GOLDER
MEMBER OF WSP

REPORT

Hilda Wind Power Project - Environmental Evaluation

Renewable Energy Systems Canada Inc.

Submitted to:

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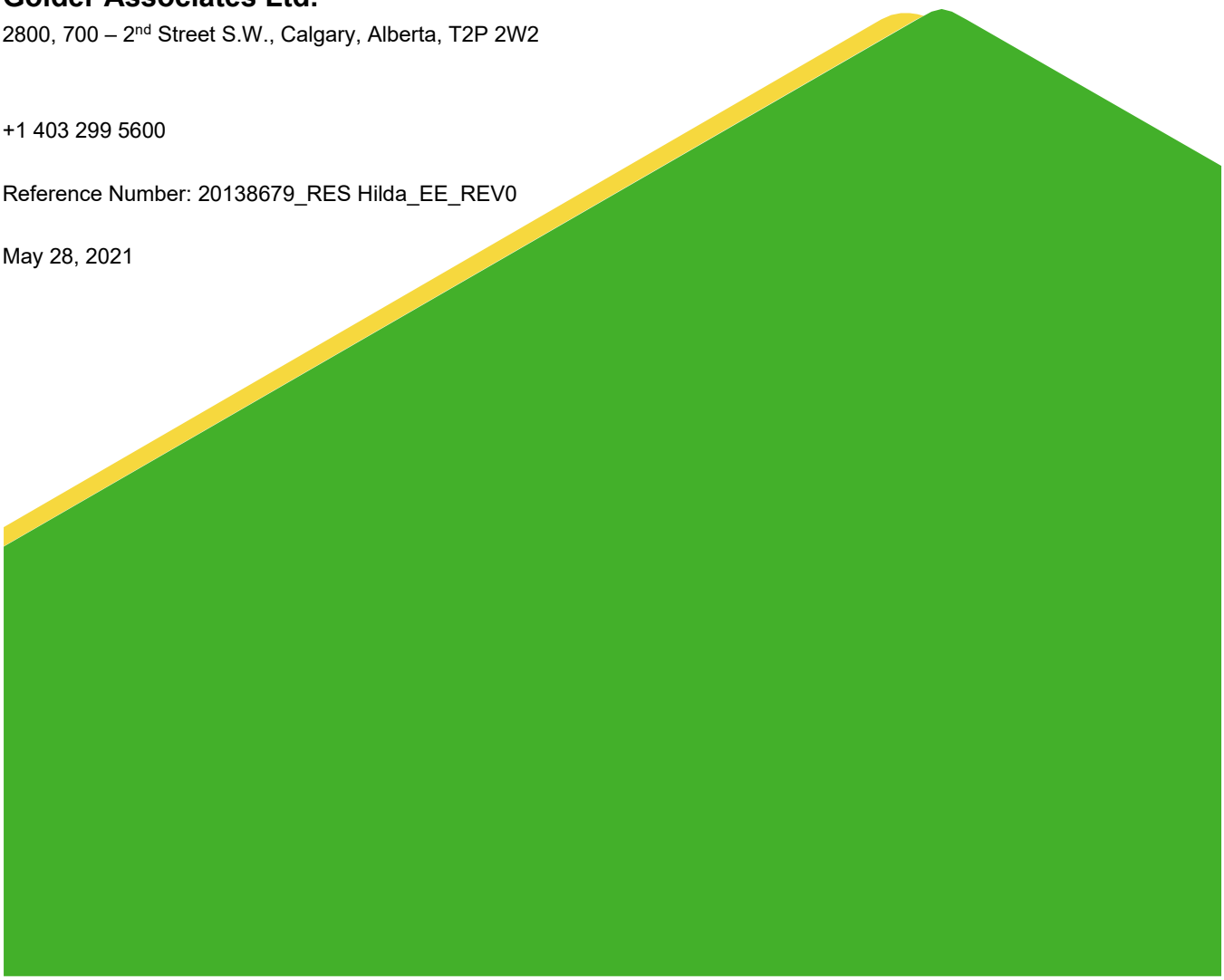
May 28, 2021



Distribution List

1 electronic copy - Alberta Utilities Commission

1 electronic copy - RES Canada Inc.

1 electronic copy - Golder Associates Ltd.

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1.0 INTRODUCTION

Renewable Energy Systems Canada Inc. (RES) retained Golder Associates Ltd. (Golder) to complete an Environmental Evaluation of their proposed Hilda Wind Power Project (the Project) located in Alberta's Cypress County (County), approximately 3 km northwest of the hamlet of Hilda, Alberta.

The Environmental Evaluation describes baseline environmental conditions, identifies potential environmental effects of the Project, describes mitigation measures to be implemented during construction, operation and decommissioning of the Project, and assesses the predicted residual effects. This Environmental Evaluation was prepared to support the Proponent's Facility Application to the Alberta Utilities Commission (AUC) for a permit to construct and a license to operate the Project. Specifically, the Environmental Evaluation addresses AUC Rule 007 information requirements PP10, PP16 and PP17 (AUC 2019). The AUC Rule 012: Noise Control information requirements for assessing potential environmental noise impacts will be provided in a separate Noise Impact Assessment document.

1.1 Project Description

The Project will be located approximately 80 km northeast of the City of Medicine Hat, Alberta within portions of Township 18, Ranges 1 and 2, west of the fourth meridian (W4M) (Figure 1.1-1). The Project layout submitted for this AUC Rule 007 Application and the Environmental Evaluation is based on a total installed nameplate capacity of up to 100 megawatts (MW) for delivery to the Alberta Interconnected Electric System (AIES).

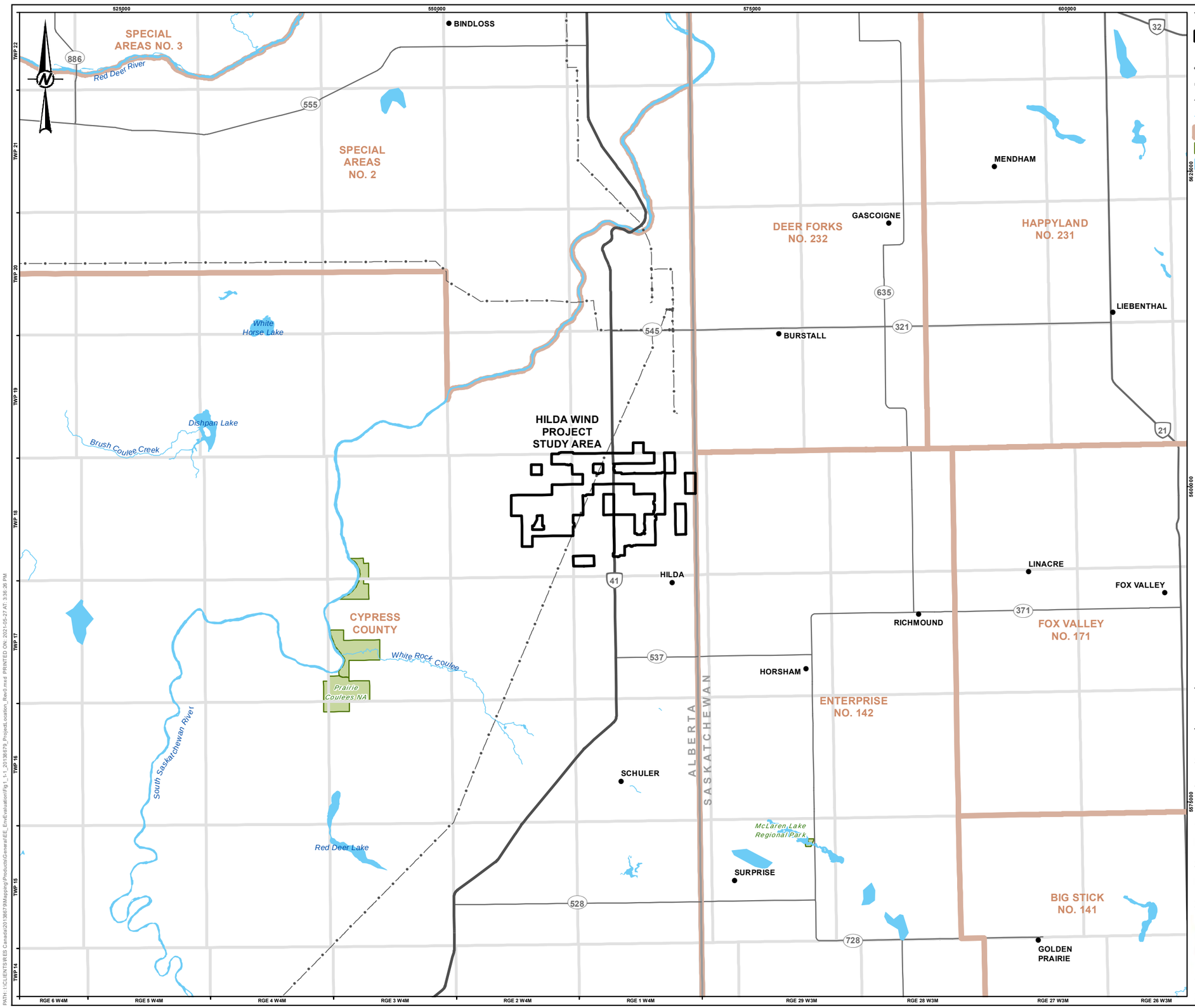
The current layout contemplates 20, 5.0 MW wind turbines. On-going discussions with turbine manufacturers may result in the selection of a turbine with a larger nameplate capacity, resulting in the need for fewer locations. The Proponent is currently permitting the baseline condition of 20 turbines locations, but potentially could remove some turbine locations from the Project prior to construction.

The Project's permanent operational footprint (i.e., 30 years, up to 50 year operation time period if a repowering option is chosen) will include Wind Turbine Generators (turbines) and associated foundation or "pad" sites (turbine locations), access roads, a Project substation including an operation and maintenance building, a short 138 kV transmission line to connect to AltaLink Management Limited's (AltaLink) existing 658L 138 kV line, and one permanent meteorological (met) tower. Public roads (within municipal road allowances) will be used to access the Project and may require some upgrades.

The Project's temporary footprint (construction footprint or limit of disturbance), required only during the construction period to install permanent infrastructure will include temporary workspace for the storage of equipment or materials in a temporary laydown area, a temporary work area around the turbine locations for the assembly and installation of turbines, temporary right-of-way (ROW) for the installation of underground collector lines, and temporary work areas adjacent to access roads and upgrades to existing public roads for construction access purposes.

The Project Study Area is approximately 5,246.9 ha of land. Based on conservative (i.e., worst-case) estimates of the area of disturbance associated with Project infrastructure, the Project Footprint (i.e., operational and construction footprint) has the potential to adversely affect 107.0 ha of land (2.0%) within the Project Study Area during construction, of which 9.2 ha (0.2% of Project Study Area) will be permanently affected through to the operational stage.

This Environmental Evaluation has been prepared in support of the Facility Application. Details pertaining to components of the Project infrastructure are presented in section PP28 of the Facility Application.



LEGEND

- PROJECT STUDY AREA[1]
- POPULATED PLACE
- EXISTING TRANSMISSION LINE
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- WATERCOURSE
- MUNICIPAL BOUNDARY
- PARK / PROTECTED AREA
- WATERBODY

0 7,500 15,000

1:300,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.

REFERENCE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
PROJECT LOCATION

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JS
PREPARED	LMS
REVIEWED	BS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	1.1-1

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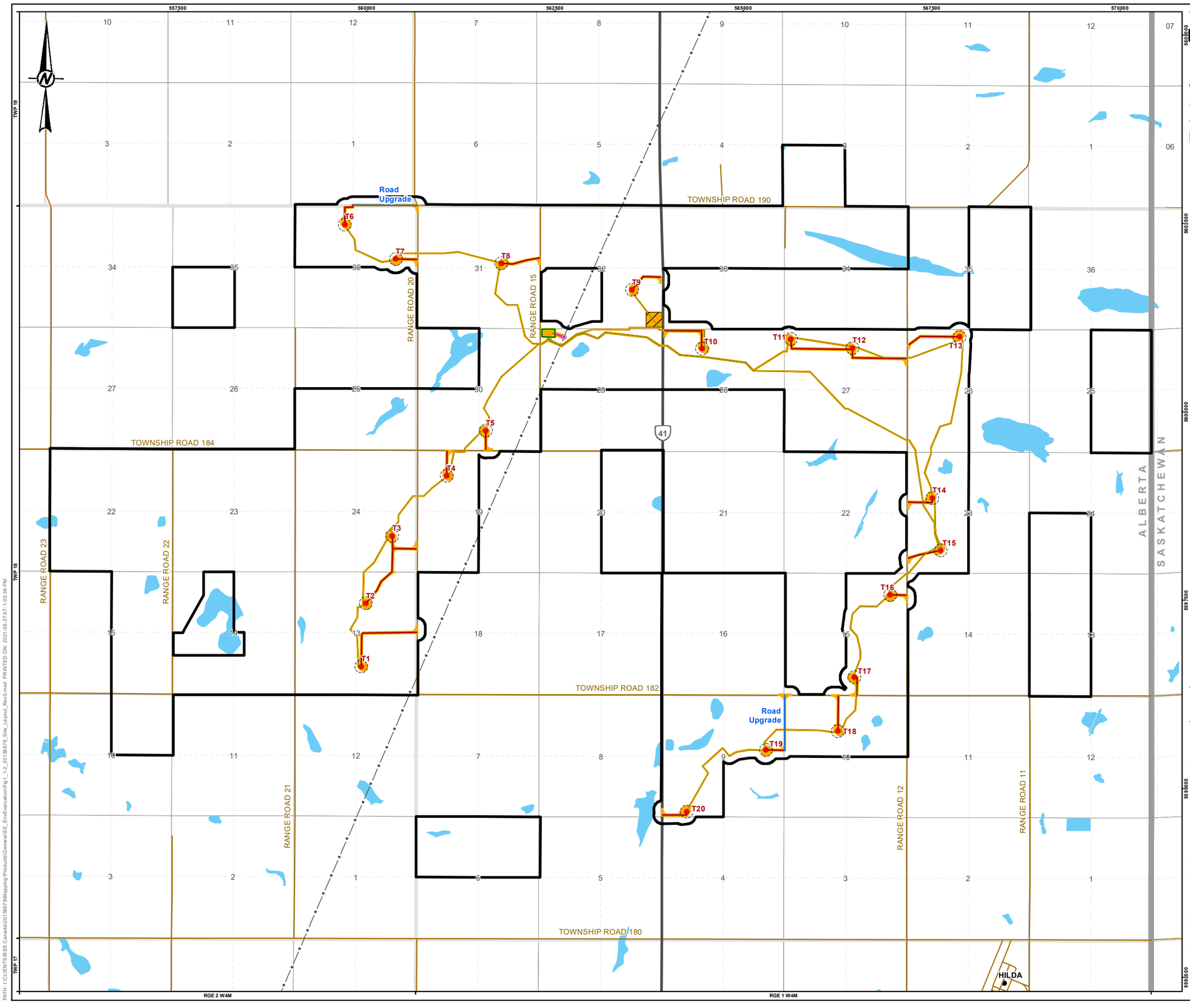

LEGEND

- PROJECT STUDY AREA[1]
- ROTOR-SWEPT AREA

BASE FEATURES

- HAMLET
- EXISTING ALTALINK 138 kV TRANSMISSION LINE
- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERBODY

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- POINT OF INTERCONNECTION
- COLLECTOR SYSTEM
- OVERHEAD TRANSMISSION LINE
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

0 1,000 2,000

1:50,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.

REFERENCE(S)

PROJECT FOOTPRINT COMPONENTS DATA OBTAINED FROM RES, DECEMBER 2020.
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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
PROJECT STUDY AREA AND SITE LAYOUT

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JS
PREPARED	LMS
REVIEWED	BS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	1.1-2

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1.2 Project Activities

1.2.1 Pre-Construction Phase

Project planning and site selection were based on a number of factors, including a wind resource assessment, review of terrain and topography, bylaw requirements, environmental considerations, access to interconnection and transmission, and landowner interest. After the Project Study Area was determined to be suitable for wind power development, a preliminary wind turbine layout was developed while considering the following factors:

- results from wind profile studies and met data (e.g., turbine layout and array design to optimize wind energy yield)
- topography, slopes, and terrain conditions
- potential effect on landowners and area residents
- existing land use and site access
- existing industrial activity and infrastructure
- environmental setback requirements, standards, and best management practices (AEP 2018a)
- historical resources information (e.g., general listing of historical resources)
- other regulatory setback or land zoning requirements from other regulatory agencies, namely:
  - Cypress County Municipal Development Plan (July 2015, amended August 2018)
  - Cypress County Land Use Bylaw 2018/04 (2018)
  - AUC Rule 012 – Noise Control (August 2019)
  - Alberta Transportation setbacks from numbered highways

The Project components (i.e., turbines, Project substation, access roads, electrical collector system, and transmission line) were sited to optimize the power output of the Project while minimizing its potential environmental and social effects. The site layout is shown in Figure 1.1-2. The Project will include the following components:

- 20 turbines, with associated work area and gravel ring, and crane pad
- underground, medium-voltage (34.5 kilovolt [kV]) collector system
- Project substation including operation and maintenance building
- 138 kV transmission line (up to150 m in length, to connect to AltaLink's existing 658L 138 kV line)
- permanent public and turbine access roads
- temporary construction turnaround loops
- temporary workspaces at the turbine locations
- temporary laydown yard

Baseline environmental surveys have been undertaken as described under each relevant environmental discipline in Section 3.0; however, other pre-construction activities (e.g., geotechnical assessment, soil surveys, final legal survey of turbine locations, and final detailed engineering and design) will take place prior to construction.

The activities for the construction, operation, and decommissioning phases of the Project components are described below.

1.2.2 Construction Phase

Typical construction equipment to be used for erection of the wind turbines, and construction of the roads, Project substation including operation and maintenance building, laydown yard and underground collector lines, includes tracked bulldozers, excavators, cranes, and assorted trucks. Various large truck and trailer combinations will be used to transport the turbine components to the site and ready-mix concrete trucks will haul concrete from either a batch plant or local ready-mix facility in the area to the turbine foundation locations. Typically, two to three cranes will be used to erect the turbines at each location. Additional vehicles will be used for personnel and small equipment transport to, from, and at the site.

Following the construction of permanent facilities, areas not containing permanent facilities or operational access roads will be returned to cultivated, tame pasture or hay land cover types.

Table 1.2-1 provides a description of the construction phase by component and construction activity.

Table 1.2-1: Description of Project Construction Activities

Project Component and Activity	Description
Surveying	The boundaries of the construction areas, including wind turbine sites, Project substation site, access roads and underground collection system, and temporary workspaces will be surveyed and staked. All existing buried infrastructure, such as pipelines and cables will be located and marked using the Alberta One-Call System. The site will be surveyed prior to the start of construction.
Access Roads	The Project will generally utilize existing public roads along with a combination of upgrading two existing trails in County road allowances and new turbine access roads. A total of approximately 1.6 km of existing trails in County road allowances will be upgraded to access roads, and 10.4 km of new access roads will be required to access the turbine locations. The trails during road upgrades and turbine access roads will be approximately 20 m and 30 m wide, respectively during construction. During operation, upgraded public roads will be approximately 10 m wide and the new turbine access roads approximately 5.0 m wide. The operational roads will consist of a combination of all-weather graveled and seasonal, cleared and compacted access roads that will be maintained for use during Project operation, while maintaining a low profile to enable farming and minimize disturbance; unless removal of the gravel surface is requested by the landowner. Culverts may be required to maintain drainage in ditches at junctions with existing roads. Permanent public roads, turbine access roads and temporary turnaround areas will be built using tracked bulldozers and graders to strip topsoil and upper subsoil, as required, to create an even travel surface. Soil management will be incorporated into the construction of the permanent access roads and temporary construction roads to facilitate site reclamation. Existing vegetation will be cleared and grubbed with the topsoil, which will be conserved and stockpiled separately from upper subsoil (a two-lift procedure) and stabilized as necessary to prevent erosion. When Project construction is complete, stripped upper subsoil and topsoil will be replaced. The turbine sites have been designed with a temporary turn-around loop for construction vehicles to pull around the turbine site. The primary purpose for the temporary turnaround loops will be to move the assembled crane from turbine to turbine and to avoid additional crane breakdowns and travel on county roads. The turnaround loops will also be used for the delivery of wind turbine components, construction materials, and equipment to the wind turbine locations. Temporary turnaround loops may not be stripped of soil unless grading is required where a two-lift procedure will then take place similar to the permanent roads. Movement of cranes will be restricted to dry or frozen conditions, where possible. Where practical, the temporary turn-around loops have been preferentially sited on cultivated land. In these disturbed areas, soil will be tilled or harrowed during reclamation to reduce soil compaction.
Delivery of Equipment	Equipment will be delivered by truck and trailer as needed throughout the construction phase and will be stored as necessary at the temporary storage area at the site, as well as directly on each of the assessed 20 wind turbine pads. As necessary, a traffic management plan will be developed using Alberta Transportation standards to limit traffic disturbance.
Turbine Sites	During construction, each turbine location with its associated temporary workspace will have a maximum disturbed area of approximately 2 ha. There will be two temporary workspaces at each turbine location for tower storage and blade storage. The operational footprint at the base of each turbine that will remain disturbed after construction and reclamation of temporary disturbance (i.e., the turbine pad area that cannot be used for cultivation) will be approximately 400 m^2 (0.04 ha). The turbine sites will be prepared using graders, compacters, tracked bulldozers, and hoes to strip topsoil and upper subsoil (a two-lift salvage procedure) to create an even work surface. Soil management will be incorporated into this process to facilitate site reclamation. Existing vegetation will be cleared and grubbed with the topsoil and stockpiled separately from stripped or excavated upper subsoil. After turbine assembly, stripped or excavated subsoil and topsoil will be replaced, as appropriate.

Table 1.2-1: Description of Project Construction Activities

Project Component and Activity	Description
Foundations	The turbine foundation will follow a typical concrete mat or gravity footing design that is approximately 20 m by 20 m and approximately 3.6 m deep. The excavation for construction of the foundation will be approximately 40 m in diameter and will be backfilled approximately one to two weeks after the concrete foundation is poured. Excess backfill materials will be redistributed onsite, transported to other areas of the Project for use as fill (where required), or disposed of off-site and/or on-site in cooperation with, and only as directed and approved, by landowners. No excess soils will be transported off-site or to other landowners' properties without the authorization and consent of both the source and receiving landowners. The foundations will be allowed to cure for up to several weeks prior to erection of the turbines. It is expected to take approximately three to four days to excavate and construct each turbine foundation, pending appropriate weather conditions.
Turbine Assembly and Installation [(a)]	Twenty (20) turbines are included in this assessment; however, it is possible that only 17 will be constructed. The turbine towers come in four sections that are assembled and erected onto the foundation by crane. The nacelle is lifted onto the tower by crane. The hub is lifted with the nacelle. Each blade is then installed separately aboveground using a crane to lift the blade to the hub. Each turbine will be 102.5 m high to the hub, with 72.5 m long rotor blades (i.e., total rotor-swept diameter of 145 m). The cranes will travel between turbine sites along the new permanent public and turbine access roads, which may require some grading. Soil management will be incorporated into this process to facilitate site reclamation. The assembly of all turbines is anticipated to take approximately three to four months.
Project Substation and Transmission Line	The Project substation consists primarily of electrical equipment including one main power transformer, high and medium voltage circuit breakers, disconnect switches, and a control building. The Project substation will be located in the northwest quarter of Section 29, Township 18, Range 1, West of the Fourth Meridian (W4M) (UTM: NAD 83, Zone 12, 562473 E, 5600927 N). It will occupy an area of up to approximately 185 m by 110 m (2.0 ha) during construction and will occupy an area of approximately 175 m by 100 m (1.8 ha) during operation. The Project substation site will be excavated to allow for the installation of a ground grid and the construction of concrete foundations. The final grade of the Project substation will consist of gravel or rock that provides an insulating barrier to electric shock during an electrical fault. The Project substation equipment will be mounted on the concrete and/or pile foundations and all metal components of the Project substation will be connected to the ground grid. This area will be fenced to prevent unauthorized access. The Project substation location has been sited directly adjacent to the existing 658L138 kV line running through the Project Study Area immediately to the east of the substation within the same quarter section, to minimize the overall disturbance in the area. The overhead transmission line will be up to 150 m in length and connect to the existing AltaLink 138 kV line to the east. The transmission line height is expected to range from 9 m to 15 m. Depending upon local conditions at the time of construction, it is anticipated to take four months to construct the Project substation.
Operation and Maintenance Building	The operation and maintenance building will mainly consist of an electrical room, workshop, supervisory control, and data acquisition (SCADA) room, parts room, conference room, and office spaces. The facility will be located within the 175 m by 105 m (approximately 1.8 ha) substation area in the northwest quarter of Section 29, Township 18, Range 1, W4M (UTM: NAD 83, Zone 12, 562473 E, 5600927 N). No area additional to the substation location is required for the operation and maintenance building during construction or operation.
Temporary Laydown Yard	One temporary laydown area will be constructed to provide a secure location for managing and storing materials, tools, and equipment during construction and to accommodate the temporary contractor site office trailers. The temporary laydown area will be up to approximately 200 m by 210 m (approximately 4 ha) in size, located on cultivated lands in the southwest quarter of Section 32, Township 18, Range 1, W4M (UTM: NAD 83, Zone 12, 563873 E, 5601123 N), and will remain in place throughout the construction period. As required, the yard will also be stripped of topsoil and upper subsoil, geotextile matting applied, and a gravel base set. Temporary power may also be provided to the temporary laydown yard, as needed. Following construction of the Project, the gravel, geotextile matting, and power supplies will be removed, and the upper subsoil and topsoil replaced.
Collector System	The collector system will consist of medium-voltage (34.5 kV) standard utility cable and a fibre optic communication cable buried to a minimum depth of approximately 1 m as per the Canadian Electrical Code. The preferred method of install for the underground cables will be the ploughing technique using a single cut tooth that splits the earth apart and allows the cables and sand bedding along with warning tape to be installed. No backfilling or compaction is required when using the ploughing method. Alternatively, in some cases (large tracts with several circuits, for example) the cables may be installed in a trench. The topsoil and upper subsoil removed from the trench will be placed adjacent to the trench separately to prevent admixing. A backhoe or small bobcat will be used to push the subsoil, followed by the topsoil back into place, and to re-compact and re-contour the disturbed area. The total length of the collection system is approximately 35.6 km. The disturbance footprint of the collection system has been conservatively assumed to be within a work area of approximately 12 m in width. Above ground junction boxes to connect segments of the underground collection line system are required and will be minimized to the greatest extent possible. The underground collection system will be located on private lands, except for crossings of road allowance, and will be installed at a depth that will enable farming operations to resume over the area.

Table 1.2-1: Description of Project Construction Activities

Project Component and Activity	Description
Permanent Meteorological Tower	One met testing tower will be located on the site for the duration of the operational phase of the Project. The disturbed area for the met tower will be <0.1 ha in size. The location of the met tower is unknown and will be finalized in discussions with the turbine manufacturer. The met tower will be sited in cultivated fields near the Project footprint and will avoid environmentally sensitive features plus their associated setbacks. The disturbance during construction is primarily associated with excavation for a concrete foundation at the met tower base and for guy wire anchors, if a guyed met tower is used, although guy wire anchors are not currently anticipated. If used, guy wires for the permanent met tower will be equipped with markers specifically designed to reduce the potential for bird collision following the marker standards provided by Power Line Sentry (Power Line Sentry 2019). This tower is expected to be in the range of 60 to 100 m in total height and would be installed in a few days.
Gates and Fencing	The turbine sites or access roads will generally not be fenced or gated, unless requested by landowners. The Proponent will place signs on the entrances of these roads indicating that they are on private lands and do not provide through access. The Project substation will be fenced to limit uncontrolled access and for public safety. Where the Project's access roads intersect public roads, gates may be installed as per landowner request.
Parking Areas	The primary construction and operations parking area will be located at the operation and maintenance building and at the laydown yard.
Clean-Up and Reclamation	Garbage and debris will be collected and disposed of at an approved location. All construction equipment and vehicles will be removed from the construction area following the completion of construction. Compacted soils will be de-compacted and stripped soils will be replaced and re-contoured at the temporary workspaces and laydown yard. The non-cultivated disturbed areas (including trenches) will be re-seeded as appropriate or left in a condition specified by the landowner. Site clean-up and reclamation will be conducted concurrently with construction, as appropriate. Lease roads and turbine sites on private land are subject to the AEP-FWS standards for surface lease construction in regard to soil horizon's preservation and reclamation.
Wind Turbine Commissioning	Turbine commissioning will occur once the wind turbines have been mechanically completed and inspected and when the Alberta Electric System Operator is ready to accept grid interconnection. Commissioning involves testing and inspection of electrical, mechanical, communications and control function operability. A detailed set of operating instructions will be followed to connect with the electrical grid.

(a) The Renewable Energy Project Submission to Alberta Environment and Parks (Appendix G) was prepared using more conservative turbine assumptions as the turbine specifications were not available during preparation of the report.

AEP-FWS = Alberta Environment and Parks, Fish and Wildlife Stewardship; E = Easting; ha = hectares; kV = kiloVolts; m = metres; m^2 = square metres; NAD = North American Datum; N = Northing; UTM = Universal Transverse Mercator; W4M = West of the Fourth Meridian; < = less than.

Pending receipt of the required regulatory approvals, construction of the Project is planned to start in Q4 2021 when conditions are suitable for construction, with operations commencing as early as December 2022. The anticipated Project construction schedule is outlined in Table 1.35-1 of the AUC Rule 007 Facility Application. It accounts for a potential delay in equipment arrival, and adverse weather conditions. If regulatory approval is substantially delayed, subsequent construction delays may result due to a corresponding construction start in unfavorable season/poor weather conditions that would prolong construction activities.

1.2.3 Operation Phase

The wind turbines selected for the Project operate automatically and are monitored and controlled through a remote Supervisory Control and Data Acquisition (SCADA) system. Modern wind turbines are designed to require minimal on-going maintenance. Due to the mechanical nature of the components, the changing of the oil in the gearbox and hydraulic systems, and other general maintenance, maintenance activities will be required regularly throughout the wind turbine's life span.

Preventative maintenance is likely to be carried out quarterly during the first operational year (as per manufacturers recommended "break-in" period). Other routine servicing will be completed at that time, as required. Following the "break-in" period, the regularly scheduled maintenance cycle is every six months, notwithstanding unplanned maintenance visits, as required. Used oil and other wastes will be disposed of at an approved facility following each maintenance visit.

1.2.4 Repowering Phase

The design life of the Project is estimated to be 30 years; however, it is not uncommon for well-maintained projects to have a longer useful life than the design life. To extend the life of the Project up to 50 years it is possible that it will be repowered prior to considering any decommissioning activities. Repowering may involve switching/updating gearboxes and generators with new equipment, replacing blades, and upgrading electrical equipment.

1.2.5 Decommissioning Phase

Following any repowering activities, at the end of the useful life of the turbines, decommissioning activities would be implemented. The decommissioning and restoration process comprises of removal of above-ground structures; removal of below-ground structures to a depth of approximately 1.2 m below surface, with the exception of collection lines, which will be left in place; and re-vegetation and seeding. Reclamation will be conducted to meet the requirements of the *Conservation and Reclamation Directive for Renewable Energy Operations* (AEP 2018b) or updates that may be in place at the time of decommissioning, and other applicable bylaws.

Above-ground structures include the wind turbines (including blades, nacelles, and towers), pad-mounted transformers, crane pads, Project substation, met tower, and access gates. Below-ground structures include wind turbine foundations, foundations of the pad-mount transformers and Project substation, underground collection lines, and drainage structures.

The process of removing structures involves evaluating and categorizing all components and materials into categories of recondition and reuse, salvage, recycling, and disposal. In the interest of increased efficiency and minimal transportation effects, components and material may be stored on-site in a pre-approved location until the bulk of similar components or materials are ready for transport. The components and material will be transported to the appropriate facilities for reconditioning, salvage, recycling, and/or disposal.

When decommissioning occurs, reclamation standards at the time of decommissioning will be followed but are generally expected to require the creation of temporary workspaces and access roads, and the use of equipment similar to that used for Project construction, as described in Section 1.2.2. Soil management will be incorporated into this process to facilitate site reclamation.

The turbines will be disassembled and removed from the site. The wind turbine's concrete foundation will be removed to a depth of 1.2 m below surface, and the excavation backfilled with subsoil to match the natural grade. Removal of below-ground concrete structures to a depth of 1.2 m is expected to provide a sufficient soil profile to allow successful revegetation and typical land-use practices (i.e., ploughing, seeding, harvesting, grazing croplands and/or pasture), despite the underlying remnant concrete foundation. Buried concrete is commonly associated with decommissioned industrial facilities (i.e., oil/gas wells), which have in the past been successfully reclaimed. Additional mitigation measures at turbine foundation locations include the removal of surface gravels, and soil decompaction.

Underground cables will be terminated and capped at connection points. It is anticipated that properly terminated and capped underground cables will remain in place, from a practical perspective, in perpetuity. Current farming practices do not use ploughing techniques deeper than 1 m. Given that underground cables are to be buried to a depth of at least 1 m, limited adverse effects to land-use are predicted. Additionally, landowners will be consulted post-Project decommissioning with regard to any concerns that may arise. Gravel, where used, will be removed from the sites.

After infrastructure is removed, the turbine sites and access roads/cabling routes may be ploughed as appropriate to alleviate soil compaction and graded to restore terrain profiles. Topsoil will be replaced and prepared for seeding by the landowner(s) on cultivated areas. All waste material and equipment will be removed from the site. Turbine access roads and new public roads may be left in place at the request of landowners and/or the county.

1.3 Project Setting

1.3.1 Natural Region and Subregion

The Project is located within the Dry Mixedgrass Natural Subregion of the Grassland Natural Region (NRC 2006). The Dry Mixedgrass Subregion is characterized by low-growing, drought-tolerant grass species. Due to moisture deficiencies in this Subregion, crop production is limited. Native areas are generally dominated by blue grama (*Bouteloua gracilis*), needle-and-thread (*Hesperostipa comata*), June grass (*Koeleria macrantha*), and western wheatgrass (*Apropyron smithii*). Shrub communities typically only occur in moister locations, such as ravines and coulees, depressional areas, and north facing slopes. Shrub communities in these areas typically consist of buckbrush (*Symphoricarpos occidentalis*), silver sagebrush (*Artemesia cana),* wolfwillow (*Elaeagnus commutata*) and prickly rose (*Rosa acicularis*) (NRC 2006).

Marshes were the most frequently observed wetland type with temporary marshes (M-G[III]) covering 99.3 ha and seasonal marshes covering (M-G[III]) 71.5 ha, followed by Ephemeral (Class I) water bodies within the Project Study Area. Plant species associated with the wetlands in the Project Study Area included common cattail (*Typha latifolia*), common dandelion (*Taraxacum officinale*), dock species (*Rumex* spp.), foxtail barley (*Hordeum jubatum*), reed canary grass (*Phalaris arundinacea*), rush species (*Juncus* spp.), sedge species (*Carex* spp.), slough grass (*Beckmannia syzigachne*) and willow species (*Salix* spp.). Canada (creeping) thistle *(Cirsium arvense) and* perennial sow-thistle (*Sonchus arvensis*)*,* two noxious weeds in Alberta, was often observed in the transition zone between wetland vegetation and adjacent, upland vegetation (often cultivated or tame pasture or hay).

Terrain within the Project Study Area is generally gently undulating and includes several areas of depressions and low lying areas with organic deposits. The Project is located within the Schuler Uplands Physiographic District which is characterized by hummocky to undulating morainal till deposits (Pettapiece 1986).

1.3.2 Existing Infrastructure and Populated Places

The Project Study Area is situated entirely within Cypress County in southeastern Alberta. Provincial Highway 41 crosses through the east-central portion of the Project Study Area going north and south. Range Roads 11, 12, 15, 21, and 23 enter, cross through or run immediately adjacent to the Project Study Area going north and south and Township Roads 182, 184 and 190 enter, cross through, or run immediately adjacent to the Project Study Area going east and west. Nearby residential communities include the Hamlet of Hilda (2016 population of 45), located approximately 3 km southeast on provincial Highway 11, the Town of Burstall, Saskatchewan (2016 population of 378), located approximately 13 km northeast, and the Hamlet of Schuler (2016 population of 72), located approximately 18 km south of the Project Study Area and approximately 4 km east of Highway 41 (Statistics Canada 2021). Overall, the residential density within the Project Study Area is low. A total of eight occupied residences and farmyards are located within the Project Study Area and a few additional homes are within a few km of the Project Study Area.

The Project Study Area is located in an area that is mainly agricultural and also supports oil and gas activity, including well sites and associated infrastructure (e.g., access roads and pipelines). Other infrastructure includes communication towers, and railroads. The AltaGas Pembina Empress Extraction Plant which produces ethane and natural gas liquids is located approximately 11 km north of the Project Study Area and approximately 4 km east of Highway 41.

1.3.3 Regional Land Use Plans and Policies

The Project overlaps with the boundaries of the following regional land use plans:

- The *South Saskatchewan Regional Plan* (SSRP) (GOA 2018a): The SSRP established a long-term vision for the region and identifies strategic directions for the region over a ten-year period. The Project is consistent with the following objectives under the SSRP Implementation plan (with corresponding numbering):

  1. Economy: the Renewable Energy objectives are to maintain opportunities for the responsible development of the region's renewable energy industry in support of Alberta's commitment to greener energy production and economic development.

  3. Biodiversity and ecosystems: the Project has been planned so that 78% of the footprint is on cultivated lands, and Crown lands are avoided, to minimize impacts to sensitive native land cover types that support biodiversity.

  5. Efficient use of land: the Project has been planned to minimize disturbance, while meeting avoidance and setbacks from sensitive features, to the extent practical, as described in the Environmental Evaluation.

- The *Approved Water Management Plan for the South Saskatchewan River Basin* (GOA 2006): the key objective of this plan is to provide a strategy for a publicly acceptable balance between water consumption and environmental protection in the South Saskatchewan River Basin. The Project will require no operational water inputs to support electrical generation and no discharges to surface water, so is consistent with this plan.

As the Project is located within Cypress Country, it must be developed and operated in adherence to the municipal bylaws present in this county:

- Land Use Bylaw No. 2018/04: the Proponent has engaged with County representatives to verify the municipal requirements under the Land Use Bylaw for the development permit application. An application will be submitted to re-zone the area as a Wind Energy Facility District (WEF). The Project will be developed and designed in compliance with all property, wetland, water body and coulee setbacks. The Proponent will work in close consultation with Cypress County administrative and planning officials.

2.0 ENVIRONMENTAL EVALUATION METHODS

2.1 Approach to the Assessment

The purpose of this Environmental Evaluation is to describe the effects that the Project may have on the environment, using an environmental assessment approach. This section describes the approach and methods used to carry out the assessment. The approach was to identify and address the likely effects of the Project on environmental resources, and analyze and classify the Project effects (i.e., residual effects) remaining after implementing mitigation. This was undertaken using the following steps:

- Determine the scope of the Project and assessment, including identification of issues to be addressed, characteristics of the natural environment to be assessed, and spatial and temporal boundaries.

- Determine the existing environmental setting (i.e., baseline conditions) in the area potentially affected by the Project based on available desktop data and the field studies completed in 2018 and 2020.

- Identify potential interactions between assessed characteristics of the natural environment and Project activities.

- Identify mitigation measures that are technically and economically feasible, and accepted by applicable regulators, to avoid, reduce or eliminate potential effects.
- Describe the likely Project residual effects on assessed characteristics of the natural environment following implementation of the proposed mitigation and predict their significance.
- Describe monitoring plans to evaluate the predicted residual Project effects and the success of applied mitigation.

The Project effects assessment has been conducted by qualified professionals and discipline experts on the study team. The following sub-sections describe the steps taken to conduct the assessment.

2.2 Scope of the Assessment

The scope of the assessment is defined by the interactions between Project activities and the existing natural environment. The assessment of this interaction requires a study area that includes regional and local considerations and is dependent on the activity being undertaken. The environmental baseline information and potential environmental issues addressed in the environmental evaluation were identified through a variety of sources, including:

- review of best available information, including government databases and available technical reports and maps
- field surveys
- information received from stakeholder consultation activities
- input from regulators

2.2.1 Identification of Valued Components

To describe and assess the potential effects of the Project, Valued Components (VCs) were identified. The VCs include any part of the natural environment that is considered important by the proponent, members of the public, or scientists and government agencies involved in the assessment process. Importance may be determined on the basis of cultural value or scientific concern and was assessed for the Project based on proponent and assessor experience with similar projects, regulatory requirements, and stakeholder consultation.

The VCs selected to address the potential environmental effects in relation to this Project and the rationale for their selection are presented in Table 2.2-1.

2.2.1.1 Identifying Project and Environmental Interactions

The likely Project-environment interactions are identified at a screening level. The screening approach allows the assessment to focus on the issues of key importance. All relevant Project works or activities are analyzed individually to determine if there is a plausible mechanism for an effect on each VC during normal Project conditions. The analyses are based on professional judgement and experience of the assessment team with the physical and operational features of the Project and their potential for interaction with the environment.

Potential interactions of the Project with the VC and where adverse effects are likely or possible are illustrated in Table 2.2-1. The interactions identified in Table 2.2-1 were used to focus the description of the baseline conditions, and the assessment and mitigation of potential effects. Where potential interactions between the Project component and a VC are not predicted, no further analysis is performed.

Table 2.2-1: Valued Components, Project Interactions and Rationale

Valued Components	Rationale
Land Cover	■ Provides an indication of both how the land is being used by local landowners and of the potential for the land to support sensitive wildlife and vegetation species
Environmentally Sensitive Areas	■ Represent lands that have been assigned a level of environmental protection, or indicate lands that may have a higher level of environmental sensitivity
Terrain and Soils	■ Altered terrain can change land use and have effects on other environmental components (e.g., surface water, vegetation) ■ Importance of soil quality or productivity to maintain agricultural capability ■ Terrain and soils are important factors in the successful reclamation of a disturbed site ■ Provincial Regulatory requirement for soil conservation and reclamation success (AEP 2018b)
Vegetation	■ Potential implications to wildlife habitat potential, species, and community diversity ■ Regulatory requirement: potential adverse effect on federally listed plant species (Committee on the Status of Endangered Wildlife in Canada [COSEWIC]; Species at Risk Act [SARA] Government of Canada 2020); or plant species of conservation concern (Alberta Conservation Information Management System [ACIMS; ACIMS 2018a]) ■ Regulatory requirement to control noxious weeds (Alberta Weed Control Act and Regulations [GOA 2017a])
Wetlands and Water bodies	■ Provincial regulatory requirements: Alberta Water Act (GOA 2000a) and the Alberta Wetland Policy (GOA 2013a) ■ Potential implications to wildlife habitat potential and plant species habitat potential ■ Potential implications to species and community level biodiversity ■ Potential impacts to surface water quality and quantity ■ Potential implications to water quality and water attenuation within wetlands ■ Regulatory requirement to control noxious weeds and eliminate prohibited noxious weeds (Alberta Weed Control Act and Regulations [GOA 2017a])
Groundwater	■ Regulatory requirement: Alberta Water Act (GOA 2000a) and associated Water Ministerial Regulation (AR205/1998) ■ Potential public concern and importance of water wells to nearby landowners

Surface Water, Aquatic Species and Habitat	■ Regulatory requirements:
	  ▪ Alberta Water Act (GOA 2000a) and Alberta Environmental Protection and Enhancement Act (GOA 2000b)
	  ▪ Fisheries Act: potential to cause harmful alteration, disruption or destruction of fish habitat as defined under the Fisheries Act and administered by Fisheries and Oceans Canada (DFO); pollution prevention provisions dealing with the deposition of deleterious substances into water frequented by fish (administered and enforced by Environment and Climate Change Canada [ECCC])
	■ Response to alteration may include erosion and instability
	■ Potential to alter natural local / regional drainage patterns
	■ Consideration of regional users, regulatory, potential Indigenous, and general public concern
	■ Potential to alter water quality and affect aquatic life
	■ Ecosystem conservation concerns; importance to ecosystem diversity and inter-relation to other environmental components (e.g., wildlife)

Wildlife and Wildlife Habitat	■ Economic importance (i.e., hunting licenses), recreational importance, and ecological importance ■ Regulatory requirement to comply with applicable provincial (Alberta Wildlife Act [GOA 2018c]; Wildlife Directive for Alberta Wind Energy Projects [AEP 2018a]) and federal (COSEWIC, SARA, Migratory Bird Convention Act [MBCA]) regulations
Air Quality	■ Regulatory requirement to comply with applicable provincial (Environmental Protection and Enhancement Act [GOA 2000b]) and Alberta Ambient Air Quality Objectives (GOA 2019a) ■ Consideration of potential nuisance effects

2.2.2 Spatial Boundaries

The spatial boundaries of the assessment were determined based on the extent of potential environmental effects resulting from the Project. The spatial boundaries must be able to capture scale-dependent processes and activities that influence the geographic distribution or movement patterns specific to each VC.

This assessment uses two spatial boundaries for the assessment of potential Project effects on the VCs: Project Footprint and Project Study Area. The Project Footprint is used to address the disturbance caused during construction, operation, and decommissioning, while the Project Study Area refers to the general area suitable for wind power development. These boundaries are sufficient to describe the potential Project effects on each VC, as well as to understand the context within which Project effects are predicted to occur.

- Project Footprint: Represents the area where direct effects are expected to occur during construction, operation, and decommissioning. The Project construction footprint has been conservatively assumed to include the maximum extent of the land that could be disturbed by the construction of the Project (107.0 ha) based on conservative (i.e., worst-case) estimates. The Project operation footprint is 9.2 ha. The Project Footprint includes the following components:
  - Turbine pads (approximately 8,000 m^2 (0.8 ha) comprised of the turbine foundation during construction and approximately 400 m^2 (0.04 ha) during operation after laydown areas are reclaimed).
  - Permanent turbine access roads (approximately 30 m wide during construction and 5.0 m wide during operation).
  - Upgrades to existing trails within municipal road allowances (approximately 20 m wide during construction and 10 m wide during operations).
  - Underground collector line system (approximately 12 m wide during construction).
  - Project substation including operation and maintenance building (up to approximately 185 m by 110 m during construction and 175 m by 100 m during operation).
  - Temporary laydown yard (up to approximately 200 m by 200 m during construction).
- Project Study Area: The Project Study Area is 5,246.9 ha and represents the general area of interest that is suitable for wind power development, which was identified at Project initiation for evaluation based on the preliminary siting and constraints analysis, and the general area within which environmental surveys and mapping was initiated and took place. The Project Study Area includes the Project Footprint and adjacent lands (Figure 1.1-2). The Project Study Area is expected to be large enough to describe the potential direct and indirect effects for most VCs.

