch	<i>Sitta carolinensis</i>					1	1
brown creeper	<i>Certhia americana</i>			1		4	5
golden-crowned kinglet	<i>Regulus satrapa</i>	1	2			3	6
American goldfinch	<i>Turdus migratorius</i>	1					1
fox sparrow	<i>Passerella iliaca</i>					1	1
song sparrow	<i>Melospiza melodia</i>					2	2
dark-eyed junco	<i>Junco hyemalis</i>					29	29
pine grosbeak	<i>Pinicola enucleator</i>	1		2			3
purple finch	<i>Carpodacus purpureus</i>			1		3	4
red crossbill	<i>Loxia curvirostra</i>					1	1
white-winged crossbill	<i>Loxia leucoptera</i>	25	2				27
common redpoll	<i>Carduelis flammea</i>			2			2
pine siskin	<i>Carduelis pinus</i>			3			3
American black-backed woodpecker	<i>Carduelis tristis</i>		1				1
Totals		49	27	65	44	148	333

Flock sizes were generally small, with a few exceptions. Three species that were detected infrequently, but in elevated numbers, include white-winged crossbill, Canada goose, and dark-eyed junco, with single flock sizes of 25, 20, and 20, respectively. The most numerous and frequently detected species were black-capped chickadee and common raven. Black-capped chickadee were detected in 46% of the surveys, in flock sizes of 1 to 10 birds. Seven species made up 78% of individuals counted during the 15 minute surveys, including the five species mentioned above, hairy woodpecker, and blue jay. Nearly 50% of the 31 species detected during the surveys were detected in only one 15-minute survey. No birds were detected during seven of the surveys throughout the winter monitoring period.

Kent Hills 3 Wintering Bird Surveys (2017)

Surveys were conducted twice in 2017, on February 21 and March 10. They were 10 minutes in duration, and were conducted at 14 locations within the WFSA, as close as possible to the PDA depending on road access, although only 10 of the 14 were surveyed on any one day (Figure 4.10). Birds recorded between surveys were also noted; however, these observations did not increase the species list. All birds reported during the 2017 winter surveys are listed in Table 4.10. A total of 63 individuals of 10 species were detected over 20 10-minute surveys.

Table 4.10 Wintering Birds within the WFSA – 2017

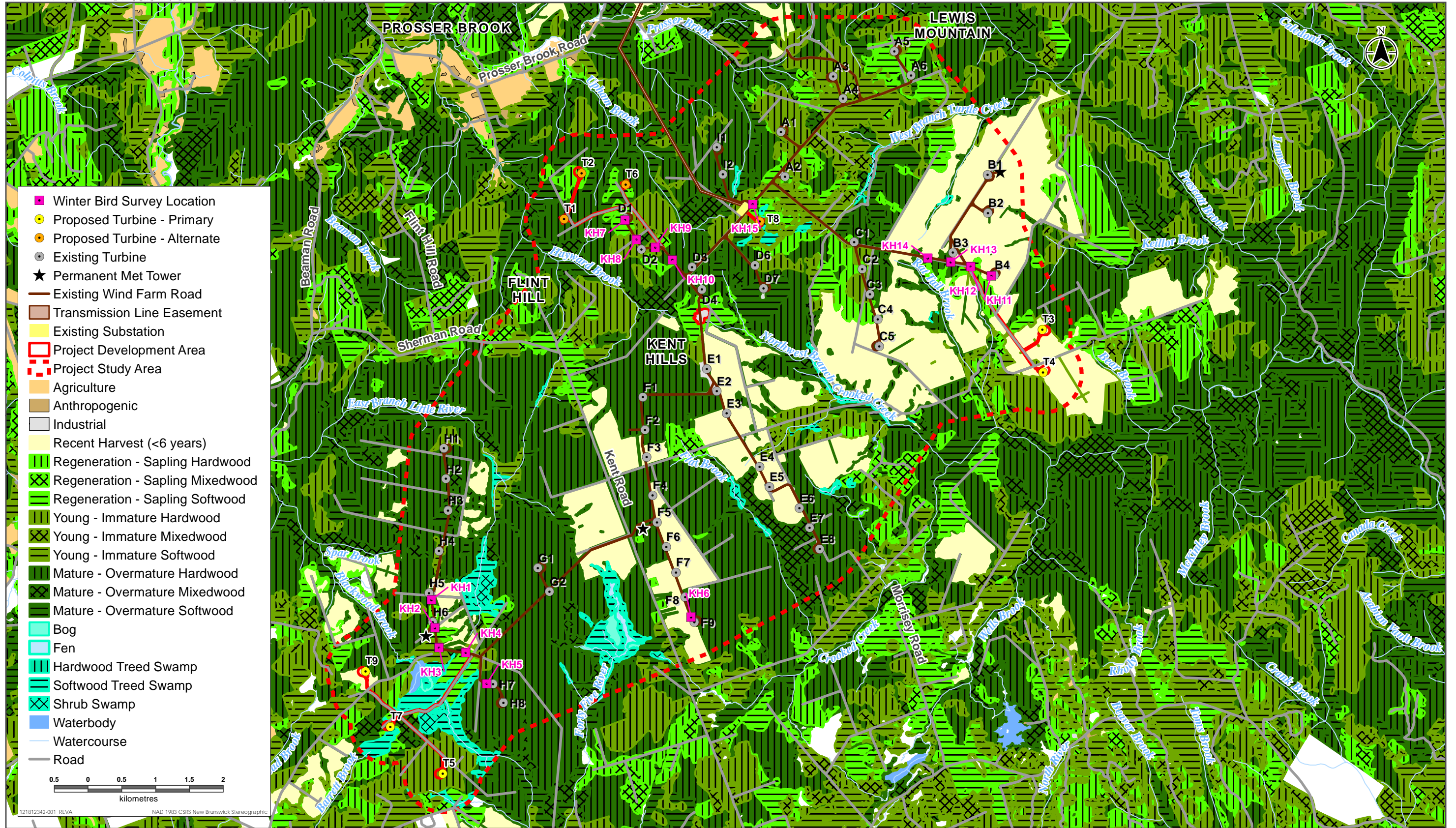
Common Name	Scientific Name	Survey Date	
		Feb. 21	Mar. 10
bald eagle	<i>Haliaeetus leucocephalus</i>	1	0
gray jay	<i>Perisoreus canadensis</i>	0	1
American crow	<i>Corvus brachyrhynchos</i>	4	4
black-capped chickadee	<i>Poecile atricapillus</i>	9	5
red-breasted nuthatch	<i>Sitta canadensis</i>	0	2
white-breasted nuthatch	<i>Sitta carolinensis</i>	1	0
golden-crowned kinglet	<i>Regulus satrapa</i>	0	3
cedar waxwing	<i>Bombycilla cedrorum</i>	11	9
purple finch	<i>Haemorhous purpureus</i>	0	1
American goldfinch	<i>Spinus tristis</i>	12	0
Total		38	25

Three species made up 73% of individuals counted during the 10 minute surveys, including black-capped chickadee, cedar waxwing, and American goldfinch. Flock sizes were generally small. The most numerous species observed was cedar waxwing, with single flock sizes of 9 to 11 individuals. With a total of 13 detections, the most frequently observed species was black-capped chickadee.

Although they will occasionally range across the general area, most of the landbirds that inhabit the WFSA during the winter will remain close to vegetation cover, which provides shelter, food and protection from predators. Few birds (e.g. woodpeckers, chickadees, nuthatches, grouse) will use the open clear cut habitats and deciduous forest of the WFSA during the winter.

Bird SAR and SOCC detected in the WFSA during the winter surveys include bald eagle, listed as *endangered* under NB SARA, and pine grosbeak ranked by the AC CDC as S2B, S4S5N, S4S5M. A single bald eagle was observed flying over the WFSA during a survey in February 2017. A total of three pine grosbeak were detected in mature softwood stands at two locations during surveys in 2007.





Sources: Government of New Brunswick

Service Layer Credits:

2017 Winter Bird Survey Locations

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Migrant Birds

Migration monitoring at the Kent Hills Wind Farm was conducted over three years from 2006 through 2008 in support of the previous phases of the Kent Hills Wind Farm. These surveys identified a total of 95 species, predominantly landbirds. The majority of the individuals observed were foraging, resting, or flying within 40 m of the ground. Observations of waterfowl and waterbirds were rare. Diurnal raptor surveys were also conducted during the migration monitoring in spring and fall of 2006 and 2007 to observe the movements of raptors through the site. No concentrations of raptors were observed during the surveys, with a maximum of three individuals of a single species noted at one time. Seventy-six individual raptors were observed during the surveys, many of which were likely repeat observations of locally breeding individuals.

Information collected on the bird migration in the area includes the abundance and diversity of birds observed, the relative height that birds flew through the area, their direction and their general behaviour.

Kent Hills 1 Spring and Fall Migration

Surveys were conducted on 11 separate days within the spring migration period between April 23 and May 26, 2007, and on six separate days within the fall migration between early September and mid-October, 2006. Surveys began at the site in the early morning, at or just after dawn (usually 30 minutes before scheduled sunrise) to target migrating songbirds. As well as early morning surveys, spring and fall migration monitoring included additional surveys around midday to observe possible raptor migration. The detailed results from the monitoring program are presented in Jacques Whitford (2007a).

Migration surveys in fall 2006 and spring 2007 recorded a total of 94 species; the majority of birds observed (95% of individual birds) were within 40 m of the ground (Table 4.11). Only 5% of the birds were observed flying at 40 – 100 m. Out of a total of 6,114 birds observed, less than 1% were flying above 100 m. The most frequently recorded birds in the WFSAs were white-throated sparrow (*Zonotrichia albicollis*), dark-eyed junco, American robin (*Turdus migratorius*), and hermit thrush (*Catharus guttatus*). Common grackle (*Quiscalus quiscula*) were the third most numerous species after white-throated sparrow and hermit thrush, due to two large flocks. Waterbird and waterfowl observations were rare, with only two records of double-crested cormorant (*Phalacrocorax auritus*) and four single bird observations of waterfowl in the spring, and a single flock of Canada geese in the fall.

The flying heights of the bird groups observed during surveys are summarized in Table 4.11. Birds observed within 10 m of the ground were considered to be at "Tree" (T) height; those flying between 10 m and 40 m above ground were considered to be "Above Tree" (AT) height; those flying between 40 m and 100 m above ground were considered to be "Well Above Tree" (WAT) height; and those birds observed flying above 100 m were characterized as "High" (H).

Table 4.11 Relative Heights of Birds Observed during Migration, 2006/2007

Bird Group	Height ¹				N ²
	T	AT	WAT	H	
Gamebirds	100% (100%)	-	-	-	60 (85)
Landbirds	96% (87%)	2% (9%)	2% (9%)	-	1,771 (5,832)
Owls	100% (100%)	-	-	-	25 (47)
Raptors	31% (30%)	22% (23%)	22% (22%)	25% (25%)	64 (73)
Shorebirds	100% (100%)	-	-	-	6 (8)
Waterbirds	-	-	100% (100%)	-	2 (28)
Waterfowl	40% (5%)	-	60% (95%)	-	5 (41)
All species	93% (86%)	3% (9%)	3% (5%)	1% (<1%)	1,933 (6,114)
¹ Data presented are percentage of observations (percentage of individual birds) observed in each area. T = Tree height, flying below 10 m; AT = Above Tree height, flying between 10 m – 40 m; WAT = Well Above Tree height, flying between 40 m and 100 m; H = High, flying above 100 m. ² Total number of observations (total number of individual birds).					

