Addendum

To: Qikiqtaaluk Corporation

Date: 15 July 2022

Re: **Addendum to Biophysical Impact Assessment – High Displacement Renewable Energy Project: Avian Breeding and Acoustic Surveys**

1. Background and Scope

The Sanikiluaq High Displacement Renewable Energy Demonstration Project (the 'Project') is a wind energy and storage platform tailored for deployment in the remote Hamlet of Sanikiluaq. The project aims to provide clean, affordable, and reliable energy to the community and to reduce diesel reliance for electricity production in the community by at least 50%. The Project will integrate up to ten turbines, e+ micro controller and a containerized Battery Energy Storage System (BESS) within Sanikiluaq's diesel grid to achieve high diesel displacement. The preliminary design is based on 1,000 kW (1 MW) wind energy combined with 500 kWh of battery energy storage. The proposed turbine design has a 50 – 60 meter (m) hub height with a 24 – 36 m rotor diameter.

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood) was retained by the Qikiqtaaluk Corporation (QC) to provide environmental consulting services to complete a Biophysical Impact Assessment (BIA). Section 4.2.2. of the BIA presented a desktop review of birds and relevant habitat features occurring near the Project Site (the Site), as well as the results of avian passage migration surveys, winter resident surveys, and time-lapse photography surveys conducted at the Site. However, the breeding bird and acoustic analysis components of the avian survey program were not yet complete at the time of submittal.

This memo is intended to supplement the material in the BIA by summarizing the breeding bird and acoustic survey results. It does not repeat the information presented in the BIA.

2. Field Surveys

Although the habitat types found in the Project Area are not unique to the region and the size of the proposed wind farm is relatively small (1MW; up to 10 turbines), construction and operation of the wind farm may lead to habitat loss and/or disturbance and displacement of birds at the Site, as discussed in Section 4.2.2. of the BIA (Wood, 2022a). To address these concerns, pre-construction breeding bird and acoustic bird surveys were conducted following guidance presented in *Wind Turbines and Birds: A Guidance Document for Environmental Assessment* (EC, 2007a). The objective of these surveys was to assess the baseline activity of migratory and breeding birds at the Site, assess habitat suitability for breeding birds, and to determine potential impacts of the Project on breeding and migratory birds.

Breeding Bird Survey

Methodology

The breeding bird survey was carried out by Marley Aikens, an Avian Biologist with experience surveying avifauna in the subarctic, with the support of local hunters with knowledge of the habitat and fauna present at the Site. The survey protocol was developed in consultation with the Canadian Wildlife Service branch of Environment and Climate Change Canada (ECCC-CWS) and in accordance with ECCC-CWS guidance documents (EC, 2007a; EC, 2007b). The survey was conducted on June 22 and June 24, 2022 from approximately 8 am to 2 pm each day. The survey consisted of point counts conducted at 23 fixed locations along at the Site, including four along the ridge

where the proposed turbines will be situated, 11 along the proposed access road and transmission line, two along the existing all-terrain vehicle (ATV) trail, and six on the proposed alternative access road. The point count locations are presented in Attachment 1 (Figure 1). Each location was surveyed once during the survey program. Point count locations were spaced a minimum of 500 m apart to avoid counting birds twice (OBBA, 2021), and were selected to capture representative terrain and habitat types at the Site. Table 2.1 includes a habitat description and dominant vegetation type at each point count location. A photo log of representative Site photographs is presented in Attachment 2.

During each 10-min point count, all birds heard or seen within each distance category relative to the observer (<50 m, 50-100 m, and >100 m) were recorded. Breeding evidence was also recorded following Birds Canada's Ontario Breeding Bird Atlas protocol (OBBA, 2021), which allows for categorization of species as confirmed, probable, or possible breeders at the Site based on standardized criteria. The survey was conducted under suitable weather conditions (i.e., high visibility, relatively low winds of 4 or less on the Beaufort Scale, and no precipitation). Incidental bird species seen or heard while traversing the Site between point count locations were recorded separately and are included in the species list for the Site (Table 2.2). Incidental observations of other non-target species (e.g., visual observations, scat, tracks) and indirect evidence of bird presence (e.g., pellets, unused nests, eggshells) were also noted.