2.2.3 Temporal Boundaries

The temporal boundaries of this Project are linked to the following:

- Project development phases (i.e., construction, operation and decommissioning of the Project).
- Predicted durations of effects from the Project, which may extend beyond decommissioning (i.e., post-closure).

Thus, the temporal boundary for a VC is defined as the amount of time between the start and end of a relevant Project activity, plus the duration required for the effect to be reversed.

2.3 Determination of Baseline Conditions

Published reports and government databases were reviewed for information about existing environmental conditions in the study areas. Discussions were held with regulators and stakeholders to identify potential constraints to development and to identify environmental features of potential concern. Site surveys were conducted in 2018 and 2020 to characterize the following:

- land cover
- vegetation communities, listed plant species and plant communities and listed weeds
- wetlands and water bodies
- wildlife and wildlife habitat including:
  - sharp-tailed grouse (*Tympanuchus phasianellus*)
  - raptor nests
  - breeding birds
  - burrowing owl (*Athene cunicularia*)
  - bat migration (spring and fall)
  - bird migration (spring and fall)

2.4 Project and Valued Component Interactions

This assessment considers the potential interactions between the Project and the VCs. The Project interactions with VCs may occur directly as a result of a Project activity or component affecting a VC, or indirectly as a result of a change to another VC.

Development of mitigation to avoid, reduce or eliminate potential effects on VCs occurs during:

- the engineering design phase
- planning, and consultation and engagement activities
- construction planning and execution
- Project operation
- decommissioning planning and execution

Consideration is focused on mitigation strategies that are technically and economically feasible. Mitigation measures will be continually incorporated into the Project as part of the planning process and are identified in the effects assessment section for each VC.

For this assessment, a potential effect is considered to occur where anticipated future conditions resulting from the Project differ from the conditions otherwise expected from natural change. The evaluation of predicted effects from the Project and VC interactions assumes that identified mitigation measures have been implemented. Effects to VCs that are anticipated even after the application of mitigation measures are identified as residual effects. Where negative residual effects are predicted, the VC is carried forward in the effects assessment to determine the significance of the predicted residual effect on the VC. For VCs where positive or no residual effects are anticipated, the effects assessment is complete and the VCs are not carried forward for further analysis.

2.5 Mitigation

Mitigation applied during Project planning and to be implemented during construction and operation of the Project has been developed in consideration of the mitigation hierarchy. The mitigation hierarchy is a globally accepted tool that guides environmental assessment practitioners towards limiting, as far as possible, the negative impacts on biodiversity from development projects. The Cross Sector Biodiversity Initiative (CSBI) defines the mitigation hierarchy as “the sequence of actions to anticipate and avoid impacts on biodiversity and ecosystem services; and where avoidance is not possible, minimize; and, when impacts occur, rehabilitate or restore, and where significant residual impacts remain, offset (Ekstrom et al. 2015). The mitigation hierarchy is outlined further in Ekstrom et al. (2015) and is consistent with mitigation requirements outlined in Alberta regulatory guidance such as the Wildlife Directive for Alberta Wind Energy Projects (the Directive; AEP 2018a) and the Alberta Wetland Policy and the Guiding Principles of the Wetland Minimization System (GOA 2013a).

Specific mitigation measures to be implemented relevant to individual environmental components are described within the evaluations of those components in Section 3.0.

2.6 Effects Analysis

The environmental assessment approach is based on the Alberta Environment and Parks (AEP) assessment principles and methodology, and associated federal policy, as guided by the following documents:

- *Guide to Preparing an Initial Project Description and Detailed Project Description under the Impact Assessment Act* (IAAC 2019)
- *Guide to Preparing Environmental Impact Assessment Reports in Alberta* (ESRD 2013b)

2.6.1 Assessment of Predicted Residual Effects

During the completion of the Environmental Evaluation, Golder considered the existing baseline environmental conditions, the likely effects associated with the planned Project, and the mitigation measures proposed to reduce or avoid potential environmental effects of the Project on environmental components to identify the residual effects (i.e., those remaining following the application of the mitigation measures) of the Project on each VC. The level of importance of the residual effects were then evaluated based on the following criteria, which are defined in Table 2.6-1:

- direction
- magnitude
- geographic extent
- duration, which incorporates consideration of the timing, frequency, and reversibility of the effect

Table 2.6-1: Definition of Criteria Used to Describe the Importance of Predicted Residual Effects

Criteria	Definition	Environmental Description
Direction	Direction relates to the value of the effect in relation to the environment.	■ Positive – net gain or benefit; effect is desirable ■ Negative – net loss or adverse effect; effect is undesirable
Magnitude	Magnitude is the intensity of the effect, or a measure of the degree of change from existing (baseline) conditions.	■ Minimal – no detectable change is expected from baseline values ■ Low – effect occurs that might be detectable, but is expected to be within the range of baseline or guideline values, or within the range of natural variability ■ Medium – effect is expected to be at or to slightly exceed the limits of baseline or guideline values – clearly an effect and may become a management concern(a) ■ High – effect is expected to exceed the limits of baseline or guideline values – the effect can pose a serious risk and represents a management concern[(a)]
Geographic Extent	Geographic extent refers to the spatial extent over which a Project effect will occur.	■ Local – the effect is confined to the Project Study Area ■ Regional – the effect extends beyond the Project Study Area
Duration	Duration is the period of time over which the environmental effect will be present; and the timing and frequency with which it occurs. The amount of time between the start and end of a Project activity or stressor (which relates to Project development phases), plus the time required for the effect to be reversed. Duration and reversibility are functions of the length of time the VC are exposed to Project activities.	■ Immediate – the effect occurs during construction or decommissioning ■ Short-term – the effect occurs during construction or decommissioning, and is reversible less than three years beyond completion of construction or decommissioning ■ Medium-term – the effects occur during the life of the Project ■ Long-term – the effect persists beyond decommissioning, but is reversible ■ Permanent – the effect persists beyond decommissioning and is irreversible

[(a)] An effect that poses a management concern may require actions such as research, monitoring or recovery initiatives that exceed current standard best practices.

The importance of the predicted residual effects is determined by considering the combination of the criteria defined above, as shown in Figure 2.6-1, as well as consideration of the environmental context for each VC using professional judgement based on the experience and expertise of the environmental assessment practitioners for each relevant environmental discipline. The level of importance of a predicted residual effect is described as minimal, low, medium, or high. Table 2.6-2 provides narrative descriptions of the assessed levels of importance that correspond with the ratings assigned in Figure 2.6-1.

Figure 2.6-1: Predicted Residual Effect Attributes Leading to Importance

Table 2.6-2: Definitions of the Assessed Levels of Importance of Predicted Residual Effects

Level	Definition
Minimal	Potential **negative** effect could result in a slight decline in the VC during Project construction and/or decommissioning within the project study area or the geographic context that is appropriate for management of the VC, but the VC should return to baseline levels following construction.
	Potential **positive** effect could result in a slight improvement in the VC during Project construction and/or decommissioning within the project study area or the geographic context that is appropriate for management of the VC, but the VC should return to baseline levels following construction and/or closure.
Low	Potential **negative** effect could result in a slight decline in the VC area during the life of the Project within the project study area or the geographic context that is appropriate for management of the VC. Research, monitoring, and/or recovery initiatives that exceed current standard best practices would not normally be required.
	Potential **positive** effect could result in a slight improvement in the VC during the life of the Project within the project study area or the geographic context that is appropriate for management of the VC.
Medium	Potential **negative** effect could result in a decline in the VC to lower-than-baseline but stable levels after Project closure and into the foreseeable future within the project study area or the geographic context that is appropriate for management of the VC. Regional management actions such as research, monitoring and/or recovery initiatives that exceed current standard best practices may be required.
	Potential **positive** effect could result in an improvement in the VC to better-than-baseline levels after Project closure and into the foreseeable future within the project study area or the geographic context that is appropriate for management of the VC.
High	Potential **negative** effect could threaten sustainability of the VC and should be considered a management concern. Research, monitoring and/or recovery initiatives that exceed current standard best practices should be considered.
	Potential **positive** effect could result in an improvement of a resource condition that is currently a management concern, so that the existing resource concern is resolved.

2.6.2 Likelihood

In addition to their importance, residual effects are also characterized by their likelihood. Likelihood refers to the probability of an occurrence that a Project activity will result in an effect. For this assessment, likelihood is characterized as none, unlikely, possible, or likely (Table 2.6-3):

Table 2.6-3: Likelihood

Likelihood	Definition
None	No evidence to support the occurrence of the effect in similar projects.
Unlikely	The effect is not likely to occur. The effect has been reported only rarely for similar projects.
Possible	The effect may occur but is not likely. Evidence supports the occurrence of the effect in some, but less than half, of similar projects.
Likely	The effect is likely to occur. The effect is considered common for similar projects.

2.6.3 Determination of Significance

Sustainable development (i.e., satisfying the needs of present generations without compromising the ability of future generations to meet their own needs) is a key consideration in determining the significance of the effects on the natural environment. Effects are considered significant if they compromise the objectives of sustainable development.

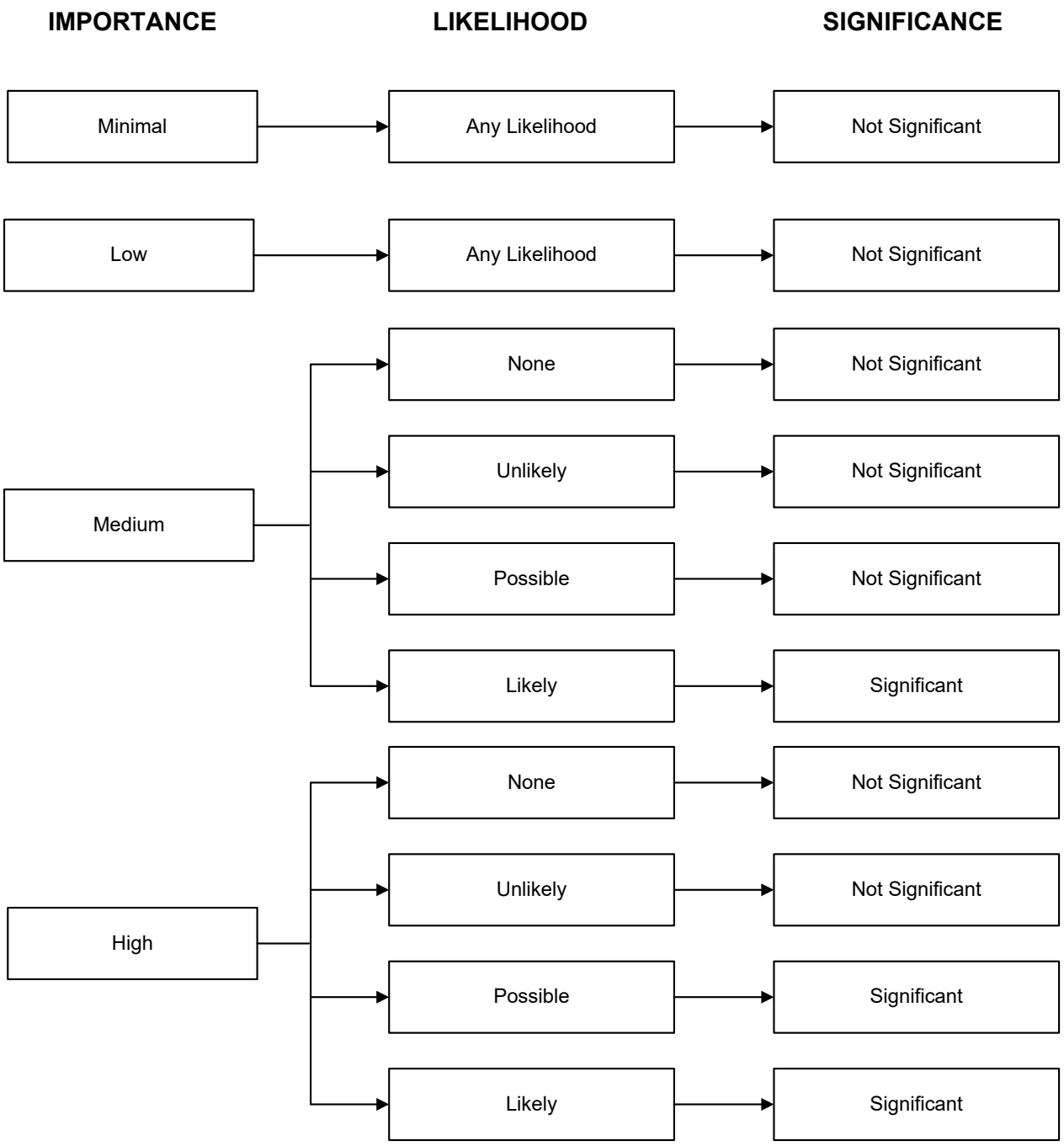
Sustainable development objectives are based on established public objectives such as: land use plan or policy; government commitment on the use/conservation of resources; legislation, regulations, or guidelines. For natural resource valued components VCs (e.g., wildlife species, vegetation communities, fish and fish habitat), the residual effect is determined to be significant if the VC is expected to be altered to a point where it will no-longer be self-sustaining. To be considered not significant, an effect might be detectable, but the VC is expected to remain self-sustaining.

The significance ratings of Project-related effects on the VCs are defined as follows:

- **Significant:** The effects are measurable and result in a change to the VC that will alter its status or integrity beyond an acceptable level.
- **Not Significant**: The effects are detectable but are not likely to result in a change that will alter the VC's status or integrity beyond an acceptable level, based on relevant sustainable development objectives, as described above.

The determination of significance considers a predicted residual effect that is adverse in direction, its level of importance and the likelihood of its occurrence (FEARO 1994), as shown in Figure 2.6-2.

Figure 2.6-2: Determination of Effect Significance



3.0 ENVIRONMENTAL EVALUATION

3.1 Land Cover

3.1.1 Introduction

Land cover is considered in the Environmental Evaluation because it provides an indication both of how the land is being utilized by local landowners and of the potential for the land to support sensitive wildlife and plant species. This section of the report contains the results of a desktop assessment in which land cover types were mapped and delineated, and results from dedicated land cover field surveys.

3.1.2 Baseline Data Collection Methods

3.1.2.1 Desktop Assessment

Preliminary land cover constraints were identified through remote mapping to identify and delineate land cover type polygons within the Project Study Area. The following data sources were used to provide the initial basis for desktop land cover mapping:

- 0.5 m world imagery (ESRI 2015)
- Alberta Biodiversity Monitoring Institute (ABMI) Human Footprint 2012 Version 3 (ABMI 2010)
- Grassland Vegetation Inventory obtained from AEP (AEP 2016)
- Alberta Merged Wetland Inventory (AEP 2018c)
- AltaLIS 1:20, 000 Base Features Hydrography Layer (GOA 2020)

During desktop mapping, the Golder vegetation ecologist used 1.5 m resolution aerial photography and ArcView Geographic Information Systems (GIS) software to refine and update land cover polygons at a 1:7,500 scale. During the desktop assessment, land cover polygons were classified into the following categories:

- native grassland
- tame pasture or hay
- cultivation (cropland)
- wetlands
- farmyard
- road
- developed

3.1.2.2 Field Assessment

In addition to the desktop review, targeted field verification of land cover mapping in the Project Study Area was completed August 18 to 20, 2018, June 3 to 9, 2020 and September 8 to 10, 2020 in conjunction with rare plant and wetland surveys. During the land cover field assessment, the dominant plant species for each land cover type were noted, any adjustments to land cover classification or mapped boundaries were recorded, and photographs and global positioning system (GPS) waypoints were taken.

3.1.3 Baseline Conditions

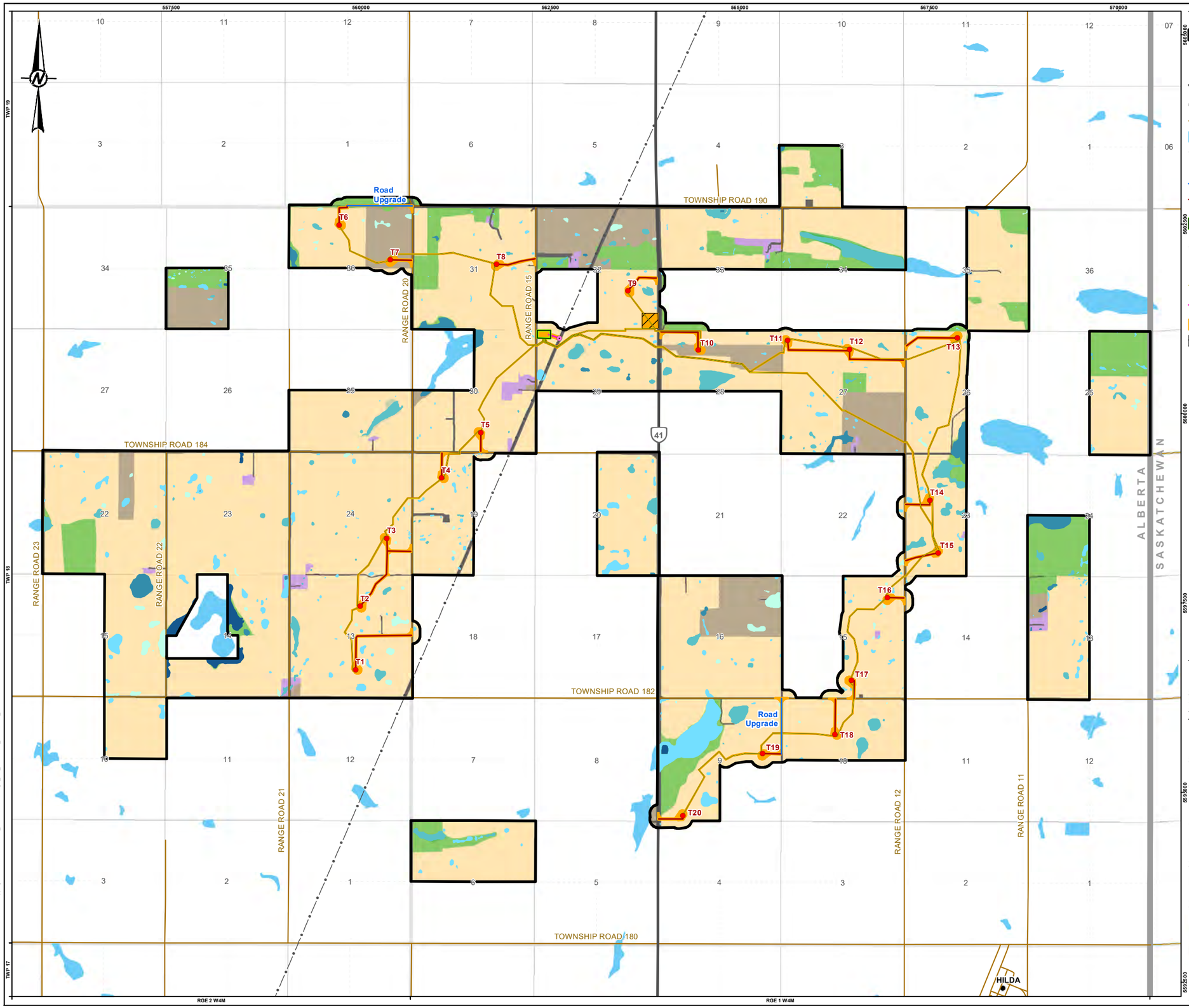
Areas surveyed during the field assessment supported some type of agricultural land use, including areas of native grassland and wetlands where livestock grazing occurs. An overview of the land cover types observed during the desktop assessment, and 2020 field surveys is shown on Figure 3.1-1 and more detailed mapping is provided in Appendix A, Figures A-1 to A-5. Approximate percentages of each land cover type within the Project Study Area are provided in Table 3.1-1. The most common land cover types within the Project Study Area are cultivation, followed by native grasslands and tame pasture or hay covering 3,920.9 ha (75%), 412.0 (8%) and 371.2 ha (7%), respectively.

Wetlands occupy 303.1 ha (6%) and miscellaneous land cover occupy 239.7 ha (5%) (Table 3.1-1) of the Project Study Area. Of the miscellaneous land cover types, the road/trail is the most dominant with 186.0 ha (4%) of the Project Study Area. In total, modified vegetation and miscellaneous land cover types (i.e., cultivation, tame pasture or hay, developed, farmyard, road/trail, and transmission lines) occupy 87% of the Project Study Area (Table 3.1-1).

3.1.4 Potential Effects, Mitigation and Predicted Residual Effects

3.1.4.1 Potential Effects

The Project has the potential to adversely affect land use in the Project Footprint due to vegetation removal and soil disturbance during construction and due to the presence of turbines and other facilities during operation. The Project also has the potential to introduce or spread weed species listed as noxious or prohibited noxious by the Alberta *Weed Control Act and Regulations* (GOA 2017a).



LEGEND

PROJECT STUDY AREA[1]

BASE FEATURES

- HAMLET
- EXISTING ALTALINK 138 kV TRANSMISSION LINE
- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERBODY

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- POINT OF INTERCONNECTION
- COLLECTOR SYSTEM
- OVERHEAD TRANSMISSION LINE
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

LAND COVER[2]

- CULTIVATED
- DISTURBED[3]
- FARM YARD
- NATIVE GRASSLAND
- TAME PASTURE OR HAY
- EPHEMERAL (CLASS I) WATER BODY
- TEMPORARY (CLASS II) WETLAND
- SEASONAL (CLASS III) WETLAND
- SEMI-PERMANENT (CLASS IV) WETLAND
- PERMANENT (CLASS V) WETLAND

0 1,000 2,000

1:50,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.
2. LAND COVER TYPES MAY BE DESKTOP OR FIELD-VERIFIED.
3. DISTURBED LAND COVER MAY INCLUDE ROADS, TRAILS, TRANSMISSION LINES, RAILWAYS, AND DEVELOPED AREAS.

REFERENCE(S)

PROJECT FOOTPRINT COMPONENTS DATA OBTAINED FROM RES, DECEMBER 2020.
DIGITAL BASE DATA MAY BE OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED, OR ALTALIS LTD.© GOVERNMENT OF ALBERTA 2016. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
PROJECT LAYOUT AND LAND COVER

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JS
PREPARED	LMS
REVIEWED	BS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	3.1-1

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Table 3.1-1: Land Cover Types within Hilda Wind Power Project Study Area

Land Cover Type	Total Project Study Area [ha]		Temporary Project Footprint [ha]		Permanent Project Footprint [ha]		Total Project Footprint	
	Area [ha]	Percent of Project Study Area [%]	Area [ha]	Percent of Temporary Project Footprint [%]	Area [ha]	Percent of Permanent Project Footprint [%]	Area [ha]	Percent of Total Project Footprint [%]
Native Grassland								
Native grassland	412.0	8	1.2	1	0.5	5	1.7	2
Wetlands								
Class I-II	134.7	3	0.2	<1	<0.1	<1	0.2	<1
Class III-V	168.3	3	0.0	0	0.0	0	0.0	0
Subtotal Wetlands	*303.1*	*6*	*0.2*	*<1*	*<0.1*	*<1*	0.2	*<1*
Modified Vegetation								
Cultivation	3,920.9	75	84.8	87	7.2	78	92.0	86
Tame Pasture or Hay	371.2	7	6.6	7	0.2	3	6.9	7
Subtotal Modified Vegetation	*4,292.1*	*82*	*91.4*	*93*	*7.4*	*80*	98.8	*92*
Miscellaneous								
Developed	3.6	<0.1	0.0	0	0.0	0	<0.1	<0.1
Farmyard	38.0	1	0.0	0	0.0	0	0.0	0
Road/Trail [(a)]	186.0	4	4.8	5	1.3	14	6.1	6
Transmission Line	12.0	<1	0.3	<1	<0.1	<0.1	0.3	<1
Subtotal Miscellaneous	*239.7*	*5*	*5.1*	*5*	*1.3*	*14*	*6.4*	*6*
Total	**5,246.9**	**100**	**97.8**	**100**	**9.2**	**100**	**107.1**	**100**

Note: Some numbers are rounded for presentation purposes; therefore, totals may not equal the sum of the individual values.
[(a)] Road/Trail include provincial, county and private roads and trails in the Project Study Area as per the AltaLis transportation feature dataset.
ha = hectare

The Project has the potential to adversely affect 107.1 ha of land (2% of the Project Study Area), of which 9.2 ha (<1% of the Project Study Area) will be permanently affected during the operational stage of the Project. Approximately 92% of the total Project Footprint is located on modified vegetation land cover types, including cultivation (92.0 ha, or 86% of the Project Footprint) and tame pasture or hay (6.9 ha, or 7% of the Project Footprint).

The Project Footprint overlaps with native grassland areas (1.7 ha); however, only 0.5 ha (<1% of the total Project Footprint) of native grassland are anticipated to be permanently affected during construction. The Project will temporarily affect 1.2 ha (1% of the total Project Footprint) of native grassland during construction. The Project will also temporarily affect 0.2 ha of Class I-II permanence wetlands during construction (Table 3.1-1). Permanent and temporary impacts to Class III-V wetlands are not anticipated during construction and operation. Project effects to native grassland are discussed in more detail in Section 3.4, while Project effects to wetlands are discussed in Section 3.5.

Approximately 5.1 ha of miscellaneous land cover types will be temporarily affected by the Project by encompassing 4.8% of the total Project Footprint. Permanent impacts through the operational stage will impact 1.3 ha of miscellaneous land cover types, encompassing 1.2% of the total Project Footprint. (Table 3.1-1)

The removal of Project equipment during decommissioning will require the re-widening of access roads and temporary workspace using bulldozers and excavators, and the removal of turbine assemblies, concrete foundations (to a depth of 1.2 m) and other equipment using excavators, cranes, heavy trucks, and trailers. Underground cables will be terminated and capped at connection points, so the majority of the underground cables will remain in place at approximately 1 m in depth, which will reduce re-disturbing soils and vegetation during decommissioning. Agricultural land use (i.e., cultivation and tame pasture or hay) within the Project Footprint is expected to resume as a result of final reclamation, with consideration of the landowners' preferences.

3.1.4.2 Mitigation

A review of the land cover mapping was completed during the planning process to minimize adverse effects of siting Project infrastructure on sensitive land cover types including native grasslands and wetlands, which cover 14% of the Project Study Area (Table 3.1-1). The Proponent's efforts to avoid sensitive land cover types resulted minimal permanent effects (0.5 ha) to native grassland. These impacts are associated with road upgrading activities within and existing County road allowance. Impacts to wetlands and other water bodies land cover types were minimized at 0.2 ha, representing only <0.1% of wetlands within the Project Study Area.

To limit adverse effects on land cover, vegetation and soil disturbance will be restricted to the extent necessary to safely construct and operate the Project. Grading will be restricted to what is required for the access and safe construction and operation practices. All vehicle traffic and equipment will remain within the designated ROW (e.g., County road allowances) and associated temporary workspaces. However, construction may occur during the crop growing or haying season. Consultation with landowners will be ongoing to avoid damages to crops and tame pasture or hay where possible. Construction and decommissioning equipment will enter construction or reclamation areas within the Project site in clean condition to limit the potential for introduction of weeds or crop diseases. Following the completion of construction, areas not containing permanent facilities or operational access roads will be reclaimed to the extent possible to an equivalent land use capability in accordance with landowner expectations and regulatory requirements, as appropriate.

At the end of the Project life, above-ground structures will be decommissioned and removed; below-ground structures will be removed to a depth of approximately 1.2 m below surface. The concrete foundation for the wind turbines will be removed to a depth of 1.2 m below surface, and the excavation backfilled with subsoil to match the natural grade. Underground cables will be terminated and capped at connection points and will remain in place to limit re-disturbing surface soil and vegetation.

When decommissioning occurs, reclamation standards outlined in the current *Conservation and Reclamation Directive for Renewable Energy Operations* (the C&R Directive; AEP 2018b) or subsequent standards in place at the time of decommissioning will be followed. Soil management will be incorporated into this process to facilitate site reclamation. After the infrastructure is removed, areas of disturbance will be ploughed to alleviate soil compaction and graded to restore terrain profiles. Topsoil will be replaced and prepared for seeding by the landowner(s) on cultivated areas. Areas of native grassland and wetlands will be replanted with certified and inspected native grass and forb seed mixes appropriate for the land cover type.

3.1.4.3 Predicted Residual Effects

The predicted residual Project effects on land cover are:

- loss or alteration of cultivation and tame pasture or hay land cover types
- introduction or spread of weeds and/or non-native plant species

Potential Project effects to native grassland and wetlands are discussed in more detail in Sections 3.4 and 3.5, respectively.

3.1.5 Evaluation of Predicted Residual Effects of the Project

A summary of the predicted residual effects of the Project on land cover is provided in Table 3.1-2 and a rationale for the evaluation is provided below. Predicted residual Project effects to wetlands are discussed in Section 3.5.

Table 3.1-2: Predicted Residual Project Effects Description, Importance and Likelihood for Land Cover

Predicted Residual Effect	Project Activity	Effects Assessment Criteria[(a)]				Importance[(a)]	Likelihood[(a)]
		Direction	Magnitude	Geographic Extent	Duration		
Loss or alteration of cultivation and tame pasture or hay land cover types	Construction, operation, and decommissioning	Negative	Low	Local	Short-term to Medium-term	Low	Likely
Introduction or spread of weeds and/or non-native plant species	Construction, operation, and decommissioning	Negative	Low	Local	Medium-term	Low	Likely

[(a)] Effects assessment criteria are defined in Table 2.6-1. Importance and Likelihood are defined in Table 2.6-2 and Table 2.6-3, respectively.

Loss or alteration of cultivation and tame pasture or hay land cover types

Loss or alteration of cultivation and tame pasture or hay land cover types will be negative in direction and low in magnitude because there will be a net loss of 7.4 ha of cultivation, tame pasture and hay land cover types where Project infrastructure will permanently affect these land cover types. The geographic extent is local, as it is not expected to extend beyond the Project Study Area. The loss or alteration of cultivation and tame pasture or hay land cover types is expected to be short-term to medium-term because these areas will be reclaimed to the extent possible to an equivalent land use capability during construction or decommissioning. Following the construction of permanent facilities, areas not containing permanent facilities or operational access roads will be returned to cultivation, tame pasture or hay land cover types. During decommissioning, Project infrastructure will be removed and the land will be reclaimed to equivalent land cover capability in accordance with landowner expectations and regulatory requirements, as appropriate. In general, land is expected to be returned to either cultivation and tame

pasture or hay land cover types. The probability of loss or alteration of cultivation and tame pasture or hay land cover types is likely but is considered common for similar projects. The loss or alteration of cultivation, tame pasture or hay land cover types is considered to be of low importance.

Introduction or spread of weeds and/or non-native plant species

The introduction or spread of weeds and non-native plant species will be negative in direction and low in magnitude. Implemented mitigation will limit vehicle traffic and equipment to the Project Footprint, reducing the potential to introduce or spread weeds. Additionally, all construction equipment will enter the Project site in a clean condition to limit the potential for introduction of weeds. Equipment will be visually inspected and cleaned off-site as needed and the Proponent will develop and implement a vegetation management plan as per the C&R Directive to prevent and control the spread of invasive species. The geographic extent is not expected to extend beyond the Project Study Area, and is therefore local. The introduction or spread of weeds and non-native plant species is expected to be of medium-term duration; the Proponent will abide by the Alberta *Weed Control Act and Regulations* (GOA 2017a) and eradicate any prohibited noxious weed populations and control any noxious weed populations in the Project Footprint. Weeds and non-native species may be introduced or spread, but the mitigation practices will reduce the likelihood of this occurrence. Overall, the introduction or spread of weeds and non-native species is considered to be of low importance.

3.1.6 Determination of Significance

The effect of the Project on cultivation, tame pasture and hay land cover types is considered to be of low importance. Effects will be limited to the Project Footprint within the Project Study Area; 92% of the Project Footprint is currently sited on cultivation, tame pasture or hay land cover types (Table 3.1-1). Outside of where permanent infrastructure components are located, the effects are reversible, as the temporary disturbances will be seeded, where applicable, and land use restored following construction. The effect of the Project on the introduction or spread of weeds and/or non-native plant species is considered to be of low importance. Compliance with the C&R Directive and the *Alberta Weed Act* and its regulations will assist in re-establishment of desired plant species in the Project Study Area.

Given the mitigation measures that will be implemented to minimize the introduction or spread of weeds and/or non-native plant species, and given the limited loss or alteration of cultivation and tame pasture and hay land cover types as a result of the Project, the residual effects on land cover are predicted to result in a change that will not alter the sustainability of land cover in the Project Study Area beyond a manageable level, and is predicted to be not significant.

3.2 Environmentally Sensitive Areas

3.2.1 Introduction

Environmentally sensitive areas are considered in the Environmental Evaluation because they represent lands that may have a higher level of environmental sensitivity or significance that should be considered in land use or watershed planning. Activity timing restrictions, restrictions on the location, type or scale of development and the implementation of enhanced mitigation measures may be required within designated areas. Environmentally sensitive areas are intended for use as an informational tool, but do not replace other more detailed and indicator specific tools (e.g., wetland inventories).

3.2.2 Baseline Data Collection Methods

Various spatial data sets were mapped in GIS and used to determine the location of designated Environmentally Significant Areas (ESAs) relative to the Project Study Area. Information on ESAs associated with the Project Study Area was obtained from AEP (2014) and is based on Fish and Wildlife Management Information System

(FWMIS), ACIMS and other publicly available data sets, which are used to gather baseline data about areas which may contain unique or rare elements, identified at the scale of individual quarter sections. The updated ESA inventory uses a GIS based multi-criteria decision analysis to organize ESAs into a hierarchy of sub-components, including sub-criteria and indicators, with weighted indicators for each criterion. The ESA framework and associated provincial map generated from this process are intended for land-use planning and do not represent government policy or designate legal land protection (Fiera 2014).

3.2.3 Baseline Conditions

Parks and Protected Areas

There are no provincially or federally designated protected areas within the Project Study Area. Hardgraves Coulee Natural Area is the closest park or protected area to the Project Study Area and is approximately 12 km southwest of the Project Study Area.

Environmentally Significant Areas – Provincial

Approximately 46.5 ha or 0.9% of the total Project Study Area (5,246.9 ha) is classified as an ESA by Alberta Environment and Parks (AEP; AEP 2014).

Important Bird Areas

Important Bird Areas (IBA) are discrete sites that support either listed avian species, large groups of birds, or avian species that are restricted by either their population range or habitat requirements (IBA 2020). The Suffield (AB007) IBA is the nearest IBA and is approximately 9.3 km west of the Project Study Area. This area is within the Suffield Military Range and has been identified as large, high quality remnants of mixed grassland and sand hills with intermittent saline lakes and springs in the area (IBA 2020).

Key Wildlife and Biodiversity Zones

The Project Study Area does not overlap with any Key Wildlife and Biodiversity Zones.

Grizzly Bear Zones

The Project Study Area does not overlap with the Grizzly Bear Zone.

The Special Access Zone

The Project Study Area does not overlap with the Special Access Zone.

3.2.4 Potential Effects, Mitigation and Predicted Residual Effects

3.2.4.1 Potential Effects

The Project Footprint does not encroach on any parks, protected areas, IBAs, Key Wildlife and Biodiversity Zones, Grizzly Bear Zone or the Special Access Zone, and no direct effects on these areas are expected.

The Project Study Area overlaps 46.5 ha of ESAs within SW 14-18-02 W4M and SW 35-18-01 W4M; however, no construction or operational footprint overlaps with areas designated as ESAs. Additionally, the Project has been sited to avoid direct impacts to native grassland and wetland areas to the extent possible.

ESAs can contain native habitat, sensitive wildlife species, and large natural areas, which may be affected by the Project during construction, operation, and decommissioning. While no direct effects from construction, operation, or decommissioning will occur given that no Project activities will occur directly within ESAs, potential indirect effects (i.e., noise, dust, light) from the Project on wildlife and wildlife habitat in ESAs may occur. Potential effects on wildlife and wildlife habitat, including sensitive species, are evaluated in Section 3.8.

3.2.4.2 Mitigation

Mitigation measures to limit adverse effects on native habitat, wetlands and sensitive wildlife species are discussed in Section 3.4, 3.5 and 3.8, respectively.

3.2.4.3 Predicted Residual Effects

The predicted residual effect of the Project on ESAs is:

- loss or alteration of ecological function of lands with environmental sensitivity or significance

Predicted residual effects related to native vegetation, wetlands and sensitive wildlife species within the Project Study Area are discussed in Sections 3.4, 3.5 and 3.8, respectively.

3.2.5 Evaluation of Predicted Residual Effects of the Project

A summary of the predicted residual effect of the Project on ESAs is provided in Table 3.2-1 and a rationale for the evaluation is provided below.

Table 3.2-1: Predicted Residual Project Effects Description, Importance and Likelihood for Environmentally Sensitive Areas

Predicted Residual Effect	Project Activity	Effects Assessment Criteria[a]				Importance[a]	Likelihood[a]
		Direction	Magnitude	Geographic Extent	Duration		
Loss or alteration of ecological function of lands with environmental sensitivity or significance	Construction, Operation, and Decommissioning	Negative	Low	Local	Medium-term	Minimal	Possible

[a] Effects assessment criteria are defined in Table 2.6-1. Importance and Likelihood are defined in Table 2.6-2 and Table 2.6-3, respectively.

Loss or alteration of ecological function of lands with environmental sensitivity or significance

Loss or alteration of ecological function of lands with environmental sensitivity or significance will be negative in direction and low in magnitude because there will be no direct disturbance within ESAs associated with Project infrastructure during construction or operations. The geographic extent is not expected to extend beyond the Project Study Area and is therefore local. The loss or alteration of ecological function of lands with environmental sensitivity or significance is expected to be medium-term; following the construction of permanent facilities, areas not containing permanent facilities or operational access roads will be reclaimed. The probability of this occurrence is possible but not likely because this assessment is precautionary. Therefore, the loss or alteration of ESAs is considered to be of minimal importance.

3.2.6 Determination of Significance

The effect of the Project on the loss or alteration of ESAs is considered to be of minimal importance. Effects will be limited to the Project Study Area and no direct effects to ESAs will occur from the Project. The effects are reversible, and any indirect effects will be removed following Project decommissioning. The residual effect on ESAs is predicted to not result in a change that will alter the ecological function of ESAs within the Project Study Area beyond a manageable level and is predicted to be not significant.

3.3 Terrain and Soils

3.3.1 Introduction

Terrain and soils form the foundation of a healthy terrestrial ecosystem. Vegetation and ultimately wildlife habitat reflect soil and terrain conditions at a particular time. This section assesses potential changes to the soil and terrain's capability to support healthy ecosystems as a result of development of the Project.

The terrain and soils assessment was conducted for the Project Study Area at a desktop level to identify potential sensitive areas that may be affected by Project activities. The assessment was based on activities occurring during the construction phase, which represent the largest spatial disturbance. Field surveys will also be conducted on Project Footprint areas during construction and operations as needed to address any concerns from landowners or municipality, or to inform soil salvage planning prior to construction of the Project infrastructure once detailed siting information is available.

The removal of Project equipment during decommissioning will use similar mitigation strategies as during construction and will have reduced impact as not all equipment is removed, as described in Section 1.2.5; buried foundations and collector cables will be, for the most part, left in situ, which will minimize disturbance to surface soils and vegetation in these areas. Terrain features assessed include parent material and slope. Soil quality features assessed include wind and water erosion risk, compaction ratings, and salinity.

3.3.2 Baseline Data Collection Methods

3.3.2.1 Desktop Assessment

Terrain and soils information was gathered from the following sources:

- Physiographic Subdivisions of Alberta (Pettapiece 1986)
- Bedrock Topography of the Gleichen Map Area, Alberta (Geiger 1968)
- Drift Thickness of Alberta (Pawlowicz and Fenton 1995)
- Quaternary geology, Southern Alberta (Shetsen 1987)
- Alberta Soil Information Viewer (AAF 2016)
- Alberta Soil Names File (Generation 4) User's Handbook (ASIC 2016)
- Soil Series Information for Reclamation Planning in Alberta (Pedocan 1993)

Soil profile descriptions, slope information, and soil characteristics such as modal topsoil depth, horizon textures, soil parent material, salinity, and wind and water erosion risk were obtained from Soil Series Information outlined in Reclamation Planning in Alberta (Pedocan 1993) and the Agricultural Region of Alberta Soil Inventory Database (AGRASID) Alberta Soil Information Viewer horizon data (AAF 2016). Compaction ratings for soils were determined using modified criteria from Lewis et al. (1989).

3.3.3 Baseline Conditions

Soil series is a term used to describe soils that have been classified to the subgroup level and then coupled with the parent material it was formed on along with its associated physical and chemical characteristics (ASIC 2016). Soil map units (SMU) are the spatial representation of similar soil series and landscapes in an area and can contain a combination of soil series.

Terrain

Surficial geology mapping by Shetsen (1987) indicates the parent material in the Project Study Area is characterized by glaciolacustrine and stagnant ice moraine (till) deposits. The glaciolacustrine sediments extend throughout the central part of the Project Footprint. These sediments were deposited in proglacial lakes, are generally flat to gently undulating and have been modified by wind in places (Shetsen 1987). They are composed primarily of coarse sediments (sand and silt) but may also include clay and ice-rafted stones. The till in the northern part of the Project Study Area consists largely of hummocky topography formed from the collapse and slumping of englacial and supraglacial debris in response to the melting of buried stagnant ice near the glacial margin (Fenton et al. 2013). Shetsen (1987) describes the hummocky topography in this area as strongly developed with areas of round, well-defined knobs (hills), dimple knobs and doughnut shaped hills and kettles (depressions). The till in the southern portion of the Project Study Area is also hummocky but is moderately to weakly developed and is characterized by areas of irregularly shaped and poorly defined knobs and kettles. Both areas of till are composed of an unsorted mixture of clay, silt, sand, and gravel with thicknesses generally less than 25 m in upland areas and up to 100 m in thickness at lower elevations (Shetsen 1987). Drift thickness mapping by Pawlowicz and Fenton (1995) suggests the surficial sediments in this area are approximately 45 m thick.

The Project Study Area overlies bedrock of the Dinosaur Park and Bearpaw Formations (Prior et al. 2013). The Dinosaur Park Formation covers all but an area in the western part of the Project Footprint. It is comprised of sandstone, siltstone and mudstone deposited in a marginal marine to nonmarine environment during the Upper Cretaceous period (Prior et al. 2013). The Bearpaw Formation, located in the western part of the Project Footprint, is comprised of shale deposited in a marine environment during the Upper Cretaceous period (Prior et al. 2013).

The Schuler Uplands are a prominent upland in the Schuler Uplands area where bedrock is at 700 meters above sea level (masl) or higher in the Project Study Area (Geiger 1968) The topography within the Project Study Area is typically gently undulating with several level or depressional areas where organic deposits occur. The North Saskatchewan River is located approximately 8 km to the northwest of the Project Study Area, and no major water bodies were identified within the Project Study Area. Elevations range from a low of 320 masl to a high of 412 masl.

Soils

The Project Study Area occurs within the Soil Correlation Area 1 (SCA 1) from the Alberta Soil Names File (Generation 4) User's Handbook (ASIC 2016). An SCA identifies areas of similar soil climate and landscape ecology within a specific geographic limit (ASIC 2016). The SCA 1 is identified as the Brown Soil Zone of South Eastern Alberta where Chernozemic soils are dominant, but there are significant areas of Solonetzic soil and other salt-affected soils on the landscape. Soils within this SCA are typically associated with reclamation concerns including: thin and discontinuous topsoil that is difficult to salvage and replace resulting in a potential for admixing, soils that are susceptible to wind erosion, limits to revegetation from drought, and occurrences of salt-affected soils that may require special handling (Pedocan 1993).

Information obtained from Alberta Soil Information Viewer (AAF 2016) indicates there are 15 SMUs in the Project Study Area (Table 3.3-1) and nine SMUs found in the Project Footprint (Table 3.3-2). Terrain within the Project Study Area and Project Footprint has been included in Appendix B. The terrain dominantly is undulating low to high relief, with significant areas of hummocky (low to high relief) and inclusions of longitudinal (low relief) dunes.

Table 3.3-1: Soil Map Units Found within the Project Study Area

SMU	Soil Series			Total Area	Percentage of Total Project Study Area
	Dominant[a]	Significant[b]	Inclusion[c]	ha	%
CFD1/U1h	CFD	-	CFH, FMT	1162.7	22.2
CHN1/U1l	CHN	-	-	915.0	17.4
CFFM1/H1l	-	CFD, FMT	-	616.3	11.7
CFCH3/U1h	-	CHN, CFD, LYB	-	563.2	10.7
CFFM4/U1h	-	CFD, FMT	ZER	412.2	7.9
FMT1/H1m				405.6	7.7
BVL4/U1h	BVL	-	ANO, ZER	235.6	4.5
BVL1/U1h	BVL	-	ANO	228.0	4.3
CFCH2/I3l	-	CFD, CHN	ZGW	195.9	3.7
CFFM4/H1l	-	CFD, FMT	ZER	192.5	3.7
LYB1/U1l	LYB	-	CHN	180.7	3.4
CVVS1/D1l	-	CVD, VST	-	72.7	1.4
FMT4/H1m	FMT	-	ZER	53.3	1.0
FMT1/H1l	FMT	-	-	8.6	0.2
CVVS5/D1m	-	CVD, VST	FMT, PLS	4.6	0.1
			Total	**5,246.9**	**100.0**

- not applicable; soil series SMU codes are outlined in Appendix B.
(a) Dominant soil series within the AAF (2016) polygons are 60% or greater.
(b) Significant soil series within the AAF (2016) polygons are >20 to <60%
(c) Soil series inclusions within the AAF (2016) polygons are less than 20%.

Table 3.3-2: Soil Map Units Found within the Project Footprint

SMU	Soil Series			Total Area	Percentage of Total Project Footprint
	Dominant[a]	Significant[b]	Inclusion[c]	ha	%
CFFM1/H1l	-	FMT, CFD	-	36.7	34.3
CFD1/U1h	CFD	FMT, CHN	-	25.8	24.1
CFFM4/U1h	-	FMT, CFD, ZER	-	20.3	19.0
CHN1/U1l	CHN	-	-	13.1	12.3
BVL1/U1h	BVL	-	ANO	5.8	5.4
CVVS1/D1l	-	CVD, VST	-	3.6	3.3
CFCH3/U1h	-	CHN, CFD, LYB	-	0.7	0.7
FMT1/H1m	FMT	-	-	0.7	0.6
LYB1/U1l	LYB	-	CHN	0.2	0.2
			Total	**107.1**	**100.0**

- not applicable; soil series SMU codes are outlined in Table 3.3-3.
(a) Dominant soil series within the AAF (2016) polygons are 60% or greater.
(b) Significant soil series within the AAF (2016) polygons are >20 to <60%
(c) Soil series inclusions within the AAF (2016) polygons are less than 20%.