Very little purposeful flight indicating migration was observed overall. Compared to the spring migration, visible migration appeared larger in the fall. Much of the spring migration was unseen, likely occurring at night when birds tend to fly hundreds of metres above the ground on their way to their northern breeding grounds. Evidence of nocturnal migration observed during early morning surveys was infrequent or of low magnitude. Spring flock size of migrants ranged from 1 to 10 individuals; however, thrush and common grackle migration on two mornings in the fall at one survey location had up to several hundred birds. A slight preference for survey site 6 was noted as a staging and/or foraging area for migrating and local birds. Site 6 is near three small watercourses, including one near a regenerating clear cut. Monitoring results suggest that if there are migrants passing through the WFSa, they are doing so at night.

Diurnal (mid-day) surveys were conducted in the spring and fall of 2006 to observe the movements of raptors through the WFSa. Mid-day conditions produce updrafts, or thermals, which raptors use to travel effortlessly during migration. There were no concentrations of raptors observed during the surveys, with no more than three individuals of a single species noted at one time. A total of 76 raptors were seen during the fall or spring surveys, many of which were repeat observations of local breeders. A number were noted flying at blade height through the WFSa; based on observations it is believed many of these were local birds hunting. All diurnal raptors avoid hunting high up during heavy precipitation or during poor visibility, reducing the potential for interaction with turbine blades during periods of poor visibility.

Anecdotal information from naturalists and birders in the region suggest that overland migration of black scoter (*Melanitta nigra*), a sea duck, may occur in the general vicinity of the Project (NatureNB 2017). Volunteer birders conducting nocturnal owl surveys in southern NB have occasionally recorded black scoter flying overhead. The Rocher Bay area near Waterside, on the Fundy Coast is a staging



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point for black scoter, and it is believed that they may fly overland towards the Petitcodiac River and beyond to the Northumberland Strait (D. Christie, pers. comm. in Jacques Whitford 2007a).

To determine if migration of black scoter occurs near Kent Hills, spring migration surveys were conducted at two locations over five nights near Kent Hills in the hours after sunset in mid to late April 2007, which corresponds with the peak of scoter migration in the spring, up the Fundy Coast. Seaducks were recorded on two nights. long-tailed ducks (5 birds) were recorded near Caledonia Mountain on April 20, and a lone individual was recorded on April 25. Black scoter was recorded at each of the two locations surveyed on April 25. A few sparse flocks were recorded at varying heights (AT, WAT and H), totaling 10 birds heard during the nocturnal survey near the confluence of Sherman Road and Kent Road, and a single black scoter was recorded west of survey site 10 (located near Turbine A5) at the northern extent of the site. Therefore, there is some overland movement of black scoters and long-tailed ducks in the Kent Hills area.

Kent Hills 2 Supplemental Migration Studies

As follow up to the 2006 and 2007 bird monitoring programs, supplemental migration bird surveys were completed in fall 2008 and spring 2009, focusing on the southern (G-row and H-Row) part of the expanded wind farm. Seven stationary watch count locations were identified in areas that provide a better view of the sky in the western end of the WFSA as compared to the areas covered by surveys conducted in support of the original EIA. Stationary surveys ten minutes in duration were conducted at each of the seven survey stations in fall 2008 and spring 2009.

Fall 2008

Fall migration activity was monitored during 14 hours of 10-minute stationary watch counts (30 hours on site) over 12 individual survey days conducted weekly from August 18 – October 30, 2008. A total of 56 species were identified during the 2008 fall migration period which fall within five bird group categories: gamebirds, waterfowl, raptors, shorebirds, and landbirds. No waterbirds or owl species were observed during the surveys.

Bird observations by flight height are summarized in Table 4.12, presented as a percent of the total, number of observations and total number of individuals.

Table 4.12 Fall Migration Flight Height Behaviour, 2008

Bird Group	Height ¹				N ²
	T (1-10m)	AT (10-40m)	WAT (40-100m)	H (>100m)	
Gamebirds	100%(100%)	-	-	-	1 (1)
Landbirds	89%(82%)	11%(18%)	-	-	445 (981)
Owls	-	-	-	-	
Raptors	50%(50%)	50%(50%)	-	-	4 (4)
Shorebirds	100%(100%)	-	-	-	1 (1)
Waterbirds	-	-	-	-	



Table 4.12 Fall Migration Flight Height Behaviour, 2008

Bird Group	Height ¹				N ²
	T (1-10m)	AT (10-40m)	WAT (40-100m)	H (>100m)	
Waterfowl	-	100%(100%)	-	-	1 (1)
All species	88%(82%)	12%(18%)	-	-	452 (988)
¹ Data presented are percentage of observations (percentage of individual birds) observed in each area. T = Tree height, flying below 10 m; AT = Above Tree height, flying between 10 m – 40 m; WAT = Well Above Tree height, flying between 40 m and 100 m; H = High, flying above 100 m.					
² Total number of observations (total number of individual birds).					

Overall, observations of species present and flight heights at the Kent Hills site, made during the 2008 fall migration were consistent with those made in 2006/2007. SAR noted during the surveys included a single record of Canada warbler, and three eastern wood-pewee.

The majority of observations were landbirds, fairly evenly distributed among the seven point count sites. All of the sightings were of birds either not flying (foraging or loafing) or flying at or below tree top levels. The most commonly observed landbird species was white-throated sparrow, all of which were observed foraging singly or in small groups at T height. One sighting of one individual gamebird (ruffed grouse) was made. This individual was observed at ground level, and would be a year-round resident in the area. There were only four sightings involving four individual raptors during the 2009 fall survey. Three species were noted: American kestrel (two sightings), red-tailed hawk, and sharp-shinned hawk. These birds appeared to be foraging within the WFSA, rather than actively migrating through. No owl sightings were made during the fall migration survey period. Only one shorebird, an American woodcock, was observed during the fall migration period. This individual was observed at ground level, and was likely staging in the area. One sighting of one individual waterfowl (Canada goose) was made. The bird was flying over the WFSA at AT height.

Due to the low numbers of birds, it does not appear as though the area is a major fall migration route for raptors or waterfowl, which is consistent with the conclusions of the 2006 and 2007 bird surveys.

Spring 2009

Spring migration activity was monitored for a total of five hours and 50 minutes over five survey days from May 7 to June 4, 2009. A total of 42 species were identified during the 2009 spring migration period which fall within four bird group categories: gamebirds, landbirds, raptors, and shorebirds. No waterfowl, waterbird, or owl species were observed during the surveys.

Bird observations by flight height are presented in Table 4.13 as a percent of the total, number of observations and total number of individuals.



Table 4.13 Spring Migration Flight Height Behaviour, 2009

Bird Group	Height ¹				N ²
	T (1-10m)	AT (10-40m)	WAT (40-100m)	H (>100m)	
Gamebirds	100%(100%)	-	-	-	10 (10)
Landbirds	94%(93%)	6%(7%)	-	-	270 (384)
Owls	-	-	-	-	-
Raptors	100%(100%)	-	-	-	1 (1)
Shorebirds	-	100%(100%)	-	-	1 (1)
Waterbirds	-	-	-	-	-
Waterfowl	-	-	-	-	-
All species	94%(93%)	6%(7%)	-	-	282 (396)
¹ Data presented are percentage of observations (percentage of individual birds) observed in each area. T = Tree height, flying below 10 m; AT = Above Tree height, flying between 10 m – 40 m; WAT = Well Above Tree height, flying between 40 m and 100 m; H = High, flying above 100 m. ² Total number of observations (total number of individual birds).					

Overall, observations of species present and flight heights in the WFSA, made during the 2009 spring migration were consistent with those made in 2006. SAR noted during the surveys included a single record of Canada warbler and three each of eastern wood-pewee and evening grosbeak.

Most of the observations were of resident species and local breeding birds. Ten sightings of ten individual gamebirds (ruffed grouse) were made at ground level. The majority of observations were landbirds, fairly evenly distributed among the seven point count sites. Most of the sightings were of landbirds either not flying (foraging or loafing) or flying at or below tree top levels. The most commonly observed landbird species was White-throated Sparrow, all of which were observed foraging singly or in small groups at T height. One sighting of one individual raptor (American kestrel) was made during the spring migration period at Kent Hills. This bird appeared to be foraging within the WFSA, rather than actively migrating through. No owl sightings were made during the spring migration survey period.

Due to the low numbers of birds, it does not appear as though the study site is a major spring migration route for raptors, which is consistent with the conclusions of the 2006 and 2007 bird surveys. Only one shorebird, a Wilson's snipe, was observed during the fall migration period. This individual was observed at AT height, and appeared to be actively migrating through the WFSA.

Kent Hills 3 Spring Migration Monitoring

The protocol and results of the 2017 migration monitoring program are presented in Appendix F. Surveys were conducted on 11 separate days within the spring migration period between April 18 and May 29, 2017, for a total of 16 hours and 30 minutes. Surveys began at the site in the early morning, at or just after dawn (usually 30 minutes before scheduled sunrise) to target migrating passerines. As well as early morning surveys, spring migration monitoring included additional four-hour watch surveys to

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observe possible raptor migration. The detailed results from the monitoring program are presented in Appendix F.

The flying heights of the bird groups observed during surveys are summarized in Table 4.14. Modifications to the height categories were made in consideration of the dimensions of the proposed new wind turbines. Birds observed within 10 m of the ground were considered at Tree (T) level; those from 10 to 60 m of the ground were considered to be “Above Tree” (AT) height; those flying between 60 m – 120 m above ground were considered to be “Well Above Tree” (WAT) height; those birds observed flying 120-180 m were characterized as “High” (H) and those above 180 m were classified as very high (VH). WAT and H height classifications correspond with the blade sweep of the turbines proposed for Kent Hills 3 Wind Project.

Migration surveys recorded a total of 63 species, and the majority of birds observed (96% of individual birds) were within 60 m of the ground. Three percent of the birds were observed flying at 60 m to 180 m. Out of a total of 1,115 birds observed, less than one percent were observed flying above 180 m. The most frequently recorded birds in the WFSA were American robin (*Turdus migratorius*) white-throated sparrow (*Zonotrichia albicollis*), dark-eyed junco (*Junco hyemalis*), and winter wren (*Troglodytes hiemalis*). In terms of abundance, hermit thrush (*Catharus guttatus*) were the fourth most numerous species after American robin, white-throated sparrow, and dark-eyed junco. Waterfowl observations were rare, with four records of American black duck (*Anas rubripes*), two records of small flocks of Canada goose (*Branta canadensis*), and single record of mallard (*Anas platyrhynchos*). A single record of common loon (*Gavia immer*) was the only waterbird.