Table 2.1: Habitat descriptions and vegetation types at avian point count locations

Point Count Location	Habitat Description	Dominant Vegetation Type
PC01	Riparian. Relatively flat with low vegetation.	Grass, lichen.
PC02	Upland mesic tundra. Short, vegetated hummocks interspersed with gravel/dry pools.	Willow, wildflower.
PC03	Rocky upland mesic tundra.	Grass, Wildflower.
PC04	Upland mesic tundra. Tall, vegetated hummocks interspersed with rocky/dry pools.	Grass, Wildflower.
PC05	Upland xeric tundra. Vegetated with small (< 30 cm) rocks.	Lichen, moss, wildflower.
PC06	Upland xeric tundra. Vegetated with small (< 30 cm) rocks.	Lichen, moss, wildflower.
PC07	Upland mesic tundra. Short, vegetated hummocks interspersed with rocky/dry pools.	Lichen, moss, wildflower.
PC08	Upland xeric tundra. Vegetated with small (< 30 cm) rocks.	Grass, moss, wildflower.
PC09	Upland xeric tundra. Vegetated with small (< 30 cm) rocks.	Grass, wildflower.
PC10	Upland mesic tundra. Overlooking wetland with deep hummocks.	Lichen, moss, wildflower.
PC11	Rocky, dry barrens with shallow wet pools.	Lichen, moss.
PC12	Rocky, dry barrens.	None (rock).
PC13	Rocky, dry barrens interspersed with wet pools.	Grass (sparse patches).
PC14	Rocky, dry barrens interspersed with wet pools.	Grass (sparse patches).
PC15	Rocky, dry barrens.	Lichen, moss, wildflower (sparse patches).
PC16	Wetland adjacent to watercourse. Tall grassy hummocks.	Grass, wildflower, moss.
PC17	Upland xeric tundra. Vegetated with many small (< 30 cm) rocks.	Grass, moss, wildflower.
PC18	Upland mesic tundra. Hummocks with shallow wet pools.	Lichen, wildflower (on hummocks).

Point Count Location	Habitat Description	Dominant Vegetation Type
PC19	Upland xeric tundra. Rocky hummocks with shallow dry pools.	Lichen, wildflower (on hummocks).
PC20	Upland mesic tundra. Deep hummocks with wet pools.	Grass, lichen.
PC21	Upland xeric tundra. Shallow hummocks with gravel/dry pools.	Willow, wildflower, lichen.
PC22	Upland xeric tundra. Shallow hummocks with gravel/dry pools.	Lichen, moss, wildflower.
PC23	Upland xeric tundra. Relatively flat and rocky.	Lichen, moss, wildflower.

Results

Table 2.1 summarizes the results of the breeding bird survey at the Site. A total of 1,118 individual birds comprised of 13 species were recorded during the survey. Canada Goose comprised 91% of all individuals recorded and were predominantly observed flying northbound over the Site at a height of 25-50 m in small (<10 individuals) to large (100+ individuals) flocks. Less frequently, small flocks or individuals were observed using available habitats at the site (e.g., waterbodies, riparian areas). Based on discussions with local hunters, it is likely that most goose flocks observed during the breeding bird survey include individuals migrating north to moult their flight feathers. Following Canada Goose, the most observed species included Horned Lark, Lapland Longspur, and American Pipit, all of which are known to breed in the region (Arctic Eider Society, 2021). The surveys confirmed that at least three species are active breeders at the Site, including Canada Goose (depredated egg observed), Horned Lark (two nests with eggs/nestlings observed), and Semipalmated Plover (nest with eggs observed). Breeding evidence suggested that an additional three and eight species are probable and possible breeders at the site, respectively. No Species at Risk (SAR) were observed during field surveys at the Site. The raw survey data is presented in Attachment 3 (Table 1).