The SMUs in Table 3.3-3 have soil series that contain Orthic Brown Chernozems with significant areas of Rego Brown Chernozems and inclusions of Gleyed Brown Chernozems. Table 3.3-3 provides information on the dominant, significant, and inclusion soil series within the SMUs overlapped by the Project Footprint.

Table 3.3-3: Soil Series and General Soil Characteristics for Soil Map Unit Components within the Project Footprint

Soil Series		Soil Subgroup	Parent Material		Salinity	Calcareous
Code	Name		Type	Texture Class		
CFD	Cranford	Orthic Brown Chernozem	Glaciolacustrine over Till	ME over MF	N	M
FMT	Foremost	Orthic Brown Chernozem	Till	ME	N	M
CHN	Chin	Orthic Brown Chernozem	Glaciolacustrine	ME	N	M
BVL	Bingville	Orthic Brown Chernozem	Glaciofluvial	MC	N	M
ZER	Misc. Eroded	Rego Brown Chernozem	Variable	VT	-	-
CVD	Cavendish	Orthic Brown Chernozem	Fluvio-eolian (fluvial or eolian)	VC	N	M
VST	Vendisant	Rego Brown Chernozem	Fluvio-eolian (fluvial or eolian)	VC	N	M
ANO	Antonio	Orthic Brown Chernozem	Glaciofluvial over Till	MC over MF	N	W
LYB	Lilybrown	Gleyed Brown Chernozem	Fluvial	ME	M	M

Source: Alberta Soil Information Viewer (AAF 2016)
Parent Material:
MC; moderately coarse textured: Sandy Loam and fine Sandy Loam
ME; medium textured: Loam, Silty Loam, very fine Sandy Loam
MF; moderately fine textured: Sandy Clay Loam, Clay Loam and Silty Clay Loam
VC: very coarse textures: Sand and Loamy Sand
VT: variable textured (not differentiated)

Salinity:
N; non-saline
M; moderately saline
- Unknown
Calcareous
M; moderately
W; weakly
- Unknown

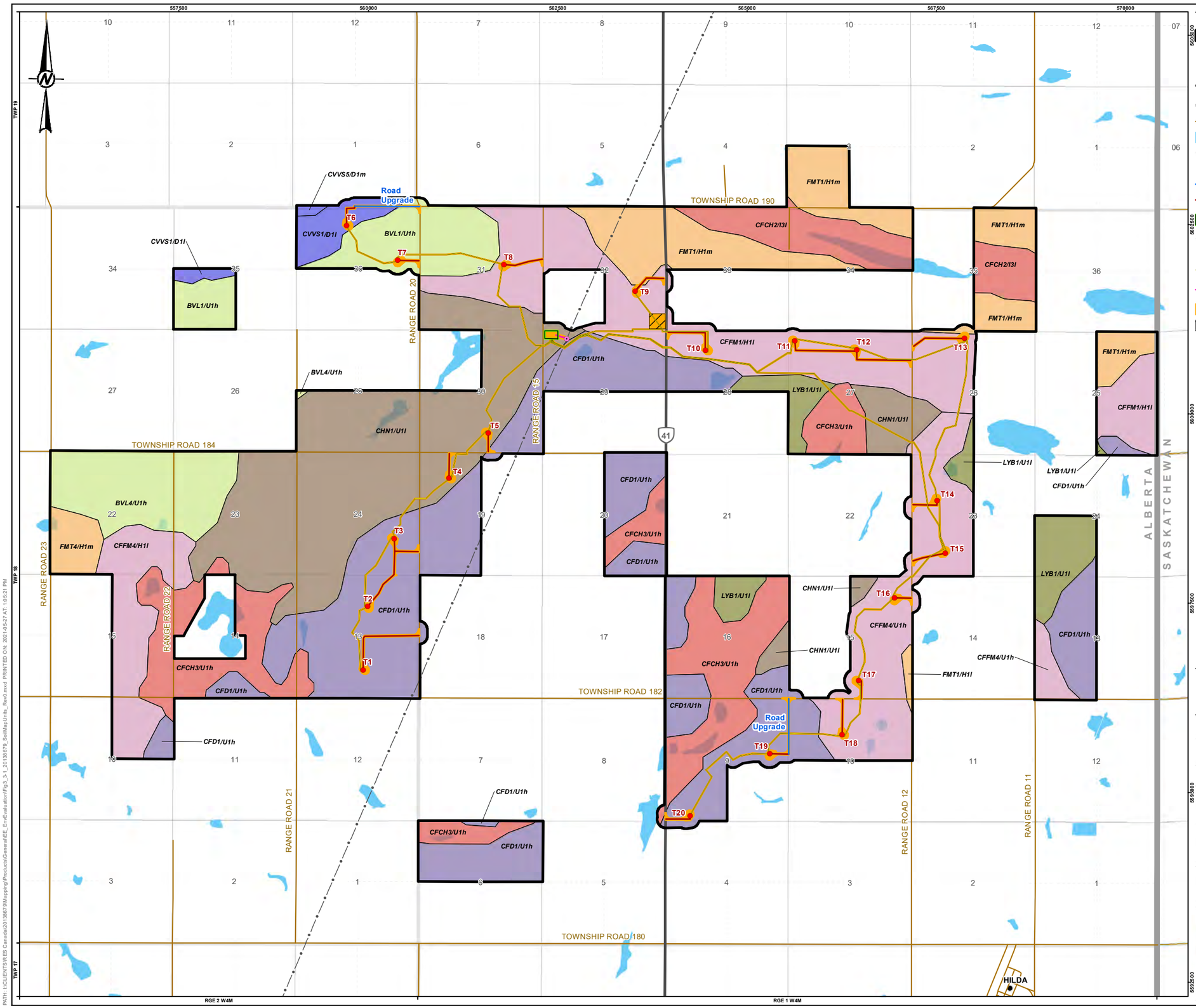
The final detailed construction plan is not currently available, so estimated topsoil stripping volumes have been calculated based on the conservative assumption that the Project Footprint. The collector lines areas have been estimated and removed from the Project Footprint area; it is assumed that topsoil will need to be stripped in the remaining area. The required soil salvage volumes will be refined prior to construction of the Project.

Based on the published representative soil profiles for soil series located within the Project Footprint, topsoil depths are estimated at 12 cm (AAF 2016). The Project Footprint is 107.1 ha and the collector lines (outside of the Project Footprint) are assumed to be 36.4 ha, and the estimated topsoil volume to be stripped is approximately 84,815 m^3 (Table 3.3-4).

Table 3.3-4: Estimate Topsoil Salvage Volumes by Soil Series within the Project Footprint

Soil Series	Proportion of SMU	Topsoil Thickness Range	SMU Area[(b)]	Estimated Volume of Topsoil to be Salvaged[(c)]
	%	m[(a)]	m^2	m^3
Cranford (CFD)	26.9	0.12	189,791	22,775
Foremost (FMT)	54.1	0.12	382,447	45,894
Chin (CHN)	9.3	0.12	66,040	7,925
Bingville (BVL)	4.6	0.12	32,819	3,938
Vendisant (VST)	5.0	0.12	35,692	4,283
Total	**100.0**	**-**	**706,790**	**84,815**

Note:
(a) Representative topsoil values taken from Alberta Soil Information Viewer (AAF 2016)
(b) Volumes are rounded to the nearest whole number for presentation purposes.
(c) Estimated volumes are determined based on average topsoil thickness.



LEGEND

- PROJECT STUDY AREA[1]

BASE FEATURES

- HAMLET
- EXISTING ALTALINK 138 kV TRANSMISSION LINE
- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERBODY

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- POINT OF INTERCONNECTION
- COLLECTOR SYSTEM
- OVERHEAD TRANSMISSION LINE
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

SOIL MAP UNITS

- BVL
- CFCH
- CFD
- CFFM
- CHN
- CVVS
- FMT
- LYB

0 1,000 2,000

1:50,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.

REFERENCE(S)

PROJECT FOOTPRINT COMPONENTS DATA OBTAINED FROM RES, DECEMBER 2020.
SOIL MAP UNITS FROM AGRASID, ALBERTA AGRICULTURE AND FORESTRY.
DIGITAL BASE DATA MAY BE OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED, OR ALTALIS LTD.© GOVERNMENT OF ALBERTA 2016. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
PROJECT LAYOUT AND SOIL MAP UNITS

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JS
PREPARED	LMS
REVIEWED	BS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	3.3-1

3.3.3.1 Soil Sensitivities

Wind and Water Erosion

Wind and water erosion risk primarily applies to disturbed or exposed soils because vegetated soils are at a much lower risk to erosion. The wind erosion and water risk ratings were adapted from “Wind Erosion Risk” and “Water Erosion Risk” (Pedocan 1993).

The potential for soil erosion by wind is affected primarily by soil texture or strongly correlated to soil texture. The ratings have been developed using a refined Chepil wind erosion index including surface roughness and aggregation, soil resistance to movement, drag velocity of wind at the soil surface, soil moisture shear resistance, and available moisture of the surface soil (Pedocan 1993). The potential for soil erosion by water is affected by soil texture, organic matter content, water content, permeability, topography, slope gradient, and vegetation cover. In areas where slope gradient and slope length increases, so does the potential for soil erosion regardless of soil texture. The wind and water erosion risks for each soil map unit are presented in Table 3.3-5.

The majority of soil series found within the Project Footprint are rated as having moderate to high wind erosion risk. Water erosion risk is rated low throughout the Project Footprint.

Table 3.3-5: Soil Sensitivities of Dominant Soil Map Units within the Project Footprint

Soil Series	Dominant Soil Texture (Topsoil/Subsoil)	Slope (%)	Wind Erosion Risk[a]	Water Erosion Risk[a]	Compaction Rating[b]	Salinity/ Sodicity[c]
Cranford (CFD)	Loam/Loam	3 to 6	Moderate	Low	Moderate	Low
Foremost (FMT)	Loam/Loam	4 to 9	Moderate	Low	Moderate	Low
Chin (CHN)	Loam/Loam	2 to 4	High	Low	Moderate	Low
Bingville (BVL)	Sandy Loam/Sandy Loam	4	High	Low	Moderate	Low
Misc. Eroded (ZER)	Clay Loam	4	n/a	n/a	Very High	n/a
Cavendish (CVD)	Loamy Sand/Sand	6	High	Low	Low	Low
Vendisant (VST)	Sand/Sand	6	n/a	n/a	Low	Low
Antonio (ANO)	Sandy Loam/Sandy Loam	4	High	Low	Moderate	Low
Lilybrown (LYB)	Silty Loam/Silty Clay Loam	2 to 3	n/a	n/a	Very High	Moderate

[a] Soil Series Information for Reclamation Planning in Alberta (Pedocan 1993)

[b] Modified from Developing Timber Harvesting Prescriptions to Minimize Site Degradation – Interior Sites (Lewis et al. 1989).

[c] Soil Quality Criteria Relative to Disturbance (SQCWG 1987)

%; = percent; n/a = no rating information available.

Compaction

Soil compaction ratings were assigned to soil series within the Project Footprint and were based on soil texture under moist conditions and can be found in Table 3.3-6, and all ratings are listed in Table 3.3-5. Generally, coarse textured soils (e.g., sandy loam, loamy sand) have low compaction risk, and moderately fine to fine textured soils have moderate to high compaction risk depending on soil moisture conditions. The Project Footprint is located on land ranging from moderate to very high sensitivity to soil compaction.

Table 3.3-6: Assessment Criteria for Topsoil Compaction in the Project Footprint

Soil Texture	Compaction Rating[a]		
	Dry	Moist	Wet
Sand (Sand, Loamy Sand)	Low	Low	Moderate
Loamy (Sandy Loam, Loam)	Low	Moderate	High
Silty (Silt, Silty Loam)	Moderate	High	Very High
Clayey (Sandy Clay, Silty Clay, Sandy Clay Loam, Clay Loam, Silty Clay, Clay)	High	Very High	Very High

(a) Adapted from Developing Timber Harvesting Prescriptions to Minimize Site Degradation – Interior Sites (Lewis et al. 1989).

Salinity/Sodicity

Typically, the soluble salts responsible for salinization include calcium chloride ($CaCl_2$), magnesium chloride ($MgCl_2$), magnesium sulphate ($MgSO_4$), sodium chloride (NaCl), and sodium sulphate (Na_2SO_4). Excluding species that are tolerant to these growing conditions, salt accumulation in soils can result in reduced plant growth, poor germination of plant seeds, and plant death (Richards 1954; Henry et al. 1992).

Sodic soils are often variable throughout the landscape and have highly variable chemical (e.g., sodium adsorption ratio, sodium content) and physical (e.g., A horizon thickness) properties (Miller and Brierley 2010). High levels of sodium and low electrical conductivity can result in clay dispersion and poor soil structure. Further, calcium deficiencies associated with high sodium content can restrict vegetation growth. Mixing of sodic subsoil with topsoil can result in surface water ponding (from poor infiltration) and poor seedling emergence (Miller and Brierley 2010; Sparks 2003).

The majority of the Project Footprint is located on soils with weak salinity characteristics (Table 3.3-7), with localized areas of moderately saline or sodic soils in the Lilybrown soil series (AAF 2016) and soils that are not delineated at the scale of available desktop mapping.

Table 3.3-7: Soil Sensitivities of Dominant Soil Map Units within the Project Footprint

Soil Series	Dominant Soil Texture (Topsoil/Subsoil)	Slope (%)	Wind Erosion Risk[a]	Water Erosion Risk[a]	Compaction Rating[c]	Salinity/ Sodicity[d]
Cranford (CFD)	Loam/Loam	3 to 6	Moderate	Low	Moderate	Low
Foremost (FMT)	Loam/Loam	4 to 9	Moderate	Low	Moderate	Low
Chin (CHN)	Loam/Loam	2 to 4	High	Low	Moderate	Low
Bingville (BVL)	Sandy Loam/Sandy Loam	4	High	Low	Moderate	Low
Misc. Eroded (ZER)	Clay Loam	4	n/a	n/a	Very High	n/a
Cavendish (CVD)	Loamy Sand/Sand	6	High	Low	Low	Low
Vendisant (VST)	Sand/Sand	6	n/a	n/a	Low	Low
Antonio (ANO)	Sandy Loam/Sandy Loam	4	High	Low	Moderate	Low
Lilybrown (LYB)	Silty Loam/Silty Clay Loam	2 to 3	n/a	n/a	Very High	Moderate

[a] Soil Series Information for Reclamation Planning in Alberta (Pedocan 1993)
[b] Modified from Developing Timber Harvesting Prescriptions to Minimize Site Degradation – Interior Sites (Lewis et al. 1989).
[c] Soil Quality Criteria Relative to Disturbance (SQCWG 1987)
%; = percent; n/a = no rating information available.

Spills/Contamination

During the desktop assessment a search of the Environmental Site Assessment Repository (ESAR; AEP 2017) was completed and found two historical spills within the Project Footprint.

3.3.4 Potential Effects, Mitigation and Predicted Residual Effects

3.3.4.1 Potential Effects

This section describes the potential effects of the Project on terrain and soils that differ from the conditions otherwise expected from natural change (Section 2.4).

Terrain

Overall, terrain within the Project Footprint is largely undulating or hummocky, which does not typically result in restrictions for construction. Where steep slopes occur, within valleys in the Miscellaneous Eroded SMU, construction would likely not be practical. While changes to existing slopes and natural drainage conditions through construction (grading) and operation have the potential to affect terrain stability, especially on slopes, it is not anticipated that Project activities will cause terrain stability issues.

Soils

Surface disturbances associated with the Project that may affect soils include stripping, salvage and grading, temporary and permanent workspace and pad preparation. Construction and operational maintenance of the Project, if not properly mitigated, could result in the following effects on soils:

- **Soil Erosion:** The physical loss of topsoil lowers the capability of the land to support plant growth by decreasing the amount of available nutrients and organic matter in the root zone. The severity of this potential effect is directly related to the proportion of soil lost. The problem is more severe when topsoils are thin (<15 cm) or coarse textured. Soil loss from wind erosion may occur if soil handling, from either stripping or replacement, occurs during dry, windy conditions. Soil loss from water erosion is more likely to occur on exposed soil, along slopes and in wet areas within the Project Footprint.
- **Compaction/loss of soil structure:** The capability of soil to support plant growth required for reclamation can be reduced if the soil is compacted. Compaction affects soil capability by restricting root penetration and restricting air and water movement. Compaction and loss of soil structure will be greatest if soil handling and equipment movement occurs during wet soil conditions and/or repeated handling.
- **Salinity/Sodicity and Soil admixing:** Admixing of soils (e.g., calcareous, saline and/or sodic soils) can affect the capability of the soil to support vegetation. The potential for soil admixing may be higher if clear distinctions between topsoil and subsoil in soil profiles is not apparent (i.e., poor colour contrast between topsoil and upper subsoil).
- **Soil Contamination:** Soil contamination may result from spills during the construction, operations, or decommissioning period (e.g., fueling of equipment).

3.3.4.2 Mitigation

This section describes the proposed mitigation that will be applied to limit the potential for adverse environmental effects on terrain and soils.

Terrain

During initial Project planning, terrain information was reviewed to confirm that the Project Study Area and Project Footprint does not overlap with any areas with greater than 15% slopes, therefore no terrain stability mitigations have been identified at this time.

Soil

For the purposes of this assessment, it is assumed that cranes will follow temporary construction roads and potentially collector lines that are outside of environmental setbacks. The installation of the underground collector system will be done via ploughing, or trenching where necessary. In the event that the underground collector system is installed by direct plow-in, soil stripping will not be completed for these Project components. Topsoil and upper subsoil stripping will be required for some segments of the collector line with several circuits that are installed in a trench.

Erosion

The majority of soil series found within the Project Footprint are rated as having moderate to high wind erosion risk and water erosion risk is rated low throughout the Project Footprint (Table 3.3-5). The amount of soil stripping will be limited to the extent possible. Limiting the area of disturbance and the time between salvage, storage and reclamation is expected to reduce the potential for loss of salvaged topsoil resulting from wind erosion. Soil handling activities will not occur in coarse textured soils (e.g., sand and loamy sand) and moderately coarse textured soils (e.g., sandy loam) during windy conditions. Tackifiers or seeding the stockpiles may be used to stabilize soil stockpiles, if necessary. After soil replacement, tackifiers, shredded straw or other mulches may be spread over coarse or moderately coarse soils to reduce loss of topsoil, prior to re-vegetation. Soil stabilization by re-vegetation will be achieved within the Project Footprint by seeding disturbed areas with seed mixes selected in consultation with the landowner, as appropriate.

The following measures are planned to mitigate the potential soil erosion:

- selection of appropriate structure (i.e., turbine) locations
- establishing good surface and subsurface run-off control (e.g., drainage ditches and culverts)
- regrading and reclaiming disturbed areas to a stable angle after work is completed
- re-establishing vegetation

In addition, erosion, or sediment control measures such as silt fences will be placed along Project components where required to reduce water erosion. Follow-up inspections of the workspaces and communication with landowners will occur so that potential erosion issues are addressed in a proactive manner.

Compaction/Loss of Soil Structure

The Project Footprint is located on land ranging from moderate to very high sensitivity to soil compaction (Table 3.3-6). Heavy equipment activities and soil handling will be restricted on fine (i.e., clay, sandy clay) and moderately fine-textured (i.e., clay loam, sandy clay loam) soils during wet conditions. Heavy equipment and vehicles will operate on these soils during dry or frozen ground conditions, and on previously disturbed areas, wherever possible. Construction and decommissioning will also be carried out using equipment with low ground pressure tires or wide-pad tracks, wherever possible. Rig matting or geotextile material may be used in areas identified as sensitive to compaction/loss of soil structure. Where structure may have been altered by soil handling the addition of organic matter may be used to ameliorate the soil structure on replaced soils, particularly on coarse textured soils.

Earthwork-related construction or decommissioning activities will be either shut down during wet weather or conducted after appropriate mitigation measures are applied. Such mitigation measures may include limiting equipment travel, restricting activities to areas where topsoil has been removed (e.g., temporary workspaces that have been stripped) and using equipment with low ground pressure tires or wide-pad tracks to reduce compaction. In the absence of effective mitigation procedures, construction will be suspended. Effective mitigation procedures can be determined in consultation with an environmental field monitor, and on-site contractor or coordinator/supervisor, if one of the following occurs:

- excessive compaction and rutting
- spinning tires
- build-up of mud on equipment
- formation of standing water in the work areas
- tracking mud down access or public roads as vehicles leave the development area

Salinity/Sodicity and Soil Admixing

The majority of the Project Footprint is located on soils with weak salinity characteristics (Table 3.3-7). Potential for admixing can occur whenever surface soils are disturbed. The amount of soil stripping in areas of sensitive soils will be limited to the extent possible. In areas where soil will be salvaged, the topsoil (A horizons) will be stripped and stored separately from subsoil (B or C horizons) to limit the potential for admixing. During construction, salvage of the topsoil separately from the subsoil is important because organic matter and macro- and micro-organisms are less diluted in the topsoil, which maintains growth support capability, and can potentially serve as a seed source for re-vegetation on non-cultivated lands.

Soil Contamination

Project activities will follow standard construction and decommissioning practices to minimize the potential for spills. A Spill Contingency Plan will be developed and all Project-related staff on site during all phases of the Project will be required to know the location and have an understanding of the plan. Any spill site will be reported to the appropriate authorities if necessary and remediated in a timely manner.

3.3.4.3 Predicted Residual Effects

The predicted residual Project effect on terrain and soils is:

- Loss of soil to support healthy ecosystems

3.3.5 Evaluation of Predicted Residual Effects of the Project

A summary of the predicted residual effects of the Project on terrain and soils is provided in Table 3.3-8 and a rationale for the evaluation is provided below.

Table 3.3-8: Predicted Residual Project Effects Description, Importance and Likelihood for Terrain and Soils

Predicted Residual Effect	Project Activity	Effects Assessment Criteria[(a)]				Importance[(a)]	Likelihood[(a)]
		Direction	Magnitude	Geographic Extent	Duration		
Loss of soil to support healthy ecosystems	Construction and decommissioning	Negative	Low	Local	Medium-term	Low	Likely

[(a)] Effects assessment criteria are defined in Table 2.6-1. Importance and Likelihood are defined in Table 2.6-2 and Table 2.6-3, respectively.

Loss of soil to support healthy ecosystems

Development of the Project is expected to change soil within the permanent disturbance area of the operational Project Footprint (9.2 ha). These changes can affect other ecosystem components such as vegetation and wildlife. Site clearing and the movement of soil from the landscape is required to develop the Project. The loss of soil is expected with a low magnitude, provided the appropriate mitigations are implemented during construction and decommissioning. The geographic extent is not expected to extend beyond the Project Footprint and is therefore local. The loss of soil is expected to be medium-term and in a negative direction; following the construction of permanent facilities, areas not containing permanent facilities or operational access roads will be reclaimed. The predicted residual effect is likely to occur but is considered common for similar projects. Overall, the loss or alteration of soil capability and terrain is considered to be of low importance.

3.3.6 Determination of Significance

The effect of the Project on the loss of soil is considered to be of low importance. Outside of where permanent infrastructure components are located, the effects are reversible, as the temporary disturbances will be reclaimed following construction. Given the mitigation that will be implemented to minimize the loss of soil as a result of the Project, the residual effect on soils is predicted to not result in a change that will alter the sustainability of the soil beyond a manageable level, and is predicted to be not significant.

3.4 Vegetation

3.4.1 Introduction

Much of the native vegetation in the Project Study Area has been modified or removed over the last 125 years for agricultural development. Due to its reduced extent across southern Alberta, native vegetation, particularly native grassland, is regarded by Alberta Environment and Parks, Fish and Wildlife Stewardship (AEP-FWS) as a resource to be protected and well managed. Both desktop and field-based vegetation assessments were completed to determine the location and amount of native vegetation in the Project Study Area.

Provincial and federal agencies maintain lists of plant species and ecological communities of conservation concern. In Alberta, ACIMS maintains tracking and watch lists of plant species (ACIMS 2018a) and ecological communities (Allen 2014). Species on the tracking list are of high priority because they are rare or of conservation concern (Kemper 2009). Although species on the watch list are not of immediate conservation concern, ACIMS endeavors to gather more information about the abundance and distribution of these species throughout the province.

Provincially, the Alberta *Wildlife Act* (GOA 2018c) and federally the *Species at Risk Act* (SARA), Schedule 1 (Government of Canada 2020), identify species, including plant species, at risk that have legislative protection and would require mitigation if present. As such, listed plant and listed ecological community surveys were completed to identify their potential occurrence or location in the Project Study Area.

The spread of plant species listed by the Alberta *Weed Control Act and Regulation* (GOA 2017a) across the landscape is a concern for landowners, agricultural producers, and managers of natural areas. Therefore, an assessment was completed to determine the occurrence and distribution of plant species listed as noxious or prohibited noxious by the Alberta *Weed Control Act and Regulations* (GOA 2017a). Construction equipment use can result in the introduction of or spread of weed species in an area. By knowing the locations of weed species in the Project Study Area, mitigation strategies can be focused to reduce the introduction or spread of weeds.

3.4.2 Baseline Data Collection Methods

3.4.2.1 Desktop Assessment

The northern portion of the Project Study Area falls within the slender mouse-ear cress (*Halimobos virgata*) range, a biennial plant listed as ‘Endangered’ under the provincial *Wildlife Act* and is listed on Schedule 1 of the *SARA*.

However, limited native grassland area occurs within the portion of the Project Study Area that overlaps with the range, and most of the mouse-ear cress range overlapping with the Project Study Area has been previously disturbed by agricultural practices (i.e., cultivation and tame or hay land cover types).

The ACIMS database lists 114 tracked and watched plant species and 37 ecological communities in the Dry Mixedgrass Subregion (ACIMS 2017a). A desktop assessment was conducted to determine the historical occurrence and potential occurrence of listed plant species and ecological communities in the Project Study Area, and to identify potential mitigation and reclamation strategies to protect tracked or watched plant species and natural communities in the Project Study Area. A complete list of ACIMS (2017a) tracked and watched plant species and ecological communities in the Dry Mixedgrass Subregion is presented in Appendix C.

Listed Plant Species and Ecological Communities

Data on historical occurrences of provincially listed vascular and non-vascular plant species and ecological communities within the Project Study Area were downloaded from the ACIMS database (ACIMS 2017b). The ACIMS (2015 [updated in 2018] and 2017a) list of all tracked and watch listed vascular and non-vascular plant species and ecological communities previously documented in the Dry Mixedgrass Subregion was also downloaded for use by the field crews during the vegetation survey (Appendix C). Species listed under the *Wildlife Act* and *SARA* were also noted if encountered (Appendix C). The Alberta conservation status rank definitions (ACIMS 2018b) used to classify listed plant species are presented in Appendix D.

Listed Weed Species

Plant species listed as noxious or prohibited noxious were obtained from the Alberta *Weed Control Act and Regulations* (GOA 2017a) for use by the field crews during the vegetation survey.

3.4.2.2 Field Assessment

Surveys for listed plant species are typically completed at least twice over the growing season (ANPC 2012) to capture plant species which mature and flower at different times (e.g., early and late blooming species). Exact timing of the surveys depends on the length of the growing season of the survey area, and specific conditions of the site for the given year.

Field assessments were conducted on August 18 to 20 2018, June 3 to 9 2020, and September 8 to 10 2020 to document listed plants observed within the Project Study Area. Systematic random floristic meanders of varying lengths were undertaken within the native grassland land cover type, exploring representative habitats (ANPC 2012). When rare plants were observed, the following information was collected:

- Universal Transverse Mercator (UTM) waypoint at the specific site of the listed species or community occurrence
- one or more digital photographs of the occurrence
- the approximate area covered by the listed species
- a count or estimate of the number of individuals of the listed species
- the current vegetative and/or reproductive state of the listed species
- notes on micro-habitat of the listed species occurrence.

Vegetation communities were evaluated for potential listed plants as the vegetation team travelled on foot throughout the survey areas. Minimum requirements for a listed plant survey outline that the Project Study Area be surveyed with reasonable geographic coverage of each representative plant community. Native grassland was

surveyed using GPS units and using a random meander search pattern (ANPC 2012). This search pattern was used to cover microhabitats within survey areas. Whereas cultivation, tame pasture or hay and wetland land cover types were assessed for rare plant occurrences while crew member travelled on foot between land cover types.

Scientific names and common names presented in this report follow those used by ACIMS (2018b). The Alberta conservation status rank definitions used to rank the listed plant species and ecological communities are presented in Appendix D.

Listed Weed Species Survey

A search for weed species listed by the Alberta *Weed Control Act and Regulation* (GOA 2017b) was conducted during the land cover field verification surveys, listed plant species and community surveys, and wetland surveys. The search for listed weed species was conducted in both areas of native vegetation and within disturbed areas. When high infestations of listed weed species were encountered, the following data were collected:

- species identification
- one or more UTM waypoints
- one or more digital photographs
- the approximate area covered by the listed weed species
- a count or estimate of the number of individuals of the species

In addition, populations of non-listed weed species (i.e., species listed as “exotic” by ACIMS [2015]) were documented as encountered by recording the species identification and a UTM waypoint.

3.4.3 Baseline Conditions

3.4.3.1 Vegetation Communities

Vegetation communities found within the Project Study Area during the desktop and field assessments are presented in Section 3.1, Table 3.1-1. This section focuses on the baseline conditions for native grassland and wetland vegetation communities. Other land cover types are described in Section 3.1.3.

Areas of native vegetation can be native grassland or native pasture. Differences between idled native grassland and pasture result from the periodic or continuous presence of livestock, which alter the structure and composition of vegetation to varying degrees depending on the intensity of grazing. This alteration of structure and composition in turn influences wildlife use. While heavy grazing is easily identifiable, it is not always easy to distinguish between light grazing and a naturally patchy landscape that can develop, for example, in areas of low moisture or nutrients (e.g., slopes). If the presence of livestock is uncertain, it is acceptable to identify the land cover as “native grassland” and that is the approach used for this assessment.

Native grassland in the Project Study Area is dominated by native grass species and a diversity of forb species with some non-native species present. Dominant native grass species are June grass, blue grama, and kentucky blue grass (*Poa pratensis*). Common non-native/invasive grass species include smooth brome (*Bromus inermis*), crested wheatgrass, and quackgrass (*Elymus repens*). The most common forb species include pasture sagewort (*Artemisia frigida*), common yarrow (*Achillea millefolium*), golden aster (*Heterotheca villosa*), scarlet mallow (*Sphaeralcea coccinea*), and silver sagebrush (*Artemisia cana*). Non-native weed species commonly found in native upland areas include common dandelion and russian thistle (*Salsola tragus)*.

Wetlands are naturally formed water bodies, which may contain water, or otherwise show evidence of hydric conditions (e.g., presence of hydrophytic plant species). Most wetlands within the Project Study Area have been altered by agricultural activities and plant communities associated with wetlands are altered or not present.

Plant species associated with the wetlands in the Project Study Area included common cattail, dock species, foxtail barley, reed canary grass, slough grass, needle spike rush (*Eleocharis acicularis*), manna grasses (*Glyceria* spp.), rush species, foxtail barley (*Hordeum jubatum*), and sedge (*Carex* sp.) species. Weed species observed in the transition zone between wetland vegetation and adjacent, upland vegetation (often cultivated or tame pasture or hay) included Canada (creeping) thistle, perennial sow thistle (*Sonchus arvensis*), summer-cypress (*Kochia scoparia*), common dandelion, and common goat's beard (*Tragopogon dubius*). More information on wetlands is provided in Section 3.5 of this document.

Some common non-native weed species commonly found in agricultural areas and other disturbed areas were found in the Project Study Area. A complete list of species observed during the vegetation assessment is presented in Appendix E.

3.4.3.2 Listed Plant Species and Ecological Communities

Listed plants were not identified within the Project Study Area during the 2018 and 2020 field surveys. One sensitive plant species, slender mouse-ear cress (*Halimobos virgata*), was identified by ACIMS (2017b) as occurring within the Project Study Area (Table 3.4-1). Provincially or federally-listed vascular plant species or ecological communities were not observed during vegetation field surveys of the Project Study Area undertaken in 2018 and 2020.

Table 3.4-1: Listed Plant Species Identified by ACIMS (2015) [updated in 2018] as Occurring in the Project Study Area

Common Name	Scientific Name	Vascular/ Non-Vascular	Provincial Rank[a]	Tracked or Watched[b]	COSEWIC[c]	SARA[d]
slender mouse-ear cress	*Halimobos virgata*	Vascular	S1S2	T	Threatened	Threatened

[a] Provincial Conservation ranking definitions can be found in Appendix D (ACIMS 2018b).
[b] Tracked (T) or Watched (W) ACIMS lists serve as focus for data gathering.
[c] COSEWIC category definitions can be found in Appendix D (Government of Canada 2020).
[d] SARA category definitions can be found in Appendix D (Government of Canada 2020).
- Species not ranked.

The Project Study Area has low potential for listed plant species due to the extent of lands either altered (i.e., cultivation or converted to tame pasture or hay) or disturbed (i.e., roads, residences, etc.) (approximately 82% of the total Project Study Area). However, lands associated with wetlands were considered to have a higher potential for listed plant species and these areas were investigated during the listed plant and wetland surveys in 2020.

3.4.3.3 Weed Species

Nine species of weeds were identified in the Project Study Area during the field surveys, including two regulated noxious weeds, creeping thistle and perennial sow-thistle, and 7 non-regulated exotic species as identified in Table 3.4-2. Weeds were observed in cultivation, tame pasture or hay, native grassland, wetlands and miscellaneous land cover types.

Table 3.4-2: Weeds Observed during 2018 and 2020 Field Surveys of the Project Study Area

Common Name	Scientific Name [a]
crested wheatgrass	*Agropyron cristatum*
bull thistle	*Cirsium vulgare*
Canada (creeping) thistle	Cirsium arvense[b]
Flixweed	*Descurainia sophia*
Bluebur	*Lappula squarrosa*
Alfalfa	*Medicago sativa*
russian thistle	*Salsola tragus*
dock species	*Rumex species*
perennial sow-thistle	*Sonchus arvensis* [b]

[a] Species classed as exotic as per the Alberta Conservation Information Management System (ACIMS) (ACIMS 2018a).
[b] Species classed noxious according to the Alberta Weed Control Act and Regulations (GOA 2017a).

3.4.4 Potential Effects, Mitigation and Predicted Residual Effects

3.4.4.1 Potential Effects

Because of effort made to locate the Project within areas of previous disturbance or alteration, the Project has limited potential to remove or alter native vegetation, including native grassland vegetation, listed plant species or ecological communities. The Project has the potential to introduce or spread weed species listed as noxious or prohibited noxious by the Alberta *Weed Control Act and Regulations* (GOA 2017a). Project effects to non-native vegetation are discussed in Section 3.1, while Project effects to wetlands are discussed in Section 3.5.

The Project has the potential to adversely affect 1.6 ha of native grassland (<0.1% of the Project Study Area) during construction, of these 0.5 ha will carry through to the operational stage of the Project.

3.4.4.2 Mitigation

The Proponent's efforts during planning to avoid or minimize impacts within land cover types likely to contain sensitive plant species (i.e., native grassland), is the primary mitigation employed for the Project and was an important driver in the initial constraints analysis used for siting turbines and ancillary infrastructure.

Native grassland covers only 8% of the Project Study Area (Table 3.1-1, Figure 3.1-1). Despite the limited extent of native grassland land cover within the Project Study Area, all construction equipment will enter the Project site in clean condition to limit the potential for introduction of weeds. To limit potential effects on native grassland and other sensitive land cover types, the following guidelines will be applied to development activities in areas of native vegetation (i.e., native grassland land cover type):

- Prior to construction of Project infrastructure, once detailed siting information is available, conduct targeted listed plant and ecological surveys to identify any occurrences of listed species or ecological communities.
- Limit the width of access roads and the size of workspaces.
- Where possible, utilize existing access trails and roads.
- Conserve the integrity of the sod, topsoil and subsoil *in situ* where stripping is not required.
- Limit the amount of topsoil stripping and grading required through the use of matting, geo-textiles and/or working during frozen or dry ground conditions, where required.
- Wash/steam clean all construction equipment outside the site prior to arrival to minimize risk of introducing invasive weed species.

Grading will be restricted to what is required for access and safe construction and operation practices. All vehicle traffic and equipment will be required to remain within the Project Footprint. For immediate/short-term duration

disturbances (e.g., collector system routing), alternative methods such as sod salvage and replacement may be attempted; however, for longer duration disturbances (i.e., turbine access roads and public roads) the viability of the sod salvaged may limit its application.

During construction of collector lines, the trench will be backfilled and reclaimed immediately following construction. Areas not containing permanent facilities or operational access roads will be re-vegetated as soon as reasonably possible following Project construction and reclaimed to equivalent land cover capability, so that only the area required for operations remains, and to limit the potential establishment of weeds on disturbed ground. Only certified seed mixes will be used, and these will be selected in consultation with the appropriate landowner.

The Project Footprint will be regularly monitored for weed infestations during operation, and plant species designated as prohibited noxious or noxious (GOA 2017a) will be eliminated or controlled. Control techniques will reflect site conditions and the nature of infestation, and could include a combination of hand pulling, mowing and spot spraying with appropriate herbicides.

At the end of the Project life, above-ground structures will be decommissioned and removed in accordance with the C&R Directive. The concrete foundation for the wind turbines will be removed to a depth of 1.2 m below surface, consistent with current requirements under the C&R Directive. The excavation will be backfilled with subsoil and topsoil to match the natural grade and soil profile. Underground cables will be terminated and capped at connection points and will remain in place to limit re-disturbing surface soil and vegetation.

When decommissioning occurs, reclamation standards outlined in the current C&R Directive or subsequent standards in place at the time of decommissioning will be followed. Soil management will be incorporated into this process to facilitate site reclamation. After the infrastructure is removed, areas of disturbance will be ploughed to alleviate soil compaction and graded to restore terrain profiles. Topsoil will be replaced and prepared for seeding by the landowner(s) on cultivated areas. Areas of native grassland will be replanted with certified and inspected native grass and forb seed mixes appropriate for the land cover type.

3.4.4.3 Predicted Residual Effects

The predicted residual Project effects assessed in the Vegetation section are:

- loss or alteration of native vegetation
- introduction or spread of weeds and/or non-native plant species

Predicted residual effects to non-native vegetation (i.e., loss or alteration, and reclamation of cultivated and tame pasture or hay) are discussed in Section 3.1, while predicted residual effects to wetlands are discussed in Section 3.5.

3.4.5 Evaluation of Predicted Residual Effects of the Project

A summary of the residual effects of the Project on vegetation is provided in Table 3.4-3 and a rationale for the evaluation is provided below.

Table 3.4-3: Predicted Residual Project Effects Description, Importance and Likelihood for Vegetation

Predicted Residual Effect	Project Activity	Effects Assessment Criteria[a]				Importance[a]	Likelihood[a]
		Direction	Magnitude	Geographic Extent	Duration		
Loss or alteration of native vegetation	Construction, operation, and decommissioning	Negative	Low	Local	Medium to Long term	Low	Likely
Introduction or spread of weeds and/or non-native plant species	Construction, operation, and decommissioning	Negative	Low	Local	Medium-term	Low	Likely

[a] Effects assessment criteria are defined in Table 2.6-1. Importance and Likelihood are defined in Table 2.6-2 and Table 2.6-3, respectively.

Loss or alteration of native vegetation

Loss or alteration of native vegetation will be negative in direction and low in magnitude because there will be no net loss of native vegetation to Project infrastructure. The geographic extent is not expected to extend beyond the Project Study Area and is therefore local. The loss or alteration of 1.2 ha of native vegetation is expected to be short term because disturbance in these areas is associated with temporary construction footprint and is expected to be reclaimed immediately following construction, whereas the loss of 0.5 ha of native grassland is expected to be medium to long term, because these impacts are associated with the access road upgrades in the northwest portion of the Project Study Area (Appendix A, Figure A1). Access road upgrades activities will be limited to the existing County road allowance. The probability of this occurrence is likely but is considered common for similar projects. Therefore, the loss or alteration of native vegetation is considered to be of low importance.

Introduction or spread of weeds and/or non-native species

The introduction or spread of weeds and non-native plant species will be negative in direction and low in magnitude. Implemented mitigation will limit vehicle traffic and equipment to the Project Footprint, reducing the potential to introduce or spread weeds. Additionally, all construction equipment will enter construction areas clean to limit the potential for introduction of weeds. Equipment will be visually inspected and cleaned off-site as needed and the Proponent will develop and implement a vegetation management plan as per the C&R Directive to prevent and control the spread of invasive species. The geographic extent is not expected to extend beyond the Project Study Area, and is therefore local. The introduction or spread of weeds and non-native plant species is expected to be of medium-term duration; the Proponent will abide by the Alberta *Weed Control Act and Regulations* (GOA 2017a) and eradicate any prohibited noxious weed populations and control any noxious weed populations associated with Project components. The probability of this occurrence is likely. Weeds and non-native plant species may be introduced or spread, but the mitigation practices will reduce the likelihood of this occurrence. Overall, the introduction or spread of weeds and non-native species is considered to be of low importance.

3.4.6 Determination of Significance

The effect of the Project on the loss or alteration of native grassland vegetation is considered to be of low importance. Effects will be limited to the Project Study Area, of which 82% is either cultivated or tame pasture and hay land cover types, and 8% is native grassland land cover. There will be 0.5 ha of net loss of native grassland due access road upgrades associated with Project operation footprint. Within the temporary Project construction footprint, the loss of 1.2 ha of native grassland is reversible, as this temporary disturbance will be seeded, where

applicable, and land use reclaimed to equivalent land cover capability following construction, thus resulting in no net loss of native vegetation to Project infrastructure.

The effect of the Project on the introduction or spread of weeds and/or non-native plant species is considered to be of low importance. The implementation of mitigation for control of prohibited noxious and noxious weeds should assist in the re-establishment of desired plant species in the Project Study Area.

Given that Project infrastructure has been sited or planned with construction techniques that will generate minimal (0.5 ha) permanent impacts within areas of native grassland, and that mitigation will be implemented to minimize the introduction or spread of weeds and/or non-native plant species, the residual effect on vegetation is predicted to result in a change that will not alter the sustainability of the vegetation beyond a manageable level, and is predicted to be not significant.

3.5 Wetlands and Water Bodies

3.5.1 Introduction

For all wind energy developments in Alberta, wetland mapping is required by the AUC. Disturbance to wetlands and natural drainage features requires regulatory approvals and compliance under the Alberta *Water Act,* Wetland Policy and/or the *Public Lands Act*. While the *Water Act* applies to all bodies of water, and in particular all wetlands and natural drainages, the Wetland Policy (GOA 2013a) applies only to naturally occurring wetlands as defined by the Alberta Wetland Classification System (AWCS) (e.g., not areas of wetland vegetation resulting from anthropogenic activities) and excludes ephemeral water bodies (i.e., Class I permanence; GOA 2015).

The following sections provide a summary of the methods used to identify, classify and describe wetlands within the Project Study Area, assess potential effects that the Project may have on wetlands, propose mitigation measures as applicable, and provide an evaluation of the predicted residual effects of the Project after implementing mitigation.

3.5.2 Baseline Data Collection Methods

3.5.2.1 Desktop Assessment

To document wetlands in the Project Study Area, high resolution (40 cm) stereo aerial photography from August 23, 2015 was reviewed within PurVIEW, a soft-copy mapping add-on in ArcGIS. Wetlands were delineated based on the stereo imagery, and wetland class and permanence were assigned following the AWCS (GOA 2015). Supplemental imagery (ESRI 2012) was reviewed to assist with interpretation of wetland extent and classification, as needed. In addition to the three naturally occurring wetland classes expected within the Project Study Area (i.e., marsh, shallow open water, and swamp), two other categories were used: anthropogenic and other natural water bodies (see Table 3.5-1 for definitions of water body types). Wetland permanence categories are shown in Table 3.5-2.

Table 3.5-1: Description of Project Study Area Water Bodies and Applicable Provincial Policies and Legislation

Water Body Type	Description	Applicable Policy and Legislation		
		Alberta Wetland Policy	Alberta *Water Act*[a]	Alberta *Public Lands Act*
Natural Wetlands				
Marsh[b]	Dominated by graminoid vegetation in the deepest wetland zone covering more than 25% of the total wetland area.	yes	yes	yes (Class IV and higher)
Shallow Open Water[b]	Dominated by shallow (i.e., <2 m deep at midsummer) open water in the deepest wetland zone covering more than 25% of the total wetland area; floating and/or submersed aquatic vegetation is common in the shallow open water zone, but sometimes aquatic vegetation is absent.	yes	yes	yes (Class IV and higher)
Swamp[b]	Woody plant cover, such as willows (*Salix* spp.), comprises more than 25% of the total wetland area.	yes	yes	no[c]
Anthropogenic Water Bodies/Modified Natural Wetlands				
Anthropogenic Water Body/ Modified Natural Wetland	Man-made water body; possibly, but not necessarily, occurring within a natural wetland. When historical aerial photograph review demonstrates that they occur within a natural wetland basin, they should be treated as a regulated water body under the Alberta *Water Act* (GOA 2000a) and as a wetland under the provincial Wetland Policy (GOA 2013a).	maybe	maybe	maybe
Other Natural Water Bodies[d]				
Ephemeral (Class I) Water Body[d]	Surface water is present in most years, but only for a brief period of days after snowmelt or a heavy rainfall. While some water tolerant plant species may be present, they are not dominant and are intermixed with a majority of upland species.	no	yes	no
Natural Drainage	Area where water flow is generally intermittent, often connected to one or more wetland basins. The Natural Drainage feature does not meet the AWCS definition of a wetland (i.e., land that is saturated with water long enough to promote formation of water altered soils, growth of water tolerant vegetation, and various kinds of biological activity that are adapted to wet environments [GOA 2015]), but it does meet the definition of a water body in the Alberta *Water Act* (GOA 2000a), which includes “any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or only occurs during a flood”.	no	yes	no

[a] Notification under the *Water Act* Code of Practice or a *Water Act* Approval is required for temporary and minimal permanent impacts; application includes Wetland Assessment and Impact Form. Approval under the *Water Act* is required for all permanent impacts; application includes Wetland Assessment and Impact Report (GOA 2017b).
[b] Alberta Wetland Classification System GOA 2015.
[c] consistent with the current wording of the AWCS (GOA 2015); however, future updates to the AWCS may incorporate applicability of the *Public Lands Act* to Swamps (Class IV and higher).
[d] Not considered wetlands under AWCS (GOA 2015). Not to be included in the Wetland Assessment and Impact Report (GOA 2017b) or Wetland Assessment and Impact Form, but natural water bodies that will be impacted should be included in the *Water Act* application.
% = percent; m = metres.