Table 4.14 Relative Heights of Birds Observed during Spring Migration, 2017

Bird Group	Height ¹					N ²
	T	AT	WAT	H	VH	
Gamebirds	100% (100%)	-	-	-	-	36 (36)
Landbirds	96% (92%)	4% (7%)	<1% (<1%)	<1% (<1%)	-	664 (989)
Owls	100% (100%)	-	-	-	-	2 (2)
Raptors	20% (21%)	16% (15%)	13% (13%)	31% (30%)	20% (21%)	45 (47)
Shorebirds	100% (100%)	-	-	-	-	15 (24)
Waterbirds	-	-	100% (100%)	-	-	1 (1)-
Waterfowl	29% (13%)	57% (38%)	-	14% (50%)	-	7 (16)
Total	91% (89%)	5% (7%)	1% (1%)	2% (2%)	1% (<1%)	770 (1,115)

¹ Data presented are percentage of observations (percentage of individual birds) observed in each area. T = Tree height, flying below 10 m; AT = Above Tree height, flying between 10 m – 60 m; WAT = Well Above Tree height, flying between 60 m and 120 m; H = High, flying between 120 m – 180 m; VH = Very High, flying above 180 m.

² Total number of observations (total number of individual birds).



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General trends are similar to the past migration monitoring conducted within the WFSA, with landbirds dominating the observations, mostly below the blade sweep. Gamebird observations were typically breeding displays of the same individuals drumming through the spring period. Raptor numbers are higher, as expected due to the increase from a one hour raptor watch to four hours. Outside of the raptor watch, ten sightings of raptors (including American kestrel, merlin, and broad-winged hawk) were made during the spring migration period at Kent Hills. The birds appeared to be foraging rather than actively migrating through the WFSA. Two owl sightings (great horned owl) were made during the spring migration survey period. Both sightings were of an individual flying at T height. Shorebirds included, a single solitary sandpiper observed at T height, and appeared to be actively migrating through the WFSA, as well as American woodcock repeatedly recorded in the same locations through the early spring. The only waterbird recorded was a common loon (*Gavia immer*) observed WAT during a raptor watch. Seven sightings of individual and pairs of waterfowl (Canada goose, American black duck, and mallard) were made. Six of the sightings were of birds flying no higher than AT height. One observation of a single Canada goose was made, with the bird flying at H height.

Post Construction Monitoring (2009-2012)

Following the construction of Kent Hills 1 in 2008, and Kent Hills 2 in 2010, collision monitoring of birds and bats at representative turbine locations was conducted annually during spring, summer, and fall (weekly over 6 months) beginning in the spring of 2009, and continuing until the fall of 2012. Summary results of the surveys for birds are presented in Table 4.15.

Table 4.15 Bird Collision Monitoring Data from 2009-2012.

Survey Year	# of turbines searched in a given week (Total turbines in Phase)	Number of Bird Carcasses Located	Estimated Total Bird Fatalities per Turbine per Year ¹	Estimated Total Bird Fatalities per MW per Year ¹
2009	20 (32)	9	0.96	0.33
2010	20 (32)	4	0.39	0.13
2011	10 (18)	4	1.41	0.47
2012	10 (18)	4	1.01	0.34

Note: MW – megawatt

¹ Mortality estimate correction has been applied, taking into account scavenger impact trial and searcher efficiency trial results; from Stantec (2013)

The number of carcasses located and the number of estimated mortalities fall within the low end of the expected range of bird mortalities at wind farms, as reported by the National Wind Coordinating Collaborative (NWCC 2010).

Based on historic and 2017 field surveys undertaken to date for the Kent Hills Wind Farm, and knowledge of migration within the region, the WFSA does not provide important habitat for migrating birds and does not host significant numbers of migrant birds during either the spring or the fall. There are no significant landform features to concentrate migrants within the WFSA. Results of migration surveys



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planned for fall 2017 will be provided as a supplemental report to confirm assumptions made based on past surveys and post-construction monitoring.

4.3.3.2 Amphibians and Reptiles

New Brunswick provides habitat for 18 species of amphibians, and 7 species of terrestrial reptiles (AC CDC 2017b). Amphibian and reptile species that could potentially occur in the WFSA are shown in Table 4.16.

Table 4.16 Amphibian and Reptile Species Potentially Occurring in the WFSA

Common Name	Scientific Name	SARA	AC CDC S-Rank ¹
Amphibians			
eastern red-backed salamander*	<i>Plethodon cinereus</i>	-	S5
spotted salamander	<i>Ambystoma maculata</i>	-	S5
blue-spotted salamander	<i>Ambystoma laterale</i>	-	S4
northern two-lined salamander	<i>Eurycea bislineata</i>	-	S5
eastern newt	<i>Notophthalmus viridescens</i>	-	S5
American toad*	<i>Bufo americanus americanus</i>	-	S5
spring peeper*	<i>Pseudacris crucifer</i>	-	S5
American bullfrog	<i>Lithobates catesbeianus</i>	-	S5
wood frog*	<i>Lithobates sylvatica</i>	-	S5
pickerel frog	<i>Lithobates palustris</i>	-	S5
green frog*	<i>Lithobates clamitans</i>	-	S5
mink frog	<i>Lithobates septentrionalis</i>	-	S5
northern leopard frog	<i>Lithobates pipiens</i>	-	S5
Reptiles			
snapping turtle	<i>Chelydra serpentina</i>	Schedule 1, special concern	S3
wood turtle	<i>Glyptemys insculpta</i>	Schedule 1, threatened	S2S3
common garter snake*	<i>Thamnophis sirtalis</i>	-	S5
smooth greensnake	<i>Liochlorophis vernalis</i>	-	S4
ring-necked snake	<i>Diadophis punctatus</i>	-	S4
red-bellied snake*	<i>Storeria occipitomaculata</i>	-	S5
* Species recorded during 2017 field studies			
¹ S1 = critically imperiled, S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, SNA = not applicable (typically exotic species), S#S# = a numeric range rank indicates any range of uncertainty about the status of the species (AC CDC 2017a).			

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Of the species listed, only the wood turtle, and common snapping turtle are SAR, and there are no SOCC. However, there are no records of snapping turtle within 5 km of the WFSA. AC CDC reports the closest record of snapping turtle to the WFSA is nearly 80 km away (AC CDC 2017b); however, COSEWIC (2008a) indicates a confirmed record located 20-25 km north of the WFSA, likely near Petitcodiac. There is relatively little potential habitat for snapping turtle within the WFSA; snapping turtle prefers slow-moving water with a soft mud bottom and dense aquatic vegetation, with established populations most often located in ponds, sloughs, shallow bays or river edges and slow streams (COSEWIC 2008a). Therefore, only wood turtle is discussed further in Section 4.3.3.5.

4.3.3.3 Mammals

The Central Uplands Ecoregion supports habitat for a number of mammals. Species recorded incidentally (observation and or sign) during 2017 terrestrial field studies of the PDA include: white-tailed deer (*Odocoileus virginianus*), moose (*Alces alces*), black bear (*Ursus americanus*) snowshoe hare (*Lepus americanus*), beaver, (*Castor canadensis*), porcupine (*Erethizon dorsatum*), red squirrel (*Tamiasciurus hudsonicus*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), eastern coyote (*Canis latrans*), raccoon (*Procyon lotor*), deer mouse (*Peromyscus maniculatus*), and star-nosed mole (*Condylura cristata*). None of these species are SAR or SOCC.

A separate subsection is provided below for a discussion on bats.

4.3.3.4 Bats

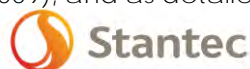
Bat species that commonly occur in New Brunswick include little brown myotis (*Myotis lucifugus*) and northern myotis (*Myotis septentrionalis*). Silver-haired bat (*Lasionycteris noctivagans*), tri-colored bat (*Pipistrellus subflavus*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*) are also known from the province, but are uncommon (AC CDC 2017b).

In late 2014, the northern myotis, little brown myotis, and tri-colored bat were listed as *endangered* under the federal *Species at Risk Act* (SARA) following the decimation of their populations due to white-nose syndrome (WNS). Since the spread of WNS, caused by the introduced fungus *Pseudogymnoascus destructans*, populations of these species have been reduced by at least 99% in New Brunswick (Parks Canada 2015).

There are no known hibernation sites such as caves or mines in the WFSA; however, Berryton Cave is located within 5 km of the WFSA to the north (see discussion in Section 4.3.2).

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 or northern myotis), and other species included hoary bat, either big brown bat or silver-haired bat, and an unidentified species.

Pre-construction monitoring of bats for the Project has been conducted in June 2017 as per NBDNR (2009), and as detailed in Appendix G, using Anabat detectors. In total, only five bat detections were



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Table 4.17 Bird SAR Within 5 km of the WFSA

Common Name	Latin Name	SARA Status	COSEWIC Status	NB SARA status	AC CDC S-Rank ¹	Highest Breeding Evidence	Data Source
common nighthawk	<i>Chordeiles minor</i>	Schedule 1, <i>threatened</i>	<i>threatened</i>	<i>threatened</i>	S3B,S4M	Possible	AC CDC, MBBA, Stantec
eastern whip-poor-will	<i>Antrostomus vociferus</i>	Schedule 1, <i>threatened</i>	<i>threatened</i>	<i>threatened</i>	S2B,S2M	Possible	MBBA
bald eagle	<i>Haliaeetus leucocephalus</i>	-	<i>not at risk</i>	<i>endangered</i>	S4	Possible	Stantec
peregrine falcon	<i>Falco peregrinus anatum/tundrius</i>	Schedule 1, <i>special concern</i>	<i>special concern</i>	<i>endangered</i>	S1B,S3M	-	AC CDC
olive-sided flycatcher	<i>Contopus cooperi</i>	Schedule 1, <i>threatened</i>	<i>threatened</i>	<i>threatened</i>	S3B,S3M	Possible	AC CDC, MBBA, Stantec Incidental
eastern wood-pewee	<i>Contopus virens</i>	no schedule, no status	<i>special concern</i>	<i>special concern</i>	S4B,S4M	Possible	AC CDC, MBBA, Stantec
bank swallow	<i>Riparia riparia</i>	no schedule, no status	<i>threatened</i>	-	S2S3B,S2S3M	-	AC CDC
barn swallow	<i>Hirundo rustica</i>	no schedule, no status	<i>threatened</i>	<i>threatened</i>	S2B,S2M	Confirmed	AC CDC, MBBA
wood thrush	<i>Hylocichla mustelina</i>	no schedule, no status	<i>threatened</i>	<i>threatened</i>	S1S2B,S1S2M	Possible	AC CDC, MBBA
Canada warbler	<i>Cardellina canadensis</i>	Schedule 1, <i>threatened</i>	<i>threatened</i>	<i>threatened</i>	S3B,S3M	-	AC CDC, MBBA, Stantec Incidental
bobolink	<i>Dolichonyx oryzivorus</i>	no schedule, no status	<i>threatened</i>	<i>threatened</i>	S3B,S3M	Probable	AC CDC, MBBA
rusty blackbird	<i>Euphagus carolinus</i>	Schedule 1, <i>special concern</i>	<i>special concern</i>	<i>special concern</i>	S3B,S3M	Possible	AC CDC, MBBA

¹ S1 = critically imperiled, S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, SNA = not applicable (typically exotic species), S#S# = a numeric range rank indicates any range of uncertainty about the status of the species or community. B= Breeding, N = Nonbreeding, M = Migrant (AC CDC 2017a).