Incidental observations included numerous arctic fox (*Vulpes lagopus*), an owl pellet suspected to be produced by a Snowy Owl (*Bubo scandiacus*), and a depredated Canada Goose egg.

Table 2.1 Total abundance and breeding evidence of birds observed during the breeding bird survey

Common Name	Scientific Name	SARA[1,2]	COSEWIC[1,2]	Total Abundance[3]	Maximum Breeding Evidence[4]
Canada Goose	*Branta canadensis*	-	-	1017	Confirmed
Horned Lark	*Eremophila alpestris*	-	-	28	Confirmed
Lapland Longspur	*Calcarius lapponicus*	-	-	19	Probable
American Pipit	*Anthus rubescens*	-	-	14	Probable
Herring Gull	*Larus argentatus*	-	-	10	Probable
Glaucous Gull	*Larus hyperboreus*	-	-	7	Possible
Common Raven	*Corvus corax*	-	-	6	Possible
Tundra Swan	*Cygnus columbianus*	-	-	4	Possible
Herring Gull / Glaucous Gull	*Larus argentatus / Larus hyperboreus*	-	-	3	Possible
Northern Pintail	*Anas acuta*	-	-	2	Possible
Semipalmated Plover	*Charadrius semipalmatus*	-	-	2	Confirmed
Snow Bunting	*Plectrophenax nivalis*	-	-	2	Possible
Unidentified Bird	*Aves (gen, sp)*	-	-	2	-
Common Loon	*Gavia immer*	-	-	1	Possible
Least Sandpiper	*Calidris minutilla*	-	-	1	Possible

Notes:

[1] SARA = Federal Species at Risk Act; COSEWIC = Committee on the Status of Endangered Wildlife in Canada.

[2] Species at Risk (SAR) include any species designated as Endangered, Threatened or Special Concern by COSEWIC and/or SARA.

[3] Includes individuals observed during 10-min point counts and incidentally at the Site.

[4] Maximum breeding evidence categorization follows OBBA criteria (OBBA, 2021).

Habitat Assessment

The habitats along the proposed access road / transmission line, alternative access road, and existing trail contain suitable nesting habitat for ground-nesting passerines, shorebirds, raptors, and waterfowl. However, the habitat is relatively homogeneous and not unique to the Project site. Refer to Table 2.1 for general habitat descriptions at each survey location.

The ridge where the turbines are proposed predominantly contains exposed, rocky barren habitat with sparse vegetation. Due to the degree of exposure and lack of vegetative cover, the turbine footprints do not contain suitable nesting habitat for most bird species known to breed in the area. Additionally, the ridge is relatively flat and does not contain any suitable cliffs for cliff-nesting raptors such as Peregrine Falcon (*Falco peregrinus*). The ridge does contain suitable perches for Peregrine Falcon and other birds of prey, which could further deter nesting in the area by smaller-bodied species with high predation rates of nests and young (i.e., small shorebirds, passerines). The only species observed within the turbine footprints was Common Raven (*Corvus corax*). Therefore, it is unlikely that Project activities will significantly reduce available habitat for nesting birds. However, birds of prey utilizing perches atop the ridge may be at a higher risk of colliding with turbines.

Acoustic Bird Survey

Methodology

To monitor acoustic activity of birds at the Site, including northbound migrants, breeding birds, and southbound migrants, a SongMeter SM4 acoustic recorder (manufactured by Wildlife Acoustics Inc.) was deployed at the onsite meteorological (MET) tower for several months in 2021. The unit was mounted to the tower at a height of approximately 1.25 m, with the unit facing east and the two built-in weatherproof microphones oriented to the north and south, as shown in Figure 2.1. Monitoring began on 12 May 2021 and continued until 28 October 2021. However, acoustic data between 06 August and 28 October (i.e., fall migration period) was lost due to technical issues.