Table 3.5-2: Wetland/Water Body Permanence Categories

Permanence[a]	Hydroperiod
Ephemeral (I)	Surface water is present for only a brief period of days after snowmelt or a heavy rainfall.
Temporary (II)	Surface water is present for a short period of time (i.e., generally a span of a few weeks) after snowmelt or a heavy rainfall.
Seasonal (III)	Surface water is present throughout the majority of the growing season (i.e., generally a span of a few months), but is typically dry by the end of summer.
Semi-permanent (IV)	Surface water is present for most or all of the year, except in periods of drought.
Permanent (V)	Surface water is present throughout the year.
Intermittent Alkali (VI)	Alternates between saline open water and exposed alkali salt flats.

[a] Roman numerals in parentheses are equivalent to wetland classes by Stewart and Kantrud (1971).

Source: GOA 2015.

3.5.2.2 Field Assessment

Desktop-delineated wetlands were plotted on field maps at a 1:7,500 scale, and a wetland field verification survey was carried out by two of Golder's Qualified Wetland Science Practitioners from June 3 to 9 2020, and September 8 to 10, 2020. Wetlands with greater water permanence (i.e., seasonal, semi-permanent and permanent) and wetland areas where there was uncertainty of their attributes were considered the highest priority for field verification. Sufficient wetlands were visited to bring the field verification total to approximately 25% of all wetlands mapped within the Project Study Area.

At each field assessed wetland polygon, the desktop-derived wetland/water body type (Table 3.5-1) and water permanence (Table 3.5-2) were evaluated and updated as required, and dominant plant species were noted. Soils were assessed as needed to determine wetland/upland boundaries, and desktop wetland delineations were adjusted using a GPS track file, if necessary. The presence of weed species and any current wetland impacts associated with human activities were noted, as applicable, and photographs were taken at each wetland. Following the field assessment, the delineations of field verified wetlands were revised and questionable wetland areas that were ultimately determined to be upland were removed, as needed, to reflect direct assessment in the field.

3.5.3 Baseline Conditions

In total 576 wetlands occupying 303.1 ha were documented in the Project Study Area. Of these, 445 are natural wetlands occupying 223 ha of the Project Study Area (Table 3.5-3; Figure 3.1-1). Marshes were the most frequently observed natural wetland type, with 435 occurrences, and they occupied 198.7 ha (89.0%) of the natural wetland area within the Project Study Area (Table 3.5-3). Water permanence of most marshes was relatively short, with 338 marshes (44.5%) classified as temporary wetlands (Table 3.5-3). In addition to the 445 natural wetlands, there were 41 anthropogenic water bodies covering 48.1 ha and 90 ephemeral (Class I) water bodies covering 31.9 ha. During field surveys, natural drainages were not observed within the Project Study Area. However, based on the AltaLIS watercourse layer, multiple unnamed and indefinite watercourses and water bodies occur within or near the Project Footprint (Section 3.7)

Out of the 576 original desktop-delineated wetlands and other water bodies, 235 were field verified (approximately 40% of the wetlands within the Project Study Area). Representative photographs of wetlands and water bodies observed during field verification surveys are provided in Appendix F. During post-field revisions to the wetland mapping, some wetland basins were merged together to reflect field conditions that were wetter than observed in the stereo imagery.

Plant species associated with wetlands in the Project Study Area are described in the Vegetation section of this document (Section 3.4). Information on wildlife use within the Project Study Area is available in the Wildlife and Wildlife Habitat section of this document (Section 3.8).

Table 3.5-3: Water Bodies and Wetlands within the Hilda Wind Power Project Study Area

Water Body Type	Water Permanence[a][b]	Desktop		Field Verified Sample[c]		Total[e]	
		Number	Area [ha]	Number	Area [ha]	Number	Area [ha]
Natural Wetlands							
Marsh[a]	Temporary (II)	275	41.6	63	57.6	338	99.3
	Seasonal (III)	44	12.3	46	59.2	90	71.5
	Semi-permanent (IV)	2	0.5	5	27.5	7	27.9
Marsh Total		*321*	*54.4*	*114*	*144.3*	*435*	*198.7*
Shallow Open Water [a]	Seasonal (III)	0	0.0	3	6.3	3	6.3
	Semi-permanent (IV)	1	0.2	3	0.9	4	1.1
	Permanent (V)	0	0.0	1	16.8	1	16.8
Shallow Open Water Total		*1*	*0.2*	*7*	*24.0*	*8*	*24.2*
Shrubby Swamp [a]	Temporary (II)	*2*	0.2	*0*	0.0	2	0.2
Shrubby Swamp Total		*2*	*0.2*	*0*	*0.0*	*2*	*0.2*
Natural Wetland Total		***324***	***54.7***	***121***	***168.3***	***445***	***223.0***
Anthropogenic Water Bodies/Modified Natural Wetlands							
Anthropogenic Water Body/Modified Natural Wetland [d]	Temporary (II)	1	0.1	3	3.2	4	3.4
	Seasonal (III)	3	0.3	11	28.2	14	28.6
	Semi-permanent (IV)	9	1.1	9	12.6	18	13.7
	Permanent (V)	2	0.4	3	2.1	5	2.5
Anthropogenic Water Bodies/Modified Natural Wetlands Total		**15**	**1.9**	**26**	**46.2**	**41**	**48.1**
Other Natural Water Bodies							
Ephemeral (Class I) Water Body[d]		2	0.9	88	31.1	90	31.9
CUMULATIVE TOTAL		**341**	**57.5**	**235**	**245.5**	**576**	**303.0**

[a] GOA 2015.
[b] Roman numerals in parentheses are equivalent to wetland classes by Stewart and Kantrud (1971).
[c] Approximate 40% of total number of mapped wetlands were field verified.
[d] Not part of the AWCS (GOA 2015); described in Table 3.5-1.
[e] Includes only the area that falls within Project Study Area boundaries.
ha = hectares

3.5.4 Potential Effects, Mitigation and Predicted Residual Effects

3.5.4.1 Potential Effects

The Project has the potential to alter wetland condition through direct temporary or permanent disturbances, changes in hydrology, or changes in plant communities within the Project Study Area. Water quality within wetlands could also be directly or indirectly affected by siltation or spills during Project construction or operation.

During Project construction, six wetlands have the potential to be temporarily affected (Table 3.5-4). Of these, two wetlands were field verified to confirm wetland delineation and classification and four were delineated during

desktop mapping. The desktop mapping followed a conservative approach to capture the full extent of the wetlands. All the wetlands/water bodies to be temporarily affected are Class I-II systems, which have been previously altered by cultivation (Table 3.5-4). Temporary effects to wetlands will result from disturbance associated with turbine access roads. Temporary impacts from construction activities to Class III-V wetlands are not anticipated.

Where possible, permanent Project infrastructure has been sited to avoid wetlands; based on the current Project Footprint layout, only one Class II wetland has the potential to be permanently affected during Project operation (Table 3.5-4 and Appendix A, Figures A-1 to A-5). Project infrastructure is expected to permanently affect only <0.1 ha of wetland area, or 0.01% of the total natural wetland area within the Project Study Area (Table 3.5-4). Permanent impacts to the Class II wetland will result from accommodating a turbine access road that must remain in operation throughout the life of the Project. Permanent impacts to Class III-IV wetlands are not anticipated.

Table 3.5-4: Potential Direct Temporary and Permanent Project Effects on Wetlands/Water Bodies

Wetland/Water Body Type	Temporary (Project Construction) Impacts			Permanent (Project Operations) Impacts			Total Project Footprint		
	Number	Total Wetland Area [ha][(a)]	Area to be Impacted [ha]	Number	Total Wetland Area [ha][(a)]	Area to be Impacted [ha]	Number	Total Wetland Area [ha][(a)]	Area to be Impacted [ha]
Class I-II	6	0.7	0.2	1	0.1	<0.1	6	0.7	0.2
Class III-V	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Wetland Total	**6**	**0.7**	**0.2**	**1**	**0.1**	**<0.1**	**6**	**0.7**	**0.2**

[(a)] This value represents the entire extent of the wetland/water body areas within which the directly impacted areas are expected to occur.
Note: Some numbers are rounded for presentation purposes; therefore, totals may not equal the sum of the individual values.
ha = hectares

3.5.4.2 Mitigation

Avoidance of wetlands and other natural water bodies will be the primary mitigation employed during construction and operation of the Project. Field-verified wetland mapping was used by the Proponent during the planning stage to develop the Project Footprint layout. If construction activities are required in the vicinity of wetlands or other natural water bodies, measures will be taken to limit the potential for silt or spills to reach these areas. Minimal temporary impacts to Class II wetlands (0.2 ha) and avoidance of Class II-V wetlands reflect the Proponent's efforts to avoid or minimize wetland impacts. Existing road upgrades will temporarily affect 0.1 ha of an ephemeral water body (Class I), whereas turbine access roads will temporarily affect approximately 0.2 ha of Class II wetland area during construction. The Turbine T1 access road is predicted to permanently impact <0.1 ha of one Class II wetland during Project operation. Prior to detailed engineering, design and construction, the Proponent will field verify mapped delineations of affected wetlands to confirm wetland area, in accordance with *Water Act* requirements, and may adjust final siting where possible.

Mitigation measures to protect wetlands will include construction during dry ground conditions to the extent possible, and use of rig matting, geotextiles, vegetated buffer zones, earthen berms and/or silt fencing, as appropriate. Safety fencing will be installed to prevent vehicle traffic from entering wetlands, as appropriate. Following the construction phase, construction access roads and workspaces in the vicinity of wetlands will be re-vegetated, with an appropriate seed mix, as quickly as feasible to reduce the potential for siltation. Project access roads are currently planned to be reclaimed at the end of the Project's operational life; however, they may be left in place if requested by the landowner. Permanent erosion and spill control measures will be employed

around facilities and operational access roads including re-vegetation or placement of large diameter rock on slopes and the installation of permanent berms, as appropriate.

The Proponent will follow permitting requirements under the Alberta *Water Act* (GOA 2000a) and Alberta Wetland Policy (GOA 2013a) where temporary or permanent disturbance to wetlands cannot be avoided. Specifically, a Wetland Assessment and Impact Form (WAIF) will accompany the *Water Act* application for temporary and minimal permanent wetland impacts. A Wetland Assessment and Impact Report (WAIR) will not be required under the *Water Act* application, because permanent direct impacts to wetlands are expected to be minimal in extent (less than 15% of any individual wetland area). However, for permanent impacts, the proponent will follow compensation requirements under the Alberta Wetland Policy (GOA 2013a) and the Alberta Wetland Replacement Fact Sheet (GOA 2019b). Mitigation for potential wildlife species occurring in wetlands habitats (e.g., amphibians) is described in Section 3.8.4.2).

3.5.4.3 Predicted Residual Effects

The predicted residual effects on wetlands are:

- loss or alteration of natural wetlands
- loss or alteration of other natural water bodies (i.e., ephemeral wetlands)
- introduction or spread of weeds and/or non-native plant species

3.5.5 Evaluation of Predicted Residual Effects of the Project

A summary of the predicted residual effects of the Project on wetlands and other natural water bodies is provided in Table 3.5-5 and a rationale for the evaluation is provided below.

Table 3.5-5: Predicted Residual Project Effects Description, Importance and Likelihood for Wetlands/Water Bodies

Predicted Residual Effect	Project Activity	Effects Assessment Criteria[(a)]				Importance[(a)]	Likelihood[(a)]
		Direction	Magnitude	Geographic Extent	Duration		
Loss or alteration of wetlands	Construction, operation, and decommissioning	Negative	Low	Local	Short to Medium-term	Low	Likely
Loss or alteration of other natural water bodies[(b)]	Construction, operation, and decommissioning	Negative	Minimal	Local	Short term	Minimal	Likely
Introduction or spread of weeds and/or non-native species	Construction, operation, and decommissioning	Negative	Low	Local	Medium-term	Low	Likely

(a) Effects assessment criteria are defined in Table 2.6-1. Importance and Likelihood are defined in Table 2.6-2 and Table 2.6-3, respectively.
(b) Ephemeral (Class I) natural waterbodies that are not part of the AWCS (GOA 2015); described in Table 3.5-1.

Loss or alteration of wetlands

Loss or alteration of wetlands will be negative in direction and low in magnitude because there will be a net loss of <0.1 ha where permanent infrastructure (i.e., turbine access road) will permanently affect one Class II wetland. The effects are not expected to extend beyond the Project Study Area, so the geographic extent is local. The loss or alteration of wetlands is expected to be short to medium-term in duration. Although one wetland will be directly affected by Project infrastructure that must remain in operation throughout the 20 to 50 year life of the Project, upon completion of the Project construction phase, wetlands not containing permanent infrastructure will be re-vegetated as quickly as feasible. The Proponent will address permanent adverse effects to wetlands through the replacement requirements under the *Water Act* approval process (GOA 2018b) to provide “no net loss” of wetlands. The probability of this occurrence is likely, but is considered common for similar projects. The loss or alteration of wetlands is considered to be of low importance.

Loss or alteration of other natural water bodies

Loss or alteration of ephemeral natural water bodies will be negative in direction and minimal in magnitude, because there will be no net loss to water bodies and only <0.01 ha of an ephemeral water body will be temporarily disturbed. Effects are not expected to extend beyond the Project Study Area, so the geographic extent is considered local. The loss or alteration of ephemeral natural water bodies is expected to be short term because temporary impacts to water bodies will be restored following construction. The probability of this occurrence is likely, but is considered common for similar projects. The small scale of loss or alteration of ephemeral natural water bodies is considered to be of minimal importance.

Introduction or spread of weeds and/or non-native plant species

The introduction or spread of weeds and non-native plant species will be negative in direction and low in magnitude. Implemented mitigation will limit vehicle traffic and equipment within Project Footprint, reducing the potential to introduce or spread weeds. Additionally, all construction equipment will enter the Project site in a clean condition to limit the potential for introduction of weeds. Equipment will be visually inspected and cleaned off-site as needed and the Proponent will develop and implement a Vegetation Management Plan as per the C&R Directive to prevent and control the spread of invasive species. The geographic extent is not expected to extend beyond the Project Study Area, and is therefore considered local. The introduction or spread of weeds and non-native plant species is expected to be of medium-term duration. The Proponent will abide by the Alberta *Weed Control Act and Regulations* (GOA 2017b) and eradicate any prohibited noxious weed populations and control any noxious weed populations associated with Project components. The probability of introduction or spread of weeds is likely, as this can be expected to occur intermittently throughout the life of the Project. Weeds and non-native plant species may be introduced or spread, but the mitigation practices will reduce the likelihood of this occurrence. Overall, the introduction or spread of weeds and non-native plant species is considered to be of low importance.

3.5.6 Determination of Significance

Wetland loss and alteration associated with the Project is considered to be of low importance. Effects will be limited to the Project Study Area, of which 6% is covered by wetlands/water bodies (Table 3.1-1). The effects of temporary disturbance are reversible, as disturbed areas will be seeded with an appropriate seed mix, and temporarily disturbed wetland areas will be restored following construction. Permanent impacts to the Class II wetland associated with turbine T1 access road will be reclaimed to equivalent land capability following decommissioning of the Project. The Proponent will follow the requirements of the Alberta Wetland Policy, including any required compensation for permanent wetland losses.

The effect of the Project on the loss or alteration of other natural water bodies (i.e., ephemeral wetlands) is considered to be of minimal importance and are not expected to extend beyond the Project Study Area.

The effect of the Project on the introduction or spread of weeds and/or non-native plant species is considered to be of low importance. Compliance with the *Alberta Weed Act* and its regulations will assist in re-establishment of desired plant species in the Project Study Area.

Given the mitigation that will be implemented to minimize temporary wetland impacts and limit permanent loss or alteration of wetlands and other natural water bodies, residual effects to wetlands and other natural water bodies is not predicted to result in a change that will alter the sustainability of these landscape features beyond a manageable level, and is predicted to be not significant.

3.6 Groundwater

3.6.1 Introduction

A desktop evaluation was conducted to determine baseline conditions and areas for potential effects on groundwater resulting from the construction, operation, and decommissioning of the Project. The groundwater evaluation considered the local hydrogeology within a regional context and identified aquifer resources and wells within the Project Study Area.

The following sections outline the methods used to assess groundwater within the Project Study Area, identifies potential effects that the Project may have on groundwater, and summarizes proposed mitigations.

3.6.2 Baseline Data Collection Methods

3.6.2.1 Desktop Assessment

Geological and hydrogeological map information that was reviewed, applicable to the Project Study Area, includes bedrock topography and geology, drift (overburden) thickness, surficial geology, and hydrogeology. The maps and published information was obtained from the Alberta Geological Survey archives, including:

- Bedrock Geology of Alberta, Map 600 (Prior et al., 2013)
- Surficial Geology of Alberta, Map 601 (Fenton et al., 2013)
- Drift Thickness of Alberta (Pawlowicz and Fenton 1995)
- Quaternary Geology, Southern Alberta (Shetsen 1987)
- Regional Groundwater Assessment for Cypress County (Hydrogeological Consultants Ltd. 2001)

A search of provincial water well records (February 2021), maintained by the Groundwater Information Centre (AEP 2021a), was conducted for the Project Study Area.

3.6.3 Baseline Conditions

Surficial and Bedrock Geology

Within the Project Study Area, the overburden geology is documented as primarily coarse sediments deposited by proglacial lakes, consisting of a sand and silt as well as till, gravel and silt deposited by glacial ice (Fenton et al. 2013 and Shetsen 1987). The glacolacustrine deposits extend throughout the central part of the Project Study Area and moraine (till) deposits are present in the northern and southern parts of the Project Study Area. Sediment thickness is variable and uneven but estimated up to approximately 45 m thick within the Project Study Area, with undulating to hummocky topography, reflecting variations in till thickness (Shetsen 1987, Pawlowicz and Fenton 1995). Sand and gravel deposits in the surficial deposits are sources of groundwater in the vicinity of the Project Study Area. The thickness of the sand and gravel aquifer is generally less than 5 m and the aquifer is not usually continuous in the region (Hydrogeological consultants Ltd. 2001). The upper sand and gravel aquifer is not present (or saturated) on the west, but may be present on the east (Hydrogeological consultants Ltd. 2001). Overburden materials are often heterogenous in nature and vary greatly over short distances. The presence of

the upper sand and gravel aquifer will be dictated by continuous sand and gravel deposits, if present. Groundwater hydrochemistry is variable depending on depth and location but generally interpreted to be mainly calcium-magnesium-bicarbonate or calcium-magnesium-sulfate type (Hydrogeological Consultants Ltd. 2001).

Bedrock within the Project Study Area is documented as consisting of the Dinosaur Park Formation that is underlain by the Oldman and Foremost Formations, as part of the Upper Cretaceous Belly River Group (Prior et al., 2013). The Bearspaw Formation overlays the Dinosaur Park Formation, however, has largely been removed by erosion and has a minor presence in the Project Study Area. The Foremost Formation is geologically oldest and characterized as sandstone (pale grey and pale brown), siltstone (grey to greenish grey) and carbonaceous mudstone. The Foremost Formation contains some coal near the top of the formation and is of marginal marine to non-marine origin. The Oldman Formation is characterized as a non-marine formation with a fining upward sequence of fine to coarse grained sandstone (light grey to yellow), muddy siltstone and weathered mudstone (grey to greenish grey). The Dinosaur Park Formation is of fluvial and estuarine origin with the uppermost part marginal marine. The geology is characterized as bentonitic to carbonaceous sandstone (pale grey) interbedded with siltstone (grey to brownish-grey), carbonaceous siltstone to mudstone, and coal restricted to the upper part. There is a disconformity at the base of this formation.

Groundwater hydrochemistry in the bedrock formations is interpreted to be predominantly sodium-bicarbonate or sodium-sulfate type (Hydrogeological Consultants Ltd. 2001). Water supply wells completed in bedrock are predominately within the Oldman Formation (Hydrogeological Consultants Ltd. 2001).

Water Wells

A search of provincial water well records, maintained by the Groundwater Information Centre (AEP 2021a), identified 47 drilling records within the Project Study Area (Table 3.6-1). The locations of these wells are typically not surveyed (i.e., often assigned to the centre of quarter sections, so actual well locations may vary) and the majority are listed as new well or well inventory. Other records are listed as chemistry or unknown. The drilling records reported date ranges of drilling from 1911 to 2000 (where a date is provided) and document well constructions with total depths ranging from 6.1 m in surficial materials, to 161.5 m bedrock wells (Table 3.6-1).

Assuming a maximum average thickness of 45 m for the Quaternary sediments (Shetsen 1987) and based on available data, non-pumping water levels in wells completed in the surficial deposits within the Project Study Area varies from 2.4 to 20.1 m (13% of records have water levels <4 m); non-pumping water levels for bedrock wells varies from 15.2 to 27.4 m (Table 3.6-1).

Table 3.6-1: Water Wells Within the Project Study Area

Well ID	Quarter Section or Legal Subdivision	Section	Township	Range	Meridian	Static Water Level [m bgs]	Total Drilled Depth [m bgs]	Proposed Use	Listed Well Type
185583	3	3	19	1	4	9.75	18.29	Stock	New Well
185625	SW	6	19	1	4	3.05	6.1	Stock	Well Inventory
185629	SW	6	19	1	4	9.14	15.24	Domestic	New Well
187298	NW	13	18	1	4	-	17.37	Domestic	Chemistry
187300	NW	13	18	1	4	2.44	9.14	Domestic	New Well
187342	9	15	18	1	4	5.49	7.62	Domestic	New Well
187344	NE	16	18	1	4	3.66	15.24	Stock	New Well
187402	SW	18	18	1	4	-	-	Domestic	Chemistry
187405	SW	19	18	1	4	15.24	18.29	Domestic & Stock	New Well
187417	SW	19	18	1	4	-	38.1	Unknown	New Well
187420	NW	19	18	1	4	17.37	54.86	Unknown	Well Inventory
187426	16	19	18	1	4	20.12	21.95	Domestic & Stock	New Well
187433	16	19	18	1	4	-	17.07	Unknown	Unknown
187452	2	27	18	1	4	6.71	12.8	Stock	New Well
187456	2	27	18	1	4	-	6.1	Domestic	Unknown
187466	SE	30	18	1	4	4.57	9.14	Domestic	Chemistry
187468	SE	30	18	1	4	19.81	30.48	Domestic	Chemistry
187470	SE	30	18	1	4	4.57	7.62	Domestic	New Well
187483	NE	30	18	1	4	15.24	91.44	Domestic & Stock	New Well
187487	9	30	18	1	4	10.36	28.65	Stock	New Well
187502	NE	31	18	1	4	4.57	15.24	Domestic	Chemistry
187507	NE	31	18	1	4	5.49	12.19	Unknown	Well Inventory
187508	NE	31	18	1	4	3.35	12.19	Unknown	Well Inventory
187509	NE	31	18	1	4	5.79	15.24	Domestic	New Well
187514	15	31	18	1	4	-	29.57	Stock	New Well
187518	NW	32	18	1	4	4.57	15.24	Domestic & Stock	New Well
187525	NW	32	18	1	4	2.44	15.24	Domestic & Stock	New Well
187529	NW	32	18	1	4	-	-	Domestic	Chemistry
187531	13	32	18	1	4	7.62	14.94	Stock	New Well
187535	NE	33	18	1	4	10.36	14.63	Unknown	Well Inventory
187536	16	33	18	1	4	12.19	30.48	Stock	New Well
187698	15	10	18	2	4	9.75	15.24	Stock	New Well
187705	SW	13	18	2	4	7.32	9.75	Domestic & Stock	New Well
187711	NW	13	18	2	4	3.35	10.36	Domestic	Chemistry
187712	13	13	18	2	4	4.57	9.75	Domestic & Stock	New Well
187716	16	14	18	2	4	5.49	10.36	Stock	New Well
187744	SE	22	18	2	4	8.84	14.33	Domestic	Chemistry
187759	SE	22	18	2	4	4.57	17.68	Stock	Chemistry
187763	SE	22	18	2	4	10.06	15.24	Domestic	New Well
187766	1	22	18	2	4	8.53	12.19	Domestic & Stock	New Well
187774	NE	23	18	2	4	-	21.34	Domestic	Chemistry
187777	10	23	18	2	4	12.19	18.29	Domestic & Stock	New Well
187780	SE	25	18	2	4	6.1	12.19	Unknown	Well Inventory
286189	NE	30	18	1	4	4.48	15.24	Domestic	New Well
294391	SE	14	18	2	4	27.4	161.54	Domestic	New Well
295310	SE	14	18	2	4	24.6	90.22	Domestic	New Well
12018569	SW	6	19	1	4	-	12.19	Stock	Well Inventory

Source: AEP (2021).

- = Not available; ID = identification; m bgs = metres below ground surface.

3.6.4 Potential Effects, Mitigation and Predicted Residual Effects

3.6.4.1 Potential Effects

Excavation for wind turbine foundation construction, trenching for the installation of the collector system, and excavation for the Project substation and operation and maintenance building foundations may intersect the groundwater table, and groundwater quality has the potential to be impacted. Groundwater contamination may result from spills during the construction, operations, or decommissioning period (e.g., fueling of equipment). If excavation of foundations were to intersect the groundwater table in areas of shallow subsurface groundwater, the water levels of nearby wells could be temporarily affected if construction dewatering is required.

3.6.4.2 Mitigations

The following mitigation measures will be implemented to limit adverse effects to groundwater:

- Because water well locations in the provincial database are typically not surveyed (i.e., often assigned to the centre of quarter sections), the Proponent will work with landowners to identify specific locations of water wells prior to areas of construction. Wind turbines will be setback from residences/wells to minimize the potential for impacts on residential and/or livestock wells.
- The Proponent will conduct a geotechnical assessment at planned turbine locations and substation location to help inform the project layout and construction methods in support of final detailed engineering and design.
- If shallow groundwater is encountered during geotechnical drilling, the turbine or infrastructure will be moved to a lower impact location within a 50 m radius. Furthermore, turbines are preferentially sited on areas of high ground and typical foundations only extend approximately 3.6 m into the ground which is considered quite shallow and often above a water table and well installation depths. If turbines or infrastructure encounter groundwater and is unavoidable, construction dewatering will be of short-term scale during the location specific construction period and not consist of long-term pumping. Construction dewatering is non-consumptive, and all pumped groundwater will be returned to the environment in the local area.
- All Project activities will follow standard construction practices and applicable laws to minimize the potential for and impact of any spills. Any spill site will be reported to the appropriate authorities, as necessary, and remediated in a timely manner in compliance with Alberta regulations.

3.6.4.3 Predicted Residual Effects

The predicted residual Project effects on groundwater are:

- temporary change in water levels of nearby wells due to limited construction dewatering
- groundwater contamination in the event of a spill

3.6.5 Evaluation of Predicted Residual Effects of the Project

A summary of the predicted residual effects of the Project on groundwater is provided in Table 3.6-2 and a rationale for the evaluation is provided below.

Table 3.6-2: Predicted Residual Project Effects Description, Importance and Likelihood for Groundwater

Predicted Residual Effect	Project Activity	Effects Assessment Criteria[a]				Importance[a]	Likelihood[a]
		Direction	Magnitude	Geographic Extent	Duration		
Change in water levels of wells	Construction	Negative	Minimal	Local	Short-term	Minimal	Unlikely
Groundwater contamination	Construction	Negative	Minimal	Local	Short-term	Minimal	Unlikely

[a] Effects assessment criteria are defined in Table 2.6-1. Importance and Likelihood are defined in Table 2.6-2 and Table 2.6-3, respectively.

Change in Water Levels of Wells

The predicted residual effect of changing water levels on groundwater is described as negative because of the potential to alter groundwater levels. The magnitude of the effect is considered minimal and is unlikely to be a management concern because geotechnical investigations will be conducted prior to construction verifying that turbines and other Project infrastructure will not be sited at locations where excavations for foundations would interact with the water table or in immediate proximity to local wells, which will minimize adverse effects.

Additionally, as the turbine excavations are near surface and quite shallow, their potential to intersect the groundwater table are minimal. The geographic extent is considered local, as the impact to water levels will be limited to the Project Footprint and any nearby wells. The effect is considered to be of short-term duration because the impacts will be temporary during construction for a limited period of time and not applicable following completion of construction and decommissioning. The effect is expected to occur infrequently during construction and decommissioning. Although this residual effect is possible, the importance is expected to be minimal.

Groundwater Contamination

The predicted residual effect of groundwater contamination is described as negative. However, with the use of appropriate mitigation, groundwater is unlikely to become contaminated through spills during construction or decommissioning. The magnitude of the effect is considered negligible because the use of hazardous substances will be limited. The effects are unlikely to be a management concern once the Project is operational because the appropriate mitigation will be used to minimize the potential for adverse effects. The geographic extent is considered local, as impacts will be limited to the Project Footprint and locations are planned to be sited away from local wells and above the water table. The effect is considered to be of short-term duration because the impacts will be temporary and removed following completion of construction and decommissioning. The effect is expected to occur infrequently during construction and decommissioning. This residual effect is unlikely, and the importance is expected to be minimal.

3.6.6 Determination of Significance

Proper siting, pre-construction engineering and study of construction locations and effective implementation of proven mitigation will reduce the duration and magnitude of potential adverse effects on groundwater. Potential impacts on the water levels of groundwater wells will be avoided during detailed Project planning to verify that turbines and other project infrastructure will not be sited at locations where excavations for foundations will interact with the water table and away from local wells. All Project activities will follow standard construction practices to minimize the potential for spills. Spills will be reported to the appropriate authorities, as required, and remediated in a timely manner. The predicted residual effects of the Project on groundwater are not anticipated to result in a measurable change; and are therefore considered to be not significant.

3.7 Surface Water, Aquatic Species, and Habitat

3.7.1 Introduction

Water bodies are recognized as valuable resources in the landscape, as they provide wildlife habitat and vital ecosystem services, such as aquifer recharge (Alberta Water Council 2019). Under the provincial *Water Act*, the Government of Alberta requires that an approval be obtained prior to affecting any water bodies, including watercourses (GOA 2000a). Works and activities at or near water bodies and/or watercourses also needs to follow regulations and guidelines in the Alberta *Environmental Protection and Enhancement Act* (GOA 2000b), the *Water Act* (GOA 2000a) and applicable Alberta *Water Act* – Code of Practice (COP), and the federal *Fisheries Act* to avoid or minimize negative effects to aquatic environments and fish and fish habitat.

This section of the Environmental Evaluation provides a description of existing surface water drainage patterns, watercourses, and fish and fish habitat within the Project Study Area, based on a desktop review and field reconnaissance.

3.7.2 Baseline Data Collection Methods

The surface water desktop assessment was conducted using GIS mapping software and a 1:20,000 AltaLIS watercourse layer to identify drainage pathways and watercourses crossed or adjacent to the Project Footprint. The AltaLIS watercourse layer has not been field verified. Satellite imagery was also viewed to verify potential watercourses identified on the AltaLIS watercourse layer. A search for existing fish and fish habitat information was conducted using the AEP FWMIS database (AEP 2021b). Fisheries-specific FWMIS data were accessed using AEP's Fish and Wildlife Internet Mapping Tool (FWMIT; AEP 2021b).

In the desktop assessment, water bodies proposed to be crossed by the Project were conservatively identified as watercourses (i.e., having defined bed and banks and flow that may be permanent or intermittent). A field reconnaissance was subsequently conducted on May 11, 2021 to determine whether any potential water bodies identified during the desktop assessment have defined bed and banks and potential for fish habitat.

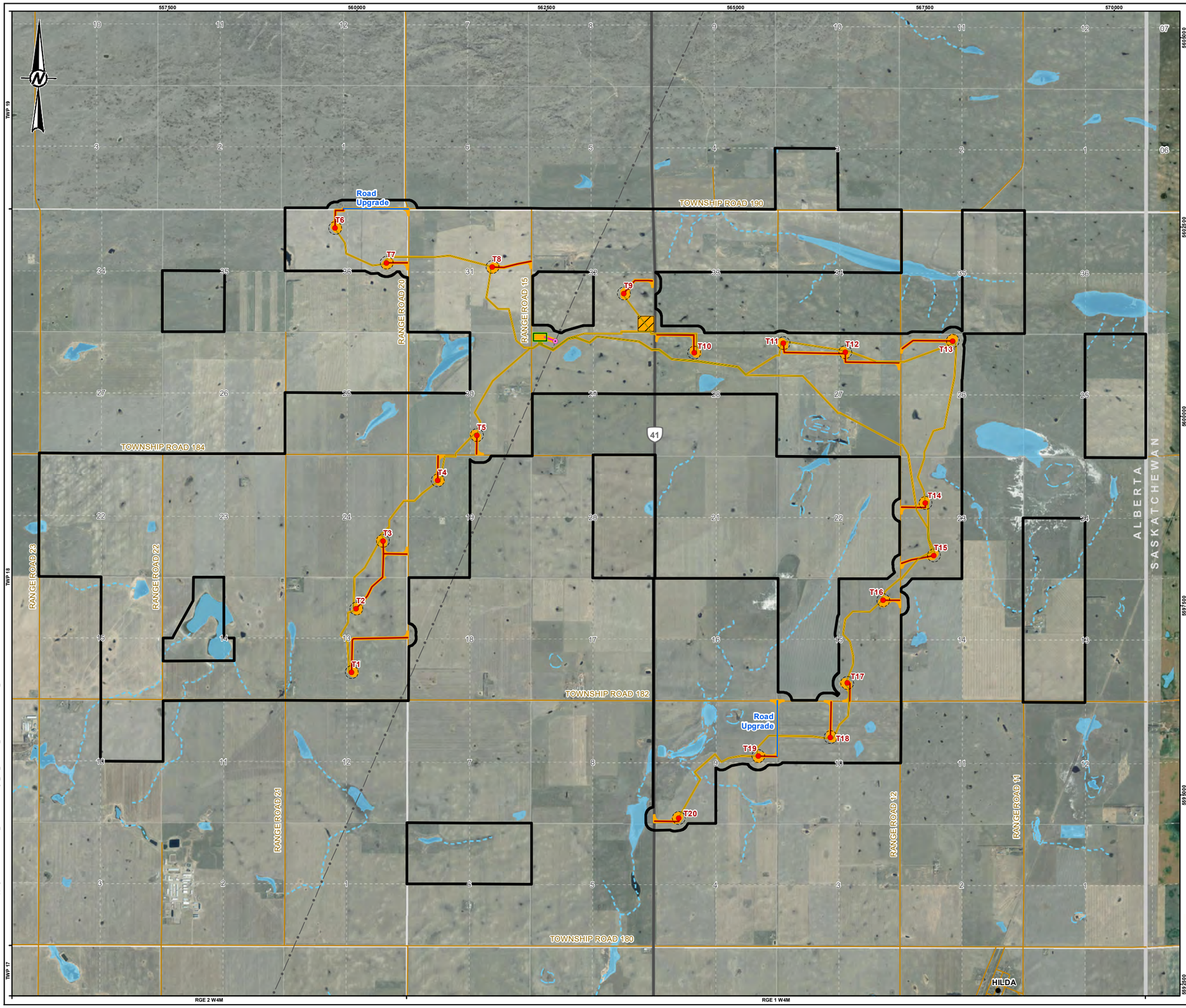
Each water body crossed by the Project was assigned a class and restricted activity period (RAP) based on AEP's Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body (GOA 2013) and Code of Practice for Watercourse Crossings (GOA 2019c). The RAP represents the timeframe when work that disrupts the bed or bank of a water body should be avoided to avoid disrupting sensitive lifecycle periods (e.g., migration, spawning, egg incubation, and fry emergence and early development are likely to occur in a water body).

3.7.3 Baseline Conditions

Based on the AltaLIS watercourse layer, the watercourses and water bodies that within or near the Project Footprint are unnamed and identified as indefinite streams and perennial lakes, respectively (AEP 2021b). Taking a conservative approach and overlaying the Project on the AltaLIS layer, the Project includes one potential watercourse crossing to accommodate the collector system cable between turbine T19 and T20 in the south west quarter of Section 9, Township 18, Range 1, W4M (Figure 3.7-1). The Project is located within the Hydrologic Unit Code (HUC) 8 watershed named 'Lower South Saskatchewan River' (HUC8# 04030301) as part of the South Saskatchewan River basin.

No historical fish or fish habitat information was available for any of the unnamed watercourses or water bodies within the Project Footprint, nor within 6 km of the Project Study Area (AEP 2021b). The South Saskatchewan River is located approximately 10 km (straight-line distance) to the northwest; however, based on the AltaLIS layer and review of the imagery, there is no connectivity for fish to move between the South Saskatchewan River or any of its tributaries to any of the drainages or water bodies located within or adjacent to the Project Footprint.

From the field survey, the potential watercourse crossing identified during the desktop assessment was determined to be a seasonal surface drainage within cultivated agricultural fields. The drainage pathway was dry at the time of the survey, but no signs of scour were evident. No defined bed or banks were present. Due to the lack of a defined channel and bed and banks, there is no fish habitat present in this drainage. The field survey also confirmed the lack of connectivity between the South Saskatchewan River and the Project Footprint. No water bodies or watercourses with defined bed and banks are present within the Project Footprint and no fish habitat is present. As a result, no RAP would apply for work within the Project Footprint.



LEGEND

- PROJECT STUDY AREA[1]
- ROTOR-SWEPT AREA

BASE FEATURES

- HAMLET
- EXISTING ALTALINK 138 kV TRANSMISSION LINE
- PRIMARY HIGHWAY
- LOCAL ROAD
- INDEFINITE WATERCOURSE
- INTERMITTENT WATERBODY
- WATERBODY

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- POINT OF INTERCONNECTION
- COLLECTOR SYSTEM
- OVERHEAD TRANSMISSION LINE
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

0 1,000 2,000

1:50,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 M BUFFER AROUND THE PROPOSED PROJECT LAYOUT.

REFERENCE(S)

1. PROJECT FOOTPRINT COMPONENTS DATA OBTAINED FROM RES, DECEMBER 2020.
2. IMAGERY COPYRIGHT © 20190115, 20180424, 20120811 ESRI AND ITS LICENSORS. SOURCE: CYPRESS COUNTY, VIVID-MAXAR. USED UNDER LICENSE, ALL RIGHTS RESERVED.
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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
SURFACE WATER FEATURES IN THE PROJECT STUDY AREA

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JL
PREPARED	LMS
REVIEWED	BS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	3.7-1

3.7.4 Potential Effects, Mitigation and Predicted Residual Effects

3.7.4.1 Potential Effects

No potential effects to surface water, aquatic species, and habitat are anticipated for the Project because no watercourses will be affected by the Project, as no water bodies or watercourses with defined bed and banks and fish habitat are present within the Project footprint. Potential effects of the Project to natural drainages and wetlands are described in Section 3.5 – Wetlands and Water Bodies.

3.7.4.2 Mitigation

No Project activities are proposed to occur that would affect watercourses or fish habitat. As such, specific mitigation measures from surface water, aquatic species, and habitat have not been identified. However, mitigation measures for wetlands, such as erosion control and sediment control, will be implemented (Section 3.5.4).

3.7.4.3 Predicted Residual Effects

With the avoidance of watercourses and aquatic habitat, no residual effects are predicted. Consequently, the surface water, aquatic species, and habitat VC was not carried forward in the Project effects evaluation.

3.8 Wildlife and Wildlife Habitat

3.8.1 Introduction

The Project is located within the Dry Mixedgrass Natural Subregion of the Grassland Natural Region (NRC 2006). The Project Study Area falls within sharp-tailed grouse, sensitive raptor (i.e., ferruginous hawk [*Buteo regalis*], golden eagle [*Aquila chrysaetos*], prairie falcon [*Falco mexicanus*]), burrowing owl, and sensitive amphibian ranges as identified in the Wildlife Sensitivity Maps (AEP 2021c). Much of the Project Study Area has been cleared and designated for agricultural use and provides low to moderate quality habitat for most wildlife species (i.e., 81.8% of the Project Study Area is modified). Some areas of natural vegetation and wetland areas occurring in the Project Study Area provide suitable wildlife habitat for a variety of species.

Wildlife field surveys were conducted to determine the occurrence of wildlife, particularly listed species or species with setback restrictions (AEP 2018a), up to 1 km from the Project Study Area boundary. Based on species breeding and migration range, 72 provincially listed wildlife species have the potential to occur within the Project Study Area including seven listed as ‘At Risk’, 10 listed as ‘May be at Risk’, and 55 species listed as ‘Sensitive’ (AEP 2015). Based on species breeding and migration range, 30 wildlife species listed under Schedule 1 of the SARA have the potential to occur within the Project Study Area including four species listed as ‘Endangered’, 11 listed as ‘Threatened’, and 15 listed as ‘Special Concern’ (Government of Canada 2020a). Of these, all are provincially listed except for five species. Provincially and federally listed wildlife species observed incidentally during the wildlife surveys were recorded and are presented in Section 3.8.3.9. No SARA designated critical habitat was identified within 1 km of the Project Footprint (Harder, J. pers. comm. 2021).

The following sections provide an overview of the wildlife survey findings, potential effects that the Project may have on wildlife, and proposed mitigation measures. Appendix G contains additional details regarding the methods used to conduct the wildlife surveys, and detailed results of each survey conducted.

3.8.2 Baseline Data Collection Methods

3.8.2.1 Desktop Review

Wildlife surveys required to support regulatory applications for the Project align with the Directive (AEP 2018a). Specific survey requirements were determined using available habitat and wildlife information within the Project Study Area (including data from the FWMIS database and Wildlife Sensitivity Maps).

Wildlife surveys were initiated in the fall of 2018 and continued in 2020 throughout the spring, summer, and fall. The wildlife surveys conducted during 2018 and 2020 in the Project Study Area include:

- sharp-tailed grouse survey
- raptor nest survey
- breeding bird survey
- burrowing owl survey
- bat migration survey (spring and fall)
- bird migration survey (spring and fall)

Surveys were conducted throughout the Project Study Area and along the nearby, publicly accessible roads within a 1 km buffer of the Project Study Area. The sharp-tailed grouse, breeding bird, burrowing owl, bat migration, and bird migration survey locations are shown in Appendix G, Figures A-6 to A-9. The wildlife and wildlife habitat features observed during the field assessments are shown in Appendix G, Figure A-5. Appendix G provides detailed methods and additional details regarding the findings of the baseline surveys for wildlife.

3.8.3 Baseline Conditions

3.8.3.1 Wildlife Habitat

Land cover was delineated in the Project Study Area, as described in Section 3.1.3. Native grassland and Class III to VI wetlands are more likely to be used by wildlife (particularly sensitive species) than cultivation, tame pasture or hay. Cultivation, and tame pasture and hay represent the largest land cover type in the Project Study Area at 4,292.1 ha (82%); approximately 91.4 ha (93%), 7.4 ha (80%) of the temporary construction Project footprint and permanent Project footprint occurs on these land cover types, respectively (Table 3.1-1). Approximately 412.0 ha (8%) of the Project Study Area consists of native grassland; 1.2 ha (1%) of the temporary construction Project footprint occurs on native grassland and 0.5 ha (5%) of the permanent Project footprint occurs on this land cover type as described in Section 3.1.3. Overall, approximately 303.1 ha (6%) of the Project Study Area consists of wetlands. Three Class III-VI wetland setbacks will be encroached upon to accommodate corner widening for turbine access roads during construction. Direct temporary or permanent impacts to Class III-VI wetlands due to the Project are not anticipated. Approximately 0.2 ha (<1%) of Class I to II wetlands will be temporarily disturbed during Project construction and less than 0.1 ha (0.1%) will be permanently lost or altered due to the Project Footprint. The remaining land cover types traversed by Project components comprise about 5% of the Project Study Area and include transmission line, farmyard, roads, and development (239.7 ha).

3.8.3.2 Sharp-tailed Grouse Survey

The sharp-tailed grouse survey was conducted between April 20 and 29, 2020. No sharp-tailed grouse leks were confirmed during the sharp-tailed grouse survey. One lek was suspected north of plot RESHSTGR42 in SW 06-19-01 W4M outside of the Project Study Area (Appendix G, Figure A-9) Sharp-tailed grouse were heard at this location but not directly observed. No land access was available at the time of survey for confirmation of the lek. Plot RESHSTGR42 is located approximately 700 m north of the nearest Project infrastructure (i.e., turbine T8)

and active sharp-tailed grouse leks have a required setback of 500 m following the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a). As such, no infringements on the suspected lek setback are anticipated.

3.8.3.3 Raptor Nest Survey

A raptor nest search was conducted in the Project Study Area and a 1 km buffer of the Project Study Area from April 20 to 26 and 29, 2020 and from June 3 to 6, 2020. A total of nine active raptor nests were observed in 2020 including: three ferruginous hawk (*Buteo regalis*) nests, three great horned owl (*Bubo virginianus*) nests, two Swainson's hawk (*Buteo swainsonii*) nests, and one nest with great horned owl observed during the first round of surveys and Swainson's hawk observed during the second round of surveys.

Four of the nests and their setback buffers were observed outside of the Project Study Area. Three of the nests were observed outside of the Project Study Area with their applicable setback buffers overlapping the Project Study Area (Appendix G; Figure A-5). Two nests were observed within the Project Study Area including one ferruginous hawk nest of which the Project infrastructure infringes on the required 1,000 m setback buffer. This ferruginous hawk nest is located immediately adjacent Range Road 12. During the first round of surveys the ferruginous hawk was observed flushing off the nest during the observer's travel along Range Road 12. During the second round of surveys the nest was observed to be falling apart and not found to be active at the time of survey. Though the nest may have been abandoned after the first round of surveys, the nest is considered active and a precautionary 1,000 m setback buffer has been applied (Appendix G; Figure A-5).

3.8.3.4 Breeding Bird Survey

Breeding bird surveys were conducted over two site visits during the spring and summer of 2020 (June 3 to 6 and 8, 2020 and June 25 to 27, 2020). The breeding bird survey plot locations were selected so that all land cover types within the Project Study Area were sampled, and plots were spaced to provide adequate coverage of the Project Study Area. A total of 321 individual birds of 16 species were observed at 40 plots (Appendix G; Figure A-7). The most common species detected were horned lark (*Eremophila alpestris*), red-winged blackbird (*Agelaius phoeniceus*), and western meadowlark (*Sturnella neglecta)*. Three provincially listed species were identified including: eastern kingbird (*Tyrannus tyrannus*; 7 individuals including incidental observations during breeding bird surveys), eastern phoebe (*Sayornis phoebe;* 1 individual), and Sprague's pipit (*Anthus spragueii;* 9 individuals including incidental observation during breeding bird surveys). Of these, Sprague's pipit is federally listed as Threatened under Schedule 1 of the SARA (Government of Canada 2020).