Common nighthawk

The common nighthawk is a medium-sized bird which nests in almost all of North America, and in some parts of Central America. This species occurs in all of the Canadian provinces and territories with the exception of Nunavut (COSEWIC 2007a). The common nighthawk is considered *threatened* under Schedule 1 of SARA and under NB SARA, and is ranked as *S3B,S4M* by the AC CDC.

Common nighthawks are most commonly observed in a wide range of open, vegetation-free habitats including beaches, recently cleared forests, rocky outcrops, and grasslands (SARA 2015). The species has probably benefited from newly-opened habitats created by the forestry industry (COSEWIC 2007a). Suitable habitat for common nighthawk, particularly clear cut areas, exists within the PDA and WFSa. A single common nighthawk was observed during nightjar field studies conducted in 2017, with an additional two other records near the PDA during breeding bird point counts, however the two separate records near turbine T7 likely only represent one individual or a pair.

ECCC (2017a) reports that BBS data indicate a decline in this species Canada-wide and at a NB-wide level. The exact causes of the decline of this species are not well understood, however it may be related to the widespread decline in insect populations which this species relies upon for food. This theory is supported by the widespread declines observed among many other insectivorous bird species (COSEWIC 2007a).

Eastern whip-poor-will

The eastern whip-poor-will is a medium-sized bird which nests in deciduous and mixedwood forests in eastern North America. In Canada, this species range extends from east-central Saskatchewan to Nova Scotia (COSEWIC 2009). The Eastern whip-poor-will is considered *threatened* under Schedule 1 of SARA and under NB SARA, and is ranked as *S2B,S2M* by the AC CDC.

Eastern whip-poor-will are most commonly observed breeding in forest stands with a particular forest-structure. This species avoids both wide-open spaces and dense forests, preferring rock barrens with scattered trees, savannahs, old burns or other disturbed sites in an early to mid-stage of forest succession (COSEWIC 2009). Suitable habitat for eastern whip-poor-will exists within the WFSa. No eastern whip-poor-will were detected during field surveys in 2017.

ECCC (2017a) reports that BBS data indicate a decline in this species Canada-wide. Factors implicated in the species decline are speculative and include habitat loss and degradation, and changes in food supply related to the use of pesticides and climate change.

Bald eagle

The bald eagle is a large, distinctive raptor found across Canada, and much of North America. This species is listed as *endangered* under NB SARA and *S4* by the AC CDC; however, is considered not at risk nationally due to recovering populations.

Bald eagles build the largest nest of any bird in North America, and prefer nesting sites near open water. During winter, individuals from the resident population are often found in the southwestern part

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of the province, where they have access to the Bay of Fundy for fishing. Suitable habitat, for this species, particularly forested areas near waterbodies, is found within the WFSA. Bald eagle was recorded 10 times during spring migration field surveys in 2017; however, most were likely repeated records of one or two individuals.

ECCC (2017a) reports that BBS data indicate an increase in population of this species in Canada and at the province level in NB. The main factors which were once responsible for the species decline include trapping, shooting and poisoning of the birds, as well as the use of the pesticide DDT which contributed to reproductive failure. Continuing threats to this species include lead poisoning from ammunition in hunter-shot prey, collisions with motor vehicles and stationary structures and destruction and alteration of their habitat (Cornell Lab of Ornithology 2017).

Peregrine falcon

The peregrine falcon is a power, fast-flying raptor which hunts medium-sized birds. This species is listed as *special concern* under Schedule 1 of SARA and by COSEWIC, and *endangered* under NB SARA.

Peregrine falcons are associated with a wide range of habitats, but generally nest on cliff ledges or crevices, or less commonly, on tall building and bridges near good foraging areas. Suitable nesting habitat for this species was not noted within the PDA, but may be present in the RSA. This species was not observed during field surveys in 2017.

ECCC (2017a) reports that BBS data indicate an increase in population of this species in Canada. There were insufficient data to report a trend for New Brunswick. The primary factor causing the decline of populations of peregrine falcon was the widespread use of organochlorine pesticides which caused a decline in reproductive success (COSEWIC 2007c). Other limiting factors include human disturbance at nest sites, including harvesting of eggs or young for falconry.

Olive-sided flycatcher

The olive-sided flycatcher is a stout, medium-sized passerine which breeds in scattered locations throughout most of forested Canada (COSEWIC 2007b). This species is listed as *threatened* under Schedule 1 of SARA and NB SARA. The AC CDC lists the olive-sided flycatcher as S3B,S3M.

Olive-sided flycatchers are most often associated with open areas, where they are found foraging for flying insects, and perching in tall live trees (COSEWIC 2007b). Suitable habitat for this species is found within the WFSA, and this species was observed during field surveys in 2017, recorded incidentally on three occasions along an access road upgrade.

ECCC (2017a) reports that BBS data indicate a decline in this species Canada-wide and NB-wide. The main factors thought to be associated with the decline of olive-sided flycatchers are habitat loss and alteration (COSEWIC 2007b). Declining insect populations on breeding and wintering grounds may also be a contributing factor.

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Eastern wood-pewee

The eastern wood-pewee is a small passerine which breeds in much of Canada from Saskatchewan to the Maritimes provinces (COSEWIC 2012a). This species is ranked as *special concern* by COSEWIC and NB SARA. The AC CDC ranks this species as *S4B, S4M*.

During breeding, the eastern wood-pewee is generally associated with the mid-canopy layer within forest clearings and edges of hardwood and mixed forest stands (COSEWIC 2012a). In migration periods this species utilizes a variety of habitats including edges, and clearings (COSEWIC 2012a). Suitable habitat for this species is found within the WFSA, and this species was observed during 2017 field studies near proposed turbines T1 and T9.

ECCC (2017a) reports that BBS data indicate a decline in this species Canada-wide and NB-wide. The main factors thought to be responsible in the decline of the eastern wood-pewee have not been clearly identified, due largely, to a lack of research. Possible threats include loss of habitat, and degradation of habitat quality, changes in availability in flying-insect prey, and changes in forest structure due to white-tailed deer over-browsing (COSEWIC 2012a).

Barn swallow

The barn swallow is a mid-sized passerine that is closely associated with rural human settlements. This species is the most widespread swallow in the world, and is known to breed in all provinces and territories in Canada (COSEWIC 2011). The barn swallow is ranked as *threatened* by COSEWIC and NB SARA, and *S2B,S2M* by the AC CDC. It has no SARA rank, at this time.

Following European settlement of North America, barn swallows shifted from nesting in caves and on ledges to nesting largely in human-made structures. This insectivorous species prefers open habitats for foraging such as pastoral lands, shorelines, and cleared rights-of-way. Foraging habitat for this species exists within the PDA and LAA. No nesting habitat was noted within the PDA, but it is likely that some occurs within the LAA. There is potential for this species to be found within the WFSA. No barn swallows were observed during field surveys in 2017.

ECCC (2017a) reports that BBS data indicate a decline in this species, although the species is still common and widespread (COSEWIC 2011). The main threats to the species include loss of nesting and foraging habitat, and the large-scale declines in some insect populations which provide food for this species.

Bank swallow

The bank swallow is a small, highly social songbird which feeds primarily on flying or jumping insects (COSEWIC 2013a). This species breeds in every province with the possible exception of Nunavut (COSEWIC 2013a). Bank swallow is ranked as *threatened* by COSEWIC, and has no SARA or NB SARA status. The AC CDC ranks bank swallow as *S2S3B,S2S3M*.

Bank swallows breed in a wide variety of natural and anthropogenic sites including riverbanks, aggregate pits, road cuts, and vertical sand banks or stock piles of soil. Nesting sites are generally



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situated adjacent to open terrestrial habitat used for aerial foraging (COSEWIC 2013). No suitable nesting habitat was noted in the WFSA, although some may be present in the RSA. No bank swallows were observed during field surveys in 2017.

ECCC (2017a) reports that BBS data indicate a decline in this species Canada-wide and at the province level in NB. The main factors thought to be responsible for the decline of this species includes the loss of breeding and foraging habitat, and the loss of food sources through the widespread use of pesticides (COSEWIC 2013a).

Wood thrush

The wood thrush is a medium sized bird which breeds in southeastern Canada from southern Ontario east to Nova Scotia (COSEWIC 2012b). This species is listed as *threatened* by COSEWIC and NB SARA, and *S1S2B,S1S2M* by the AC CDC.

Wood thrush nest mainly in second-growth and mature forests, both deciduous and mixed wood, with saplings and well-developed understory layers. There may be suitable habitat for wood thrush within the WFSA; however, this species has not been reported in the WFSA. No wood thrush were observed during field surveys in 2017.

ECCC (2017a) reports that BBS data indicate a decline in this species in Canada and in NB. The main factors thought to be responsible in the decline of this species include habitat degradation and fragmentation due to over-browsing by white-tailed deer and human development (COSEWIC 2012b). High rates of nest predation and parasitism by species such as brown-headed cowbird are also contributing to the decline of the wood thrush.

Canada warbler

Canada warbler is a small and brightly colored passerine. Approximately 80% of the entire breeding range of this species is located in Canada (COSEWIC 2008b), where it can be found breeding in every province and territory except Newfoundland and Labrador and Nunavut. Canada warbler is ranked as *threatened* on Schedule 1 of SARA, and under NB SARA, and *S3B,S3M* by the ACCDC.

Canada warblers breed in a wide range of forest types, including deciduous, coniferous and mixedwood forests. It is often associated with moist mixedwood forest and riparian shrub forests on slopes and ravines (COSEWIC 2008b). The presence of a well-developed shrub layer also seems to be associated with preferred Canada warbler habitat. Suitable habitat for this species, such as shrub swamps, is found within the WFSA, and this species was detected during 2017 field studies, recorded incidentally on three occasions along an access road upgrade.

ECCC (2017a) reports that BBS data indicate a decline in this species Canada-wide and at a province-wide level. Key threats to this species are unclear, but loss of primary forest in the wintering grounds in South America is a potential cause.

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Bobolink

Bobolink is a medium-sized passerine that breeds in the southern part of all Canadian provinces from British Columbia to Newfoundland and Labrador. Bobolink is ranked as *threatened* by COSEWIC and NB SARA, and *S3B* by the AC CDC. It has no SARA rank at this time.

Bobolink originally nested in the tall-grass prairie of the mid-western US and south central Canada. As this habitat was converted to agricultural land, and forests of eastern North America were cleared to hayfields and meadows, the range of bobolink expanded (COSEWIC 2010a). Bobolink presently nest in a variety of forage crop habitats, and natural grassland habitats including wet prairie, graminoid peatlands, and abandoned fields dominated by tall grasses. Suitable habitat for this species, particularly agricultural areas, was not identified in the WFSA, and this species was not detected during 2017 field studies.