The unit was programmed to record on a 25% duty cycle (15 minutes on, 45 minutes off) to monitor throughout the day and night. Manufacturer-recommended settings were applied during monitoring, including a sampling rate of 24 kHz, a pre-amp of 26 dB gain, and no high pass filter. Raw data were recorded as WAV files onto two 256 gB SD cards installed in the unit. The WAV files were subsampled into 1-min segments ("sampling intervals") during data analysis; the first minute of each hour was then reviewed and annotated manually using Wildlife Acoustics Inc.'s Kaleidoscope Pro (Version 5.3.8) software. Due to the wide range of vocalizations detected (e.g., territorial songs; flight, alarm, and social calls) species presence/absence within each 1-min sampling interval was selected as the metric for measuring relative detection frequency per species. This method allowed for a relatively unbiased comparison of species detection rates while avoiding arbitrary and potentially skewed vocalization "counts". The number of sampling intervals in which each species was detected was then tabulated.

Spectrogram analysis was conducted with guidance from Pieplow (2017). Vocalizations were classified to the lowest possible taxonomic level or species group. It must be noted that the number of vocalizations observed cannot be considered an index of migration passage or residency rates. For instance, some species are more vocal than others and therefore may be detected at higher rates. Additionally, for monitoring occurring during the peak breeding season (June and July), individuals breeding near the unit may be detected repetitively due to frequent production of territorial singing and nest defence vocalizations. Weather conditions and other interference can also affect the rates of bird movement and flight calls and/or can mask vocalizations, thereby reducing detection rates.

During spectrogram analysis, it was noted that many of the audio recordings had relatively high levels of noise interference from wind and precipitation. Therefore, the relative noise interference of each 1-min sampling interval was scored on an arbitrary scale of 0-5 (0 = none; 1 = low; 2 = low-medium; 3 = medium; 4 = medium high; 5 = high). As noted above, intervals with high noise interference may have lower detection rates.

Figure 2.1: SongMeter SM4 acoustic recorder (circled in blue) mounted on the MET tower

Results

Subsampling resulted in a total of 2,059 sampling intervals recorded between 12 May and 06 August 2022 (i.e., 24 1-min recordings per monitoring day). Of these, 220 were lost due to file corruption potentially caused by the unit's firmware and/or SD card (pers. comm., Wildlife Acoustics Support Team, 31 Jan 2022). This resulted in a total of 1839 viable sampling intervals.

Table 2.3 summarizes avian detections throughout the monitoring period. A total of 14 species were detected, with at least one species detected in 198 of the sampling intervals. Due to high noise interference and acoustic attenuation, it was sometimes not possible to identify calls to species. In these cases, the vocalizations were categorized as Unidentified Bird or to the lowest possible species grouping (e.g., Herring Gull / Glaucous Gull). The most frequent species / species groupings detected included American Pipit, Canada Goose / Snow Goose, Horned Lark, and Canada Goose. Of the species detected, nine are confirmed breeders in the Belcher Islands region; two are possible breeders; and three are known to use the Belcher Islands during migration (Arctic Eider Society, 2021). Territorial singing was detected during the peak breeding season (i.e., June and July) for Least Sandpiper, Common Loon, and several passerine species including Horned Lark, Snow Bunting, Lapland Longspur, American Pipit, and White-crowned Sparrow. For these species, songs were the most frequent vocalization detected; however, short 'chip-like' and 'whistle-like' calls were also recorded. Geese were most frequently detected calling in groups of several individuals, which could indicate flybys of migratory flocks over the Site and/or flocks on the ground near the recording unit.

No birds were detected in 1641/1839 (89%) sampling intervals. However, it should be noted that in 1437/1641 (88%) of these intervals, relative noise interference was scored as 5 (i.e., High). Therefore, it is likely that some bird vocalizations were masked due to high noise interference, leading to false negatives in the dataset.