3.8.3.5 Burrowing Owl Survey

Burrowing owl surveys were conducted on May 31, June 2 to 6, and 8, 2020. Sixty-one burrowing owl survey plot locations were chosen throughout the Project Study Area and a 500 m buffer (to account for the burrowing owl setback distance [AEP 2018a]) to maximize spatial coverage with the goal of completing approximately one plot per quarter section with potential to contain a turbine location (Appendix G; Figure A-8). Observers adjusted plot locations in the field as appropriate to focus on habitat types with moderate to high potential for burrowing owl (e.g., suitable terrain, burrows, vegetation cover, and soil characteristics). No burrowing owl nests or individuals were observed during the surveys or incidentally in the Project Study Area.

3.8.3.6 Acoustic Bat Surveys

The principal goal of the bat migration monitoring surveys was to quantitatively describe the bat activity within the Project Study Area during the spring and fall migration seasons, using nocturnal acoustic detection devices. Bat migration monitoring was conducted in spring and fall 2020. Detectors were deployed before sunset on April 28, 2020 and retrieved on June 3, 2020 to monitor the peak spring migration period (May 1 to 31; AEP 2018a), and deployed before sunset on July 14, 2020 and retrieved on October 17, 2020 (as outlined in Standard 100.2.2 of the Directive) to monitor the peak fall migration period (August 1 to September 10; AEP 2018a). A total of six SM4BAT® detector units were distributed throughout the Project Study Area in the spring of 2020 and

seven were distributed in the fall of 2020. In spring, one detector was raised to a 30 m height on an existing met tower within the Project Study Area. During fall surveys, two detectors were raised to a 30 m height, one on a temporary tower unit in the Project Study Area and one on the existing mettower used in spring (Appendix G; Figure A-6). Detectors raised to a 30 m height were paired with a ground detector (3 m height).

Within the Project Study Area, a total of 617 bat passes (2.9 bat passes per detector night) were recorded during the spring survey and 7,040 bat passes (10.6 bat passes per detector night) were recorded during fall surveys. This level of fall bat activity is within the range of bat activity reported at other wind power facilities in southern Alberta (0.78 to 14.81 bat passes per detector night; Baerwald and Barclay 2009). However, direct comparison with this range may be limited because the Baerwald and Barclay (2009) analysis is based on acoustic data collected and analyzed using Anabat detectors and software, whereas data for the Project were collected and analyzed using SM4BAT® detectors and Sonobat software. Comparative studies have found Anabat detectors to record fewer passes than newer detector models (e.g., Adams et al. 2012).

Seven species of bats were positively identified in the Project Study Area during surveys: big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), western small-footed bat (*Myotis ciliolabrum*), long-eared myotis (*Myotis evotis*) and little brown myotis (*Myotis lucifugus*). Silver-haired bat and eastern red bat are migratory species that are listed provincially as Sensitive due to their susceptibility to fatality associated with wind power facilities (AEP 2015). Western small-footed bat is also listed provincially as Sensitive; however, this species is not migratory and the reason for the listing is due to its localized distribution, lack of population information and concerns regarding habitat security (AEP 2015). One species, little brown myotis, is listed provincially as May be at Risk and federally as Endangered under Schedule 1 of the SARA (Government of Canada 2020a) due to the recent decimation of populations particularly in the eastern portion of the species' range from the fatal white-nose syndrome, which to date has not been recorded in Alberta populations (GOA 2021a).

During spring surveys bat activity was low compared to the fall and showed peaks throughout the month of May with the highest peak of activity on May 17 followed by June 1. Both peaks in activity were driven by unspecified high frequency bats (which may include various species of *Myotis* and eastern red bat). The highest activity levels during spring surveys were recorded at detector RESHBAT04G (Appendix G; Figure A-6). Approximately 54% of the activity at RESHBAT04G was by unspecified *Myotis* species which most likely includes western-small-footed bat, long-legged bat (*Macrophyllum macrophyllum*), and little brown myotis, and 24% was by unspecified high frequency bats, most of which were likely little brown myotis, but possibly other *Myotis* species and red bat. Detector RESHBAT04G was deployed in cultivated cropland and native grassland habitat, approximately 50 m from a water source and greater than 1,000 m from potential roosting habitat. Northwest of detector RESHBAT04G native grassland dominated habitat extends to the South Saskatchewan River. During fall surveys, bat activity was highest throughout mid to late August. Activity peaked in mid-August and past mid-September bat activity was low. A peak on July 14 was recorded and was driven by high frequency bats. A mid-July peak coincides with the post-volant period when young of the year are capable of flight and begin to forage. Similar to spring results, the highest activity levels during fall surveys were recorded at RESHBAT04G (Appendix G; Figure A-6). Approximately 48% of the activity at RESHBAT04G was by unspecified *Myotis* species and 20% was by unspecified high frequency bats, most of which were likely little brown myotis, but possibly other *Myotis* species and red bat. Turbines are sited greater than 4,000 m from detector RESHBAT04G and no turbines are located west of the detector location where native grassland dominated habitat extends to the South Saskatchewan River (Appendix G; Figure A-6).

Following the approach recommended in the *Bat Mitigation Framework for Wind Development* (ESRD 2013a), 501 migratory bat passes were recorded at the detectors deployed at a 30 m height between August 1 and

September 10, 2020 corresponding to 6.1 migratory bat passes per detector night. More migratory bat passes per detector night were detected at raised detector RESHBAT04R (6.7 migratory bat passes per detector night) than raised detector RESHBAT03R (5.5 migratory bat passes per detector night).

3.8.3.7 Migration Bird Surveys

A migration bird survey was conducted during fall of 2018 and spring and fall of 2020. In fall 2018, 25 plot locations were surveyed in the Project Study Area and a 1 km buffer. No stopover counts were completed in 2018. Eight stopover count survey plots were surveyed in spring 2020 and one additional plot was surveyed in fall 2020 for a total of nine stopover count survey plots in 2020. Five circular point count plots were surveyed in spring and fall 2020 (four of which were surveyed in 2018; Appendix G; Figure A-6). Fall 2018 surveys were conducted from September 7 to 11, September 20 to 23, and October 17 and 19 to 22, 2018. Spring surveys were conducted on April 4, April 19, and May 12 to 13, 2020. Fall 2020 surveys were conducted from September 2 to 3, October 4 to 5, and October 30 and 31, 2020. Surveys were conducted to provide appropriate coverage of the Project Study Area and the associated habitats consistent with the Bird Migration Survey Protocol (AEP 2020a; Appendix G; Figure A-6).

During the spring surveys, a total of 1,380 birds within 141 flocks were observed. Waterfowl were the most commonly observed species group (914 individuals, 58 flocks), followed by passerines (i.e., songbirds) (422 individuals, 76 flocks). During the fall surveys, a total of 38,092 birds within 624 flocks were observed. Waterfowl and passerines were again the most commonly observed species groups (31,627 individuals, 94 flocks and 5,127 individuals, 442 flocks, respectively). The average number of individual bird observations per minute during spring and fall surveys was 1.7 and 10.3 bird observations per minute, respectively. The total number of avian species observed during the spring and fall surveys was 34 and 89, respectively (Appendix G; Table 11; Table 17).

During spring point count surveys, the plots with the largest numbers of birds observed per plot visit were RESH20DCAUS41 and RESH18LVAUS13 (Appendix G: Figure A-6; Table 10). During fall point count surveys, the largest numbers of birds observed were at plots RESH18LVAUS17 and RESH18LVAUS09 Appendix G: Figure A-6; Table 16). Similarities between plots with the largest numbers of birds observed were noted. All plots are in the west portion of the Project Study Area or just west of the Project Study Area. At all plots, the most observations were of waterfowl, followed by passerines. All plots contained large Class IV or V wetlands which likely contributed to a relatively higher number of waterfowl compared to other plots. Cultivation was the predominant upland land cover in all plots. Large single flocks of 12,000 and 5,000 geese contributed to relatively higher activity at plots RESH18LVAUS17 and RESH18LVAUS09, respectively. Native grassland extends from west of the Project Study Area to the North Saskatchewan River and the Suffield IBA, located approximately 9.3 km west of the Project Study Area and west of the North Saskatchewan River.

During spring stopover count surveys, the plot with the largest number of birds observed per plot visit was RESH20LHSPC04 (Appendix G: Figure A-6; Table 10). During fall stopover count surveys, the largest numbers of birds observed were at plots RESH20LHSPC09 and RESH20HSPC08 (Appendix G: Figure A-6; Table 16). Plot RESH20HSPC04 consisted predominantly of native grassland upland habitat and a Class III wetland which likely contributed to a relatively higher number of waterfowl including 150 tundra swans (*Cygnus columbianus*) individuals and 45 northern pintails (*Anas acuta*) observed at this plot during the second round of surveys. Plots RESH20LHSPC08 and RESH20LHSPC09 were predominantly cultivation with some tame pasture or hay associated with each which likely contributed to only passerines being identified at each of these plot locations. Both plots are located at the southwest portion of the Project Study Area.

During spring and fall migration surveys a total of 13 provincially listed species were identified including: American kestrel (*Falco sparverius*), bald eagle (*Haliaeetus leucocephalus*), bank swallow (*Riparia riparia*), barn swallow (*Hirundo rustica*), broad-winged hawk (*Buteo platypterus*), eastern kingbird, lark bunting (*Calamospiza melanocorys*), prairie falcon, purple martin (*Progne subis*), sandhill crane (*Antigone canadensis*), and sharp-tailed grouse (listed as Sensitive); McCown's longspur (*Rhynchophanes mccownii*) (listed as May be at Risk); and chestnut-collared longspur (*Calcarius ornatus*) (listed as At Risk) (AEP 2015). Of these, five species are listed federally under Schedule 1 of the SARA including bank swallow, barn swallow, lark bunting, and McCown's longspur (listed as Threatened); and chestnut-collared longspur (listed as Endangered) (Government of Canada 2020a).

3.8.3.8 Incidental Observations

All incidental wildlife sightings were noted during each wildlife survey, and incidental wildlife observations of listed species were recorded throughout the Project Study Area. A total of 21 listed species were observed incidentally (AEP 2015; Government of Canada 2020a). Of these observations, nine are federally listed on Schedule 1 of the SARA including: barn swallow, chestnut-collared longspur (*Calcarius ornatus*), ferruginous hawk, lark bunting, loggerhead shrike (*Lanius ludovicianus excubitorides*), McCown's longspur, and Sprague's pipit (listed as Threatened); and peregrine falcon (*Falco peregrinus*) and American badger (*Taxidea taxus taxus*) (listed as Special Concern [Government Canada 2020a]).

During fall 2018 field surveys, one plains garter snake (*Thamnophis radix*) hibernaculum was recorded (Appendix G; Figure A-5). The hibernaculum was located in bushes with rocks and two possible fissures. One adult plains garter snake was observed at the location. Hibernacula of plains garter snake have a year-round 500 m setback following the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a). The required setback has been met for this Project. One other plains garter snake individual was observed incidentally, crossing a gravel road in the southern portion of the Project Study Area during 2018 field surveys. Plains garter snake is provincially listed as Sensitive.

3.8.3.9 Listed Species

Listed species include all species provincially (Alberta *Wildlife Act* [GOA 2018c]), or federally (Government of Canada 2020a) listed as Endangered, Threatened or Special Concern, as well as species identified as "At Risk", "May be at Risk", or "Sensitive" through the Alberta General Status of Wild Species (AEP 2015). Thirty-one listed wildlife species were observed within the Project Study Area including 26 listed as Sensitive, two listed as May be at Risk, and three listed as At Risk (Appendix G; Table 36). Of these, 11 are federally listed on Schedule 1 of the SARA including: little brown myotis (listed as Endangered); bank swallow, barn swallow, chestnut-collared longspur, ferruginous hawk, lark bunting, loggerhead shrike, McCown's longspur, and Sprague's pipit (listed as Threatened); and peregrine falcon and American badger (listed as Special Concern; [Government of Canada 2020]).

3.8.4 Potential Effects, Mitigation and Predicted Residual Effects

3.8.4.1 Potential Effects

The potential effects of the Project on wildlife and wildlife habitat include:

- Mortality – due to site clearing and construction, collision with wind turbines or the transmission line, increased vehicle-wildlife collisions, or attraction to waste at work sites that result in ingestion of hazardous material or management actions to deter/remove wildlife.
- Habitat loss and fragmentation – due to vegetation clearing and construction of Project infrastructure.
- Habitat avoidance or reduced reproductive success – due to sensory disturbance.

Potential effects on wildlife and wildlife habitat are summarized in Table 3.8-1. Effects on wildlife and wildlife habitat are expected during construction, operation, and decommissioning of the Project.

Table 3.8-1: Potential Effects of the Project on Wildlife and Wildlife Habitat

Potential Effect	Project Phase	Short Description of Potential Effect	Potential Wildlife Taxa Affected
Mortality	Construction	In the event wildlife is exposed to hazardous materials, wildlife mortality may occur	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Sharp-tailed grouse Mammals Amphibians and reptiles
		In the event clearing and construction activities occur within the main wildlife breeding periods, wildlife mortality may occur	Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Amphibians and reptiles
		Collision with construction vehicles	Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
Injury or mortality	Operation	Collision with turbines or transmission line	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl
		Collision with operation/maintenance vehicles	Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
	Decommissioning	In the event wildlife is exposed to hazardous materials, wildlife mortality may occur	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
		Collision with construction vehicles used for decommissioning	Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
		In the event clearing and decommissioning activities occur within the main wildlife breeding periods, wildlife mortality may occur	Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
Habitat loss and fragmentation	Construction	Vegetation clearing to support construction of the Project will result in site-specific habitat loss and fragmentation and may affect wildlife habitat use, species richness and abundance	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
	Operation	Project infrastructure will reduce the amount of suitable habitat available for wildlife and may affect wildlife habitat use, species richness, abundance, and the dynamics of the ecosystem	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles

Table 3.8-1: Potential Effects of the Project on Wildlife and Wildlife Habitat

Potential Effect	Project Phase	Short Description of Potential Effect	Potential Wildlife Taxa Affected
	Decommissioning	Vegetation clearing to support decommissioning of the Project will result in site-specific habitat loss and may affect wildlife habitat use	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
Habitat avoidance or reduced reproductive success	Construction	Increased human activity levels and sensory disturbance in association with the construction of the Project may cause wildlife to avoid habitat adjacent to the Project or may reduce reproductive success of wildlife in habitat adjacent to the Project	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
	Operation	Presence of turbines and increased human activity associated with operation/maintenance of the Project may cause wildlife to avoid habitat adjacent to the Project or may reduce reproductive success of wildlife in habitat adjacent to the Project	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles
	Decommissioning	Increased human activity levels and sensory disturbance in association with decommissioning of the Project may cause wildlife to avoid habitat adjacent to the Project or may reduce reproductive success of wildlife in habitat adjacent to the Project	Migrating and resident bats Raptors Grassland birds Migrating songbirds Shorebirds Waterfowl Sharp-tailed grouse Mammals Amphibians and reptiles

3.8.4.2 Mitigation

Mitigation measures will be implemented in accordance with the mitigation hierarchy to avoid or minimize the potential effects of the Project on wildlife. The Proponent will/has implemented the mitigation measures outlined in the Renewable Energy Project Submission (Appendix G) and May 14, 2021 Information Request Responses (Appendix H) to Alberta Environment and Parks during the planning, construction, operation and decommissioning of the Project. A summary of applicable sections in the Renewable Energy Project Submission to Alberta Environment and Parks and example mitigation measures are provided:

- Section 2.0: Wildlife Habitat Land Cover - *when decommissioning occurs, reclamation standards outlined in the current C&R Directive (AEP 2018b) or subsequent standards in place at the time of decommissioning will be followed.*
- Section 8.0: Construction and Operation within Other Key Wildlife Zones – *the Project Study Area is not located within any Special Access Zones, Key Wildlife and Biodiversity Zones, or Grizzly Bear Zones.*
- Section 9.0: Minimizing Impacts on Wildlife and Wildlife Habitat – *considers mitigation measures that will be implemented to reduce the potential for effects to wildlife and wildlife habitat from Project infrastructure and activities (e.g., guy wires will be equipped with markers designed to reduce the potential for bird collision, collection lines will be sited underground, design features to limit noise and light emissions, reduced traffic speeds on access roads, fugitive dust control measures, waste management, spill prevention measures).*
- Section 10.0: Construction and Operation Mitigation Plan – *considers mitigation measures that will be implemented to reduce the potential for effects to wildlife and wildlife habitat from Project construction and operations (e.g., reporting of injured or dead wildlife, reclamation measures, and general construction and operation measures).*
- Section 11.0: Post-construction Monitoring and Mitigation Plan – *considers mitigation measures that will be implemented to reduce the potential for injury or mortality to birds and bats due to Project operations (e.g., post-construction surveys completed as directed by the AEP-FWS Post Construction Survey Protocols for Wind and Solar Energy Projects [AEP 2020b] including carcass monitoring surveys, carcass removal trials, searcher efficiency trials, and site-specific wildlife surveys).*

3.8.4.3 Predicted Residual Effects

The predicted residual Project effects on wildlife and wildlife habitat are presented in Table 3.8-2.

Table 3.8-2: Predicted Effects of the Project on Wildlife and Wildlife Habitat

Potential Effect	Project Phase	Mitigation [a]	Description of Predicted Residual Effect	Predicted Residual Effect[b]
Mortality	Construction	■ Appendix G; Section 9.44, 10.44; 10.47, and 10.50	Change in wildlife abundance due to attraction and exposure to hazardous materials during construction may harm or kill wildlife in the Project Study Area. Implementation of the mitigation provided is expected to minimize wildlife interactions during construction and mortality due to hazardous materials is predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect
		■ Appendix G; Sections 6.28(n); 6.29(g); 9.43; 10.47; 10.49; 10.50	Nests, roosts, or dens for a variety of wildlife taxa could be destroyed during clearing and construction for Project infrastructure and turbine locations. The MBCA prohibits the destruction of migratory bird nests (e.g., passerines and waterfowl) during the breeding season. The AWA is provincial legislation that restricts disturbance to a house, nest or den of prescribed wildlife species and provides additional protection for species that may not be covered under the MBCA (e.g., raptors). With implementation of the mitigation provided, avoidance and minimization of wildlife mortality during construction and compliance with the MBCA and AWA are expected. Vegetation clearing and construction is predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect
		■ Appendix G; Section 9.44; 10.47; 10.50	The development of new access roads and increase in vehicles during construction could increase wildlife mortality through vehicle-animal collisions (Jalkotzy et al. 1997; Trombulak and Frissell 2000). These incidents are anticipated to be rare but could occur more frequently on local secondary roads where construction traffic volumes (and speeds) are greater. With implementation of the mitigation provided minor changes to survival and reproduction of wildlife from vehicle strikes are anticipated. New access and increased vehicles are predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect
	Operation	■ Appendix G; Sections 9.42; 9.43; 10.47; 10.50; 11.55; 11.56	Collision with turbines, transmission line or guy wires could cause injury or mortality to birds and bats. The implementation of the mitigation provided is predicted to minimize effects to wildlife survival from collision risk; however, collision mortality is predicted to have a residual effect on bird and bat populations in the Project Study Area. The Proponent will engage with AEP-FWS about possible operational mitigation and post-construction monitoring to maintain Project effects to migratory birds and bats at acceptable levels.	**Residual effect**

Table 3.8-2: Predicted Effects of the Project on Wildlife and Wildlife Habitat

Potential Effect	Project Phase	Mitigation [a]	Description of Predicted Residual Effect	Predicted Residual Effect[b]
Mortality		■ Appendix G; Section 9.44; 10.47; 10.50	The use of access roads during operational maintenance could increase wildlife mortality through vehicle-animal collisions. Small, less mobile species, such as amphibians, may be affected by traffic associated with operation of the Project. With implementation of the mitigation provided minor changes to survival and reproduction of wildlife from vehicle strikes are anticipated. Use of access roads during operational maintenance is predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect
Mortality	Decommissioning	■ Appendix G; Section 9.44, 10.44, 10.47, and 10.50	Change in wildlife abundance due to attraction and exposure to hazardous materials during decommissioning may harm or kill wildlife in the Project Study Area. Implementation of the mitigation provided is expected to minimize wildlife interactions during decommissioning and mortality due to hazardous materials is predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect
		■ Appendix G; Section 9.44; 10.47; 10.50	The use of access roads and increase in vehicles during decommissioning could increase wildlife mortality through vehicle-animal collisions. These incidents are anticipated to be rare but could occur more frequently on local secondary roads where decommissioning traffic volumes (and speeds) are greater. Small, less mobile species, such as amphibians, may be affected by traffic associated with decommissioning of the Project. Implementation of the mitigation provided is anticipated to minimize wildlife mortality from vehicle strikes. Use of access roads during decommissioning is predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect
		■ Appendix G; Sections 10.47; 10.49; 10.50	Nests, roosts, or dens for a variety of wildlife taxa could be destroyed during activities associated with decommissioning and reclamation. With implementation of the mitigation provided, avoidance and minimization of wildlife mortality during decommissioning is anticipated resulting in compliance with the MBCA and AWA. Activities associated with decommissioning are predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect

Table 3.8-2: Predicted Effects of the Project on Wildlife and Wildlife Habitat

Potential Effect	Project Phase	Mitigation [a]	Description of Predicted Residual Effect	Predicted Residual Effect[b]
Habitat loss and fragmentation	Construction	■ Appendix G; Sections 2.15; 4.19(i); 9.43; 10.48; 10.49; 10.50	Habitat loss and fragmentation may affect wildlife habitat use during construction and may alter species richness and abundance in the Project Study Area. Implementation of the mitigation provided is predicted to minimize effects due to changes in habitat however, habitat loss and fragmentation are predicted to have a residual effect on wildlife populations in the Project Study Area.	**Residual effect**
	Operation	■ Appendix G; Sections 9.43; 10.48; 10.50	Habitat loss and fragmentation may affect wildlife habitat use during operation and may alter species richness and abundance in the Project Study Area, may increase nest predation, brood parasitism, or change the predator community composition and behaviour. The implementation of the mitigation provided is predicted to minimize effects due to changes in habitat; however, habitat loss and fragmentation are predicted to have a residual effect on wildlife populations in the Project Study Area.	**Residual effect**
	Decommissioning	■ Appendix G; Sections 9.43; 9.44; 10.48; 10.50	Habitat loss may affect wildlife habitat use during decommissioning and may alter species richness and abundance in the Project Study Area. The implementation of the mitigation provided is predicted to minimize effects due to changes in habitat. Habitat loss during decommissioning will be temporary while turbines are disassembled, and associated infrastructure is removed. Habitat will be reclaimed to pre-construction land use and access roads will be removed from the landscape. There is reasonable certainty in the success of reclamation because 92.3% of the Project Footprint is comprised of cultivation and tame pasture or hay land cover types under baseline conditions. Therefore, following decommissioning the effects of habitat loss and alteration are predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect

Table 3.8-2: Predicted Effects of the Project on Wildlife and Wildlife Habitat

Potential Effect	Project Phase	Mitigation [a]	Description of Predicted Residual Effect	Predicted Residual Effect[b]
Habitat avoidance or reduced reproductive success	Construction	■ Appendix G; Sections 9.44; 10.49; 10.50	Increased human activity levels and sensory disturbance may cause wildlife to avoid habitat adjacent to the Project or may reduce reproductive success of wildlife in habitat adjacent to the Project due to increased physiological stress. The implementation of the mitigation proposed is predicted to minimize effects due to sensory disturbance; however, sensory disturbance during construction is predicted to have a residual effect on wildlife populations in the Project Study Area.	**Residual effect**
	Operation	■ Appendix G; Sections 9.44; 10.50; 11.55	Presence of turbines and increased human activity associated with operation/maintenance of the Project may cause wildlife to avoid habitat adjacent to the Project or may reduce reproductive success of wildlife in habitat adjacent to the Project. The implementation of the mitigation proposed is predicted to minimize habitat avoidance during operations. Noise generated during operation is less than that during construction and decommissioning because there is no heavy machinery or concentrated activities that would generate noise. Human disturbance at the site is minimal during operation and only a few onsite personnel are required for occasional maintenance of turbines. Some grassland species (e.g., Sprague's pipit) may avoid anthropogenic disturbance, however, a recent study in Alberta mixed-grass prairie suggests that reproductive success of grassland songbirds is not correlated with anthropogenic noise (Bernath-Plaisted and Koper 2016). Effects on wildlife due to habitat loss and fragmentation is addressed separately above. Wildlife avoidance or reduced reproductive success due to sensory disturbance in the Project Study Area during operation is predicted to have a negligible net effect on wildlife populations in the Project Study Area.	No residual effect
	Decommissioning	■ Appendix G; Section 9.44; 10.50	Increased sensory disturbance (e.g., noise) associated with decommissioning of the Project could cause temporary wildlife avoidance of habitat adjacent to the Project or may reduce reproductive success of wildlife in habitat adjacent to the Project due to increased physiological stress. The implementation of the mitigation proposed is predicted to minimize effects due to sensory disturbance; however, sensory disturbance during decommissioning is predicted to have a residual effect on wildlife populations in the Project Study Area.	**Residual effect**

[a] Mitigation cited in this table corresponds to the mitigation outlined in the Renewable Energy Project Submission to Alberta Environment and Parks (Appendix G) as Section, then question number, then sub-question (i.e., 6.29(n) refers to Section 6, Question 29, sub-question n).

[b] Residual effects predicted after mitigation are bolded and evaluated in Section 3.8.5. Potential effects with no predicted residual effect after mitigation are not further evaluated. The purpose of this screening is to focus the evaluation of predicted residual effects on the most important Project-environment interactions.

MBCA = Migratory Birds Convention Act, 1994; AWA = Alberta Wildlife Act (GOA 2018c)

Evaluation of Predicted Residual Effects of the Project

For wildlife, magnitude is a function of the numerical and qualitative changes in measurement parameters and the associated influence on the abundance and distribution of the wildlife and wildlife habitat VCs. Changes in physical (e.g., habitat quantity, quality, and fragmentation) and biological (e.g., survival, reproduction, movement, and behaviour) measurement parameters result in effects on the abundance and distribution of populations. The magnitude of residual effects is assessed at the population level because the maintenance of self-sustaining and ecologically effective wildlife populations is a common objective for wildlife managers and is an indicator of environmental integrity. Self-sustaining populations are healthy, robust populations capable of withstanding environmental change and accommodating random demographic processes (Reed et al. 2003). Ecologically effective populations are those that are large enough to maintain ecosystem function (e.g., pest control by bats).

Critical thresholds such as amount of quality habitat required to maintain a self-sustaining population or the specific number of individuals required for an ecologically effective population size are not available for wildlife evaluated in this assessment. Moreover, ecological thresholds vary by species, landscape type, and spatial scale (Fahrig 1997; Swift and Hannon 2010). Consequently, a qualitative discussion of the predicted effects associated with changes to wildlife populations in general, with reference to species-specific examples as appropriate is used to provide a reasoned narrative. The discussion is supported with available scientific literature, baseline data collected for the Project, logical reasoning and experience of the practitioners completing the assessment (a reasoned narrative approach). Because of the uncertainty regarding the effects of development on the wildlife and wildlife habitat VCs, magnitude classification was applied conservatively to avoid underestimating effects.

A summary of the predicted residual effects of the Project on wildlife and wildlife habitat is provided in Table 3.8-3 and a rationale for the evaluation is provided in the sections below.

Table 3.8-3: Predicted Residual Project Effects Description, Importance and Likelihood for Wildlife and Wildlife Habitat

Predicted Residual Effect	Project Activity	Effects Assessment Criteria[(a)]				Importance[(a)]	Likelihood[(a)]
		Direction	Magnitude	Geographic Extent	Duration		
Bird and bat mortality due to collision with turbines during operation	Operations	Negative	Medium	Regional	Medium-term	Low	Likely
Changes in wildlife habitat use due to habitat loss and fragmentation during construction and operations	Construction, operations, and decommissioning	Negative	Low	Local	Medium to Long term	Low	Likely
Habitat avoidance or reduced reproductive success due to increased sensory disturbance during construction and decommissioning	Construction and decommissioning	Negative	Low	Local	Short-term	Minimal	Likely

[(a)] Effects assessment criteria are defined in Table 2.6-1. Importance and Likelihood are defined in Table 2.6-2 and Table 2.6-3, respectively.

Bird and bat mortality due to collision with turbines during operation

Collision with turbines during operation could cause injury or mortality to birds and bats. High bird and bat mortality can occur in areas with high bird or bat densities, areas with landscape features that funnel bird or bat movement (e.g., ridges, steep slopes, and valleys) and occasionally as a result of extreme weather conditions.

Birds

Appropriate siting of turbines is the most effective mitigation to reduce bird mortality risk due to collision with turbines. Generally, the potential for bird collision was reduced by incorporating the guidance outlined in the Directive (AEP 2018a) into the early planning stages of the Project. Most of the Project Study Area is characterized by modified vegetation including cultivation (74.7%) and tame pasture or hay (7.1%) (Section 3.1). However, 7.9% of the Project Study Area is composed of native grassland and 5.8% is wetlands and these areas are considered higher potential habitat for birds. Pre-construction wildlife surveys were conducted to identify wildlife features such as burrowing owl nests, sharp-tailed grouse leks, and raptor nests. No burrowing owls or their nests were observed during burrowing owl surveys within the Project Study Area. As such, Project infrastructure will not encroach on any active nests of these species or their 500 m setback requirements. One active lek was suspected outside of the Project Study Area north of the survey plot from which it was detected (RESHSTGR42; Appendix G; Figure A-9). Sharp-tailed grouse were heard at this location but not directly observed; however, a precautionary 500 m setback was applied to the predicted location of the lek. The survey plot is located approximately 684 m north of the nearest edge of the rotor-swept-area and the predicted lek location was north of the plot location and undetermined distance. As such, Project infrastructure will not encroach on any active leks or their 500 m setback requirements.

A total of nine active raptor nests were observed including: three ferruginous hawk nests, three great horned owl nests, two Swainson's hawk (*Buteo swainsonii*) nests, and one nest with great horned owl observed during the first round of surveys and Swainson's hawk observed during the second round of surveys. The Proponent has adhered to a minimum turbine setback distance of 710 m from the edge of the rotor-swept-area to all Swainson's hawk and great horned owl nests (Appendix G; Figure A-5). The Proponent has adhered to a minimum turbine setback distance of 1,025 m from the edge of the rotor-swept-area to all ferruginous hawk nest locations (Appendix G; Figure A-5).

The Project has been set back from landscape features (i.e., Class III-VI wetlands, native grassland) which were observed to have contributed to higher numbers of waterfowl) to minimize the risk of mortality (Section 3.8.3.7). The Project Footprint has been sited to avoid direct impacts to Class III-VI wetlands. The proponent has adhered to a minimum of 102 m from the edge of the rotor-swept-area to all Class III-VI wetlands and 14 m to native grassland.

All plots with relatively higher number of bird observations with the exception of RESHLHSPC04 are located in the west portion of the Project Study Area or west and outside of the Project Study Area (RESH18LVAUS09). Native grassland extends from west of the Project Study Area to the North Saskatchewan River and the Suffield IBA, located approximately 9.3 km west of the Project Study Area and west of the North Saskatchewan River. The Suffield IBA has been identified as large, high quality remnants of mixed grassland and sand hills with intermittent saline lakes and springs in the area (IBA 2020). Important Bird Areas support either listed avian species, large groups of birds, or avian species that are restricted by either their population range or habitat requirements (IBA 2020). The Project Footprint was sited within the Project Study Area as far away from the west boundary of the Project Study Area as possible (Appendix G; Figure A-2). Careful planning and design led to siting of turbine rotor-swept-areas between 835 m (plot RESH20LHSPC08) and 4,204 m (plot RESH18LVAUS09) from point count and stopover count plots with the highest numbers of bird activity. Turbines were sited greater than 10.3 km away from the IBA and 7.3 km away the South Saskatchewan River. To reduce mortality risk, the Proponent did not place any turbines west of plots RESH20DCAUS41, RESH18LVAUS13, RESH18AUS17, RESH18LVAUS09, RESH20LHSPC09, and RESHLHSPEC08, or between these plot locations and the South Saskatchewan River or IBA (Appendix G; Figure A-6). RESH20LHSPC04 is located at the northeast portion of the Project Study Area. No turbines are located north or east of the plot location between the plot and patches of native grassland habitat extending in the same directions (Appendix G; Figure A-6). Fatality monitoring surveys will be conducted at all

turbine locations, as outlined in the Post Construction Survey Protocols for Wind and Solar Energy Projects (AEP 2020b).

Lighting requirements on wind turbines can attract migrating birds and increase their collision risk. The implementation of the mitigation referenced in Section 3.8.4.2 is predicted to minimize collision risk for migratory birds due to lighting (Appendix G; Section 9.44). The Proponent is committed to completing post-construction surveys as directed by the AEP-FWS Post Construction Survey Protocols for Wind and Solar Energy Projects and the Directive including carcass monitoring surveys, carcass removal trials, searcher efficiency trials, and site-specific wildlife surveys (AEP 2020b; AEP 2018a). Pre-construction wildlife surveys (i.e., burrowing owl, raptor nest and sharp-tailed grouse lek surveys) will be kept current within two years between issuance of the AEP-FWS referral letter and construction of the Project in accordance with Standard 100.2.4 of the Directive (AEP 2018a), and as due diligence to prevent contraventions of the Alberta *Wildlife Act* (AEP 2018c). If lek or additional nest features are identified, AEP-FWS will be notified and consulted to identify mitigation that will be applied to any nearby Project Footprint components to reduce potential adverse effects on wildlife.

Bats

A precautionary estimate of migratory bat activity documented at the detectors deployed at a 30 m height within the Project Study Area between August 1 and September 10, 2020 was 6.1 migratory bat passes per detector night. According to AEP's Bat Mitigation Framework for Wind Power Development (ESRD 2013a), the Project Study Area is rated as having "potentially high risk" of bat fatalities because the bat activity documented within the Project Study Area during fall surveys is greater than two migratory bat passes per detector night and "operational mitigation will most likely be required to reduce bat fatality to an acceptable level".

The raised bat detector location that exhibited higher migratory bat activity during the fall 2020 migration period (RESHBAT04R) relative to the other raised detector was paired with the ground detector that had the highest overall total bat passes per detector night during both spring and fall surveys (RESHBAT04G). Turbines were sited over 4 km from the location where these paired detectors were deployed, with the closest turbines (T1, T2, and T3) including the rotor-swept-area, approximately 4.4 km, 4.1 km, and 4.4 km from the detector's location, respectively (Appendix G; Figure G-6). Northwest of the plot location, native grassland dominated habitat extends to the South Saskatchewan River between which no turbines are located. Other locations within the Project Study Area where elevated levels of migratory bat activity were detected in 2020 (i.e., RESHBAT02 and RESHBAT05) were likewise avoided by more than 948 m, including rotor-swept-area, during the Project design phase. All of the Project's turbines will be monitored as part of the post-construction mortality monitoring program.

There are limited data showing a relationship between pre-construction acoustic data and bat fatality post-construction. Baerwald and Barclay (2009) found a positive correlation between bat fatalities at tall turbines (i.e., towers > 65 m) and bat activity recorded at a 30 m height, but they also noted a large amount of variation among sites. Correlating local scale habitat features such as treed areas and wetlands with bat fatalities has not yielded consistent results that could inform turbine siting (Arnett et al. 2016; Bennett and Hale 2018). The available data indicate that pre-construction acoustic data does not accurately predict post-construction bat mortalities, possibly because the relationship is influenced by the potential for bat attraction to turbines (Hein et al. 2013). Pre-construction acoustic data is nevertheless useful for continuing to explore the relationship between pre-construction bat activity and post-construction fatalities and for understanding site-specific bat activity patterns to help inform operational mitigation. The Proponent will engage with AEP-FWS about possible operational mitigation and post-construction monitoring to maintain Project effects on migratory bats at acceptable levels. If AEP-FWS determines that bat fatalities have exceeded an acceptable level, the Proponent will implement all recommendations agreed upon with AEP-FWS at that time.

Listed Species

After mitigation, mortality of bat species listed provincially as “Sensitive” (e.g., red bat, silver-haired bat, western small-footed bat) or “May be at Risk” (i.e., little brown myotis) is likely to occur and would contribute to the total number of wind-related bat fatalities in Alberta. Frick et al. (2017) suggests that hoary bat populations in North America could decrease by 90% over the next 50 years without appropriate mitigation of wind-related bat fatalities. Little brown myotis is federally listed as “Endangered” and on Schedule 1 of SARA due to the decimation of populations particularly in the eastern portion of the species’ range from the fatal white-nose syndrome (Government of Canada 2020a). To date this disease has not been recorded in Alberta (GOA 2021a) but given its rapid spread in eastern North America and recent detections in Washington state, it is likely going to affect Alberta’s populations during the operational life of the Project.

Several federally listed migratory bird species observed during baseline surveys including: bank swallow, barn swallow, chestnut-collared longspur, ferruginous hawk, lark bunting, loggerhead shrike, McCown’s longspur, Sprague’s pipit, and peregrine falcon. Adherence to the 1,000 m recommended setback of turbines plus blade length to active ferruginous hawk nests is expected to mitigate mortality risk for resident ferruginous hawks.

Sprague’s pipit has the potential to experience increased mortality during the breeding season due to its aerial display behaviour. No Sprague’s pipit were observed during spring and fall migration surveys. During breeding bird surveys, 44% of Sprague’s pipit were detected at plots in native grassland, 33% were detected at plots characterized by open water wetlands surrounded by native grassland and 11% were detected greater than 100 m from the plot centre of plots characterized by cultivation but with native grassland present outside of the 100 m plot radius. No turbines are located in native grassland or within 100 m of open water wetlands, suggesting that collision risk for this species is low. Of the six plots at which Sprague’s pipit were observed, four (22% of detections) are located on the north, south or west perimeter of the Project Study Area, outside of the general turbine layout area. The closest observation of Sprague’s pipet was greater than 700 m from the nearest turbine, including rotor-swept-area, and transmission line.

Passerines are generally at lower risk of collision with transmission lines than other bird guilds (APLIC 2012). The transmission line will be up to 150 m in length and contained entirely within cultivation. As such, ferruginous hawk, peregrine falcon, and listed passerine species are anticipated to avoid the immediate area. However, barn swallow may be found nesting in the substation footprint as it prefers to nest in protected areas such as on or inside buildings (Godfrey 1986). Barn swallow is highly maneuverable in flight due to its forked tail and is capable of sharp turns and dives and rarely strikes buildings, wind turbines, or transmission towers during their migration (Brown and Brown 2019). While not as maneuverable as barn swallow, bank swallow is able to make frequent and rapid course changes. Bank swallow was observed southwest and outside of the Project Study Area (RESH18LVAUS09; Appendix G; Figure A-6) at just one survey location during fall bird migration surveys. As such, collision risk for these species is considered to be low.

Lark bunting was observed at just one survey location with a single individual observed in tame pasture or hay during fall bird migration surveys (RESH18LVAUS26; Appendix F; Figure A-6). McCown’s longspur was observed at eight survey locations during breeding bird and fall bird migration surveys. McCown’s longspur prefers shortgrass species in sparsely vegetated areas such as overgrazed pastures (With 2020). Of the eight survey locations where McCown’s longspur was observed, five locations were on the perimeter, and two locations were outside of the Project Study Area including three located further south than all turbine locations, three located further west than all turbine locations, and one located further east than all turbine locations. Chestnut-collared longspur was observed at six plot locations in the Project Study Area during breeding bird and spring bird migration surveys. These plot locations were characterized by tame pasture or hay or native grassland, with the

exception of one spring bird migration plot location that was predominantly cultivated but contained an island of native grassland associated with a wetland. Two turbines are located in tame pasture or hay and these turbines are over 1.5 km away from the nearest observations of lark bunting, McCown's longspur, and chestnut-collared longspur.

The majority of listed breeding bird observations occurred within native grassland and wetland habitats. A total of 27.5% of listed species observations were recorded at plots locations outside of the Project Study Area. A total of 32.5% of observations of listed species occurred in the west portion of the Project Study Area and west of all turbine locations including those plot locations west and outside of the Project Study Area. As such, the magnitude of the Project effects on resident, listed species of migratory birds is considered low.

Increased wildlife mortality during operation due to collision with turbines is predicted to be negative in direction and medium in magnitude because after mitigation, mortality of provincially and federally listed bats is likely to occur and mortality of provincially and/or federally listed birds is likely. Although mortality events would be restricted to the Project Study Area, effects on migrating birds and bats could affect wildlife populations that extend beyond the Project Study Area. Therefore, the geographic extent is regional. The effect is reversible over the medium-term because mortality due to collision with turbines will cease when turbines are decommissioned. These criteria lead to an overall effect of low importance and the effect is considered likely to occur (Table 3.8-2).

Changes in wildlife habitat use due to habitat loss and fragmentation during construction and operation

Vegetation clearing during construction will result in site-specific habitat loss. Fragmentation due to Project infrastructure may reduce the quality of remaining habitat patches throughout operation. Adverse effects of increased habitat fragmentation may include increased nest predation and brood parasitism (Gates and Gysel 1978; Johnson and Temple 1990) and may change predator community composition and behaviour through operations (Bernath-Plaisted and Koper 2016). It is important to note that the existing Project Study Area consists of 87% disturbed habitat such as cultivation, tame pasture or hay, roads, railway and farmyards. Approximately 8% of the Project Study Area consists of native grassland and wetlands comprise 6%. In addition, there are eight occupied residences in the Project Study Area.

Habitat loss was minimized by siting all turbines in disturbed areas that provide lower quality habitat for wildlife compared to native upland. Habitat fragmentation was minimized using existing access, where possible. The Project has the potential to disturb 1.7 ha of native grassland (<1% of the Project Study Area) during construction due to temporary road upgrades (1.5 ha) and collector line installation (0.2 ha). Of this, 0.5 ha of disturbance in native grassland will carry through to the operational stage of the Project. Temporary and permanent disturbance associated with road upgrades are due to development of the access road to turbine T6 which was designed to parallel an existing disturbance (trail) and is located within the County road allowance (Appendix G; Figure A-4). The access road will be limited to 20 m wide to minimize impacts to native grassland. Portions of the Project Footprint not required for operation will be reclaimed following construction. Native grass and forb seed mixes will be used as appropriate. After mitigation, Project infrastructure will likely lead to a small incremental increase of habitat fragmentation in the Project Study Area and may result in reduced abundance of species that are sensitive to human disturbance, such as Sprague's pipit.

Amphibians may be particularly sensitive to habitat fragmentation due to their low mobility. Increased access in the Project Study Area may limit or alter amphibian movement and their use of remaining habitat if roads are sited between breeding ponds and foraging or overwintering habitat. Baseline surveys for amphibians were not conducted for the Project. The Proponent has sited the Project to avoid direct impacts to all Class III-VI wetlands.

The Proponent adhered to the 100 m plus blade length (i.e., 172.5 m from the turbine base) setback requirement from Class III+ wetlands during the Project design phase. The Project will slightly encroach the 100 m setback of three Class III-IV wetlands, all of which are associated with temporary disturbance related to corner widening at three turbine access roads. A table outlining the three 100 m setbacks of wetlands that are overlapped by the temporary Project Footprint is provided in Appendix G, Table 7. Prior to construction activities occurring within 100 m of all Class III-V wetlands, a non-intrusive field survey will be conducted by an experienced wildlife biologist to determine the presence of breeding amphibians and, if necessary, mitigation will be applied to reduce any effects to breeding amphibians as per Appendix A in the Directive (AEP 2018a). The Proponent will discuss findings and the need for additional mitigation with AEP-FWS so that potential residual effects on amphibians are acceptable. The Proponent will schedule construction within setbacks or direct disturbances to wetlands with the potential to support amphibian populations outside of the breeding period or will commit to having an experienced wildlife biologist onsite if construction during the breeding period is necessary. Additional mitigation and best management practices described in Section 3.5.4.2 are predicted to minimize adverse effects of temporary disturbance of wetlands in the Project Study Area.

Habitat loss/alteration during Project construction and operations is predicted to be negative in direction and low in magnitude because over 98% of temporary and permanent disturbance is located in habitat with existing human disturbance (i.e., cultivation, roads, developed, and tame pasture or hay). The geographic extent is local because habitat loss and fragmentation is restricted to the Project Study Area and is therefore predicted to affect wildlife in the Project Study Area. The effect is predicted to be reversible over the medium to long-term because temporary disturbance will be reclaimed after construction and the remaining habitat will be restored when turbines and associated infrastructure are decommissioned. These criteria lead to an overall effect of low importance and the effect is considered likely to occur (Table 3.8-3).

Habitat avoidance or reduced reproductive success due to increased sensory disturbance during construction and decommissioning

Increased sensory disturbance (e.g., noise) associated with the construction and decommissioning of the Project could cause temporary wildlife avoidance of habitat in the Project Study Area or reduced reproductive success due to physiological stress (Dahlgren and Korschgen 1992). In general, sensory disturbance effects on wildlife abundance are most detrimental at key times of the year, such as during the reproductive season (spring or early summer), when wildlife are raising young (Yarmoloy et al. 1988). Depending on the timing and level of stress, other potential stresses to animals from noise can include interference with communication and reduced reproductive success, particularly for bird and amphibian species (Habib et al. 2007). Noise levels in the Project Study Area will be elevated during Project construction as a result of clearing, grading, foundation building, and turbine assembly. However, noise dissipates quickly. In addition, the duration of construction at any one location will be limited and intermittent in different areas of the Project layout; thereby reducing the amount of time a given location will be exposed to Project-related noise and the presence of construction workers.

Little information is available regarding the physiological effects of sensory disturbance on wildlife indicators. Physiological stress as a result of sensory disturbance has not been measured directly as the less apparent long-term effects on wildlife physiology and reproduction are difficult to observe and predict. A recent study by Bernath-Plaisted and Koper (2016) in Alberta mixed-grass prairie suggests that reproductive success of grassland songbirds is not correlated with noise associated with oil and gas infrastructure, but they did not evaluate the more intense, but temporary, noise associated with construction equipment and activities. Heavy equipment (i.e., large cranes) associated with turbine assembly and installation may displace animals, cause stress, and result in reduced breeding success. Potential mitigation to limit such impacts include clearing vegetation outside

of the typical migratory bird nesting period (Zone B3; April 12 to August 23; ECCC 2018), reducing construction noise by fitting vehicles and construction equipment with internal combustion engines with muffler systems, minimizing vehicle and machinery emissions by turning vehicles and equipment off when not in use, ensuring all vehicles and machinery are in good working order and restricting construction activities to the surveyed Project Footprint.