ECCC (2017a) reports that BBS data indicate a decline in this species Canada-wide and province-wide. The main threats to this species include land-use change, especially the loss of meadows and hay fields, and the early mowing of hay fields in which the species is nesting.

Rusty blackbird

The rusty blackbird is a medium-sized passerine most commonly associated with forest wetlands. This species is listed as *special concern* on Schedule 1 of SARA and under NB SARA. The AC CDC ranks the rusty blackbird as *S3B,S3M*.

The rusty blackbird nests in boreal forests, generally near the shores of forest wetlands, slow-moving streams, beaver ponds, and pasture edges (COSEWIC 2006c). **This species' main diet in its breeding range consists primarily of aquatic invertebrates, and occasionally salamanders and small fish.** Some habitat for rusty blackbird exists within the WFSA, though the species was not detected during 2017 field surveys.

ECCC (2017a) reports that BBS data indicate a decline in this species Canada-wide and at the provincial level in NB. The main factor thought to be associated with the decline of rusty blackbirds is the conversion of its main wintering grounds (forests in Mississippi Valley flood plains) into agricultural lands or human habitation (COSEWIC 2006c). Other factors include destruction of wetlands within the species breeding range, and the spread of dominant, competing, species such as the red-winged blackbird.

Other Wildlife SAR

A full list of other wildlife SAR and SOCC as recorded by the AC CDC (2017b) is available in Appendix C. Table 4.18 focusses on wildlife SAR (other than birds) that may be present within 5 km of the WFSA, followed by additional information below.

Table 4.18 Other Wildlife SAR Within 5 km of the WFSA

Common Name	Latin Name	SARA Status	COSEWIC Status	NB SARA status	AC CDC S-Rank ¹	Data Source
little brown myotis	<i>Myotis lucifugus</i>	Schedule 1, endangered	endangered	endangered	S1	AC CDC
northern myotis	<i>Myotis septentrionalis</i>	Schedule 1, endangered	endangered	endangered	S1	AC CDC
tri-colored bat	<i>Pipistrellus subflavus</i>	Schedule 1, endangered	endangered	endangered	S1	AC CDC
long-tailed shrew	<i>Sorex dispar</i>	Schedule 3, special concern	Not-at-risk	-	S2	AC CDC
wood turtle	<i>Glyptemys insculpta</i>	Schedule 1, threatened	threatened	threatened	S2S3	AC CDC
monarch	<i>Danaus plexippus</i>	Schedule 1, special concern	endangered	special concern	S3B, S3M	Stantec

¹ S1 = critically imperiled, S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, SNA = not applicable (typically exotic species), S#S# = a numeric range rank indicates any range of uncertainty about the status of the species (AC CDC 2017a).

Myotis and perimyotis bats

Three bat species including the little brown myotis, northern myotis and tri-colored bat are listed as *endangered* under Schedule 1 of SARA and as *endangered* under NB SARA. All three species are small, brown-coated insectivores (COSEWIC 2013b).

All three species overwinter in cold, humid hibernacula, often caves or mines. Large numbers of bats typically overwinter in relatively few hibernacula in the eastern part of Canada. Females establish summer maternity colonies in buildings or large-diameter trees, and forage over water, within gaps in the forest, or at forest edges. Large open fields and clear cuts are generally avoided.

Berryton Cave, a known hibernaculum for bats, is located within 5 km of the WFSA, although more than 6.5 km away from the PDA.

These species have all undergone drastic population declines in New Brunswick (>99%; Fundy National Park 2015) and across North America following the onset of white-nose syndrome (WNS), a fungus infection that impacts hibernating bats and which ultimately results in the deaths of those infected.

Long-tailed shrew

Long-tailed shrew (*Sorex dispar*) is considered by the AC CDC to be synonymous with *Sorex gaspensis* (AC CDC 2017b), which is considered *special concern* under Schedule 3 of SARA, and *not at risk* by COSEWIC. This species is a small insectivore with a long tail. Little is known about the size and distribution

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of the populations within New Brunswick. This species prefers rocky outcrops and talus slopes, generally near cool water sources, such as streams (COSEWIC 2006b).

Long-tailed shrew was reported within 5 km of the WFSA within the Caledonia Gorge NPA (AC CDC 2017b). No long-tailed shrew were noted during field surveys conducted in 2017. There is no suitable habitat within the WFSA near the PDA.

Wood turtle

Wood turtle is ranked as *threatened* on Schedule 1 of SARA and under NB SARA. Wood turtle typically occupies broad ranges, existing in sparse, widespread populations. This species is the most terrestrial of New Brunswick's turtles, spending extended periods out of water, foraging on the forest floor (COSEWIC 2007d). These turtles forage over large areas, and may be seen in different places from year-to-year. No wood turtles or suitable wood turtle habitat were noted within the PDA during field surveys conducted in 2017, or during field studies in support of the Kent Hills Wind Farm in previous years. The nearest known records of wood turtle are more than 5 km from the WFSA. Given that the footprint of the Project components is relatively small, and there is a low likelihood of wood turtle being present within the WFSA, it is expected that the effects on regional wood turtle populations will be minimal.

Monarch butterfly

A single monarch butterfly (*Danaus plexippus*) was noted incidentally in June of 2017. The butterfly was located near the Kent Hills substation, and appeared to be travelling through the area.

Monarch butterfly is a SAR, listed as *special concern* on Schedule 1 of SARA and NB SARA, however recently reassessed as endangered by COSEWIC in November 2016. They are dependent on milkweed plants (*Asclepias* spp.) where they lay their eggs, and on which the caterpillars feed after hatching (COSEWIC 2010b). There are two species of milkweed in New Brunswick: common milkweed (*Asclepias syriaca*, S4S5), which grows in open areas such as abandoned agricultural areas, meadows, ditches, and roadsides; and swamp milkweed (*Asclepias incarnata*, S4) which grows in marshes, the edges of swamps, shorelines, and other wet areas (COSEWIC 2010b). Neither of these species were observed within the PDA, though conditions exist for them to be found within the WFSA.

4.4 WETLANDS

Wetlands were surveyed by trained wetland delineators within the PDA and a buffer of approximately 30 m concurrently with vegetation surveys on June 19-22 and June 28, 2017. Wetland boundaries were identified and delineated using a combination of hydrology and hydrophytic vegetation. Wetland classification followed the classes and types of the Canadian Wetland Classification System (NWWG 1997). In this system, there are five wetland classes: bog, fen, swamp, marsh, and shallow water, and eight wetland types, which distinguish wetland communities based on dominant vegetation.

Five wetlands were delineated within the surveyed area, totaling an area of 0.82 ha within the PDA. Wetland Ecological Services Protocol-Atlantic Canada (WESP-AC) forms were completed by a trained wetland biologist for three of the five wetlands (GeoNB-mapped wetlands and wetlands within

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proposed turbine footprints) to assess wetland function. The completed WESP-AC tables are provided in Appendix H. Wetlands represent approximately 2.4% of land use within the PDA, and is much lower than the average amount of wetland in New Brunswick, which is typically approximately 18%, based on past experience. The lower amount of wetland in the PDA is partially due to location in the hilly Central Uplands Ecoregion, and because large portions of the PDA are centered on existing roads.

Wetlands delineated within 30m of the PDA are described below and shown on Figures 4.5 to 4.8. Areas of wetlands provided below are estimates based on a combination of field and desktop delineation.

WL01 is a sprawling riparian wetland complex located primarily north of an unnamed forest access road to the proposed turbines T7, T9 and T5. The delineated area of the wetland is 78.4 ha, which includes portions that are GeoNB mapped wetlands. The forest access road crosses the wetland at several points; however, installed culverts are large enough to allow the free flow of water (i.e., no impoundment of water). This wetland is the headwaters of an unnamed tributary to Forty Five River and follows the watercourse where it crosses the road and heads south. The wetland is GeoNB-mapped in areas adjacent to the mapped watercourse. This wetland contains several wetland types, including tall shrub swamp, softwood treed swamp, hardwood treed swamp, and marsh. Dominant species within the portion of the wetland north of the road include speckled alder (*Alnus incana*), blue joint reedgrass (*Calamagrostis canadensis*), three-seeded sedge (*Carex trisperma*), fowl mannagrass (*Glyceria striata*), black spruce (*Picea mariana*) and balsam fir (*Abies balsamea*). Areas south of the road are dominated by speckled alder, balsam fir, black spruce, red maple (*Acer rubrum*), pussy willow (*Salix discolor*), Bebb's willow (*S. bebbiana*), narrow-leaved meadowsweet (*Spiraea alba*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), and spotted jewelweed (*Impatiens capensis*). WL01 provides a number of moderate to highly rated functions (Appendix H). Primary functions are aquatic such as stream flow support and water cooling. Organic nutrient export in support of aquatic ecosystems is also an important function for this wetland. WL01 provides moderate to high quality habitat for terrestrial and aquatic wildlife and plant species. Surface water retention and nitrate removal/retention were the only functions determined to be low.

WL02 is a softwood treed swamp located at the proposed location of turbine T7 and within an area that was harvested for timber in 2009 and was planted in 2011 with Norway spruce (*Picea abies*) and white pine (*Pinus strobus*). The delineated area of the wetland is 12.1 ha. In addition to regenerating trees, WL02 is dominated by bog willowherb (*Epilobium leptophyllum*), rough-stemmed goldenrod (*Solidago rugosa*), and sedges such as nodding sedge (*Carex gynandra*). The wetland continues outside of the PDA to the southwest, and appears to form the headwaters to Barrett Brook, likely contributing to stream flow support of that watercourse. Because of the fairly recent harvesting and planting activity, this wetland provides little habitat function; but ponded water in skidder tracks may provide habitat for amphibians (Appendix H).

WL03 is a softwood treed swamp located at the proposed location of turbine T8. The wetland is partially within immature to over-mature black spruce (*Picea mariana*) dominated swamp. The remainder of the wetland was harvested for timber in 2002 and planted with black spruce in 2004. The delineated area of the wetland is 6.6 ha. In addition to black spruce, un-harvested areas of the wetland are dominated by three-seeded sedge, cinnamon fern, mountain holly (*Nemopanthus*



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mucronatus), and balsam fir, while the harvested area is dominated by the three-seeded sedge and cinnamon fern. Most functions of WL03 rate low to moderate; however, the wetland provides high quality habitat for bird, mammal, plant and pollinating insects. Its ability to retain phosphorus rates high but is not relevant given that phosphorus loading is unlikely because there are few sources within the WFSA (Appendix H).

WL04 is a small (0.06 ha) basin shrub swamp located south of an unnamed forestry road to the proposed turbines T7, T9 and T5 with no clear hydrological connections to any other wetlands, though it is close to WL01. This wetland is dominated by willows (*Salix* spp.), mountain maple (*Acer spicatum*), speckled alder (*Alnus incana*), cinnamon fern and blue-joint reedgrass. The wetland generally has few functions, but contains some ephemeral pools, which likely provide suitable habitat for amphibians. A Canada warbler was also noted singing near the wetland, and may be using it for foraging purposes. There was no indication (e.g., agitation) that this species was nesting in the wetland.