Refer to Table 2 in Attachment 3 for a supplementary table summarizing species detections by month.

Table 2.2: Summary of bird species detected during acoustic monitoring

Common Name	*Scientific Name*	SARA[1,2]	COSEWIC[1,2]	Total number of sampling intervals detected	Expected timing of occurrence and confirmed breeder status on Belcher Islands[3]
American Pipit	*Anthus rubescens*	-	-	64	Summer, confirmed breeder
Canada Goose / Snow Goose	*Branta canadensis / Anser caerulescens*	-	-	48	Summer, confirmed breeder and migration (Canada Goose) Migration (Snow Goose)
Horned Lark	*Eremophila alpestris*	-	-	30	Summer, confirmed breeder
Canada Goose	*Branta canadensis*	-	-	23	Summer, confirmed breeder and migration
Snow Bunting	*Plectrophenax nivalis*	-	-	21	Summer, confirmed breeder
Common Loon	*Gavia immer*	-	-	14	Summer, confirmed breeder
Snow Goose	*Anser caerulescens*	-	-	11	Migration

Common Name	*Scientific Name*	SARA[1,2]	COSEWIC[1,2]	Total number of sampling intervals detected	Expected timing of occurrence and confirmed breeder status on Belcher Islands[3]
White-crowned Sparrow	*Zonotrichia leucophrys*	-	-	10	Summer, possible breeder
Unidentified Bird	*Aves (gen, sp)*	-	-	8	n/a
Herring Gull / Glaucous Gull	*Larus argentatus / Larus hyperboreus*	-	-	6	Year round, confirmed breeder (Glaucous Gull) Summer, confirmed breeder (Herring Gull)
Common Raven	*Corvus corax*	-	-	5	Year-round, confirmed breeder
Least Sandpiper	*Calidris minutilla*	-	-	5	Possible breeder
Herring Gull	*Larus argentatus*	-	-	2	Summer, confirmed breeder
Lapland Longspur	*Calcarius lapponicus*	-	-	2	Summer, confirmed breeder
Sandhill Crane	*Grus canadensis*	-	-	2	Migration
Black-bellied Plover	*Pluvialis squatarola*	-	-	1	Migration
Semipalmated Plover	*Charadrius semipalmatus*	-	-	1	Summer, confirmed breeder

Notes:

[1] SARA = Federal Species at Risk Act; COSEWIC = Committee on the Status of Endangered Wildlife in Canada.

[2] Species at Risk (SAR) include any species designated as Endangered, Threatened or Special Concern by COSEWIC and/or SARA.

[3] Information obtained from Arctic Eider Society, 2022.

3. Conclusion

This Addendum addresses the survey requirements identified in the BIA (Section 4.2.2.5, 2nd para.) by summarizing the breeding bird and acoustic bird surveys conducted at the Site. A review of the updated survey results supports the BIA's conclusion that the level of residual impact of the Project on avifauna is expected to be low (Wood, 2022a). The mitigation measures summarized in Table 6.2 of the BIA (Wood, 2022a) are sufficient to minimize Project impacts on avifauna.

4. Supporting Documents

Arctic Eider Society. 2021. Bird species list for Qikigtait area, Belcher Islands, Nunavut (Draft). 22 pp.

Environment Canada (EC). 2007a. Wind Turbines and Birds: A Guidance Document for Environmental Assessment. Environment Canada – Canadian Wildlife Service. 46pp.