Temporary and permanent Project infrastructure has been sited greater than 100 m from all great horned owl and Swainson's hawk nest locations. Turbine access roads to turbines T12 and T13 and installation of sections of three collector lines require new disturbance within one ferruginous hawk nest setback (RESHSN07; Appendix G, Figure A-5). A total of 901 m of turbine access road is proposed within the 1,000 m setback of this nest resulting in 0.5 ha of permanent disturbance and 2.4 ha of temporary disturbance. A total of 4,762 m of collector line is proposed within the 1,000 m setback buffer of this nest resulting in 5.7 ha of temporary disturbance. Collector lines within the nest setback will be installed using direct plough-in techniques using a single cut tooth that splits the earth apart and allows the cables and sand bedding along with warning tape to be installed and no backfilling or compaction is required. Given the proposed installation method of the collector line within the nest setback, no permanent disturbance due to collector line installation is anticipated. To minimize the probability of nest abandonment, installation of the collector line within the 1,000 m nest setback buffer will be scheduled outside of the raptor breeding period (March 15 to July 15; AEP 2020b; GOA 2021b). Therefore, after mitigation, the impact of the collector lines within the ferruginous hawk nest setback is considered negligible.

Construction of the turbine access roads within the 1,000 m nest setback buffer will be scheduled outside of the raptor breeding period (March 15 to July 15; AEP 2020b; GOA 2021b) to minimize the probability of nest abandonment. To eliminate traffic on turbine access roads within the nest setback, construction of turbines T11, T12, and T13 will be scheduled outside of the raptor breeding period. Further, no delivery of equipment or materials to turbine sites T11, T12, or T13 or other sites within the nest setback will occur during the raptor breeding period. As described in Section 1.2.2, Table 1.2-1, the turbine access roads are expected to be 30 m wide during construction, but only a 5 m width will remain in place for access to the turbines during operations. Temporary disturbance will be reclaimed outside of the raptor breeding period (March 15 to July 15) to equivalent land use (cultivated, tame pasture or hay) following construction.

The proposed layout makes use of existing access and minimizes the amount of new road disturbance in the Project Study Area, with consideration that there is existing traffic in these areas on the public roads, dirt trails and within the farmed fields that are already closer to the ferruginous hawk nest. It is noted that the ferruginous hawk nest is located immediately adjacent Range Road 12 and it is expected that if the nest remains active throughout a breeding season, the ferruginous hawk may be accustomed to local traffic including large farm equipment. The 1,000 m nest setback is predominantly cultivation which is accessed by heavy farm machinery extensively during the breeding bird season. Heavy farm machinery will continue to utilize Range Road 12 and cultivated fields during the breeding period. Additional local traffic on turbine access roads is expected to be minimal because the turbine access roads are dead-end roads leading only to turbines, so are not expected to be subject to additional use by the public. The Proponent will place signs on the entrances of these turbine access roads indicating that they are on private lands and do not provide through access. Regular maintenance visits during operations have the potential to cause increased traffic with up to one maintenance visit during the breeding season, however, the Proponent will schedule these visits outside of the raptor nesting period (March 15 to July 15; AEP 2018a) to the extent practical. Therefore, after mitigation, the impact of the turbine access roads within the ferruginous hawk nest setback is considered negligible. The status of the nest will be verified as part of the post-construction monitoring and mitigation program and the results will be communicated to AEP-FWS in an annual report summarizing the post-construction monitoring results.

The Project does not occur within 500 m of the sensitive species snake range (AEP 2021c). However, disturbance may displace individuals, cause stress and abandonment of dens or breeding sites, and result in reduced breeding success (ESRD 2013d). One plains garter snake hibernaculum was located in the Project Study Area with one adult plains garter snake observed at the location (Appendix G; Figure A-5). Hibernacula of plains garter snake have a year-round setback of 500 m following the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a). The Proponent sited the Project Footprint greater than 2 km from the hibernaculum. Therefore, due to careful siting of the Project Footprint the impact on sensitive snake species is predicted to be negligible.

Habitat avoidance and reduced reproductive success during construction and decommissioning of the Project due to sensory disturbance is predicted to be negative in direction and low in magnitude given that vegetation clearing is scheduled to occur outside of the typical migratory bird nesting period (April 12 to August 23), construction of the turbine access roads, installation of collector lines, and reclamation of temporary disturbance is scheduled to occur outside of the raptor breeding period (March 15 to July 15), and mitigation to reduce construction noise will be implemented during construction and decommissioning. The geographic extent is local because sensory disturbance is predicted to affect wildlife in the Project Study Area. The effect is predicted to be reversible upon completion of construction and decommissioning. These criteria lead to an overall effect of minimal importance and the effect is considered likely to occur (Table 3.8-3).

3.8.5 Determination of Significance

Residual, adverse effects (i.e., after mitigation) were predicted for the following Project effects on wildlife:

- Bird and bat mortality due to collision with turbines during operation.
- Changes in wildlife habitat use due to habitat loss and fragmentation during construction and operation.
- Habitat avoidance or reduced reproductive success due to sensory disturbance during construction and decommissioning.

Project effects on wildlife are considered to be of minimal to medium importance and likely to occur. With effective implementation of mitigation measures referenced in Section 3.8.4.2, the predicted residual effects of the Project on wildlife and wildlife habitat are not expected to result in a change that will alter the sustainability of wildlife and wildlife habitat beyond a manageable level. Project effects on wildlife are determined to be not significant.

There is a moderate level of confidence in the predictions for wildlife and wildlife habitat because the Project has been appropriately sited in cultivation and tame pasture or hay land cover types. The largest source of uncertainty is related to mortality of listed species of birds, waterfowl, and bats due to collisions with turbines. The Proponent will address this uncertainty through adaptive management as outlined in its proposed post-construction monitoring and mitigation plan (Appendix G; Section 11.0).

3.9 Air Quality

3.9.1 Introduction

A desktop evaluation was conducted to determine baseline air quality conditions and the potential effects of Project construction, operation, and decommissioning on air quality. The following sections outline the methods used to assess air quality within the Project Study Area, identify potential effects that the Project may have on air quality, and describe proposed mitigation measures.

3.9.2 Baseline Data Collection Methods

3.9.2.1 Desktop Assessment

The Project Study Area is located in a rural area, approximately 80 km northeast of Medicine Hat, Alberta in Cypress County. The air quality in the vicinity of the Project Study Area is influenced by oil and gas activity, and agricultural activities (e.g., seeding, harvesting) that are present in the area.

Environment and Climate Change Canada (ECCC) operates a network of stations that collect climate data; climate normals, averages, and extremes are available for stations with at least 15 years of data collected between 1981 and 2010 (ECCC 2020). The closest ECCC climate station is the Schuler station, located approximately 20 km south of the Project Study Area. Data for temperature and precipitation are available for this station. Given the proximity of the station to the Project Study Area, the Schuler site climate normals can be considered representative of the Project Study Area.

The Project Study Area lies within the Palliser Airshed Society (PAS) that operates in southeast in Alberta. The PAS was established in the spring of 2003 to monitor ambient air quality in the Medicine Hat/Redcliff region and has expanded to cover the southeastern portion of the province. PAS currently maintains two continuous monitoring sites as well as 16 passive sampling sites distributed throughout the airshed. The closest continuous operational air monitoring station is the Medicine Hat Trap Club location north of the City of Medicine Hat's industrial park, approximately 59 km to the southwest corner of the Project Study Area. The closest passive air quality monitoring stations is PAS Site 1, which is located approximately 7.5 km south of the south boundary of the Project Study Area.

The continuous monitoring station is located north of the City of Medicine Hat's industrial park. Because it is located adjacent an urban area, air quality may be commensurately affected by the activities that accompany a city (e.g., vehicle traffic, power generation, and various heavy and light industrial activities). These influences on air quality are not typical of those present in a rural setting such as the Project Study Area. Data from the passive monitoring stations were thus used to characterize the air quality in the Project Study Area.

3.9.3 Baseline Conditions

Data recorded by ECCC (2020) at the Schuler station (1981 to 2010) show that the daily average temperature ranges between -10.5 degrees Celsius (°C) in January to 18.7°C in July. The daily average temperature annually was 4.7°C between 1981 and 2010. The average annual total precipitation is 353.6 millimetres (mm), of which 259.5 mm falls as rain. Table 3.9-1 summarizes the climatological data recorded by ECCC at the Schuler station.

Table 3.9-1: Climate Data at the Schuler Station (1981 to 2010)

Climate Parameter	Annual Average Value
daily average temperature	4.7°C
daily maximum temperature (July)	26.7°C
daily minimum temperature (January)	-15.9°C
extreme maximum temperature (August)	38.5°C
extreme minimum temperature (December)	-44.5°C
average annual precipitation	353.6 mm
extreme daily rainfall	55.8 mm
extreme daily snowfall	29.0 cm
average number of days with measurable precipitation (≥0.2 mm)	84.1 days

°C = degrees Celsius; mm = millimeters; cm = centimeters; ≥ = greater than.
Source: ECCC 2020b.

A summary of the passive monitoring results was included in the PAS 2019 Annual Report (PAS 2019). In 2019, the annual average nitrogen dioxide (NO_2) concentration in the PAS passive network ranged from 0.3 to 3.2 parts per billion (ppb), which is substantially less than the annual Ambient Air Quality Objectives (AAAQO; GOA 2019) of 24 ppb. The maximum 30-day average NO_2 concentration of 6.2 ppb was detected in January at Site 11 (Brooks), while the lowest concentration was 0.1 ppb at Site 17 (Onefour) in April (PAS 2019). The annual average concentration observed at PAS Site 1, closest to the Project Study Area recorded an annual average NO_2 concentration of 1.2 ppb.

The concentration of sulphur dioxide (SO_2) generally is quite low in the PAS Airshed zone. There was no exceedance of the annual AAAQO of 8 ppb for SO_2 (GOA 2019). The annual average concentration of SO_2 for the airshed was 0.4 ppb (PAS 2019). The concentration observed at PAS Site 1, closest to the Project Study Area recorded an annual average SO_2 concentration of 0.4 ppb.

3.9.4 Potential Effects, Mitigation and Predicted Residual Effects

3.9.4.1 Potential Effects

All Project construction and decommissioning activities are expected to affect air quality through exhaust emissions and dust generation. The changes in air quality due to construction and decommissioning activities can affect other environmental components such as soil, vegetation, wildlife, and water quality.

The two primary sources of air emissions associated with Project construction and decommissioning that may affect air quality are road dust and mobile equipment exhaust. On-site vehicular traffic will be the primary source of dust from the Project during the construction and decommissioning activities. Mobile equipment includes cranes, haul trucks, dozers, excavators, and other support vehicles. The key emissions from mobile equipment exhaust are SO_2, oxides of nitrogen, carbon monoxide, and particulate matter with a diameter of less than 2.5 micrometres (µm) ($PM_{2.5}$).

3.9.4.2 Mitigation

The following mitigation measures will be implemented during construction and decommissioning to limit adverse effects to air quality:

- Stationary and mobile equipment will adhere to federal emission standards and will be regularly maintained. There are no Alberta emission standards for non-road diesel mobile equipment.
- Dust suppressant or water will be applied to construction areas in proximity to highways and residences to mitigate dust, as appropriate. Project traffic will be restricted to public or Project access roads.
- Project traffic will adhere to posted speed limits and road bans on public roads, and reduced speed limits will be implemented on Project access roads.

3.9.4.3 Predicted Residual Effects

The predicted residual Project effect on air quality is:

- Adverse effect on local air quality through combustion emissions and fugitive dust generation.

3.9.5 Evaluation of Predicted Residual Effects of the Project

A summary of the predicted residual effects of the Project on air quality is provided in Table 3.9-2 and a rationale for the evaluation is provided below.

Table 3.9-2: Predicted Residual Project Effects Description, Importance and Likelihood for Air Quality

Predicted Residual Effect	Project Activity	Effects Assessment Criteria[a]				Importance[a]	Likelihood[a]
		Direction	Magnitude	Geographic Extent	Duration		
Adversely affect local air quality through combustion emissions and fugitive dust generation	Construction and Decommissioning	Negative	Low	Local	Immediate	Minimal	Likely

[a] Effects assessment criteria are defined in Table 2.6-1. Importance and Likelihood are defined in Table 2.6-2 and Table 2.6-3, respectively.

Adversely affect local air quality through combustion emissions and fugitive dust generation

The residual effects on air quality from Project construction and decommissioning are expected to be negative and of low magnitude given mitigation measures will be in place to limit combustion emissions and fugitive dust. The effects are not expected to extend beyond the Project Study Area, so the geographic extent is local. The duration is immediate and infrequent, as it will occur only during construction and decommissioning.

3.9.6 Determination of Significance

Combustion emissions and fugitive dust generation are expected to be produced only intermittently during construction and decommissioning and are considered to be of minimal importance. Mitigation will be implemented to minimize combustion emissions and fugitive dust and as a result, the Project is not expected to result in a substantial change to air quality that would result in exceedances of AAAQO. Therefore, the residual effects on air quality from the Project are predicted to be not significant.

4.0 POST-CONSTRUCTION MONITORING AND MITIGATION

The Proponent has committed to undertaking a Post-construction Monitoring and Mitigation Plan, as required under the Directive (AEP 2018a), and outlined in the Renewable Energy Project Submission to Alberta Environment and Parks (Appendix G). The post-construction surveys will be completed as directed by the AEP-FWS “Post Construction Survey Protocols for Wind and Solar Energy Projects” (AEP 2020b) or the version that is in effect at the time the Project commences operations. An annual post-construction monitoring report will be submitted to AEP-FWS by January 31 of the following year and will include information outlined in the Protocol (AEP 2020b).

5.0 CONCEPTUAL CONSERVATION AND RECLAMATION PLAN

The Proponent has prepared a Conceptual C&R Plan as required under the C&R Directive (AEP 2018b) and is included in Appendix I. The Conceptual C&R Plan will be updated following completion of the Pre-Disturbance Site Assessments prior to construction of the Project, and also following completion of the Interim monitoring Site Assessments once the temporary construction disturbance associated with the Project has been reclaimed. Following the operational life of the Project, reclamation standards outlined in the current C&R Directive or subsequent standards in place at the time of decommissioning will be followed.

6.0 SUMMARY OF ENVIRONMENTAL EVALUATION

The predicted residual environmental effects and their predicted level of importance as outlined in the evaluations in Section 3.0 are summarized in Table 6.0-1.

Table 6.0-1: Summary of Predicted Residual Effects and Significance Rankings for Valued Components[a]

Valued Components Subject to Effects	Project Phase	Potential Effects – Short Description	Summary of Mitigation Measures	Residual Predicted Effects	Predicted Level of Importance[b]	Significance
Land Cover	■ Construction ■ Operations ■ Decommissioning	■ changes to land cover due to vegetation removal and soil disturbance during construction, operations, and decommissioning activities	■ siting of Project Footprint components out of sensitive land cover types ■ restrict disturbance to areas necessary for safe construction ■ restrict activity to designated ROWs and workspaces during construction ■ restrict activity to designated areas necessary for safe operations ■ landowners have been consulted in order to minimize disruption to or loss of use during operations ■ current land uses expected to continue ■ reclamation is expected to return land to equivalent land use capability	■ loss or alteration of cultivated and tame pasture or hay land cover types, and associated changes to land use ■ residual Project effects to native upland and wetlands are discussed in sections 3.4 and 3.5	Low	Not significant
	■ Construction Operations Decommissioning	■ introduction or spread of weeds and/or non-native species	■ vehicle traffic and equipment will be limited to the Project Footprint ■ construction equipment will enter the Project site in clean condition (i.e., free of soils and vegetative debris) and in good working order (i.e., no oil or hydraulic fluid leaks). ■ equipment will be visually inspected and cleaned off-site as needed. ■ equipment will be cleaned prior to moving between worksites ■ the Proponent will abide by the Alberta *Weed Control Act and Regulations* (GOA 2017b) and eradicate any prohibited noxious weed species populations and control any noxious weed species populations on the Project site.	■ introduction or spread of weeds and/or non-native species	Low	
Environmentally sensitive areas	■ Construction Operations Decommissioning	■ loss or alteration of lands with environmental sensitivity or significance during construction, operations, or decommissioning	■ siting Project Footprint components outside of designated areas	■ loss or alteration of ecological function of lands with environmental sensitivity or significance ■ residual Project effects to native upland, wetlands and wildlife habitat are discussed in the applicable sections	Minimal	Not significant
Terrain and Soils	■ Construction Operations Decommissioning	■ slope instability ■ soil compaction ■ admixing ■ soil erosion ■ soil contamination	■ surface and subsurface run-off controls (e.g., ditches and culverts) will be installed as appropriate ■ areas of steep terrain were avoided during Project siting ■ existing roads and trails will be used to the extent practical ■ surveys completed using light vehicles and on foot ■ topsoil will be stripped and stockpiled for reclamation ■ soil stockpiles will be low profile and stabilized to prevent erosion ■ heavy equipment and vehicle traffic will be restricted to ROW, leases and temporary work spaces ■ heavy equipment activity will be restricted if wet soil conditions occur ■ travel on existing and constructed access roads during operations ■ any spills will be addressed in a timely manner ■ waste will be removed during each maintenance visit ■ connection points will be excavated, and buried power line removed to 1.2 m below surface during decommissioning ■ buried connection lines will be left in place, below the cultivation layer to prevent soil disturbance ■ soil will be ploughed as necessary to repair any compaction prior to reclamation ■ disturbed areas on native or tame pasture or hay will be seeded with the appropriate seed mixture at reclamation	■ loss or alteration of soil capability and terrain to support healthy ecosystems	Low	Not significant

Table 6.0-1: Summary of Predicted Residual Effects and Significance Rankings for Valued Components[a]

Valued Components Subject to Effects	Project Phase	Potential Effects – Short Description	Summary of Mitigation Measures	Residual Predicted Effects	Predicted Level of Importance[b]	Significance
Vegetation	Construction Operations Decommissioning	■ loss and/or alteration of native vegetation including listed species individuals	■ siting of Project Footprint components out of sensitive vegetation types ■ targeted listed plant and ecological surveys were conducted in the Project Study Area to identify any occurrences of listed species or ecological communities for avoidance or mitigation ■ existing roads and trails will be used to the extent practical ■ turbines are located on cultivation and tame pasture or hay to limit disturbance of native vegetation or areas with higher potential for listed species ■ construction activity will be restricted to designated work areas and ROWs ■ roads, fencing and other infrastructure on native upland is minimized to the extent practical ■ topsoil will be stripped and salvaged for use during reclamation ■ areas not containing permanent facilities or operational access roads will be re-vegetated as soon as reasonably possible so that only the area required for operations remains ■ limit the amount of topsoil stripping and grading required using matting, geo-textiles and/or working during frozen or dry ground conditions ■ minimal disturbance techniques (e.g., plough-in) will be used for underground collection system installation to the extent practical ■ during construction of collector lines, the trench will be backfilled and reclaimed immediately following construction ■ sod salvage and replacement may be attempted in areas of short duration and small footprint disturbance (i.e., underground collection routing) ■ reclamation on native upland will use certified, inspected seed mixture ■ monitoring of reclamation status and ongoing reclamation measures	■ loss/alteration of native upland vegetation is expected due to temporary and permanent footprint siting associated with a Collector line and a turbine (T1) access road upgrade, respectively ■ residual Project effects to native wetlands are discussed in that section	Low	Not significant
Vegetation (continued)	Construction Operations Decommissioning	■ introduction or spread of weeds and/or non-native species	■ all vehicle traffic and equipment will be required to remain within the Project Footprint ■ construction equipment will enter the Project site in clean condition (i.e., free of soils and vegetative debris) and in good working order (i.e., no oil or hydraulic fluids) ■ equipment will be visually inspected and cleaned off-site as needed ■ the Proponent will develop and implement a vegetation management plan as per the C&R Directive to prevent and control the spread of invasive species ■ the Proponent will abide by the Alberta *Weed Control Act and Regulations* (GOA 2017b) and eradicate any prohibited noxious weed species populations and control any noxious weed species populations on the Project site.	■ introduction or spread of weeds and/or non-native species	Low	
Wetlands and Other Natural Water Bodies	Construction Operations	■ direct temporary or permanent disturbance to wetlands	■ siting of Project Footprint components to avoid wetlands and water bodies to the extent possible ■ the Proponent will follow compensation requirements under the Alberta Wetland Policy (GOA 2013a) for permanent direct impacts to wetlands that are not considered “minimal”. ■ construction during dry or frozen ground conditions to the extent practical, and the employment of rig matting, geotextiles, vegetated buffer zones, earthen berms and/or silt fencing, as appropriate ■ vehicle traffic and equipment will be required to remain within the Project Footprint ■ permanent erosion and spill control measures will be employed around facilities and access roads ■ indirect effect (i.e., siltation) to wetland is expected to be minimal and temporary ■ all disturbed areas not used for subsequent operations will be reclaimed following construction to minimize erosion and siltation	■ loss or alteration of wetlands	Low	Not Significant
	Construction Operations	■ changes in the hydrology or plant communities of wetlands				
	Construction Operations Decommissioning	■ water quality within wetlands could also be affected by siltation or spills				
		■ changes or alterations of other water bodies due to crossing by the Project Footprint	■ permanent erosion and spill control measures will be employed around facilities and access roads ■ all applicable Best Management Practices and mitigations described under the Water Act Codes of Practice (GOA 2019a; GOA 2019b), Alberta Transportation Fish Habitat Manual (AT 2001) and DFO’s Measures to Protect Fish and Fish Habitat outlined by Fisheries and Oceans Canada (DFO 2019) will be followed. ■ for all water body crossings, the applicable Code of Practice notification will be submitted to AEP prior to affecting any watercourse or water body ■ watercourse crossing and routinely inspected for damage and effectiveness over the duration of the Project and repaired and/or altered if needed	■ loss or alteration of natural drainages	Minimal	

Table 6.0-1: Summary of Predicted Residual Effects and Significance Rankings for Valued Components[a]

Valued Components Subject to Effects	Project Phase	Potential Effects – Short Description	Summary of Mitigation Measures	Residual Predicted Effects	Predicted Level of Importance[b]	Significance
Wetlands and Other Natural Water Bodies (continued)	Construction Operations Decommissioning	■ introduction or spread of weeds and/or non-native species	■ vehicle traffic and equipment will be limited to the Project Footprint ■ construction equipment will enter the Project site in clean condition (i.e., free of soils and vegetative debris) and in good working order (i.e., no oil or hydraulic fluids) ■ equipment will be visually inspected and cleaned off-site as needed ■ the Proponent will develop and implement a vegetation management plan as per the C&R Directive to prevent and control the spread of invasive species ■ the Proponent will abide by the Alberta *Weed Control Act* and *Regulations* (GOA 2017) and eradicate any prohibited noxious weed species populations and control any noxious weed species populations	■ introduction or spread of weeds and/or non-native species	Low	
Groundwater	Construction	■ changes in groundwater levels	■ wind turbines will be setback from residences/wells to minimize the potential for impacts on residential and/or livestock wells ■ the Proponent is planning geotechnical investigations of planned turbine locations and the proposed substation location to inform project planning. ■ the Proponent will preferentially site turbines on areas of high ground and locations where a shallow groundwater table is not intersected ■ If construction dewatering is required, it is short term and local in nature as well as non-consumptive and all water would be returned to the natural environment.	■ changes in groundwater levels	Minimal	Not significant
	Construction	■ changes in groundwater quality	■ wind turbines will be setback from residences/wells to minimize the potential for impacts on residential and/or livestock wells ■ Project activities will follow standard construction practices to minimize the potential for spills ■ any spill site will be reported to the appropriate authorities if necessary and remediated in a timely manner	■ changes in groundwater quality	Minimal	
Surface water, aquatic species, and habitat	Construction	■ redirection of flow during diversions	■ construction activities below the ordinary high water mark of a watercourse with defined bed and banks would be conducted in isolation if the watercourse is flowing ■ any disturbed bed and banks will be returned to stable conditions, with original contour and gradient where possible ■ if other construction activities take place within the vicinity of watercourses, measures which include developing a spill response plan will be taken to minimize the potential for contamination due to spills ■ no vehicle and equipment refueling, maintenance, or washing will occur within 100 m of a watercourse or water body ■ watercourse crossing construction activities will take place during periods of low or no flow whenever possible to prevent or limit downstream sedimentation ■ for watercourse crossings, the applicable Code of Practice notification will be submitted to AEP prior to construction activities ■ applicable Best Management Practices and mitigations described under the *Water Act* Codes of Practice (GOA 2019a, GOA 2019b), Alberta Transportation Fish Habitat Manual (Alberta Transportation 2001) and DFO's Measures to Protect Fish and Fish Habitat (DFO 2019) will be followed ■ sediment and erosion control measures will be installed where required at watercourse crossings and routinely inspected for damage and effectiveness over the duration of the Project and repaired and/or altered if needed ■ for trenchless watercourse crossings where drilling fluid is used, monitoring of drilling fluid volume and pressure, on-land monitoring for frac-outs, and monitoring of sediment concentrations in the watercourse (when water is present) will be completed ■ an appropriate frac-out contingency response plan will be in place and understood by crews on site, and all materials listed in the frac-out contingency response plan will be readily available to quickly contain the released drilling fluid in the event of a frac-out	■ redirection of flow during diversions	Minimal	Not significant
	Construction and operation	■ changes to surface runoff		■ changes to surface runoff	Minimal	
	Construction	■ potential for localized scour or bank erosion		■ potential for localized scour or bank erosion	Minimal to low	
	Construction	■ disturbance or alteration of riparian vegetation		■ disturbance or alteration of riparian vegetation	Minimal to low	
	Construction and operation	■ disturbance or alteration of instream fish habitat		■ disturbance or alteration of in stream fish habitat	Minimal	
	Construction	■ increase in sediment load and sediment deposition at and downstream of the crossing locations		■ increase in sediment load and sediment deposition at and downstream of the crossing locations	Minimal	

Table 6.0-1: Summary of Predicted Residual Effects and Significance Rankings for Valued Components[a]

Valued Components Subject to Effects	Project Phase	Potential Effects – Short Description	Summary of Mitigation Measures	Residual Predicted Effects	Predicted Level of Importance[b]	Significance
Wildlife	Construction	■ wildlife mortality ■ habitat loss and fragmentation ■ habitat avoidance or reduced reproductive success	■ feasibility studies and pre-construction surveys were completed to identify sensitive areas for avoidance ■ pre-construction wildlife surveys (i.e., burrowing owl, raptor nest and sharp-tailed grouse lek surveys) will be kept current within two years between issuance of the AEP-FWS referral letter, prior to initiation of construction ■ during siting, 18 turbines were located on cultivation land and 2 were located on tame pasture or hay ■ pre-construction surveys will be conducted in wetlands with potential to support amphibians where 100 m setbacks cannot be met ■ existing roads and trails will be used to the extent practical ■ vehicle speeds on access roads will be limited to 30 km/h ■ clearing will be scheduled to avoid bird and amphibian breeding seasons to the extent possible. ■ if construction during breeding seasons is required within wildlife setback areas or sensitive habitat areas (e.g., native upland), the Proponent will have a wildlife monitor onsite ■ construction activity will be restricted to designated work areas ■ construction will occur as quickly as safety allows ■ areas not containing permanent facilities or operational access roads will be re-vegetated as soon as reasonably possible so that only the area required for operations remain ■ construction will follow best management practices for minimizing human interactions with wildlife and reducing sensory disturbance ■ construction activities will be avoided during non-daylight periods, where practical	■ habitat loss and fragmentation ■ habitat avoidance or reduced reproductive success	Low Minimal	Not Significant
	Operations	■ wildlife mortality ■ habitat loss and fragmentation ■ habitat avoidance or reduced reproductive success	■ feasibility studies and pre-construction surveys were completed to identify sensitive areas for avoidance ■ pre-construction surveys were completed to assess bird and bat activity during migration and breeding seasons ■ during siting 18 turbines were located on cultivation and 2 were located on tame pasture or hay ■ cultivation is of limited habitat suitability, particularly to species of concern ■ existing roads and trails will be used to the extent practical ■ vehicle speed will be restricted on the Project access roads ■ access roads have been designed as dead-end roads to be used for turbine access only ■ signs will be placed on the entrances of access roads indicating that they are on private lands and do not provide through access ■ limited use of access roads for operations and maintenance ■ as per guidelines, turbines were sited away from terrain features that concentrate wildlife, particularly birds and bats ■ lighting for ground infrastructure will be reduced, down-shielded, and controlled by proximity sensors ■ post-construction mortality surveys will be conducted and additional mitigation considered, if necessary	■ wildlife mortality ■ habitat loss and fragmentation	Low Low	Not Significant
	Decommissioning	■ wildlife mortality ■ habitat loss and fragmentation ■ habitat avoidance or reduced reproductive success	■ decommissioning work will be restricted to designated work areas ■ work will be scheduled to avoid sensitive breeding periods to the extent possible ■ vehicle speeds on access roads will be limited to 30 km/h ■ decommissioning will occur as quickly as safety allows ■ decommissioning will follow best management practices for minimizing human interactions with wildlife and reducing sensory disturbance	■ habitat avoidance or reduced reproductive success	Minimal	
Air quality	Construction and decommissioning	■ changes in air quality due to emissions and dust from construction and decommissioning activities	■ stationary and mobile equipment will adhere to federal emission standards and will be regularly maintained ■ dust suppressant or water will be applied to construction areas in proximity to highways and residences to mitigate dust, as appropriate. ■ project traffic will be restricted to access roads ■ project traffic will adhere to posted speed limits on public roads ■ public road bans and reduced speed limits will be implemented on Project access roads.	■ adversely affect local air quality through combustion emissions and fugitive dust generation	Minimal	Not Significant

[a]The criteria for direction, magnitude geographic extent, duration, importance, and likelihood are described in Section 2.0.
[b]Level of Importance of residual impacts is described in Table 2.6-2.
n/a = not applicable.

7.0 CONCLUSION

The Proponent is planning to construct, operate, and decommission a 100 MW wind power project located approximately 80 km northeast of Medicine Hat, Alberta. The Project is located in an area of mainly agricultural activity. Approximately 98% of the Project Footprint is located on modified vegetation and miscellaneous land cover types including cultivation (92.0 ha; 86% of the Project Footprint), tame pasture or hay (6.9 ha; 7% of the Project Footprint), and roads/trails, farmyards, developments, and transmission lines (6.4 ha; 6% of the Project Footprint). All turbines are located in cultivation except for two which will be located within tame pasture or hay.

The Proponent retained Golder to conduct an Environmental Evaluation of the Project. This Environmental Evaluation assessed baseline environmental conditions, identified the potential environmental effects of the Project, described the mitigation measures to be implemented during Project construction, operation, and decommissioning, and assessed the predicted residual effects of the Project. The Environmental Evaluation followed a systematic approach to characterizing the Project's predicted residual effects on the environment and the significance of these effects, in the context of sustainable development objectives.

The potential effects of the Project were assessed for nine VCs. These nine VCs were selected based on their importance to the public, to scientists and/or to government agencies, and based on the experience of the Proponent and Golder with similar projects.

The effects assessment approach was based on the *Impact Assessment Act* and the AEP assessment principles and methodology, as guided by the following documents:

- *Guide to Preparing an Initial Project Description and Detailed Project Description under the Impact Assessment Act* (IAAC 2019)
- *Guide to Preparing Environmental Impact Assessment Reports in Alberta* (ESRD 2013b)

The effects assessment considered the direction, magnitude, geographic extent, and duration of potential effects, after the implementation of mitigation measures. These criteria were then used to assign a level of importance to the predicted residual effects of the Project on each VC. Overall, the importance of predicted residual effects on the VCs is predicted to be minimal to low for all VCs except wildlife mortality, which is predicted to be of medium importance because of the potential mortality of birds and bats due the risk of collision with turbines. The Proponent will address uncertainty associated with wildlife collision risk through adaptive management as outlined in its proposed Post-construction Monitoring and Mitigation Plan. The Proponent is committed to working with AEP-FWS to maintain Project effects on wildlife mortality at an acceptable level. The residual effects are not predicted to alter the sustainability of the VC beyond a manageable level and are therefore predicted to be not significant for all VCs.

Based on the information provided in this Environmental Evaluation and summarized above in Table 6.0-1, it is the professional opinion of the assessors that the Project is not likely to cause significant adverse environmental effects considering the implementation of appropriate mitigation measures. This includes adherence to the regulations, requirements and best practices identified in the Directive (AEP 2018a), the Conservation and Reclamation Directive for Renewable Energy Operations (AEP 2018b), and the Alberta Wetland Policy (GOA 2013a).

8.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

Please be aware that Golder has been acquired by and is now a Member of the WSP family of companies. Golder remains as a legal entity and is the proposed contracting entity for this proposal. We are in the process of integrating the resources of our companies. Correspondence for this proposal should continue to be addressed to the undersigned.

Golder Associates Ltd.

Brittney Sammons, B.E.S.
Project Manager

Trevor Cuthbert, M.Sc., PMP
Associate, Project Director

JS/

https://golderassociates.sharepoint.com/sites/141864/project files/6 deliverables/3000 - regulatory applications/3002 - environmental evaluation/20138679_res hilda_environmental evaluation_rev0.docx

9.0 REFERENCES

AAF (Alberta Agriculture and Forestry). 2016. Alberta Soil Information Viewer, Agricultural Region of Alberta Soil Inventory Database (AGRASID). Available at: https://soil.agric.gov.ab.ca/agrasidviewer/

ABMI (Alberta Biodiversity Monitoring Institute). 2010. Landcover map Version 1.0 obtained from ABMI (2014).

ACIMS (Alberta Conservation Information Management System). 2017a. Tracked Elements Listed by Natural Subregion. Alberta Environment and Parks, Edmonton AB [Datafile]. [accessed January 2021]. https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/download-data/#trackedWatch

ACIMS. 2017b. ACIMS Data Request Search. Alberta Environment and Parks. [accessed June 2018] https://albertaparks.ca/acims-data/.

ACIMS. 2018a. ACIMS List of Elements in Alberta – Vascular Plants. [accessed January 2021] https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/download-data/#trackedWatch.

ACIMS. 2018b. Species Conservation Ranks. Alberta Environment and Parks, Edmonton AB. [accessed January 2021] http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation

Adams, A.M., M.K. Jantzen, R.M. Hamilton and M.B. Fenton. 2012. Do you hear what I hear? Implications of detector selection for acoustic monitoring of bats. Methods in Ecology and Evolution 3: 992-998.

AEP (Alberta Environment and Parks). 2014. Environmentally Significant Areas Report. [updated 2014; accessed January 2021]. https://www.albertaparks.ca/albertaparksca/library/environmentally-significant-areas-report/

AEP. 2015. The General Status of Alberta Wild Species 2015. Alberta Environment and Sustainable Resource Development. Fish and Wildlife Service. [updated March 1, 2017]. Available at: http://esrd.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx.

AEP. 2016. Forest & Vegetation Inventories: Grassland Vegetation Inventory Geometry (Polygons, Lines, Points). [accessed June 2019]. https://www.alberta.ca/forest-and-vegetation-inventories-data.aspx.

AEP 2017. Environmental Site Assessment Repository (ESAR). [accessed 6 May 2021]. http://www.esar.alberta.ca/esarmain.aspx.

AEP. 2018a. Wildlife Directive for Alberta Wind Energy Projects. Wildlife 2016 No. 6. January 2017; September 17, 2018.

AEP. 2018b. Conservation and Reclamation Directive for Renewable Energy Operations. Land Policy 2018 No.4. September 14, 2018.

AEP. 2018c. Alberta Merged Wetland Inventory. Obtained from Alberta Environment and Parks (AEP). Informatics branch.

AEP. 2019. Alberta Ambient Air Quality Objectives and Guidelines Summary. February 1, 2019. [accessed May 2021]. https://open.alberta.ca/dataset/0d2ad470-117e-410f-ba4f-aa352cb02d4d/resource/4ddd8097-6787-43f3-bb4a-908e20f5e8f1/download/aaqo-summary-jan2019.pdf.

AEP. 2020a. Bird Migration Survey Protocol. January 2020 updated in June 2020. [accessed January 2021]. Available at: https://open.alberta.ca/publications/bird-migration-survey-protocol.

AEP. 2020b. Post Construction Survey Protocols for Wind and Solar Energy Projects. Contracted to: Stantec Consulting Ltd. January 2020. Accessed: September 28, 2020.

AEP. 2021a. Groundwater Well data downloaded on February 4, 2021; [accessed 4 February 2021]. http://groundwater.alberta.ca/WaterWells/d/.

AEP. 2021b. Fish and Wildlife Internet Mapping Tool. [accessed 6 May 2021]. https://maps.alberta.ca/FWIMT_Pub/Viewer/?TermsOfUseRequired=true&Viewer=FWIMT_Pub.

AEP. 2021. Wildlife Sensitivity Maps. [accessed January 2021] https://www.alberta.ca/wildlife-sensitivity-maps.aspx

Alberta Transportation (AT). 2001. Fish Habitat Manual – Guidelines and Procedures for Watercourse Crossings in Alberta. October) 2001. [revised August 2009; accessed May 2021] http://www.transportation.alberta.ca/2644.htm.

Alberta Water Council. 2019. 2019 Annual Report. [accessed 6 May 2021]; https://www.awchome.ca/uploads/source/25484_AWC-19-ARreport-compressed_compressed.pdf.

Allen, L. 2014. Alberta Conservation Information Management System ecological community tracking list. Alberta Tourism, Parks and Recreation. Edmonton AB.

ANPC (Alberta Native Plant Council). 2012. ANPC Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update. Alberta Native Plant Council. Edmonton AB. [accessed January 2021] http://anpc.ab.ca/wp-content/uploads/2015/01/Guidelines-For-Rare-Plant-Surveys-in-AB-2012-Update.pdf

APLIC (Avian Power Line Interaction Committee). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC, Washington D.C.

Arnett EB, Baerwald EF, Mathews F, Rodrigues L, Rodriguiez-Duran A, Rydell J, Villegas-Patraca, R, Voigt CC. 2016. Impacts of Wind Energy Development on Bats: A Global Perspective. In: Voigt C., Kingston T. (eds) Bats in the Anthropocene: Conservation of Bats in a Changing World. Springer, Cham

ASIC (Alberta Soil Information Centre). 2016. Alberta Soil Names File (Generation 4) User's Handbook. M.D. Bock (ed.). Agriculture and Agri-Food Canada, Science and Technology Branch, Edmonton, AB. p.166

AUC (Alberta Utilities Commission). 2019. Rule 007: Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments. August 1, 2019.

Baerwald EF, Barclay RMR. 2009. Geographic Variation in Activity and Fatality of Migratory Bats at Wind Energy Facilities. Journal of Mammalogy. 90:1341-1349.

Bennett VJ, Hale AM. 2018. Resource Availability May Not Be a Useful Predictor of Migratory Bat Fatalities or Activity at Wind Turbines. Diversity, 10(2), 44: https://doi.org/10.3390/d10020044.

Bernath-Plaisted, J, Koper N. 2016. Physical Footprint of Oil and Gas Infrastructure, not Anthropogenic Noise, Reduces Nesting Success of some Grassland Songbirds. Biological Conservation. [accessed August 2019] http://www.sciencedirect.com/science/article/pii/S0006320716307315

Brown MB, Brown CR. 2019. Barn Swallow (*Hirundo rustica*), version 2.0 In The Birds of North America (P.G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. [accessed August 2019]. https://doi.org/10.2173/bna.barswa.02.

Coote DR, Pettapiece WW. 1989. Wind Erosion Risk, Alberta. Agriculture Canada publication 5255/B. p.12, tables, maps.

Dahlgren RB, Korschgen CE. 1992. Human Disturbances of Waterfowl: An Annotated Bibliography. Fish and Wildlife Service, US Department of Interior. D.C. Resource Publishers. Washington, DC.

DFO (Fisheries and Oceans Canada). 2019. Measures to Protect Fish and Fish Habitat. [accessed May 2021] https://dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html

ECCC (Environment and Climate Change Canada). 2018. General Nesting Periods of Migratory Birds in Canada. [accessed January 2021] https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html

ECCC. 2020. 1981-2010 Climate Normals & Averages. [accessed January 2021] https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=schuler&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=2138&dispBack=1.

Ekstrom J, Bennum L, and Mitchell R. 2015. A Cross-sector Guide for Implementing the Mitigation Hierarchy. Prepared by: The Biodiversity Consultancy. Prepared for: Cross Sector Biodiversity Initiative. p. 83 and appendices.

ESAR (Alberta Environmental Site Assessment Repository). 2017. Environmental Site Assessment Repository – Land. Alberta Environment and Parks. [accessed 5 May 2021] http://www.esar.alberta.ca/esarmain.aspx

ESRD (Alberta Environment and Sustainable Resource Development). 2013a. Bat Mitigation Framework for Wind Power Development – June 19, 2013. Alberta Environment Sustainable Resource Development. Edmonton, AB.

ESRD. 2013b. A Guide to Preparing Environmental Impact Assessment Reports in Alberta. [updated March 2017; accessed March 2017] https://open.alberta.ca/publications/4903114

ESRD. 2013c. Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body. *Water Act* - Water (Ministerial) Regulation. Alberta Queen's Printer. June 2013. Edmonton, AB. p. 36-37.

ESRD. 2013d. Sensitive Species Inventory Guidelines April 2013. Government of Alberta, ESRD – Wildlife Management. 128 p. [accessed 15 January 2021]. https://open.alberta.ca/dataset/93d8a251-4a9a-428f-ad99-7484c6ebabe0/resource/f4024e81-b835-4a50-8fb1-5b31d9726b84/download/2013-sensitivespeciesinventoryguidelines-apr18.pdf.

ESRI (ESRI World Imagery). 2015. Southern Alberta Partnership 2015, 0.5 m resolution imagery. Taken 2015-0115.

Fahrig L. 1997. Relative Effects of Habitat Loss and Fragmentation on Population Extinction. The Journal of Wildlife Management, 61: 603-610.

FEARO (Federal Environmental Assessment Review Office). 1994. A Reference Guide for the Canadian Environmental Assessment Act: Addressing Cumulative Environmental Effects. November 1994. p. 24.

Fenton MM, Waters EJ, Pawley SM, Atkinson N, Utting DJ, and McKay K. 2013. Surficial Geology of Alberta; Alberta Energy Regulator, AER/AGS Map 601, scale 1:1 000 000.

Fiera (Fiera Biological Consulting). 2014. Environmentally Significant Areas Provincial Update 2014. Edmonton, AB.

Frick WF, Baerwald EF, Pollock JF, Barclay RMR, Szymanski JA, Weller TG, Russell AL, Loeb SC, Medellin RA and McGuire LP. 2017. Fatalities at Wind Turbines May Threaten Population Viability of a Migratory Bat. Biological Conservation, 209: 172-177.

Gates JE, Gysel LW. 1978. Avian Nest Dispersion and Fledgling Success in Field-forest Ecotones. Ecology 59: 871-883.

Geiger KW. 1968. Bedrock Topography of the Gleichen Map Area, Alberta; Research Council of Alberta, RCA/AGS Earth Sciences Report 1967-02, p. 19.

GOA (Government of Alberta). 2000a. *Water Act*, Revised Statutes of Alberta 2000 Chapter W-3. Current as of December 17, 2014.

GOA. 2000b. *Environmental Protection and Enhancement Act,* Revised Statues of Alberta 2000 Chapter E-12. Current as of July 23, 2020.

GOA. 2006. Approved Water Management Plan for the South Saskatchewan River Basin. August 1, 2006. p. 45.

GOA. 2013a. Alberta Wetland Policy. [accessed September 2019] https://open.alberta.ca/publications/9781460112878.

GOA. 2013b. Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body. Water Act and the Water (Ministerial) Regulation. Alberta Queen's Printer. [accessed May 2021]. https://open.alberta.ca/publications/pipeline.

GOA. 2015. Alberta Wetland Classification System. Water Policy Branch, Policy and Planning Division, Edmonton AB.

GOA. 2017a. *Weed Control Act and Regulations.* [accessed August 2019] https://open.alberta.ca/publications/w05p1.

GOA. 2017b. Alberta Wetland Assessment and Impact Report Directive. Water Policy Branch, Alberta Environment and Parks, Edmonton, Alberta.

GOA. 2018a. South Saskatchewan Regional Plan. 2014 – 2024. An Alberta Land-use Framework Integrated Plan. Amended May 2018. 213 p.GOA. 2018b. Alberta Wetland Mitigation Directive. Water Policy Branch, Alberta Environment and Parks. Edmonton, Alberta.

GOA. 2018c. *Wildlife Act*, Revised Statutes of Alberta, 2000, Chapter W-10, current as of February 20, 2018. Alberta Queen's Printer. Edmonton AB. p. 72.

GOA. 2019a. Alberta Ambient Air Quality Objectives and Guidelines Summary. ISBN 978-1-4601-2861-9. [updated January 2019; accessed January 2021] https://open.alberta.ca/publications/9781460134856.

GOA. 2019b. Alberta Wetland Replacement Fact Sheet. [accessed August 2019].https://open.alberta.ca/publications/alberta-wetland-replacement-fact-sheet#summary.

GOA 2019c. Code of Practice for Watercourse Crossings. Water Act - Water (Ministerial) Regulation. Alberta Queen's Printer. March 2019. Edmonton, AB.

GOA. 2020a. AltaLIS 1:20,000. https://www.altalis.com/.

GOA. 2021a. White-nose Syndrome. [accessed 27 January 2021]. https://www.alberta.ca/white-nose-syndrome.aspx.

GOA. 2021b. Master Schedule of Standards and Conditions [accessed 28 January 2021]. https://open.alberta.ca/dataset/133e9297-430a-4f29-b5d9-4fea3e0a30c2/resource/fe3a031f-06c0-45a1-8277-a0817760b528/download/aep-master-schedule-of-standards-and-conditions-2021.pdf.

Godfrey WE. 1986. The Birds of Canada. National Museum of Canada. p. 595.

Government of Canada. 2020. Species at Risk Public Registry. [accessed January 2021] http://www.registrelep-sararegistry.gc.ca/sar/index/default_e.cfm.

Habib L, Bayne EM, Boutin S. 2007. Chronic Industrial Noise Affects Pairing Success and Age Structure of Ovenbirds Seirus Aurocapilla. Journal of Applied Ecology 44: 176-184.

Hein CD, Gruver J, Arnett EB. 2013. Relating pre-construction bat activity and post-construction bat fatality to predict risk at wind energy facilities: a synthesis. A report submitted to the National Renewable Energy Laboratory. Bat Conservation International, Austin, TX, USA.