WL05 is a softwood treed swamp located south of an unnamed forestry road to the proposed turbines T7, T9 and T5, within a black spruce plantation that was established in 1991. Other than planted black spruce this wetland is dominated by cinnamon fern, three-seeded sedge, and dwarf raspberry (*Rubus pubescens*). It continues outside of the PDA to the south and may be hydrologically connected to WL01. The delineated area of the wetland is 0.26 ha. This wetland may provide some surface water storage and carbon sequestration functions. In general, plantations do not provide high quality habitat because they tend to have a closed canopy and are uniform in structure. Understory species diversity tends to be low.

4.5 ATMOSPHERIC ENVIRONMENT

The following section describes the climate, air quality, greenhouse gas (GHG) emissions and sound quality surrounding the Project location.

4.5.1 Climate

Weather data were acquired from the Sackville meteorological station, which is located approximately 35 km northeast of the WFSA, and from the Moncton meteorological station ("Moncton A"), which is located approximately 45 km north of the WFSA. Situated in Albert County, New Brunswick, the WFSA lies in forested hilly terrain within 20 km of the Chignecto Bay coast line and is subject to elevated wind speeds. At the Moncton meteorological station, where wind speed and direction data are available, the average annual wind speed is about 17 km/h, based on Environment and Climate Change Canada climate normals for the period of 1981-2010 (Table 4.19). In the summer months (June – August), average wind speeds drop to 13.9 km/h; however, wind speeds increase to over 19 km/h in the winter months. Prevailing winds are consistently from the west or southwest throughout almost every month of the year.

According to the Sackville weather station climate normals from 1981-2010, the average annual temperature in the region is 5.6 °C, with the average daily maximum and minimum being 9.9 °C and 1.2°C, respectively. The warmest period during the year is typically from June to August (daily mean of



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16.4°C), while the coldest period is between December and February (daily mean of -5.9°C). The site's proximity to the coast allows for the ocean to have a temperature moderating effect, which also allows for New Brunswick's coastal regions to have a significantly longer frost-free season in comparison to inland localities.

According to 1981-2010 precipitation data at the Sackville station, precipitation occurs approximately 162 days per year and averages approximately 1,147 mm of precipitation throughout the year, where 80% is rain and the remainder is snow. Overall, winter and spring are the foggiest times of year in New Brunswick, with Moncton having an average of 50 foggy days throughout the year. No specific data are available for the WFSA, but the above numbers are expected to be reasonable estimates of what may occur in the WFSA.

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Table 4.19 Canadian Climate Normals 1981-2010 – Moncton A Meteorological Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Days with Rainfall ≥ 25 mm	0.13	0.17	0.5	0.23	0.6	0.6	0.73	0.73	0.86	1	0.7	0.47	6.7
Days With Snowfall ≥ 25 cm	0.63	0.4	0.57	0.07	0.03	0	0	0	0	0	0.13	0.37	2.2
Days with Precipitation ≥ 25 mm	0.93	0.63	1.4	0.5	0.63	0.6	0.73	0.73	0.86	1	1	1	10.1
Visibility (hours with) < 1 km	18	19.5	24.2	18.4	12.5	10.4	11.3	9.5	9.8	9.7	12.6	15.7	171.8
Days with Winds ≥ 52 km/hr	3.8	2.8	3.1	2.2	1.4	0.7	0.6	0.4	0.7	1.6	2.4	3.8	23.6
Days with Winds ≥ 63 km/hr	1.2	0.7	0.9	0.7	0.2	0.1	0	0	0.1	0.2	0.8	1.4	6.4

4.5.2 Air Quality

A network of ambient air monitoring stations is operated by industry and NBDELG within the province to measure the ground-level concentrations of air contaminants. The monitoring station considered in the analysis to establish existing conditions for ambient air quality is located at the Highfield Street water pumping station in Moncton. The Moncton monitoring station was operated in 2014, which provides the most recent recorded dataset. Air contaminants measured in Moncton are particulate matter less than 2.5 microns (PM_{2.5}), carbon monoxide (CO), nitrogen dioxide (NO₂) and ozone (O₃). Given the rural location of the Project, air quality is expected to be better than that described below.

Particulate Matter less than 2.5 microns (PM_{2.5})

Monitoring results for the Moncton monitoring station in 2014 showed no hourly values exceeding 40 µg/m³. The annual average concentration of PM_{2.5} measured at the Moncton station was 5.7 µg/m³. No provincial or national guideline or standard exists for PM_{2.5}; however, there is a Canadian Ambient Air Quality Standards (CAAQS) of 28 µg/m³ by 2015 (24-hour averaging time) where achievement is based on the annual 98th percentile ambient measurement, averaged over three consecutive years. The 98th percentile value measured at this station in 2014 was 14 µg/m³ and there were no days recorded with a 24-hour average or hours with a running 24-hour average exceeding 28 µg/m³.

Carbon Monoxide (CO)

In 2014, there were no exceedances of the 1-hour (30 ppm) CO standard recorded at the Moncton monitoring station, or any other time when the station was operating from 1998 to 2014.

Nitrogen Dioxide (NO₂)

In 2014, there were no exceedances of the 1-hour (210 ppb) NO₂ standard recorded in at the Moncton station. Maximum hourly values were less than 25% of the objective. No exceedances of NO₂ were recorded when the station was operating from 1998 to 2014.

Ozone (O₃)

In 2014, there were no exceedances of the hourly objective (82 ppb) for O₃. The CAAQS for O₃ is 65 ppb, over an 8-hour averaging time, where attainment is based on the 4th highest measurement annually, averaged over three consecutive years. In 2014, the annual CAAQS statistic was 53 ppb.

Summary of Air Quality

There are no nearby industrial sources of air pollution and ambient air quality results indicate very good air quality in the region. Activities contributing to air contaminant emissions during the wind farm expansion will include emissions from vehicles and dust generated from construction activities. In consideration of available standard mitigation practices, including water to mitigate fugitive dust on unpaved surfaces and timely re-vegetation of exposed soil and the relatively short duration of construction (5-6 months), related releases of contaminants are unlikely to cause exceedances of air quality standards. Releases of contaminants during operation of the wind farm will be infrequent and low in magnitude, with the primary potential source being small amounts of combustion gas from fossil

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fuel in vehicles and equipment used for periodic maintenance activities, as well as dust generated from vehicles, and are unlikely to cause any exceedances of air quality standards either. Exceedances are also unlikely during decommissioning, which would be comparable to construction. Therefore, air quality will not be included as a valued component, and will not be discussed further in this EIA.

4.5.3 Greenhouse Gas

In 2015, total Canada-wide GHG emissions were 722 million tonnes of carbon dioxide equivalent (tCO₂e). With 14.0 million tCO₂e being released in New Brunswick in 2015, the province represents a small portion (approximately 2.0%) of Canada's total annual GHG emissions (ECCC 2017b).

The most recently available data estimates for global GHG emissions are from 2013 and indicate global GHG releases are 43.6 billion tCO₂e, excluding land use change and forestry. Therefore, Canada contributes approximately 1.6% to global GHG emissions (World Resources Institute 2017).

The Project is considered to be a "low" emitter of GHG, because the only GHG generating activities would be small amounts during construction after which the Project would provide renewable energy, thereby offsetting NB's current generating GHG intensity of 0.28 tCO₂e/MW (ECCC 2017c). The Project is expected to produce approximately 112,000 MWh per year, which will result in an offset of 31,360 tonnes of CO₂ per year, based on the 2015 generation GHG intensity. Because the Project is considered a "low" emitter, no GHG management plan would be required according to the Canadian Environmental Assessment Agency assessment guidance (FPTCCCEA 2003). This Project will result in a long-term reduction in GHGs, since the power generated by the Project will replace more GHG intensive types of power generation. Therefore, GHG will not be included as a VC, and will not be discussed further in this EIA Registration Document.

4.5.4 Existing Sound Pressure Levels

The WFSA and surrounding region is rural with minor road traffic. Although forestry and agricultural operations are widespread in the region and forestry activities occur across most of the WFSA, the area is relatively quiet. No monitoring was done for this Project and we expect the sound quality to be good, with the sounds of nature dominant based on the WFSA location.

There are no major highways in the vicinity of the Project. Prosser Brook Road is a local road with minor traffic. Apart from this road, provincial, county and rural roads are numerous in the RSA and serve the rural residents, as well as forestry, agricultural and mineral aggregate operations. Forestry operations are located throughout the WFSA. Noises emitted from the forestry operations near the WFSA are expected to include noise from harvesting and transportation of timber.

Normal operation of the Kent Hills Wind Farm would also contribute to existing sound pressure levels near the turbines. As detailed in the EIA Registration Document for the original wind farm (Jacques Whitford 2007a), sound pressure levels adjacent to all known receptors (households) were predicted to be below 40 dBA over a ten-minute period, even when assuming that wind is coming from all directions

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at once and all receptors are downwind. The back end of some long, narrow lots on Prosser Brook Road (north of the A-row of turbines) had predicted sound levels over 40 dBA.

Noise modelling was again conducted in 2009 prior to the first wind farm expansion. The two nearest receptors (B and F) were modelled, as there were only two receptors within one kilometre of an existing or proposed wind turbine and noise effects are not expected beyond that distance. Table 4.20 provides the calculated peak sound levels for the original and Expansion (Phase 2) turbines (for receptors B and F), which will be considered the baseline peak sound levels for Kent Hills 3 Wind Project.

Table 4.20 Peak Sound Pressure Levels at Residences that are Within 1 km of an Existing Turbine, as modelled for the Expansion (Phase 2)

Wind Speed (m/s)	Recommended Limit (dBA) ¹	Sound Level at Receptor B (dBA)	Sound Level at Receptor F(dBA)	Criteria ¹ Met? (Y/N)
4	40	25.2	24.0	Y
5	40	30.2	29.0	Y
6	40	34.0	32.8	Y
7	43	36.7	35.5	Y
8	45	38.0	36.8	Y
9	49	38.2	37.0	Y
10	51	35.9	34.8	Y
11	53	35.1	34.0	Y

¹ Noise criteria as per "Additional Information Requirements for Wind Turbines" document, Government of New Brunswick, no date

As calculated, the sound pressure levels at all receptors were predicted to meet the NB criteria at all wind speeds. To date there have been no noise complaints made to TransAlta from nearby residents. (C. Macy, pers. comm. 2017).

4.6 SOCIO-ECONOMIC CONDITIONS

The WFSA is located in the rural region of Kent Hills, Albert County, New Brunswick. The WFSA is primarily Crown Land, all of which is productive woodland in various stages of succession due to forest operations. A portion of the Turtle Creek Watershed, a protected watershed as identified under the *Clean Water Act*, is located in the general WFSA; however, is not effected by the proposed Project infrastructure.

As with most rural areas in the province, economic growth is tied to such factors as proximity to natural resources, distance to markets, productivity of the land, the transportation infrastructure, and the demand for their product. Economic growth and development is also related to a healthy citizenry that have the opportunity to engage in a wide-variety of activities, including recreational and leisurely pursuits. This section provides an overview of the area, its communities, and its economic and non-economic characteristics.