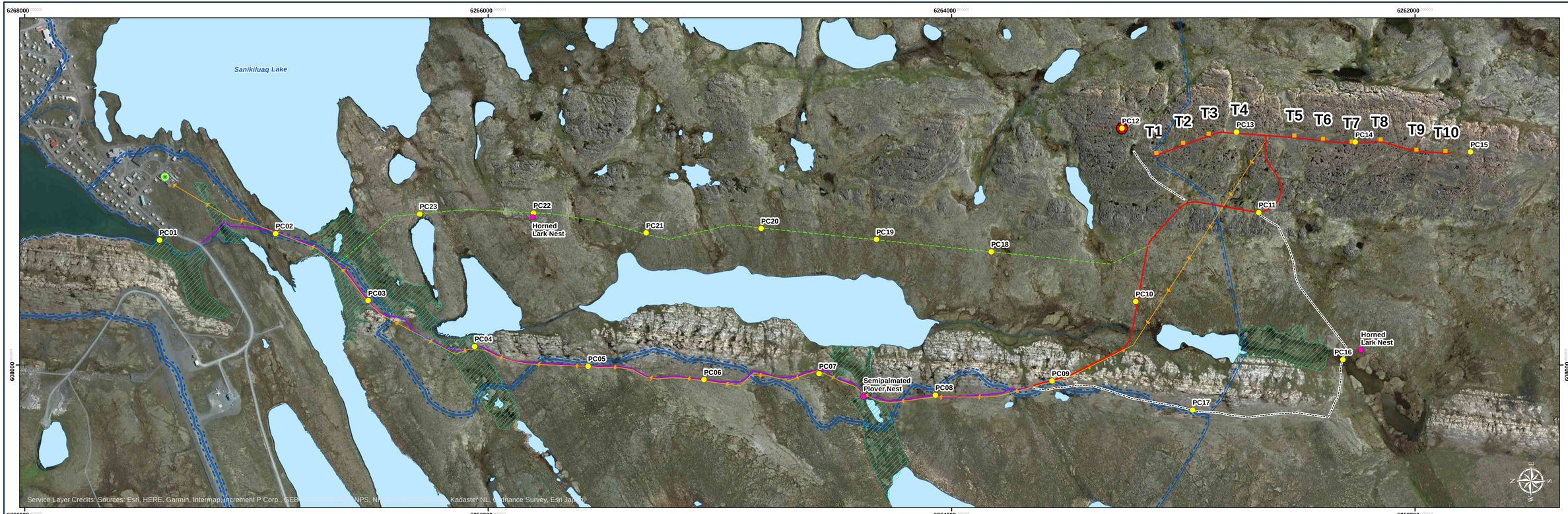
Environment Canada (EC). 2007b. Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds. Environment Canada – Canadian Wildlife Service. 33pp.

Pieplow. 2017. Peterson Field Guide to Bird Sounds of Eastern North America. Houghton Mifflin Harcourt Publishing Company, New York, NY. 593 pp.

Wood. 2022a. Biophysical Impact Assessment: High Displacement Renewable Energy Project (Final Report), Sanikiluaq, NU. Wood Environment and Infrastructure Solutions. 86 pp.

Wood 2022b. Project Specific Health and Safety Plan: Avian and Watercourse Surveys (Version 0), Sanikiluaq, NU. Wood Environment and Infrastructure Solutions. 58 pp.

Attachment 1 – Survey Locations



LEGEND:

- Avian Point Count Survey Location
- Confirmed Breeding Evidence
- MET Tower / Acoustic Recorder Location
- Proposed Wind Turbine Locations
- Qulliq Power Station
- Alternative Road and Transmission Line Route
- Existing Trail
- Existing Trail Upgraded to Access Road
- New Access Road
- New Transmission Line
- Watercourse
- Waterbody
- Wetlands
- Watershed Divide

KEYMAP

CLIENT:

QIKIQTAALUK BUSINESS DEVELOPMENT CORPORATION

wood.

TITLE:

AVIAN SURVEY LOCATIONS

PROJECT:

SANIKILUAQ WIND PROJECT

PROJECT NO:	DATE:
TAV1989301	JULY 2022
REV NO: 0	DWN BY: CM
DATUM: NAD83 CSRS 2010	PROJECTION: UTM ZONE 17 N

FIGURE:

FIGURE 1

SCALE:

1:8,500

0 100 200 400

Metres