Henry L, Harron B, Flaten D. 1992. The Nature and Management of Salt-affected Land in Saskatchewan. Saskatchewan Agriculture.

Hydrogeological Consultants Ltd. (2001). Cypress County Regional Groundwater Assessment. Prepared for Cypress County in conjunction with Agriculture and Agri-Food Canada, Prairie Farm Rehabilitation Administration.

IAAC (Impact Assessment Agency of Canada). 2019. Guide to Preparing an Initial Project Description and Detailed Project Description under the Impact Assessment Act. https://www.canada.ca/en/impact-assessment-agency.html?utm_campaign=not-applicable&utm_medium=vanity-url&utm_source=canada-ca_iaac.

IBA (Important Bird Areas). 2020. Important Bird Areas. [accessed January 2021]. http://www.ibacanada.com/explore_how.jsp?lang=en.

Jalkotzy MG, Ross PI, Nasserden MD. 1997. The Effects of Linear Developments on Wildlife: a Review of Selected Scientific Literature. Prepared for the Canadian Association of Petroleum Producers. Prepared by Arc Wildlife Services Ltd., Calgary.

Johnson RG, Temple SA. 1990. Nest Predation and Brood Parasitism of Tallgrass Prairie Birds. Journal of Wildlife Management, 54: 106-111.

Kemper JT. 2009. Alberta Natural Heritage Information Centre Vascular and Non-Vascular Plant Tracking and Watch Lists. Alberta Tourism, Parks and Recreation, Parks Division. Edmonton, AB. p. 30.

Lewis T, Carr WW, and Timber Harvesting Subcommittee. 1989. Developing timber harvesting prescriptions to minimize site degradation - Interior sites. B.C. Min. For., Victoria, B.C. Fieldguide insert.

MBCA (*Migratory Birds Convention Act*). 1994. S.C. 1994, c. 22. Government of Canada.

Miller JJ, Brierley JA. 2010. Solonetzic Soils of Canada: Genesis, Distribution, and Classification. p. 14. [accessed May 2021] http://www.nrcresearchpress.com/doi/pdf/10.4141/cjss10040.

NRC (Natural Regions Committee). 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852. [accessed January 2021] www.albertaparks.ca/media/2942026/nrsrcomplete_may_06.pdf.

PAS (Palliser Airshed Society). 2019. A Year in the Palliser Airshed: 2019 Annual Report. [accessed January 2021] https://palliserairshed.com/wp-content/uploads/2019-PAS-Annual-Board-Report.pdf.

Pawlowicz JG, Fenton MM. 1995. Drift Thickness of Alberta. Alberta Energy Regulator and Alberta Geological Survey Map 227, scale 1:2,000,000.

Pettapiece WW. 1986. Physiographic Subdivisions of Alberta. Land Resource Research Centre, Research Branch, Agriculture Canada, Ottawa. Information Available at: http://www.worldcat.org/title/physiographic-subdivisions-of-alberta-11500000/oclc/18380711#borrow

Pedocan (Pedocan Land Evaluation Ltd.) 1993. Soil Series Information for Reclamation Planning in Alberta. Alberta Conservation and Reclamation Council Report No. RRTAC 93-7. ISBN 0-7732-6041-2.

Power Line Sentry. 2019. [accessed January 2021]. https://powerlinesentry.com/wp-content/uploads/2018/03/line-markers-for-guy-wires.pdf.

Prior GJ, Hatway B, Glombick PM, Panẽ DI, Banks CJ, Hay DC, Schneider CI, Grobe M, Elgr R, Weiss JA. 2013. Bedrock Geology of Alberta; Alberta Energy Regulator, AER/AGS Map 600, scale 1:1 000 000.

Reed DH, O'Grady JJ, Brook BW, Ballou JD, Frankham R. 2003. Estimates of Minimum Viable Population Sizes for Vertebrates and Factors Influencing those Estimates. Biological Conservation 113: 23-34.

Richards LA. 1954. Diagnosis and Improvement of Saline and Alkaline Soils. United States Salinity Laboratory Staff. Agricultural Handbook No 60. United States Depart of Agriculture, p. 160.

Shetsen I. 1987. Quaternary Geology, Southern Alberta. Alberta Research Council, Map 207, scale 1:500,000.

Sparks DL. 2003. Environmental Soil Chemistry. Second Edition. Elsevier Science (USA).

SQCWG (Soil Quality Criteria Working Group). 1987. Soil Quality Criteria Relative to Disturbance and Reclamation (Revised). Alberta Soils Advisory Committee, Alberta Agriculture.

Statistics Canada. 2021. Census Profile, 2016 Census. [modified 26 April 2021; accessed 5 May 2021]. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E.

Stewart RE, Kantrud, HA. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Resource Publication 92, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. [accessed March 2017] http://www.npwrc.usgs.gov/resource/wetlands/pondlake/index.htm

Swift TL, Hannon SJ. 2010. Critical Thresholds Associated with Habitat Loss: A Review of the Concepts, Evidence, and Applications. Biological Reviews 85:35-53.

Trombulak SC, Frissell CA. 2000. A Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology 14: 18-30.

With KA. 2020. McCown's Longspur (*Rhynchophanes mccownii*), version 1.0 In Birds of the World (A.F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. [accessed January 2021] https://doi.org/10.2173/bow.mcclon.01.

Yarmoloy C, Bayer M, Geist V. 1988. Behaviour Responses and Reproduction of Mule Deer, Odocoileus hemionus, Does Following Experimental Harassment with an All-Terrain Vehicle. Canadian Field-Naturalist. 102(3):425-429

9.1 Personal Communication

Harder J. 2021. GIS Technician, Canadian Wildlife Service, Environment and Climate Change Canada. SARA designated critical habitat in Project Footprint. Email to Sparrow J, Ecologist, Golder Associates Ltd. 8 January 2021.

APPENDIX A

Project Study Area Wetlands and Land Cover Mapping

556000
558000
560400
560000
5604000
5602000
5600000
TWP 19
TWP 18
RGE 2 W4M
RGE 1 W4M
RANGE ROAD 23
RANGE ROAD 21
RANGE ROAD 20
1
2
3
25
26
27
34
35
36
T6
T7
Crossing NG-1
Crossing NG-2
Crossing NG-3

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- LOCAL ROAD

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
- SMALL-FLOWERED SAND VERBENA
- TINY CRYPTANTHE

LAND COVER[3]

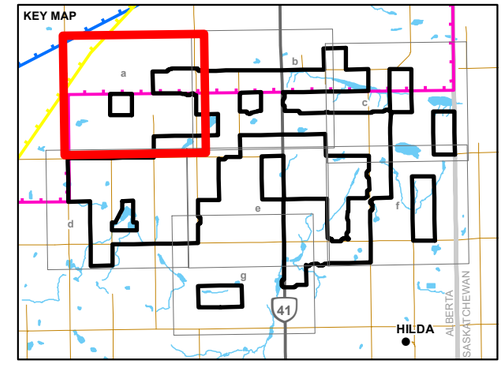
- CULTIVATED
- FARM YARD
- NATIVE GRASSLAND
- TAME PASTURE OR HAY
- DISTURBED[4]

- RARE PLANT SURVEY - 2018
- RARE PLANT SURVEY - 2020 EARLY SEASON
- RARE PLANT SURVEY - 2020 LATE SEASON
- ANTHROPOGENIC WATER BODY/MODIFIED NATURAL WETLAND
- DESKTOP WETLAND/ WATER BODY
- NATIVE GRASSLAND CROSSING (*NG-#*)

WETLAND AND WATER BODY PERMANENCE

- EPHEMERAL (CLASS I) WATER BODY
- TEMPORARY (CLASS II) WETLAND
- SEASONAL (CLASS III) WETLAND
- SEMI-PERMANENT (CLASS IV) WETLAND
- PERMANENT (CLASS V) WETLAND
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



0 400 800

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NOTE(S)

1. ***(10 m)*** = DISTANCE TO CLOSEST PROJECT INFRASTRUCTURE FOR IMPACTED WETLANDS.
2. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.
3. LAND COVER TYPES MAY BE DESKTOP OR FIELD-VERIFIED.
4. DISTURBED LAND COVER MAY INCLUDE ROADS, TRAILS, TRANSMISSION LINES, RAILWAYS, AND DEVELOPED AREAS.

REFERENCE(S)

PROJECT FOOTPRINT COMPONENTS DATA OBTAINED FROM RES, DECEMBER 2020.

PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
WETLANDS AND LAND COVER

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JS
PREPARED	LMS
REVIEWED	BS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
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25mm
0

562000
564000
5640000
5626000
5600000
TWP 19
TWP 18
RGE 2 W4M
RGE 1 W4M
6
5
4
31
32
33
30
29
28
TOWNSHIP ROAD 190
RANGE ROAD 20
RANGE ROAD 15
RANGE ROAD 13
41
Crossing NG-2
Crossing NG-3
Crossing NG-1
T5
T8
T9
T10
T11
5719 (91 m)
5758 (71 m)
5764 (0 m)

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- PRIMARY HIGHWAY
- LOCAL ROAD
- EXISTING ALTALINK 138 KV TRANSMISSION LINE

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
- SMALL-FLOWERED SAND VERBENA
- TINY CRYPTANTHE

LAND COVER[3]

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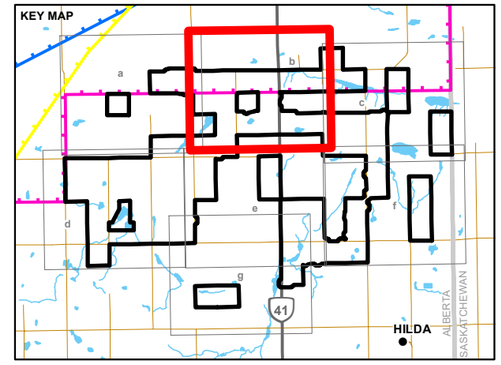
- SEASONAL (CLASS III) WETLAND
- SEMI-PERMANENT (CLASS IV) WETLAND
- PERMANENT (CLASS V) WETLAND
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



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APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	A-2

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566000 568000 570000

TWP 19

TOWNSHIP ROAD 190

RANGE ROAD 13

RANGE ROAD 12

RANGE ROAD 11

3 2 1 06

34 35 36 31

27 26 25 30

T11 T12 T13

601 (0 m)

ALBERTA SASKATCHEWAN

5602000

5600000

TWP 18

RGE 1 W4M

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- LOCAL ROAD

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
- SMALL-FLOWERED SAND VERBENA
- TINY CRYPTANTHE

LAND COVER[3]

- CULTIVATED
- FARM YARD
- NATIVE GRASSLAND
- TAME PASTURE OR HAY
- DISTURBED[4]

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- RARE PLANT SURVEY - 2020 LATE SEASON
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- SEASONAL (CLASS III) WETLAND
- SEMI-PERMANENT (CLASS IV) WETLAND
- PERMANENT (CLASS V) WETLAND
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP

a b c d e f g

41

HILDA

ALBERTA SASKATCHEWAN

0 400 800

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NOTE(S)

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GOLDER
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APPROVED	TC

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25mm

0

556000
558000
560000
559 8000
TOWNSHIP ROAD 184
TOWNSHIP ROAD 182
RANGE ROAD 23
RANGE ROAD 22
RANGE ROAD 21
TWP 18
RGE 2 W4M
21
22
23
24
16
15
14
13
9
10
11
12
T1
T2
T3
457
(0 m)

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- LOCAL ROAD
- EXISTING ALTALINK 138 KV TRANSMISSION LINE

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
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- TINY CRYPTANTHE

LAND COVER[3]

- CULTIVATED
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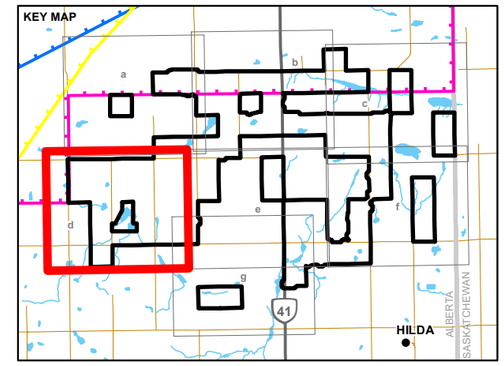
- SEMI-PERMANENT (CLASS IV) WETLAND
- PERMANENT (CLASS V) WETLAND
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



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YYYY-MM-DD	2021-05-27
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PREPARED	LMS
REVIEWED	BS
APPROVED	TC

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25mm

0

562000
564000
5598000
5596000
TWP 18
RANGE ROAD 15
RANGE ROAD 20
TOWNSHIP ROAD 184
TOWNSHIP ROAD 182
41
T3
T4
T5
T19
456 (0 m)
6550 (0 m)
19
20
21
18
17
16
7
8
9
RGE 2 W4M
RGE 1 W4M

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

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- PRIMARY HIGHWAY
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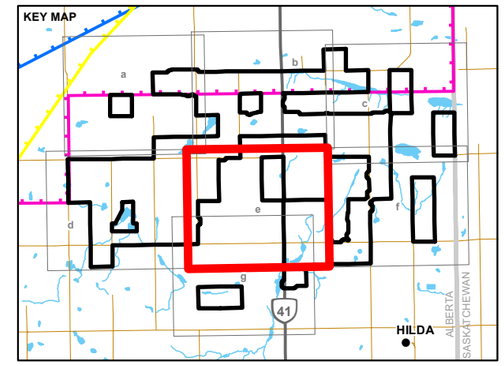
- PERMANENT (CLASS V) WETLAND
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



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PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	A-5

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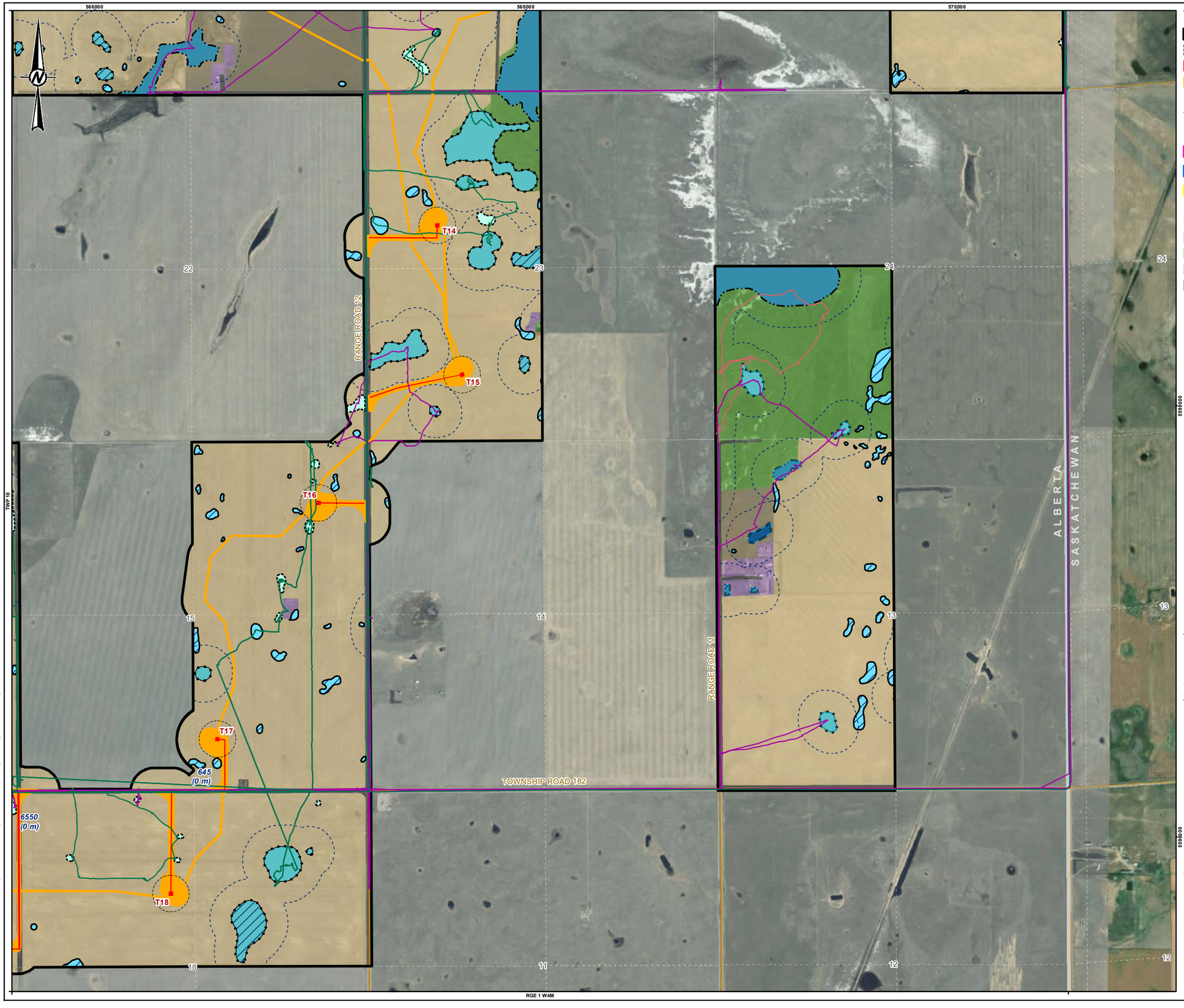

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
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- CONSTRUCTION FOOTPRINT

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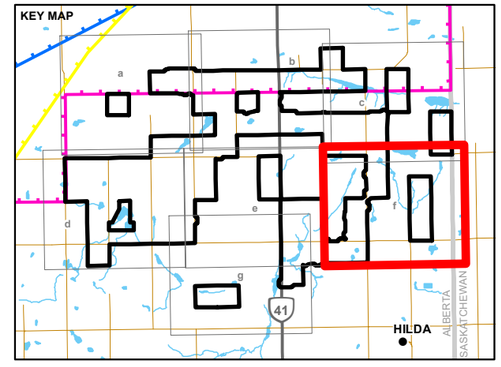

0 400 800

1:17,500 METRES

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YYYY-MM-DD	2021-05-27
DESIGNED	JS
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PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	A-6

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562000
564000
5596000
5594000
TWP 18
TWP 17
RGE 2 W4M
RGE 1 W4M
RANGE ROAD 20
TOWNSHIP ROAD 182
TOWNSHIP ROAD 180
T1
T20
457 (0 m)
456 (0 m)
6081 (87 m)
41
HILDA
ALBERTA
SASKATCHEWAN

LEGEND

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KEY MAP

0 400 800
1:17,500 METRES

NOTE(S)

1. *(10 m)* = DISTANCE TO CLOSEST PROJECT INFRASTRUCTURE FOR IMPACTED WETLANDS.
2. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.
3. LAND COVER TYPES MAY BE DESKTOP OR FIELD-VERIFIED.
4. DISTURBED LAND COVER MAY INCLUDE ROADS, TRAILS, TRANSMISSION LINES, RAILWAYS, AND DEVELOPED AREAS.

REFERENCE(S)

PROJECT FOOTPRINT COMPONENTS DATA OBTAINED FROM RES, DECEMBER 2020.

PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
WETLANDS AND LAND COVER

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JS
PREPARED	LMS
REVIEWED	BS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	3000	0	A-7

APPENDIX B

Detailed Soil Map Unit Polygon Data

Table 1: Soil Map Units within the Project Study Area and Project Footprint

POLY_ID	Map Unit Name	Landform	Landform Position	Extent (%)	Slope (%)	Slope Length (m)	Soil Code	Soil Series	Soil Subgroup	Drainage	Parent Material Texture	Parent Material Code
Project Study Area												
3894	BVL1/U1h	U1h - undulating - high relief	M - Mid slope	80	4	225	BVL	BINGVILLE	O.BC - Orthic Brown Chernozem	W - Well	MC - Moderately coarse textured: sandy loam and fine sandy loam	C3 - Moderately coarse (SL, FSL) sediments deposited by wind or water
3894	BVL1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	ANO	ANTONIO	O.BC - Orthic Brown Chernozem	W - Well	MC - Moderately coarse textured: sandy loam and fine sandy loam	L2 - Coarse textured (S, LS, SL) over medium or fine textured till
3896	BVL4/U1h	U1h - undulating - high relief	M - Mid slope	60	4	165	BVL	BINGVILLE	O.BC - Orthic Brown Chernozem	W - Well	MC - Moderately coarse textured: sandy loam and fine sandy loam	C3 - Moderately coarse (SL, FSL) sediments deposited by wind or water
3896	BVL4/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	ZERzbr	MISC.ERODED	R.BC - Rego Brown Chernozem	W - Well	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
3896	BVL4/U1h	U1h - undulating - high relief	M - Mid slope	20	4	175	ANO	ANTONIO	O.BC - Orthic Brown Chernozem	W - Well	MC - Moderately coarse textured: sandy loam and fine sandy loam	L2 - Coarse textured (S, LS, SL) over medium or fine textured till
3912	CVVS1/D1l	D1l - longitudinal dune - low relief	M - Mid slope	50	6	150	CVD	CAVENDISH	O.BC - Orthic Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3912	CVVS1/D1l	D1l - longitudinal dune - low relief	M - Mid slope	50	6	150	VST	VENDISANT	R.BC - Rego Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3920	CVVS1/D1l	D1l - longitudinal dune - low relief	M - Mid slope	50	6	150	CVD	CAVENDISH	O.BC - Orthic Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3920	CVVS1/D1l	D1l - longitudinal dune - low relief	M - Mid slope	50	6	150	VST	VENDISANT	R.BC - Rego Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3921	CVVS1/D1l	D1l - longitudinal dune - low relief	M - Mid slope	50	6	150	CVD	CAVENDISH	O.BC - Orthic Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3921	CVVS1/D1l	D1l - longitudinal dune - low relief	M - Mid slope	50	6	150	VST	VENDISANT	R.BC - Rego Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3928	CVVS5/D1m	D1m - longitudinal dune - medium relief	U - Upper slope	35	9	240	VST	VENDISANT	R.BC - Rego Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3928	CVVS5/D1m	D1m - longitudinal dune - medium relief	M - Mid slope	35	9	180	CVD	CAVENDISH	O.BC - Orthic Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3928	CVVS5/D1m	D1m - longitudinal dune - medium relief	M - Mid slope	15	9	180	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
3928	CVVS5/D1m	D1m - longitudinal dune - medium relief	L - Lower slope	15	7	45	PLS	PURPLE SPRINGS	O.BC - Orthic Brown Chernozem	W - Well	VC - Very coarse textured: sand and loamy sand	L2 - Coarse textured (S, LS, SL) over medium or fine textured till
4163	CFCH2/I3l	I3l - inclined to steep - low relief	M - Mid slope	40	9	250	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4163	CFCH2/I3l	I3l - inclined to steep - low relief	M - Mid slope	40	9	200	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4163	CFCH2/I3l	I3l - inclined to steep - low relief	L - Lower slope	20	7	50	ZGW	MISC.GLEYSOL	O.HG - Orthic Humic Gleysol	P - Poorly	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
4164	CFFM1/H1l	H1l - hummocky - low relief	U - Upper slope	50	6	105	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4164	CFFM1/H1l	H1l - hummocky - low relief	M - Mid slope	50	6	90	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4172	CFCH3/U1h	U1h - undulating - high relief	M - Mid slope	40	4	115	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4172	CFCH3/U1h	U1h - undulating - high relief	U - Upper slope	30	4	175	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4172	CFCH3/U1h	U1h - undulating - high relief	L - Lower slope	30	3	50	LYB	LILYBROWN	GL.BC - Gleyed Brown Chernozem	I - Imperfectly	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4173	CFD1/U1h	U1h - undulating - high relief	M - Mid slope	60	4	225	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4173	CFD1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4173	CFD1/U1h	U1h - undulating - high relief	L - Lower slope	20	3	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4174	CFD1/U1h	U1h - undulating - high relief	M - Mid slope	60	4	225	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4174	CFD1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)

Table 1: Soil Map Units within the Project Study Area and Project Footprint

POLY_ID	Map Unit Name	Landform	Landform Position	Extent (%)	Slope (%)	Slope Length (m)	Soil Code	Soil Series	Soil Subgroup	Drainage	Parent Material Texture	Parent Material Code
4174	CFD1/U1h	U1h - undulating - high relief	L - Lower slope	20	3	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4175	CFD1/U1h	U1h - undulating - high relief	M - Mid slope	60	4	225	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4175	CFD1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4175	CFD1/U1h	U1h - undulating - high relief	L - Lower slope	20	3	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4176	CFD1/U1h	U1h - undulating - high relief	M - Mid slope	60	4	225	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4176	CFD1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4176	CFD1/U1h	U1h - undulating - high relief	L - Lower slope	20	3	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4177	CFD1/U1h	U1h - undulating - high relief	M - Mid slope	60	4	225	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4177	CFD1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4177	CFD1/U1h	U1h - undulating - high relief	L - Lower slope	20	3	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4180	CFFM4/H1l	H1l - hummocky - low relief	M - Mid slope	40	6	105	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4180	CFFM4/H1l	H1l - hummocky - low relief	L - Lower slope	40	4	90	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4180	CFFM4/H1l	H1l - hummocky - low relief	U - Upper slope	20	6	45	ZER	MISC.ERODED	R.BC - Rego Brown Chernozem	W - Well	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
4181	CFFM4/U1h	U1h - undulating - high relief	M - Mid slope	40	4	175	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4181	CFFM4/U1h	U1h - undulating - high relief	L - Lower slope	40	3	165	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4181	CFFM4/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	ZERzbr	MISC.ERODED	R.BC - Rego Brown Chernozem	W - Well	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
4182	CHN1/U1l	U1l - undulating - low relief	M - Mid slope	100	2	210	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4183	CHN1/U1l	U1l - undulating - low relief	M - Mid slope	100	2	210	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4184	FMT1/H1l	H1l - hummocky - low relief	M - Mid slope	100	6	135	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4189	FMT4/H1l	H1l - hummocky - low relief	M - Mid slope	80	6	135	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4189	FMT4/H1l	H1l - hummocky - low relief	U - Upper slope	20	6	45	ZERzbr	MISC.ERODED	R.BC - Rego Brown Chernozem	W - Well	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
4190	FMT4/H1l	H1l - hummocky - low relief	M - Mid slope	80	6	135	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4190	FMT4/H1l	H1l - hummocky - low relief	U - Upper slope	20	6	45	ZER	MISC.ERODED	R.BC - Rego Brown Chernozem	W - Well	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
4191	FMT4/H1m	H1m - hummocky - medium relief	M - Mid slope	80	9	135	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4191	FMT4/H1m	H1m - hummocky - medium relief	U - Upper slope	20	9	50	ZER	MISC.ERODED	R.BC - Rego Brown Chernozem	W - Well	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
4192	LYB1/U1l	U1l - undulating - low relief	M - Mid slope	80	2	160	LYB	LILYBROWN	GL.BC - Gleyed Brown Chernozem	I - Imperfectly	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4192	LYB1/U1l	U1l - undulating - low relief	U - Upper slope	20	2	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4193	LYB1/U1l	U1l - undulating - low relief	M - Mid slope	80	2	160	LYB	LILYBROWN	GL.BC - Gleyed Brown Chernozem	I - Imperfectly	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water

Table 1: Soil Map Units within the Project Study Area and Project Footprint

POLY_ID	Map Unit Name	Landform	Landform Position	Extent (%)	Slope (%)	Slope Length (m)	Soil Code	Soil Series	Soil Subgroup	Drainage	Parent Material Texture	Parent Material Code
4193	LYB1/U1l	U1l - undulating - low relief	U - Upper slope	20	2	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4194	LYB1/U1l	U1l - undulating - low relief	M - Mid slope	80	2	160	LYB	LILYBROWN	GL.BC - Gleyed Brown Chernozem	I - Imperfectly	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4194	LYB1/U1l	U1l - undulating - low relief	U - Upper slope	20	2	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4195	LYB2/U1hn	U1h - undulating - high relief	D - Depression	20	1	25	ZGW	MISC.GLEYSOL	O.HG - Orthic Humic Gleysol	P - Poorly	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
Construction Project Footprint												
3894	BVL1/U1h	U1h - undulating - high relief	M - Mid slope	80	4	225	BVL	BINGVILLE	O.BC - Orthic Brown Chernozem	W - Well	MC - Moderately coarse textured: sandy loam and fine sandy loam	C3 - Moderately coarse (SL, FSL) sediments deposited by wind or water
3894	BVL1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	ANO	ANTONIO	O.BC - Orthic Brown Chernozem	W - Well	MC - Moderately coarse textured: sandy loam and fine sandy loam	L2 - Coarse textured (S, LS, SL) over medium or fine textured till
3921	CVVS1/D1l	D1l - longitudinal dune - low relief	M - Mid slope	50	6	150	CVD	CAVENDISH	O.BC - Orthic Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
3921	CVVS1/D1l	D1l - longitudinal dune - low relief	M - Mid slope	50	6	150	VST	VENDISANT	R.BC - Rego Brown Chernozem	R - Rapidly	VC - Very coarse textured: sand and loamy sand	C2 - Very coarse (S, LS) sediments deposited by wind or water
4164	CFFM1/H1l	H1l - hummocky - low relief	U - Upper slope	50	6	105	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4164	CFFM1/H1l	H1l - hummocky - low relief	M - Mid slope	50	6	90	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4166	FMT1/H1m	H1m - hummocky - medium relief	M - Mid slope	100	9	135	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4172	CFCH3/U1h	U1h - undulating - high relief	M - Mid slope	40	4	115	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4172	CFCH3/U1h	U1h - undulating - high relief	U - Upper slope	30	4	175	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4172	CFCH3/U1h	U1h - undulating - high relief	L - Lower slope	30	3	50	LYB	LILYBROWN	GL.BC - Gleyed Brown Chernozem	I - Imperfectly	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4175	CFD1/U1h	U1h - undulating - high relief	M - Mid slope	60	4	225	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4175	CFD1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4175	CFD1/U1h	U1h - undulating - high relief	L - Lower slope	20	3	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4177	CFD1/U1h	U1h - undulating - high relief	M - Mid slope	60	4	225	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4177	CFD1/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4177	CFD1/U1h	U1h - undulating - high relief	L - Lower slope	20	3	50	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4181	CFFM4/U1h	U1h - undulating - high relief	M - Mid slope	40	4	175	FMT	FOREMOST	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M4 - Medium textured (L to CL) till (Till name)
4181	CFFM4/U1h	U1h - undulating - high relief	L - Lower slope	40	3	165	CFD	CRANFORD	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	L3 - Medium textured (VFSL, L, SiCL, CL) over medium or fine textured till
4181	CFFM4/U1h	U1h - undulating - high relief	U - Upper slope	20	4	60	ZERzbr	MISC.ERODED	R.BC - Rego Brown Chernozem	W - Well	VT - Variable Texture (not differentiated)	U0 - Undifferentiated
4182	CHN1/U1l	U1l - undulating - low relief	M - Mid slope	100	2	210	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4183	CHN1/U1l	U1l - undulating - low relief	M - Mid slope	100	2	210	CHN	CHIN	O.BC - Orthic Brown Chernozem	W - Well	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water
4193	LYB1/U1l	U1l - undulating - low relief	M - Mid slope	80	2	160	LYB	LILYBROWN	GL.BC - Gleyed Brown Chernozem	I - Imperfectly	ME - Medium textured: loam, silt loam and very fine sandy loam	M2 - Medium textured (L, VFSL) sediments deposited by wind and water

APPENDIX C

Dry Mixedgrass Natural Subregion Previously Identified ACIMS Occurrences

Table C-1: Alberta Conservation Information Management System (ACIMS) Tracked Plant Species in the Dry Mixedgrass Natural Subregion

Common name	Scientific name	Provincial Rank [a]	COSEWIC [b]	SARA [c]
soil paint lichen	*Acarospora schleicheri*	S2S3	NNR	G5?
few-flowered aster	*Almutaster pauciflorus*	S3	N4	G4
Californian amaranth	*Amaranthus californicus*	S2S3	N1N2	G4
bur ragweed	*Ambrosia acanthicarpa*	S3	N2N3	G5
corymbose everlasting	*Antennaria corymbosa*	S2	N1N2	G5
cushion everlasting	*Antennaria dimorpha*	S2	N4	G5
red three-awn	*Aristida purpurea var. longiseta*	S3	N4	G5T5?
green milkweed	*Asclepias viridiflora*	S1	N5?	G5
prickly milk vetch	*Astragalus kentrophyta var. kentrophyta*	S2	N2	G5T4
Powell's saltbush	*Atriplex powellii*	S2	N1N2	G4
saltbush	*Atriplex truncata*	S1	N4	G5
water hyssop	*Bacopa rotundifolia*	S1	N1	G5
common beggarticks	*Bidens frondosa*	S3	N5	G5
tall beggarticks	*Bidens vulgata*	S1	N5	G5
Collins' rockcress	*Boechera collinsii*	S1	N5	G5T5
field grape fern	*Botrychium campestre*	S3	N2	G3G4
button lichen	*Buellia badia*	S1	NNR	G3?
button lichen	*Buellia elegans*	S2	NNR	G3G5
thorough-wax	*Bupleurum americanum*	S2	N4N5	G5
powdery jewel lichen	*Caloplaca citrina*	S1S2	NNR	G4G5
parasitic firedot lichen	*Caloplaca epithallina*	S2	NNR	G3G5
Nebraska sedge	*Carex nebrascensis*	S3	N2	G5
pasture sedge	*Carex petasata*	S3	N5	G5
downy paintbrush	*Castilleja sessiliflora*	S1	N5	G5
short-stalk mouse-ear chickweed	*Cerastium brachypodum*	S3	N4	G5

Table C-1: Alberta Conservation Information Management System (ACIMS) Tracked Plant Species in the Dry Mixedgrass Natural Subregion

Common name	Scientific name	Provincial Rank [a]	COSEWIC [b]	SARA [c]
aridland goosefoot	*Chenopodium desiccatum*	S3	N3N4	G5
Fremont's goosefoot	*Chenopodium fremontii*	S2	N5	G5
mealy goosefoot	*Chenopodium incanum var. incanum*	S1	NNR	G5T5
smooth goosefoot	*Chenopodium subglabrum*	S2	N3	G3G4
Watson's goosefoot	*Chenopodium watsonii*	S2	N2	G5
vagabond lichen	*Circinaria hispida*	S2S3	N2N3	G3
split-peg lichen	*Cladonia symphycarpia*	S2S4	N5	G5
American bugseed	*Corispermum americanum var. americanum*	S2	N4?	G5?T5?
Hooker's bugseed	*Corispermum hookeri var. hookeri*	S2	N4N5	G4G5T4T5
slender hawk's-beard	*Crepis atribarba*	S2	N5	G5
moss	*Crossidium aberrans*	S1S3	N4	G3G5
cock's-comb cryptantha	*Cryptantha celosioides*	S2S3	N4	G5
Kelsey's cat's eye	*Cryptantha kelseyana*	S3	N2	G4
tiny cryptantha	*Cryptantha minima*	S2	N3	G5
swamp dodder	*Cuscuta gronovii*	S1	N5	G5
awned nut-grass	*Cyperus squarrosus*	S2	N4N5	G5
fallacious screw moss	*Didymodon fallax*	S2S3	N5	G5
downingia	*Downingia laeta*	S3	N2	G5
creeping draba	*Draba reptans*	S2	N3	G5
rough barnyard grass	*Echinochloa muricata var. microstachya*	S1	N5	G5T5
waterwort	*Elatine triandra*	S2	N3N4	G5
Engelmann's spike-rush	*Eleocharis engelmannii*	S2	N2	G4G5
two-leaved waterweed	*Elodea bifoliata*	S2	N2N3	G4G5
Canada waterweed	*Elodea canadensis*	S2	N5	G5
squirreltail	*Elymus elymoides ssp. elymoides*	S2S3	N4	G5T5

Table C-1: Alberta Conservation Information Management System (ACIMS) Tracked Plant Species in the Dry Mixedgrass Natural Subregion

Common name	Scientific name	Provincial Rank [a]	COSEWIC [b]	SARA [c]
smooth boisduvalia	*Epilobium campestre*	S3	N2N3	G5
dwarf fleabane	*Erigeron radicatus*	S3	N2N3	G3G4
nodding umbrella-plant	*Eriogonum cernuum*	S3	N2	G5
mouse-ear cress	*Eutrema salsugineum*	S1	N5?	G5?
clammy hedge-hyssop	*Gratiola neglecta*	S3	N5	G5
spatulate-leaved heliotrope	*Heliotropium curassavicum*	S3	N4?	G5
little barley	*Hordeum pusillum*	SH	NH	G5
moss	*Jaffueliobryum raui*	S2	N2	G4?
moss	*Jaffueliobryum wrightii*	S1S2	N1N2	G4G5
Nevada rush	*Juncus nevadensis*	S1	N4	G5
rim-lichen	*Lecanora crenulata*	S1	NNR	G3G5
northern linanthus	*Leptosiphon septentrionalis*	S2	N4	G5
flowering-quillwort	*Lilaea scilloides*	S3	N2N3	G5?
western false gromwell	*Lithospermum occidentale*	S3	NNR	G4G5
lance-leaved loosestrife	*Lysimachia hybrida*	S3	N5?	G5
chaffweed	*Lysimachia minima*	S2S3	N3N4	G5
liverwort	*Mannia fragrans*	SU	N3N4	G5
hairy pepperwort	*Marsilea vestita*	S3	N2N3	G5
slender phlox	*Microsteris gracilis ssp. gracilis*	S1	N4N5	G5T5
narrowleaf umbrella-wort	*Mirabilis linearis*	S2	N3	G5
false buffalo grass	*Munroa squarrosa*	S3	N2	G5
upland evening-primrose	*Neoholmgrenia andina*	S1	N2	G4
prairie false dandelion	*Nothocalais cuspidata*	S2	N2N3	G5
Canada toad-flax	*Nuttallanthus texanus*	S2	N3	G4G5
low yellow evening-primrose	*Oenothera flava*	S3	N3	G5

Table C-1: Alberta Conservation Information Management System (ACIMS) Tracked Plant Species in the Dry Mixedgrass Natural Subregion

Common name	Scientific name	Provincial Rank [a]	COSEWIC [b]	SARA [c]
shrubby evening-primrose	*Oenothera serrulata*	S3	N5	G5
smooth sweet cicely	*Osmorhiza longistylis*	S3	N5	G5
linear-leaved scorpionweed	*Phacelia linearis*	S3	N5	G5
dark shadow lichen	*Phaeophyscia sciastra*	S3	N5	G5
arctic bladderpod	*Physaria arctica*	S3	N4N5	G4G5
spatulate bladderpod	*Physaria spatulata*	S2S3	N3	G5TNR
picradeniopsis	*Picradeniopsis oppositifolia*	S1	N1N2	G5?
water-thread pondweed	*Potamogeton diversifolius*	SU	NNA	G5
sandhills cinquefoil	*Potentilla lasiodonta*	S3	N3	G3
low cinquefoil	*Potentilla plattensis*	S2	N4	G4
dwarf woollyheads	*Psilocarphus brevissimus var. brevissimus*	S2	N2N3	G4T4?
brown-eyed scale	*Psora tuckermanii*	S2S3	NNR	G5
alkaline wing-nerved moss	*Pterygoneurum kozlovii*	S2	N2	G2G3
hairy-leaved beardless moss	*Pterygoneurum ovatum*	S2S3	N3N4	G5
crimson dot lichen	*Ramboldia elabens*	S2	NNR	GNR
early buttercup	*Ranunculus glaberrimus*	S3	N5?	G5
liverwort	*Riccia cavernosa*	S2S4	N3N4	G5
blunt-leaved watercress	*Rorippa curvipes*	S3	NNR	G5
spreading yellow cress	*Rorippa sinuata*	S2	N4?	G5
slender cress	*Rorippa tenerrima*	S3	N3N4	G5
grain-spored lichen	*Sarcogyne regularis*	S1S3	N5	G5
tumble grass	*Schedonnardus paniculatus*	S2	N3	G5
pale bulrush	*Scirpus pallidus*	S1	N4?	G5
annual skeletonweed	*Shinnersoseris rostrata*	S3	N2N3	G5?
prairie cord grass	*Spartina pectinata*	S2	N5	G5

Table C-1: Alberta Conservation Information Management System (ACIMS) Tracked Plant Species in the Dry Mixedgrass Natural Subregion

Common name	Scientific name	Provincial Rank [a]	COSEWIC [b]	SARA [c]
yellow collar moss	*Splachnum luteum*	S3	N4	G4?
annual dropseed	*Sporobolus neglectus*	S2	N4N5	G5
rock pimples	*Staurothele elenkinii*	S1	NNR	G3G5
Moquin's sea-blite	*Suaeda nigra*	S3	N3	G5
poison suckleya	*Suckleya suckleyana*	S3	N4?	G5
moss	*Syntrichia caninervis*	S1	N3N4	G5?
taraxia	*Taraxia breviflora*	S1	N1N2	G5
Navajo tea	*Thelesperma subnudum var. marginatum*	S1	N1	G5T5
western spiderwort	*Tradescantia occidentalis*	S1	N2	G5
slender mouse-ear-cress	*Transberingia bursifolia ssp. virgata*	S2	N1N2	G3
sand verbena	*Tripterocalyx micranthus*	S2	N1N2	G5
crowfoot violet	*Viola pedatifida*	S3	N4	G5
polar sunburst lichen	*Xanthomendoza hasseana*	S3	NNR	G5
soapweed	*Yucca glauca*	S1	N1	G5
northern wild rice	*Zizania palustris var. palustris*	S1	N4N5	G4G5T4T5

[a] Provincial conservation ranking definitions can be found in Appendix D (ACIMS 2018b)

[b] COSEWIC status designations can be found in Appendix D (Government of Canada 2020).

[c] SARA Status designations can be found in Appendix D (Government of Canada 2020).

Table C-2: 2017 Alberta Conservation Information Management System (ACIMS) Tracked Plant Communities in the Dry Mixedgrass Natural Subregion

Common name	Scientific name	Provincial Rank [(a)]
Manitoba maple / choke cherry forest	*Acer negundo / Prunus virginiana* Forest	S1S2
Nevada bulrush - (seaside arrow-grass) emergent marsh	*Amphiscirpus nevadensis - (Triglochin maritima)* emergent marsh	S2S3
silver sagebrush - greasewood / needle-and-thread shrub herbaceous	*Artemisia cana - Sarcobatus vermiculatus / Hesperostipa comata* shrub herbaceous	S1S2
silver sagebrush / needle-and-thread - sand grass shrub herbaceous	*Artemisia cana / Hesperostipa comata - Calamovilfa longifolia shrub herbaceous*	S3
silver sagebrush / green needle grass - western wheat grass shrubland	*Artemisia cana / Nassella viridula - Pascopyrum smithii* shrubland	S2S3
silver sagebrush / wheat grasses - Gardner's saltbush sparsely vegetated saline flats	*Artemisia cana / Pascopyrum smithii - Elymus lanceolatus - Atriplex gardneri* sparsely vegetated saline flats	S2S3
long-leaved sagewort - rabbitbrush badlands	*Artemisia longifolia - Ericameria nauseosa* badlands	S1
long-leaved sagewort bare shale community	*Artemisia longifolia* bare shale community	S1S2
water birch grassland riparian shrubland	*Betula occidentalis* grassland riparian shrubland	S2S3
sand grass - needle-and-thread grassland	*Calamovilfa longifolia - Hesperostipa comata* grassland	S3
round-leaved hawthorn / cow parsnip - common nettle - western Canada violet shrubland	*Crataegus chrysocarpa / Heracleum maximum - Urtica dioica - Viola canadensis* shrubland	S1S2
California oat grass - slender-beaked sedge herbaceous vegetation	*Danthonia californica - Carex brevior* herbaceous vegetation	S2
salt grass - western wheat grass meadow	*Distichlis stricta - Pascopyrum smithii* meadow	S2
northern wheat grass - needle-and-thread grassland	*Elymus lanceolatus - Hesperostipa comata* grassland	S2
plains rough fescue grassland	*Festuca hallii* grassland	S1
creeping juniper / sun-loving sedge - yellow umbrella-plant badland community	*Juniperus horizontalis / Carex inops ssp. heliophila - Eriogonum flavum* badland community	S1S2
winter-fat / tumble grass ephemeral drainage	*Krascheninnikovia lanata / Schedonnardus paniculatus* ephemeral drainage	S1S2
scratch grass - Nevada bulrush - salt grass meadow	*Muhlenbergia asperifolia - Amphiscirpus nevadensis - Distichlis stricta* meadow	S1S2
western wheat grass - prairie sagewort grassland	*Pascopyrum smithii - Artemisia ludoviciana* grassland	S1S2
western wheat grass - blue grama grassland	*Pascopyrum smithii - Bouteloua gracilis* grassland	S2?
western wheat grass - low sedge meadow	*Pascopyrum smithii - Carex duriuscula* meadow	S2S3
narrow-leaf cottonwood / red-osier dogwood woodland	*Populus angustifolia / Cornus stolonifera* woodland	S2S3
narrow-leaf cottonwood / buckbrush woodland	*Populus angustifolia / Symphoricarpos occidentalis* woodland	S2S3
plains cottonwood / wild licorice - wire rush woodland	*Populus deltoides / Glycyrrhiza lepidota - Juncus balticus* woodland	S2S3

Table C-2: 2017 Alberta Conservation Information Management System (ACIMS) Tracked Plant Communities in the Dry Mixedgrass Natural Subregion

Common name	Scientific name	Provincial Rank [(a)]
plains cottonwood / recent alluvial riparian community	*Populus deltoides* / recent alluvial riparian community	S1S3
plains cottonwood / buckbrush woodland	*Populus deltoides* / *Symphoricarpos occidentalis* woodland	S2S3
lance-leaf cottonwood / buckbrush woodland	*Populus x acuminata* / *Symphoricarpos occidentalis* woodland	S1S2
Nuttall's salt-meadow grass community	*Puccinellia nuttalliana* community	S3?
skunkbush / needle-and-thread shrubland	*Rhus trilobata* / *Hesperostipa comata* shrubland	S2S3
wild begonia sand dune community	*Rumex venosus* sand dune community	S2S3
samphire emergent marsh	*Salicornia rubra* emergent marsh	S2
greasewood / Gardner's saltbush badlands	*Sarcobatus vermiculatus* / *Atriplex gardneri* badlands	S2S3
greasewood / western wheat grass shrubland	*Sarcobatus vermiculatus* / *Pascopyrum smithii* shrubland	S2S3
greasewood silt dune shrubland	*Sarcobatus vermiculatus* silt dune shrubland	S1
Moquin's sea-blite - endolepis sparsely vegetated badland slopes	*Suaeda nigra* - *Atriplex suckleyi* sparsely vegetated badland slopes	S2?
buckbrush / giant wild rye shrubland	*Symphoricarpos occidentalis* / *Leymus cinereus* shrubland	S2S3
seaside arrow-grass emergent marsh	*Triglochin maritima* emergent marsh	S2?