4.6.1 Population

The rural unincorporated area of Kent Hills is located in Albert County, New Brunswick. The closest unincorporated community to the WFSA is Prosser Brook, located several km to the northwest. The nearest municipal boundaries include: Alma (4 km south); Riverside-Albert (9 km east-southeast); Hillsborough (17 km northeast); Riverview (20 km north); Petitcodiac (23 km northwest); Moncton (23 km north); and Salisbury (24 km north-northwest). The settlement history of Elgin Parish, in which the Project is located, dates back to the mid- to late-1800s, when Elgin Parish was set off from Salisbury Parish in 1847 and became the fifth parish of Albert County. Elgin Parish includes most of the interior of the county, is completely land-locked by the other parishes, and provides the headwaters for many of the small streams and rivers of the region (Albert County 2002).

In 2016, the population of Elgin Parish was 892, which represents a 7.8% decline from the 2011 population. The population of the parish accounted for approximately 3% of the Albert County population of 29,158. Unlike Elgin Parish, Albert County experienced a slight increase in population from 2011 to 2017, increasing by 1.1%. Population statistics for Elgin Parish and Albert County are summarized in Table 4.21 below.

Table 4.21 Population Statistics for Elgin Parish and Albert County

Population and Dwelling Counts	Elgin Parish	Albert County
Population in 2016	892	29,158
Population in 2011	968	28,846
2011 to 2016 population change (%)	-7.9	1.1
Total private dwellings	595	13,111
Population density per square kilometre	1.7	16.1
Land area (square km)	519.59	1,807.88
Source: Statistics Canada, 2017		

The villages of Riverside-Albert (pop. 350) and Alma (pop. 213) are the closest communities to the WFSA. The large metropolitan area of Greater Moncton, including the cities of Moncton, Dieppe, and the town of Riverview (total pop. 116,940), is more than 21 km to the north.

4.6.2 Land Use

This section describes the land use policies and zoning for the WFSA, as well as describes the current land use of the area.

4.6.2.1 Official Plan Designations and Policies

It is the policy of NBDERD that suitable Crown lands be made available for wind exploration and wind farm development. Any wind farm to be constructed in New Brunswick on Crown lands is to follow and meet the criteria set out in the Allocation of Crown Lands for Wind Power Projects Policy (NBDNR 2012). These criteria include, but are not limited to, the following: established setbacks from lakes,



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watercourses, public highways, archeological sites, and endangered species habitat; and areas to be avoided, such as parks and protected natural areas.

In December 2016, TransAlta filed an application for License for Occupation for Wind Exploration with NBDERD. Exploration consent, specifically for geotechnical work was requested for nine locations at four areas on the periphery of the existing Kent Hills Wind Farm project. The application was reviewed to ensure that it does not conflict with other programs in place for forestry and wildlife management in the area.

A License of Occupation for Exploration and Option was achieved in principle in June 2017 and is expected to be formally consented to by Cabinet and subsequently executed by the Minister in September 2017. In the interim a comfort letter is being provided by the Director of Crown Lands. Following a favourable EIA Determination an application for an expanded Lease Option that would include temporary use areas such as laydown areas for turbines will be applied for. This form of tenure would provide for exclusive use in these areas until the Lease agreement is executed.

The existing Crown Lease arrangements for additional wind towers and the License of Occupation for Access and Distribution Corridors will be amended under separate processes to include project lands contemplated for the expansion development ahead of construction.

Locally, the WFSA falls under the authority of the Southeast Regional Service Commission. The WFSA is predominantly unzoned land. There is some land zoned agricultural (i.e., along Prosser Brook Road); however, it is not within the Project footprint, with the exception of the main site access, which is existing. The Rural Plan includes setbacks for the watershed and roads which have been incorporated in the constraint analysis. The WFSA is designated as an Unincorporated Area, meaning that no zoning regulations are currently in place; however, building permits for the turbines are required.

4.6.2.2 Forestry

Elgin Parish covers a land area of approximately 519 km², while the WFSA covers approximately 61 km² in-and-around the Kent Hills area of the parish. Most the lands within the WFSA are designated as Class 4 in the Canadian Land Capability for Forestry Inventory, meaning that the lands have moderate limitations on the growth of commercial forests. These limitations relate to terrain slope, access to the resources, and soil composition. There are active forestry operations in-and-around the immediate WFSA, with a network of forestry roads to support these activities.

In the province, Crown land is divided into 10 large blocks of land (Licenses) which are leased to six forestry companies (Licensees) and approximately 50 sub-licensees. The licensees are responsible for developing government approved management plans that meet government-established goals and objectives that reflect a balance of social, ecological, and economic values. The WFSA is in License 7 (Fundy) and is licensed to J.D. Irving Ltd (New Brunswick Forestry 2007). A sub-licensee (Downey) under J.D. Irving has a block within the license, located at the northeastern end of the site. The Downey sawmill deals predominantly with hardwood species.

4.6.2.4 Trapping

The New Brunswick Trappers & Fur Harvesters Federation (NBTFHF) was contacted prior to the original wind farm construction, and a trapper who traps the largest area near the Project was interviewed. This trapper uses Flint Hill Road, Sherman Road, Kent Road, and New Ireland Road to access land for trapping in low-lying areas (i.e., wetlands). Species trapped include beaver, bobcat, mink, and coyote. In particular, beaver activity is high in this area. Trapping mainly occurs in October to December. Following notification of Kent Hills 3 Wind Project, no follow-up comments have been provided by the NBTFHF.

4.6.2.5 Tourism

There is very little commercial tourism-related activity in the WFSA although the existing Kent Hills Wind Farm has drawn local visitors to the site. The WFSA is approximately 15 km from the Bay of Fundy shoreline, the primary tourism draw for the area. Visitors are also drawn to the region to see the exceptionally high tides of the Bay of Fundy, the rocks and stone columns of Hopewell, the City of Moncton, and Magnetic Hill.

A major tourist draw in the area is Fundy National Park which is located roughly 5 km southwest of the WFSA.

There are also various outfitters that cater to hunters, and outdoor adventure operations in Albert County and surrounding areas that provide eco-tourism opportunities, and may include hiking excursions on the Dobson Trail, including the Hayward Pinnacle, a high point of land that offers a commanding view of the surrounding area.

4.6.3 Heritage Resources

To determine if heritage resources will be affected by Project-related activities, a desktop review for heritage resources in the WFSA was conducted. Heritage resources include structures, sites, or things of historical, archaeological, palaeontological, or architectural significance. The desktop survey made use of the following resources:

- Archaeological Services Sites Database at Archaeological Services Branch (ASB), New Brunswick Department of Tourism, Heritage and Culture (NBDTHC) and any relevant Maritime Archaeological Resource Inventory (MARI) forms for sites within 5 km of the PDA
- Archaeological Potential Map for the proposed PDA obtained from ASB
- A review of the Canadian Register of Historic Places (CRHP) and the New Brunswick Register of Historic Places (NBRHP)
- Archaeological impact assessments (AIAs) completed for other projects located near the current Project
- Consultation with Heritage Branch, NBDTHC
- Published and unpublished materials cited below

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There are no built heritage resources within the PDA (CRHP 2017; NBRHP 2017). For information regarding archaeological resources, the Archaeological Services Branch (ASB) was contacted to request the most recent Archaeological Potential Map for the PDA and surrounding area. The Archaeological Potential Map presents information from a variety of heritage related databases as well as identifies areas with elevated potential for archaeological resources. Typically, the shoreline areas of all watercourses are considered by the Province as having either "high" (0–50 m from the watercourse bank) potential or "medium" (50–80 m from watercourse bank) potential for Pre-Contact archaeological resources, regardless of the size of the watercourse. Confluences of any two watercourses are considered to have "high" potential for Pre-Contact archaeological resources within 100 m from the watercourse banks. Together, these areas are referred to as elevated potential zones.

In addition to the results of Archaeological Potential Map for the Project, the archaeological impact assessment (AIA) for the PDA considered the following when making any recommendation for additional assessment or mitigation:

- The physical condition of the ground including saturation level, slope, depth to surface rock, and surface conditions
- The professional experience and judgment of Stantec Archaeology Team

These conditions have been discussed with the provincial regulator, Archaeological Services, and agreed to in principle. Recommendations for any additional investigation or mitigation are based on these ground and surface conditions observed during the field component of the AIA.

Three previous AIAs were completed for this Project by Stantec (formerly Jacques Whitford); one in 2007 and two in 2008 (Jacques Whitford 2007b, 2008a, and 2008b). The results of those assessments did not identify any archaeological resources in the areas surveyed within the PDA and there were no recommendations for subsequent archaeological assessment in the PDA. The most recent AIA, a pedestrian survey (walkover) for this Project, Kent Hills 3 Wind Project, was completed in June of 2017.

The following sections provide a brief overview of the PDA, with consideration of areas within 5 km around the PDA, and includes the communities, environments and features of heritage resource significance.

4.6.3.1 Pre-Contact Resources

There are no known Pre-Contact Period archaeological sites in the PDA or within 5 km. With the exception of the elevated archaeological potential areas identified around all watercourse, in general, the archaeological potential of the PDA for Pre-Contact resources is considered low. Prior to the AIA (walkover) conducted in June 2017, no formal archaeological surveys had been conducted in the current PDA.

Although no known Pre-Contact Period archaeological sites are listed within the PDA, the area and its surroundings would likely have been used in the past for hunting, fishing, and gathering by ancestral Indigenous populations. The PDA is situated in a highland area that lies in a "boundary" territory between traditional Wolastoqiyik (Maliseet) territory to the west, and the traditional Mi'kmaq territory of



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Sigenigteoag to the east (Bock 1978; Erickson 1978; Ganong 1899). The upper Bay of Fundy south of the PDA figures into the oral history of the Mi'kmaq, with stories about Glooscap's (or Kluscap among other spellings) involvement in the formation of the dramatic tides in this area, and the formation of the "Flower Pot" rocks at Hopewell Cape, located approximately 20 km to the southeast of the Project. The dearth of information pertaining to the Pre-Contact Period in the vicinity of the WSFA is likely a function of the lack of research conducted on the Pre-Contact Period in this area, but may also be related to the relatively challenging topography of the region, coupled with the absence of large, navigable watercourses crossing through the area.

Although there is no evidence for Pre-Contact sites or settlement within the PDA, the general area surrounding the PDA would have been used by Pre-Contact populations dating back to the Palaeoindian Period. This long history is indicated by the discovery of a fluted point from New Horton Creek (Bonnichsen et al. 1991; Turnbull and Allen 1978), an artifact estimated to be close to, or older than, 10,000 years old (NBDNR 2007). Further evidence of past human habitation and use of this area is indicated by a portage or travel route taken to avoid Cape Enrage and described in Ganong (1899:246) as beginning at about Waterside, following the present-day Route 114 east, terminating at Shepody River. Further evidence from this area suggests Pre-Contact encampments near the mouth of Shepody River at "Indian Island" (Albert County Historical Society [ACHS], n.d.; Ganong 1899) shown on a 1770 land grant map (ACHS, n.d.). The discovery of the *Cape Enrage Figurine* (archaeological site BJDf-5), a carved bone human head-like effigy—possibly a pipe or musical instrument, or a mobiliary art object—of indeterminate age is interpreted as being Indigenous in origin (Black et al. 2008).

4.6.3.2 Historic Resources

Historic Period resources have been documented within several kilometres of the PDA. There are also known Historic Period sites for which the exact locations are not known but which could be in the PDA or surrounding area. CRHP does not list any Historic Places within the WSFA and consultation with Historic Places, a division of the Heritage Branch, identified no known issues of concern within the WSFA.

For a detailed list of Historic Period sites located just outside the current PDA, refer to the archaeological field research permit (AFRP) reports for the AIAs conducted in 2007 and 2008 for Kent Hills Wind Farm (Jacques Whitford 2007b, 2008a, and 2008b). Of these Historic Period sites, two are shown in close proximity to the PDA in Figure 4.11 involving a 100-m buffer zone provided by ASB for a Historic Period cemetery northwest of the PDA, as well as a registered Historic Period site, the Anglican Church site (BkDf-2), near the intersection of Morrisey Road and New Ireland Road southeast of the PDA. Additional details on these sites can be found in an earlier AIA report (specifically Jacques Whitford 2007b).

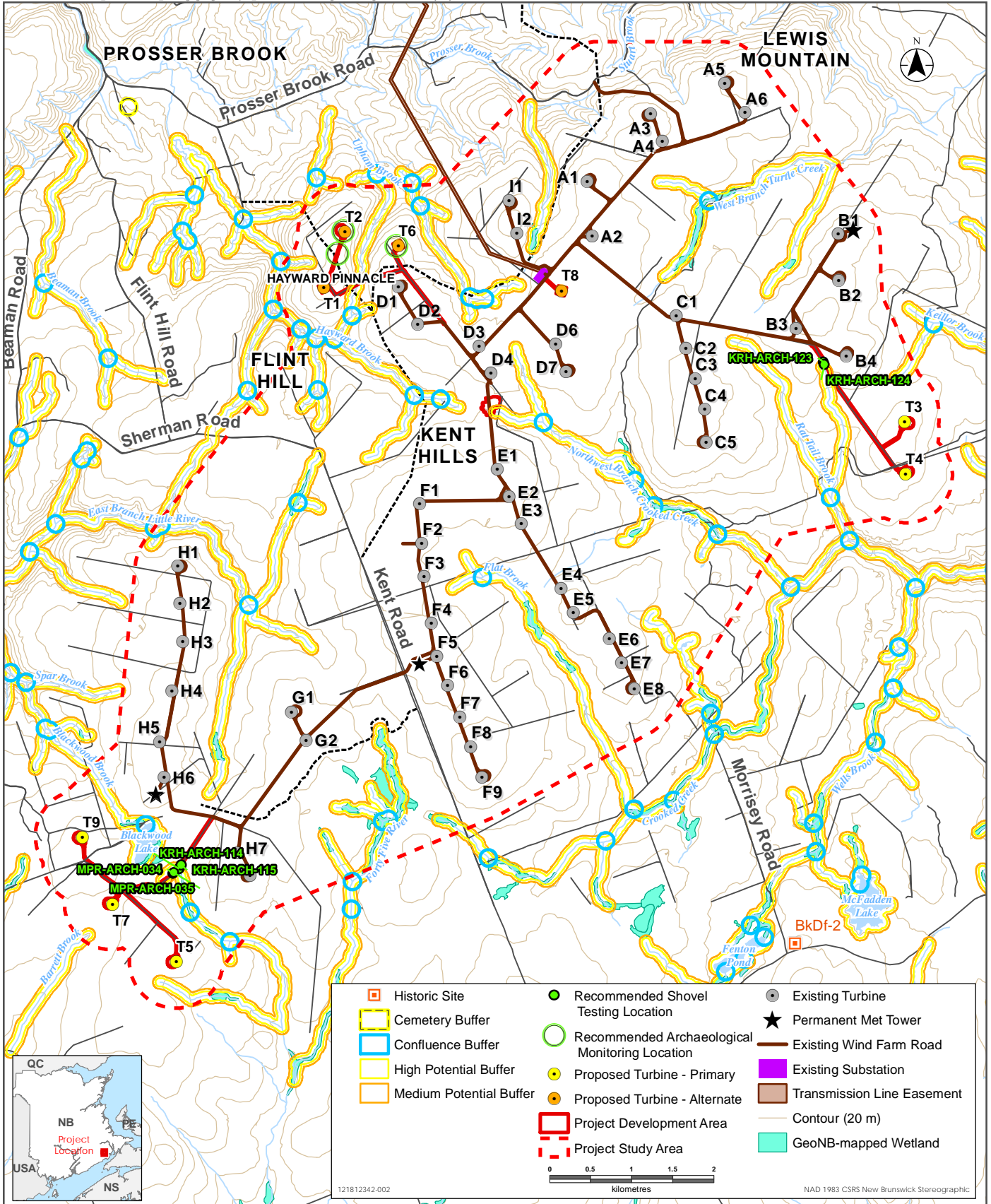
The following Historic Period sites may be located within the PDA:

- Kent Settlement
- Remains of Historic Period logging camps

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The Kent Hills area is likely named for John Kent, who had emigrated from Ireland in 1859 and after whom Kent Settlement was named (Rayburn 1975:146). Kent Settlement is believed to be located about 20 km north of Alma. This settlement is of elevated significance as it would allow for a deeper understanding of past local social patterns that lend important insights into the origins and development of the region through time.

Historic Period logging camps could be encountered in the PDA (Alward, pers. comm. 2007, originally cited in Jacques Whitford 2007b). These logging camps are considered to be of low significance because their regularity has allowed for a substantial amount of information to be recorded and known about them and their cultural communicative power is less prioritized.



Sources: Government of New Brunswick, TransAlta, archaeological data provided by the Government of New Brunswick, Department of

Heritage Resources in the Kent Hills Study Area

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Four areas, however, were identified within the PDA as elevated potential zones and shovel testing recommendations have been made to ASB for these areas. Shovel testing recommendations for these areas are based on their locations inside **ASB's elevated potential** buffers within 80 m of a watercourse bank in combination with generally favourable ground conditions. These areas are indicated by the following data points collected during the walkover (Figure 4.11):

- MPR-ARCH-034 to MPR-ARCH-035 represents a narrow 21 m long strip of terrain in open mature mixed wood on a level terrace feature overlooking an unnamed navigable tributary to Forty Five River (KHWF-05) at its southwest bank (northwest side of main access road to proposed turbine locations T5, T7, and T9). It is considered to have high archaeological potential.
- MPR-ARCH-036 indicates an area on the northeast bank of KHWF-05 (northwest side of main access road to proposed turbine locations T5, T7, and T9) in open, level and dry, low-grass terrain in which only one shovel test pit could be placed as it is otherwise surrounded by disturbances associated with the existing road construction (i.e., push pile berms). It is considered to have medium archaeological potential.
- KRH-ARCH-114 to KRH-ARCH-115 represent another narrow area on a level terrace feature on the northeast bank of KHWF-05 (southeast side of main access road to proposed turbine locations T5, T7, and T9). It is considered to have medium archaeological potential.
- KRH-ARCH-123 to KRH-ARCH-124 represent a well-drained bench feature with a south-facing aspect overlooking an unnamed tributary to Rat Tail Brook (west side of main access road to proposed turbine locations T3 and T4). It is considered to have medium archaeological potential.

With respect to an area north of Hayward Brook, known locally as "**Hayward's Pinnacle**", it is recommended that monitoring by a qualified archaeologist be conducted during any potential ground breaking activities associated with the new-build portion of access leading to proposed alternate turbine T2, the pad location for turbine T2, and the pad location for proposed alternate turbine T6. This recommendation is based on an elevated potential for encountering Paleoindian archaeological resources in this area. **Hayward's Pinnacle would have provided a strategic vista during the Paleoindian Period (13000 to 9000 years before present) for inhabitants to intercept caribou migrations moving between the Valley Lowlands of western New Brunswick to the Eastern Lowlands via the Caledonia Ecodistrict (Bonnichsen et al. 1991, Ferguson 2004, MacDonald 1968).**

Recommended shovel testing is planned for fall of 2017, pending approval from ASB. Should resources be found that may be impacted by Project-related activities, these areas will be fenced and excluded from construction activities or resources will be recovered.

4.6.4 Health and Safety Issues

Lands within the WFSA, especially the proposed Project footprint, generally do not present safety issues such as steep cliffs, deep or steep ravines and waterways. There currently exists clear, safe access to the WFSA. Safety issues are typically associated with construction and decommissioning activities associated with the wind farm. For example, during a meeting with City of Moncton officials before the construction of the original wind farm, they expressed a concern for the safety of the water supply (Turtle Creek) during the delivery of turbine components which will pass through the watershed. This was addressed verbally during the meeting, and there were no issues identified to TransAlta during construction. The proposed turbines and infrastructure will not be located in the Turtle Creek



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Watershed. However, safety issues must also be considered as they pertain to the operational phase and the potential interaction with the local populace and public access issues. Safety concerns related to electromagnetic fields (EMFs) and ice throw are issues that have been raised by the public in the past, are discussed in Section 5.2.1.6. A more recent operational safety issue identified by SENBSA is that stop signage at intersections could be improved which is currently being addressed by TransAlta. No other potential safety hazards have been brought up by stakeholders or the general public.

4.6.5 Visual Landscape

The WFSA is primarily forested, and located around Kent Hills (Photo 3), creating a large amount of vertical relief. The existing turbines, and several communication towers, including the tower located on Caledonia Mountain road near a forestry access trail, are visible from within and beyond the WFSA. Other vertical relief within and around the WFSA is created by small woodlot fragments and natural areas associated with ravines, residential yards and farm buildings.



Photo 3 View of the Kent Hills Area from Prosser Brook Road and Main Access Road to the Kent Hills Wind Farm.

A visual landscape assessment was conducted for the Kent Hills 3 Wind Project incorporating the existing viewshed of the Kent Hills 1 and Kent Hills 2 phases. This assessment was completed with the use of a computerized simulation that superimposed wind turbine images, which are accurately located and scaled to size, onto a photograph of an existing view in the area for the purpose of creating a realistic representation of the proposed wind farm from a specific view. In this instance, Vestas V126



KENT HILLS 3: KENT HILLS WIND FARM EXPANSION PHASE 3

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wind turbines built on 117 m towers were superimposed into photographs from various viewpoints within 30 km of the Kent Hills Wind Farm. Eleven views of the landscape in and around the WFSA were modeled.

Due to the presence of some open areas within the landscape, objects with vertical relief, such as wind turbines, will be visible from some close distances. However, the rolling terrain and wooded area that comprises the WFSA and RSA will mean that the turbines would be obscured from certain vantage points. The wind farm would be visible from Hillside Road, Prosser Brook, Forty Five Road at Doyle Hill and Caledonia Mountain Road. The wind farm will also be visible in the distance from certain vantage points, such as Church Hill, 13 km west of the wind farm, and Highway 1 at Scott Road Overpass, 27 km northwest of the wind farm.

Further information on the area's visual landscape is presented in the Visual Impact Assessment (Appendix J and Section 5.2.1.4).