(a) Provincial Conservation ranking definitions can be found in Appendix D (ACIMS 2018b)

APPENDIX D

Subnational Conservation Status Ranks Definitions

Table D-1: Alberta Conservation Information Management System (ACIMS) Rare Plant Ranking Definitions

Rank	Definition
SX	Taxon is believed to be extirpated from the province.
	Not located despite intensive searches of historical sites and other appropriate habitat.
	Virtually no likelihood that it will be rediscovered.
SH	Known from only historical records but still some hope of rediscovery.
	Evidence that the taxon may no longer be present but not enough to state this with certainty.
S1	Known from five or fewer occurrences or especially vulnerable to extirpation because of other factor(s).
S2	Known from twenty or fewer occurrences or vulnerable to extirpation because of other factors.
S3	Known from 100 or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factors.
S4	Apparently secure.
	Taxon is uncommon but not rare.
	Potentially some cause for long term concern due to declines or other factors.
S5	Secure - taxon is common, widespread, and abundant.
Variant Subnational Conservation Status Ranks	
S#S#	A numeric range rank is used to indicate any range of uncertainty about the status of the taxon. Example - S2S3 or S1S3.
	Ranges cannot skip more than two ranks. Example - SU is used rather than S1S4.
SU	Taxon is currently not able to be ranked due to lack of information or substantially conflicting information. Example - native versus non-native status not resolved.
SNR	Not ranked
	Conservation status not yet assessed.
SNA	Not applicable.
	A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities. Example - introduced species.
Subnational Conservation Status Rank Qualifiers	
Qualifier	**Definition**
S#?	Inexact numeric rank.
	Applied when a specific rank is most likely appropriate but for which some conflicting information or unresolved questions remain. Example - S2? Believed to be 6 to 20 occurrences but some uncertainty.
Global Status Ranks	
G1	Rare and vulnerable
G2	Uncommon and potentially vulnerable
G3	Potentially vulnerable
G4	Globally apparently secure
G5	Globally secure, common and abundant

Table D-2: COSEWIC and SARA Status Designations (Government of Canada 2020)

Rank	Definition
Extinct (X)	An animal, plant or fungi species that no longer exists.
Extirpated (XT)	An animal, plant or fungi species no longer exists in the wild in Canada, but exists elsewhere.
Endangered (E)	An animal, plant or fungi species facing imminent extirpation or extinction.
Threatened (T)	An animal, plant or fungi species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)	An animal, plant or fungi species that may become a threatened or an endangered wildlife species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)	An animal, plant or fungi species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)	A category that applies when the available information is insufficient (a) to resolve an animal, plant or fungi species' eligibility for assessment or (b) to permit an assessment of the animal, plant or fungi species' risk of extinction.

APPENDIX E

Species Observed within the Project Study Area during the Vegetation Assessment

Table E-1: List of Species Observed within the Project Study Area

Strata	Common Name	Scientific Name	Native or Exotic [a]	Provincial Rank [b]
Forb	common yarrow	*Achillea millefolium*	Native	S5
	wild white onion	*Allium textile*	Native	S5
	pygmyflower	*Androsace septentrionalis*	Native	S5
	prairie crocus	*Anemone patens*	Native	S5
	little leaf pussytoes	*Antennaria microphylla*	Native	S5
	silver sagebrush	*Artemisia cana*	Native	S5
	pasture sage	*Artemisia frigida*	Native	S5
	prairie sage	*Artemisia ludoviciana*	Native	S5
	aster species	*Aster sp.*	n/a	-
	slender milkvetch	*Astragalus flexuosus*	Native	S4
	narrow-leaved milkvetch	*Astragalus pectinatus*	Native	S5
	Gardner's saltbrush	*Atriplex gardneri*	Native	S4
	bull thistle	*Cirsium vulgare*	Exotic	SNA
	Canada (creeping) thistle	*Cirsium arvense*	Exotic	SNA
	cushion cactus	*Coryphantha vivipara*	Native	S3
	flixweed	*Descurainia sophia*	Exotic	SNA
	yellow umbrella plant	*Eriogonum flavum*	Native	S5
	small-flowered rocket	*Erysimum inconspicuum*	Native	S5
	three flowered avens	*Geum triflorum*	Native	S5
	gumweed	*Grindelia squarrosa*	Native	S4S5
	hairy golden aster	*Heterotheca villosa*	Native	S5
	povertyweed	*Iva axillaris*	Native	S4
	bluebur	*Lappula squarrosa*	Exotic	SNA
	dotting blazingstar	*Liatris punctata*	Native	S5
	skeleton weed	*Lygodesmia juncea*	Native	S5
	alfalfa	*Medicago sativa*	Exotic	SNA
	creeping nailwort	*Paronychia sessiliflora*	Native	S3
	white penstemon	*Penstemon albidus*	Native	S3S4
	dock species	*Rumex sp.*	n/a	-
	russian thistle	*Salsola tragus*	Exotic	SNA
	prairie club moss	*Selaginella densa*	Native	S5

Table E-1: List of Species Observed within the Project Study Area

Strata	Common Name	Scientific Name	Native or Exotic [a]	Provincial Rank [b]
Forb	northern spikemoss	*Selaginella selaginoides*	Native	S4
	missouri goldenrod	*Solidago missouriensis*	Native	S5
	perennial sow-thistle	*Sonchus arvensis*	Exotic	SNA
	scarlet mallow	*Sphaeralcea coccinea*	Native	S5
	white heath aster	*Symphyotrichum ericoides*	Native	S5
	dandelion	*Taraxacum officinale*	Exotic	SNA
	prairie goldenbean	*Thermopsis rhombifolia*	Native	S5
	field pennycress	*Thlaspi arvense*	Exotic	SNA
	death camas	*Zigadenus venenosus*	Native	S4
Graminoid	crested wheatgrass	*Agropyron cristatum*	Exotic	SNA
	blue grama grass	*Bouteloua gracilis*	Native	S5
	northern reedgrass	*Calamagrostis stricata spp. inexpansa*	Native	S5
	thickspike wheatgrass	*Elymus lanceolatus*	Native	S5
	slender wheartgrass	*Elymus trachycaulus*	Native	S5
	fescue species	*Festuca sp.*	n/a	-
	needle and thread grass	*Hesperostipa comata*	Native	S5
	foxtail barley	*Hordeum jubatum*	Native	S5
	June grass	*Koeleria macrantha*	Native	S5
	Western wheatgrass	*Pascopyrum smithii*	Native	S5
	kentucky blue grass	*Poa pratensis*	Native	S5
	blue grass species	*Poa sp.*	n/a	-
Shrub	prairie rose	*Rosa arkansana*	Native	S5
	woods rose	*Rosa woodsii*	Native	S5
	western snowberry	*Symphoricarpos occidentalis*	Native	S5

[a] Native or Exotic status is used to identify weed species (ACIMS 2017a).

[b] Provincial Conservation ranking definitions can be found in Appendix D (ACIMS 2018b).

- = Species not ranked.

n/a= Not Applicable

APPENDIX F

Representative Wetland Photos

Photo 1: Wetland 801 - Ephemeral Waterbody (Class I)

Photo 2: Wetland 805 - Temporary Graminoid Marsh [M-G(II)]

Photo 3: Wetland 4194 - Seasonal Graminoid Marsh [M-G(III)]

Photo 4: Wetland 7 – Semi-permanent Shallow Open Water [WA-IV]

APPENDIX G

Hilda Wind Power Project: Renewable Energy Project Submission to AEP-FWS

REPORT

Hilda Wind Power Project

Renewable Energy Project Submission to Alberta Environment and Parks

Submitted by:

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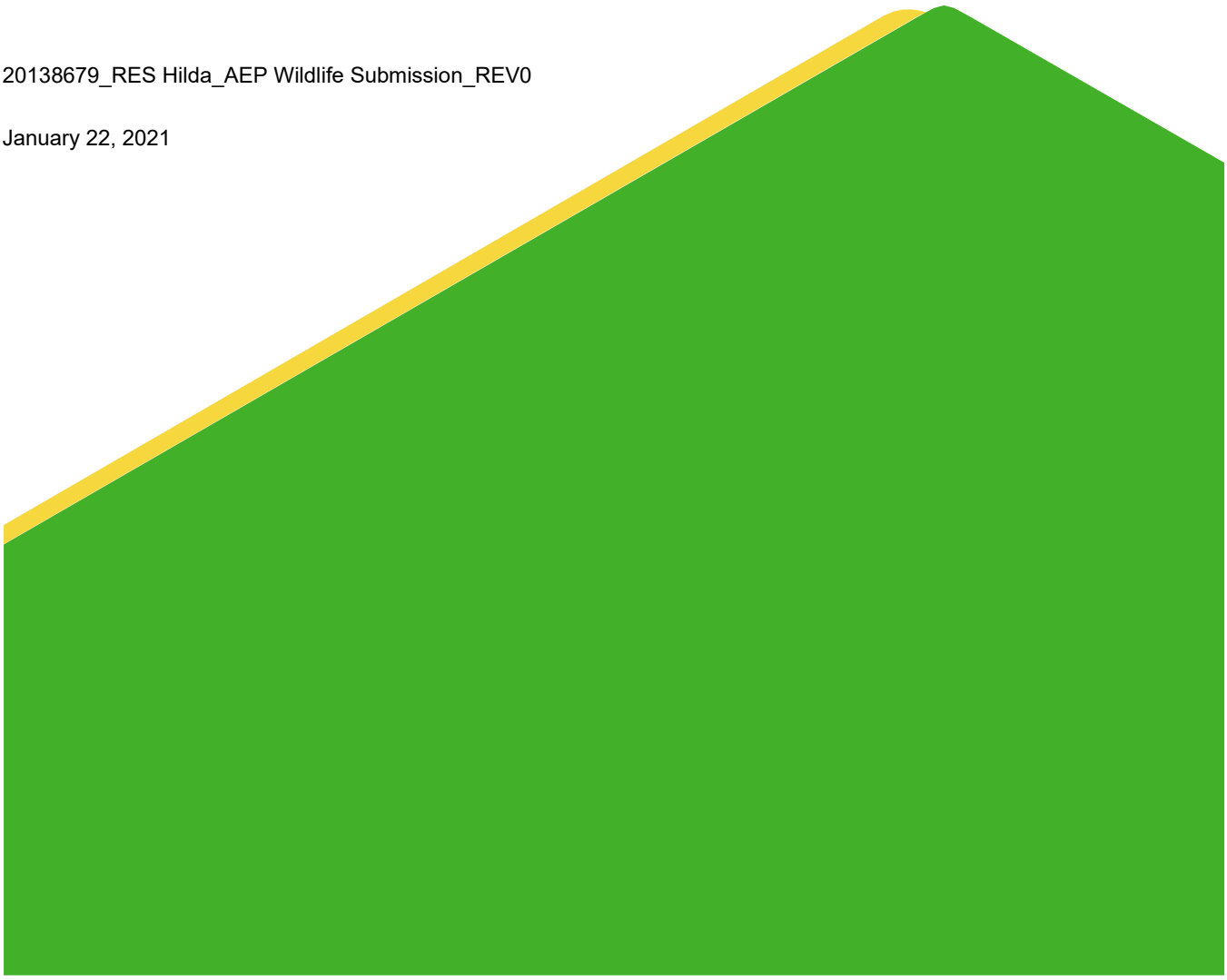
20138679_RES Hilda_AEP Wildlife Submission_REV0

January 22, 2021



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1.0 PROJECT OVERVIEW

1) Type of Project

What type of project is being proposed (wind, photovoltaic solar or other)?

Renewable Energy Systems (RES) Canada Inc. (the Proponent) is proposing a wind power project.

2) Name of Project

What is the name of the project?

The name of the project is the Hilda Wind Power Project (the Project).

3) Type of Application

WIND PROJECTS ONLY: What type of application is being proposed (standard submission, buildable area, preferred and alternate turbine locations, other)?

The Proponent is submitting a wind power plant application where changes in turbines or layout may be proposed after the filing of the application as per Section 3.4.2 under Alberta Utilities Commission (AUC) *Rule 007: Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments* (2018). The hub height and blade length would remain the same or be of smaller dimension, although the number of turbines may be reduced.

4) Name of the Proponent

What is the name of the proponent? Provide a contact name, phone number and email for the proponent.

Proponent: Renewable Energy Systems Canada Inc.
Contact: Patrick Henn, Development Manager
Office: 508 - 5605 Gaspé Avenue, Montreal, QC, H2T 2A4
Phone: (483) 266-1898 / (514) 293-9049
Email: Patrick.Henn@res-group.com

5) Name(s) of the Wildlife Consultant Company

What is the wildlife consultant company name(s) and contact information?

Jamie Sparrow, Ecologist, BSc.
Golder Associates Ltd.
1721 8th Street East, Saskatoon, Saskatchewan, S7H 0T4 Canada
Phone: (306) 667-1279 / (306) 203-6761
Email: jsparrow@golder.com

6) Project Location

What is the project location? Provide the location information in a table with the below headings and using additional rows if needed.

The Project is located in Cypress County, near Hilda, Alberta approximately 80 kilometres (km) northeast of the City of Medicine Hat, Alberta. This submission refers to two areas: the Project Study Area (refer to Figure A-1 in Appendix A) and the Project footprint (refer to Figure A-2 in Appendix A).

The Project footprint represents the disturbance during construction and operations associated with the Project layout. The legal land descriptions for the quarter sections hosting the Project footprint are summarized in Table 1.

The Project Study Area includes sections and quarter sections that were determined to be potentially affected by developments associated with the Project and represents the area where the Proponent's wildlife consultant company has conducted environmental studies for the Project between 2018 and 2020. The Project Study Area comprises the proposed Project footprint and surrounding adjacent lands.

Table 1: Legal Land Description of the Quarter Sections Hosting the Project Footprint

Quarter	Section	Township	Range	Meridian
NE	9	18	1	W4M
NW	9	18	1	W4M
SW	9	18	1	W4M
NE	10	18	1	W4M
NW	10	18	1	W4M
NW	14	18	1	W4M
NE	15	18	1	W4M
SE	15	18	1	W4M
SW	15	18	1	W4M
SE	16	18	1	W4M
NW	19	18	1	W4M
SE	22	18	1	W4M
NW	23	18	1	W4M
SW	23	18	1	W4M
NW	26	18	1	W4M
SW	26	18	1	W4M
NE	27	18	1	W4M
NW	27	18	1	W4M
SE	27	18	1	W4M
SW	27	18	1	W4M
NE	28	18	1	W4M
NW	28	18	1	W4M
NE	29	18	1	W4M
NW	29	18	1	W4M
NE	30	18	1	W4M
SE	30	18	1	W4M
SW	30	18	1	W4M
NE	31	18	1	W4M
NW	31	18	1	W4M
SE	31	18	1	W4M
SE	32	18	1	W4M
NE	13	18	2	W4M
NW	13	18	2	W4M
SE	13	18	2	W4M
SW	13	18	2	W4M
NE	24	18	2	W4M
SE	24	18	2	W4M
NE	36	18	2	W4M
NW	36	18	2	W4M

NE = northeast; NW = northwest; SE = southeast;
SW = southwest; W4M = West of the Fourth Meridian.

7) Provide the UTM zone for the Project

The Project is in Universal Transverse Mercator (UTM) zone 12 and in North American Datum (NAD) 83.

8) Provide the total MW size of the Project

The total size of the Project is 100 MegaWatts (MW).

9) Construction Footprint

What is the size of the project construction footprint (include all infrastructure, temporary workspace or other related project related space) in hectares?

The Project's permanent (i.e., 20 years, up to 50 year operation time period if a repowering option is chosen) infrastructure will include Wind Turbine Generators (turbines) and associated foundation or "pad" sites (turbine locations), access roads, a Project substation including an operation and maintenance building, a transmission interconnection line, and one permanent meteorological tower (met tower). Public roads (within municipal road allowances) will be used to access the Project layout and may require some upgrades.

The Project's temporary (i.e., construction related) footprint, required only during the construction period to install permanent infrastructure will include temporary workspace for the storage of equipment or materials in a temporary laydown area, a temporary work area around the turbine locations for the assembly and installation of turbines, temporary right-of-way for the installation of underground collector lines, and temporary work areas adjacent to access roads and upgrades to existing public roads for construction access purposes.

The Project construction footprint is shown in Figure A-2 (refer to Appendix A). The Project construction footprint has been conservatively assumed to include the maximum extent of the land that could be disturbed by the construction of the Project, or limit of disturbance. However, it is unlikely that the maximum limit of disturbance would be required for all areas of the Project during construction. The construction footprint total is the sum of the temporary workspace required during the construction of the Project and the Project operations footprint.

Based on conservative (i.e., worst-case) estimates of the area of disturbance associated with Project infrastructure, described below, the Project has the potential to affect a total of 107.0 ha of land during construction. The Project construction footprint not required following construction will be reclaimed to equivalent land use (e.g., cultivation) in accordance with the requirements of the *Conservation and Reclamation Directive for Renewable Energy Operations* (the C&R Directive; AEP 2018b).

Turbine Locations

Each turbine includes a tower foundation, tower, rotor blades, and a hub/nacelle. During construction, each turbine location with its associated temporary workspace will have a maximum disturbed area of approximately 2.5 hectares (ha). The turbine sites have been designed with a temporary turn-around loop for construction vehicles to pull around the turbine site. Turbine foundations will consist of an appropriately sized concrete spread-footing foundation with re-bar reinforcement, subsurface preparation and a concrete pedestal where the turbine tower connects to the foundation. The spread-footing foundation will be approximately 20 metres (m) in diameter at its widest point and less than 4.0 m deep. The excavation for construction of the foundation will be approximately 40 m in diameter and will be backfilled after the concrete pour of the foundation and pedestal is completed. It is expected to take three to four weeks to excavate, construct and backfill each turbine foundation.

Access Roads

The Project will utilize existing public roads, along with a combination of upgrading two existing trails in County road allowances and new access roads. Two lengths of existing trails located in County road allowances totalling approximately 1.6 km will be upgraded to provide access to turbines T6 and T19, and a total of 10.4 km of new access roads will be required to provide access to turbine locations off existing public roads.

During construction, the temporary workspace for turbine access roads will require a conservative width of approximately 30 m (i.e., including the operations footprint of approximately 5 m). During construction, the temporary workspace width for road upgrades will be limited to approximately 20 m (i.e., including the operations footprint of approximately 10 m). A 30 m wide temporary workspace for turbine access roads facilitates crane movement and allows space for delivery and temporary storage of turbine components, construction materials, and equipment required during turbine construction. The temporary workspace width of 20 m planned for the two segments of road upgrades aligns with the 20 m County road allowance right of way and also reduces impacts to native grassland in a segment of the road leading to turbine T6.

During operations, turbine access roads will be 5 m wide and two lengths of upgraded road will be 10 m wide.

Temporary crane paths will, for the most part, follow the County roads, access roads or collection system right-of-way, or will be moved overland under dry ground conditions, which is not expected to result in ground disturbance.

Underground Collection System

Power generated by the turbines will be conveyed to the Project substation through an underground collection system, which will consist of medium-voltage (34.5 kiloVolts (kV)) standard utility cable and a fibre optic communication cable buried to a minimum depth of approximately 1 m as per the Canadian Electrical Code. The preferred method of install for the underground cables will be the ploughing technique using a single cut tooth that splits the earth apart and allows the cables and sand bedding along with warning tape to be installed. No backfilling or compaction is required when using the ploughing method. Alternatively, in some cases (large tracts with several circuits, for example) the cables may be installed in a trench using a wheel-ditcher or Ditch Witch (a wheel-like or bar-like mechanism similar to a chainsaw which will be used to cut a narrow [approximately 0.15 m] trench and place the cable). The topsoil and upper subsoil removed from the trench will be placed adjacent to the trench separately to prevent admixing. A backhoe or small bobcat will be used to push the subsoil, followed by the topsoil back into place, and to re-compact and re-contour the disturbed area. The total length of the collection system is approximately 35.6 km. The disturbance footprint of the collection system has been conservatively assumed to be within a work area of approximately 12 m in width. Above ground junction boxes to connect segments of the underground collection line system are required and will be minimized to the greatest extent possible. The underground collection system is currently proposed to be located on private lands outside of the road allowance, to provide additional economic benefits to participating landowners.

Substation, Transmission Interconnection and Operation and Maintenance Building

The Project substation will be located in the northwest quarter of Section 29, Township 18, Range 1, West of the Fourth Meridian (W4M) (UTM: NAD 83, Zone 12, 562473 Easting [E], 5600927 Northing [N]), and will occupy an area of approximately 175 m by 100 m (1.8 ha). The Project substation area will be fenced to prevent unauthorized access. Fencing will have squared corners and will be embedded into the ground to stop wildlife from entering as is standard practice for other transmission facility operators in Alberta. The fence design has not been finalized and will be completed closer to construction of the Project; however, if Alberta Environment and Parks (AEP) has fencing specification guidelines, the Proponent is committed to following these guidelines.

The Project substation location has been sited directly adjacent to the existing 658L 138 kV line running through the Project Study Area, immediately to the east of the substation and within the same quarter section, to minimize the overall disturbance in the area. The overhead transmission line interconnection will be approximately 150 m in length (two poles), with approximately 28 m within the operational footprint of the substation area, connecting to the existing 138 kV line to the east. Overhead lines will be marked in accordance with the Avian Power Line Interaction Committee (APLIC) guidance.

The operation and maintenance building will be located within the operational footprint of the substation area.

Laydown Area

One temporary laydown area will be required to provide a secure location for managing and storing materials, tools and equipment during construction and to accommodate the temporary contractor site office trailers. The temporary laydown area will be up to approximately 200 m by 200 m (4.0 ha) in size, located in the southeast quarter of Section 32, Township 18, Range 1, W4M (UTM: NAD 83, Zone 12, 563873 E, 5601123 N).

Temporary Concrete Batch Plant

It is likely that a temporary on-site batch plant will be required, and it would likely be placed within the laydown area so would have no additional footprint. The third-party concrete supply contractor will comply with the requirements of Alberta Environment's Code of Practice for Concrete Producing Plant (GOA 1996), as well as follow best management practices for concrete batch plants with respect to soil and groundwater protection.

Permanent Meteorological Tower

The Project will require the construction of one permanent met tower to collect wind and weather data during the operation phase of the Project. The disturbed area for the met tower will be <0.1 ha in size. The location of the met towers is unknown, and will be finalized in discussions with the turbine manufacturer. The meteorological tower will be sited in cultivated fields near the Project footprint and will avoid environmentally sensitive features plus their associated setbacks. The disturbance during construction is primarily associated with excavation for a concrete foundation at the met tower base and for guy wire anchors.

10) Operation Footprint

What is the size of project operation footprint (include all infrastructure and other project related space) in hectares?

The Project's permanent (operational) footprint will include turbines and associated pad sites (turbine locations), access roads, a Project substation including an operation and maintenance building, transmission interconnection, and permanent met tower. Based on conservative (i.e., worst-case) estimates of the area of disturbance associated with Project infrastructure, described below, the Project footprint has the potential to permanently affect 9.2 ha of land during operations (refer to Table 2). Of the 107.0 ha of total disturbance during construction, 97.8 ha will be temporary disturbance reclaimed as soon as practicable after construction and 9.2 ha will be permanently disturbed during operations.

Table 2: Project Operation Footprint Area

Proposed Type of Infrastructure	Total Project Operation Footprint [ha]
Existing Road Upgrade[(a)]	1.6
Substation / Operation and Maintenance Building	1.8
Interconnection Poles	<0.1
Turbine Access Road	5.0
Turbine Pad	0.8
Permanent MET Tower	<0.1
Total	**9.2**

(a) All upgrades to existing trails are within County road allowance.
ha = hectares; < = less than; MET = meteorological tower.

Turbine Locations

During Project operations each turbine foundation will be surrounded by gravel pad with approximate dimensions of 20 m by 20 m. The total operation footprint at each turbine location will be less than 0.1 ha.

Access Roads and Upgraded Existing Public Road

A total of 1.6 km of new permanent road access is required during operation of the Project, which will be provided by upgrading existing trails that currently exist within County road allowances. The new permanent turbine access roads will consist of a 5.0 m wide gravel capped road that will be maintained for use during operations. New or upgraded public roads will have an operational width of 10 m.

Substation, Transmission Interconnection and Operation and Maintenance Building

The Project will require a substation, transmission interconnection, and an operation and maintenance building as described in response to Question 9. Overhead lines will be marked in accordance with the Avian Power Line Interaction Committee (APLIC) guidance.

Permanent Meteorological Towers

The Project will require one permanent met tower as described in response to Question 9.

11) Wind Turbine Locations

WIND PROJECTS ONLY: Provide locations of all proposed wind turbines in a table with the following headings, using as many rows as needed. If applicable, indicate if the turbine location is a preferred or alternate location.

The current layout contemplates 20, 5.0 MW wind turbines. On-going discussions with the turbine manufacturer could realize up to 1.0 MW increase in the wind turbine nameplate capacity. The hub height and blade length would remain the same or be of smaller dimension, although the number of turbines may be reduced. The Proponent is currently permitting the baseline condition of 20 turbines locations, but potentially would remove three turbine locations from the Project.

The UTM coordinates of the proposed 20 turbine locations are provided in Table 3 and shown on Figure A-2 in Appendix A.

Table 3: Wind Turbine Locations

Turbine ID	UTM Zone	UTM Easting	UTM Northing	Quarter	Section	Township	Range	Meridian	Land Cover Type
T1	12	560051	5596470	SE	13	18	2	W4M	Cultivated (non-irrigated)
T2	12	560100	5597309	NE	13	18	2	W4M	Cultivated (non-irrigated)
T3	12	560439	5598208	SE	24	18	2	W4M	Cultivated (non-irrigated)
T4	12	561151	5599015	NW	19	18	1	W4M	Cultivated (non-irrigated)
T5	12	561661	5599621	SE	30	18	1	W4M	Cultivated (non-irrigated)
T6	12	559751	5602328	NW	36	18	2	W4M	Cultivated (non-irrigated)
T7	12	560437	5601880	NE	36	18	2	W4M	Tame Pasture or Hay (non-irrigated)
T8	12	561835	5601843	NE	31	18	1	W4M	Cultivated (non-irrigated)
T9	12	563574	5601517	SE	32	18	1	W4M	Cultivated (non-irrigated)
T10	12	564514	5600748	NW	28	18	1	W4M	Tame Pasture or Hay (non-irrigated)
T11	12	565693	5600892	NW	27	18	1	W4M	Cultivated (non-irrigated)
T12	12	566510	5600784	NE	27	18	1	W4M	Cultivated (non-irrigated)
T13	12	567928	5600952	NW	26	18	1	W4M	Cultivated (non-irrigated)
T14	12	567597	5598808	NW	23	18	1	W4M	Cultivated (non-irrigated)
T15	12	567717	5598117	SW	23	18	1	W4M	Cultivated (non-irrigated)
T16	12	567056	5597517	NE	15	18	1	W4M	Cultivated (non-irrigated)
T17	12	566596	5596418	SE	15	18	1	W4M	Cultivated (non-irrigated)
T18	12	566386	5595700	NW	10	18	1	W4M	Cultivated (non-irrigated)
T19	12	565436	5595437	NE	9	18	1	W4M	Cultivated (non-irrigated)
T20	12	564397	5594604	SW	9	18	1	W4M	Cultivated (non-irrigated)

ID = Identification; NE = northeast; NW = northwest; SE = southeast; SW = southwest; UTM = Universal Transverse Mercator; W4M = West of the Fourth Meridian.

12) Wind Turbine Details

WIND PROJECTS ONLY: Provide the below turbine details in a table with the below format.

Table 4 provides turbine technology details.

Table 4: Wind Turbine Specifications

Specifications	Detail
Tower/Hub Height (metres from the ground)	115 m
Rotor Swept Area (minimum to maximum metres from the ground)	22,698 m^2 (30 – 200 m)
Blade Length (m)	85 m
Number of Blades	3

m = metres; m^2 = square metres.

13) Provide any general information about the proponent, or the project that may be applicable to the AEP WM review.

One of the key intents of the Alberta Environment and Parks – Fish and Wildlife Stewardship (AEP-FWS) *Wildlife Directive for Alberta Wind Energy Projects* (the Directive; AEP 2018a) is to avoid or minimize impacts from turbines, infrastructure and temporary workspaces to native grassland. The mitigation hierarchy describes the sequence in which different mitigation strategies should be considered including: avoid, minimize, rehabilitate (reclaim) and offset (BBOP 2019). The Proponent has designed the Project to avoid impacts to wildlife and wildlife habitat to the extent practicable, in consideration of numerous competing environmental and development constraints (e.g., wetlands, sensitive wildlife feature setbacks, participating landowners, other infrastructure, wind resource information). Where impacts cannot be avoided the Proponent is committed to minimizing the effects of the Project during construction and operations through best management practices, including reclaiming all construction disturbance not necessary for operation of the project, and all remaining operational disturbance following the end of the Project life.

The proponent completed surveys in a Project Study Area larger than the area required for the Project layout to identify potential constraints for avoidance during the siting of the Project layout. The Project was initiated in 2018 and some wildlife surveys including fall bird migration were completed in fall 2018 as part of surveys for a larger area prior to the Project Study Area being defined. Survey plots within 1 km of the Project Study Area were analyzed for all surveys with the exception of sharp-tailed grouse (*Tympanuchus phasianellus*) and burrowing owl (*Athene cunicularia*) surveys where plots within 500 m were considered according to the 500 m setback for active leks of the species. As a result of surveys, the Proponent created siting constraints mapping to maximize avoidance of impacts to Class III and higher wetlands, active raptor stick nests and their associated buffers, and native grassland. Avoidance was an important factor in siting turbines and supporting infrastructure; although most of the Project footprint avoids environmental features, the temporary footprint area will impact 1.2 ha of native grassland during construction with the final operational footprint impacting less than 0.5 ha (refer to Question 14). Anticipated operational impacts to native grassland are associated with road upgrades within the road allowance. Road upgrades will occur at the edge of the native grassland polygon located at SW 1-19-2 W4M, SE 1-19-2 W4M and SW 6-19-1 W4M (Appendix A, Figure A-4a). Three Class III-VI wetland setbacks will be slightly encroached to accommodate corner widening for turbine access roads to turbines T8, T9, and T20 (refer to Question 19). Direct temporary or permanent impacts to Class III-VI wetlands due to the Project are not anticipated. A total of 0.5 ha of permanent disturbance (due to a small segment of access road) and 8.1 ha of temporary disturbance within the 1,000 m setback of one ferruginous hawk (*Buteo regalis*) 1,000 m nest setback is anticipated. The intent of this submission is to provide AEP-FWS with a concise description of how the proposed Project complies with the Directive. In cases where required setbacks could not be achieved, additional mitigation measures are provided to meet the intent of the Directive. To facilitate AEP-FWS's review, all relevant data and information for the Project are summarized within this submission.

In February 2020, AEP-FWM released the Bird Migration Survey Protocol, which was last updated in June 2020 (AEP 2020b). As a result, bird migration surveys conducted in fall 2018 were conducted following Golder Associates Ltd. (Golder's) internal standardized protocol. Bird migration surveys conducted in spring and fall 2020 were consistent with the Draft Bird Migration Survey Protocol (AEP 2019) or final Bird Migration Survey Protocol (AEP 2020b) as described in Section 6.0.

Throughout this submission, a turbine setback distance is measured as the distance from the nearest edge of the rotor swept area to the nearest edge of the feature. All other setbacks are measured from the edge of the feature to the nearest edge of the Project footprint.

In this submission, the Proponent is considering alternative turbine models that may result in a reduction of three turbines from the currently proposed 20 turbine location for the Project.

2.0 WILDLIFE HABITAT LAND COVER

14) Land Cover

Land Cover within the project area: Provide the amount of each type of land cover within the project area, as identified within the project area map (refer to the Maps and Figures section below) in a table with the below format. For each habitat type, provide the total number of hectares within the entire project area, the number of hectares that will be disturbed during construction (include all temporary workspaces) and the number of hectares that will be used to support the operation of the proposed facility. Ensure the reported permanent and temporary footprint for all infrastructure (i.e., turbines, solar arrays, access roads, collection lines etc.) aligns with the definition as per the Directive. Additional rows may be added for land cover types not already identified in the below table. If an identified habitat type does not occur in the proposed project area, clearly state that it does not occur in the project footprint.

The most common land cover type in the Project Study Area is cultivation occupying 3,920.9 ha. Native grassland is the second most common land cover type occupying 412.0 ha, followed by tame pasture or hay and wetlands, with 371.2 ha and 303.1 ha respectively (refer to Table 5). The Project has the potential to adversely affect land use through vegetation removal and soil disturbance during construction and due to the presence of turbines and supporting infrastructure during operation. Table 5 provides the number of hectares by land cover type to be temporarily and permanently impacted by the Project footprint. Aspen forest, boreal forest, montane forest, mixed forest, lakes/waterbodies, rivers/watercourses, railway and trail or unpaved road do not occur in the Project Study Area; thus, impacts will not occur in these land cover types.

Table 5: Potential Project Effects on Land Cover

Land Cover Type	Total Project Study Area [ha]	Temporary Project Footprint [ha]	Permanent Project Footprint [ha]
Native Grassland	412.0	1.2	0.5
Tame Pasture or Hay	371.2	6.6	0.2
Hay land[(a)]	0.0	0.0	0.0
Aspen Forest	0.0	0.0	0.0
Boreal Forest	0.0	0.0	0.0
Montane Forest	0.0	0.0	0.0
Mixed Forest	0.0	0.0	0.0
Cultivation	3,920.9	84.8	7.2
Wetlands[(b)]	303.1	0.2	<0.1
Lake/Waterbody	0.0	0.0	0.0
River/Watercourse	0.0	0.0	0.0
Farm Yard	38.0	0.0	0.0
Road[(c)]	186.0	4.8	1.3
Railway	0.0	0.0	0.0
Trail or unimproved road	0.0	0.0	0.0

Land Cover Type	Total Project Study Area [ha]	Temporary Project Footprint [ha]	Permanent Project Footprint [ha]
Developed	15.6	0.3	<0.1
Total (ha)	**5,246.9**	**97.8**	**9.2**

Note: Some numbers are rounded for presentation purposes; therefore, totals may not equal the sum of the individual values.
(a) Hay land is included under the tame grassland category. Hay land was not mapped as a separate land cover category because it is difficult to accurately distinguish from tame grassland and cultivation during desktop mapping.
(b) Includes ephemeral Class I waterbodies and wetland types with Class II-VI permanence.
(c) Roads include provincial, County and private roads and trails in the Project Study Area as per the AltaLis transportation feature dataset.
– = no impacts; ha = hectare; < = less than

15) Habitat Types

As per the Directive, is any part or portion of the project sited in the following habitat types:

a) Native grassland?

Yes. The permanent Project footprint will impact 0.5 ha of native grassland and the temporary Project footprint will impact 1.2 ha of native grassland.

b) Old growth forests?

No

c) Named waterbodies?

No

d) Valley breaks/coulee breaks?

No

e) Valleys of large watercourse?

No

f) Eastern slopes?

No

If the project is sited in the any of the above habitat types, provide the details of the project infrastructure (location, type of infrastructure, and amount of area impacted) in each habitat type and the rationale for siting the project in an area identified as higher risk by AEP-FWS policy. Detail any proposed alternative mitigation(s) the proponent will implement to meet the intent of the Directive. If the proposed project will impact more than one of the identified habitat types, provide the details for each habitat type.

The Proponent made every effort to avoid sensitive wildlife habitat, including native grassland, and avoidance was an important factor in the constraints analysis used for siting turbines and supporting infrastructure. The temporary footprint area will impact 1.2 ha of native grassland during construction with the final operational footprint impacting 0.5 ha.

The legal location, proposed type of infrastructure, and area of impact within native grassland are provided in Table 6. All of these impacts are due to temporary disturbance that will be reclaimed as soon as practicable following construction.

Table 6: Project Footprint Sited within Native Grassland

Wildlife Habitat (ID)	Legal Location (W4M)	Proposed Infrastructure Type within Feature	Area Impacted [ha]	Rationale/ Justification for Siting Decision
Crossing NG -1	NW 31-18-1	collector line (temporary)	0.2	No other feasible alternative. The collector line crosses the native grassland polygon at the narrowest location to minimize disturbance; temporary disturbance.
Crossing NG-2a	SW 1-19-2, SE 1-19-2, SW 6-19-1	road upgrade (temporary)	0.5	Paralleling existing disturbance (trail) within County road allowance; the width of the access road will be limited to 20 m to minimize native grassland impacts associated with turbine T6 access road. No feasible alternatives; temporary disturbance.
Crossing NG-2b	SW 1-19-2, SE 1-19-2	road upgrade (permanent)	0.1	Paralleling existing disturbance (trail) within County road allowance; the width of the access road will be limited to 20 m to minimize native grassland impacts associated with turbine T6 access road. Permanent disturbance.
Crossing NG-3a	SW 1-19-2, SE 1-19-2, SW 6-19-1, NW 36-18-2	road upgrade (temporary)	0.5	Paralleling existing disturbance (trail) within County road allowance; the width of the access road will be limited to 20m to minimize native grassland impacts associated with turbine T6 access road; temporary disturbance.
Crossing NG-3b	SE 1-19-2, SW 6-19-1	road upgrade (permanent)	0.4	Paralleling existing disturbance (trail) within County road allowance; the width of the access road will be limited to 20m to minimize native grassland impacts associated with turbine T6 access road
Crossing NG-3c	SW 1-19-2, SE 1-19-2, NW 36-18-2	turbine access road (permanent)	<0.1	Paralleling existing disturbance (trail) within County road allowance; the width of the access road will be limited to 20m to minimize native grassland impacts associated with turbine T6 access road

< = less than; NG= native grassland; ha = hectare; ID = Identification; NW = northwest; SE = southeast; SW = southwest; W4 = West of the Fourth Meridian.

A total of 1.2 ha of native grassland will be impacted by the temporary construction footprint and is expected to be reclaimed immediately following construction. For those areas where avoidance was not possible, minimal disturbance construction practices will be implemented. To specifically limit potential effects on native grassland the following guidelines will be applied to development activities in areas of native vegetation (i.e., native grassland land cover type):

- Limit the width of disturbance for the construction of access roads to no more than 20 m.
- Where possible, utilize existing access trails and roads.

- Conserve the integrity of the sod, topsoil and subsoil *in situ* where stripping is not required.
- Use the direct plough technique for installing the collection system within native grassland.
- Limit the amount of topsoil stripping and grading required using matting, geo-textiles and/or working during frozen or dry ground conditions.
- Construction equipment will enter the Project site in clean condition to limit the potential for introduction of weeds (i.e., free of soils and vegetative debris) and in good working order (i.e., no oil or hydraulic fluid leaks).
- Equipment will be visually inspected and cleaned off-site as needed.
- No fueling of equipment will take place within 100 m of native grassland.

Grading will be restricted to what is required for access, and safe construction and operational practices. All vehicle traffic and equipment will be required to remain within the Project footprint. For immediate/short-term duration disturbances (e.g., collection system installation) in native grassland, alternative methods such as sod salvage and replacement may be attempted; however, for longer duration disturbances (i.e., new public roads), the viability of salvaged sod may limit its application.

Following Project construction, Project footprint components that are not required during operation will be re-vegetated as soon as reasonably possible to limit the potential establishment of weeds on disturbed ground. Only certified seed mixes will be used, and these will be selected in consultation with the appropriate landowners.

The Project footprint will be regularly monitored for weed infestations during operation, and plant species designated as prohibited noxious or noxious (Province of Alberta 2016) will be eliminated or controlled. Control techniques will reflect site conditions and the nature of infestation, and could include a combination of hand pulling, mowing and spot spraying with appropriate herbicides.

At the end of the Project life, above-ground structures will be decommissioned and removed in accordance with the C&R Directive. The concrete footings for the turbines will be removed to a depth of 1.2 m below surface, consistent with current requirements under the C&R Directive. The excavation will be backfilled with subsoil and topsoil to match the natural grade and soil profile. Underground cables will be terminated and capped at connection points and will remain in place to limit re-disturbance of soil and vegetation.

When decommissioning occurs, reclamation standards outlined in the current C&R Directive or subsequent standards in place at the time of decommissioning will be followed. Soil management will be incorporated into this process to facilitate site reclamation. After the infrastructure is removed, areas of disturbance will be ploughed to alleviate soil compaction and graded to restore terrain profiles. Topsoil will be replaced and prepared for seeding by the landowner(s) on cultivated areas. Areas of native grassland will be replanted with certified and inspected native grass and forb seed mixes appropriate for the land cover type.

3.0 WILDLIFE ZONES AND CRITICAL HABITAT

16) Wildlife Zones

As per the Directive, is the project sited in the following wildlife zones:

a) Greater Sage-Grouse Range (inclusive of the area covered by Environment Canada's Emergency Protection Order)?

No

b) Trumpeter Swan Waterbodies and Watercourses (inclusive of 800 m setback from waterbody and watercourse)

No

c) Caribou Zones?

No

d) Mountain Goat and Sheep Zones?

No

e) Piping Plover Waterbodies (inclusive of 200 m setback from waterbody)?

No

If the project is sited in the above wildlife zones, provide the details of the project infrastructure (location, type of infrastructure, and amount of area impacted) in each habitat type and the rationale for siting the project in an area identified as higher risk by AEP-FWS policy. If the proposed project will impact more than one of the identified wildlife zones, provide the details for each type of wildlife zone separately.

Not applicable for this Project.

17) Critical Habitat

Is the project sited within federally designated Critical Habitat *(Species at Risk Act*)? If yes, identify the species for which the Critical Habitat is designated, provide the details of the project infrastructure (location, type of infrastructure, and amount of area impacted) in Critical Habitat and rationale for siting the project in an area deemed high risk by AEP-FWS policy. If the proposed project will impact more than one of the identified Critical Habitats, provide the details for each species' Critical Habitat that will be impacted.

Based on correspondence with Canadian Wildlife Service (CWS; Harder, J. pers. comm. 2021), the Project is not sited within federally designated or proposed Critical Habitat under the *Species at Risk Act* (SARA; refer to Figure A-3 in Appendix A).

18) Valley or Coulee Break

Is the project sited within 100 m of a valley or coulee break? If yes, provide the details of the project infrastructure (location, type of infrastructure, and amount of area impacted) within 100 m of a valley or coulee break and rationale for siting the project in an area deemed higher risk by AEP-FWS policy.

Avoidance of coulee/valley breaks was considered as mitigation during the design phase of the Project. The Project will not be sited within 100 m of a valley or coulee break.

18i) Alternative Mitigation

Detail any proposed alternative mitigation(s) the proponent will implement to meet the intent of the Directive.

Alternative mitigations are presented in response to Question 15).

4.0 LAKES, WETLANDS AND WATERCOURSES

19) Lake, Wetlands and Watercourses

Is the Project sited within 100 m of any seasonal marshes/seasonal shallow open waterbodies, semi-permanent marsh/semi-permanent shallow open waterbodies, permanent shallow open water or intermittent shallow open water (i.e., Class III, Class IV, Class V and Class VI wetlands) as defined by the Alberta Wetland Classification System (Government of Alberta 2015)? If the project is sited within a wetland setback, provide a summary of the details (location, type of infrastructure, and amount of area impacted) and rationale for the siting decision in a table with the following headings.

In total, 142 Class III-VI wetlands occupying 168.3 ha were documented in the Project Study Area (refer to Figure A-4a - Figure A-4g in Appendix A). Graminoid marshes were the most frequently observed wetland type, with 112 occurrences and a coverage of 137.6 ha (81.7%) of the Class III-VI wetland area within the Project Study Area.

Three Class III-VI wetland setbacks will be slightly encroached to accommodate corner widening for turbine access roads to T8, T9, and T20 (Table 7; Appendix A, Figures A-4b and A-4g). Direct temporary or permanent impacts to Class III- VI wetlands due to the Project are not anticipated. Avoidance of wetlands will be the primary mitigation employed during construction and operation of the Project. Field verification of high-resolution wetland mapping was used by the Proponent during the planning stage to develop the Project footprint. Turbine locations and associated access roads, the substation, the Operations &Maintenance (O&M) facility, interconnection poles, upgrades to public roads, and the permanent met tower have been sited to avoid temporary or permanent direct wetland impacts. If construction activities are required near wetlands, measures will be taken to limit the potential for silt to reach these areas. This commitment is described in more detail below under Question 19i).

The Project has been sited to avoid direct impacts to Class III-VI wetlands. However, temporary Project disturbances (i.e. construction footprint) are sited slightly within 100 m of three Class III-VI wetlands. Table 7 summarizes Class III-VI wetland occurrences within 100 m of the Project footprint, and the rationale for Project siting decisions. Figure A-4a - Figure A-4g show all wetlands within the Project Study Area and the nearest distance from the wetland edge to the Project footprint.

Table 7: Project Footprint Sited within 100 Metres of Class III-VI Wetlands

Wetland Name/ ID Number	Wetland Class[a,b]	Legal Location (W4M)	Proximity of Infrastructure to Nearest Edge of Wetland (m)	Nearest Proposed Infrastructure Type within Setback[c]	Area of Wetland Intersecting Operation Footprint (Direct Permanent Impact) [ha][d]	Area of Wetland Intersecting Construction Footprint (Direct Temporary Impact) [ha] [d]	Rationale/ Justification for Siting Decision
Within 100 m of Temporary (Construction) Footprint (Indirect temporary Impact)							
6081	W-A (IV)	SE 8-18-1	87.1	corner widening for turbine T20 access road	0	0	Utilizing existing Highway 41
5719	M-G (III)	NW 32-18-1	90.9	corner widening for turbine T9 access road	0	0	Utilizing existing Range Road 15
5758	M-G (III)	SE 32-18-1	70.8	corner widening for turbine T8 access road	0	0	Utilizing existing Highway 41

(a) Alberta Wetland Classification System (ESRD 2015).

(b) Roman numerals in parentheses are equivalent to wetland permanency by Stewart and Kantrud (1971).

(c) Construction footprint associated with infrastructure components will be reclaimed upon completion of construction.

(d) Values of 0 ha indicate features that are not directly impacted by the Project, but rather Project infrastructure encroaches on the recommended 100 m setback from the feature.

ha = hectare; ID = identification; NE = northeast; NW = northwest; SE = southeast; SW = southwest; W4M = West of the Fourth Meridian; m = metres.

19i) Alternative Mitigation

Provide details of construction and operational mitigation the proponent will implement to meet the intent of the Directive.

Mitigation measures to protect wetlands will include construction during dry or frozen ground conditions, and the employment of rig matting, geotextiles, vegetated buffer zones, earthen berms and/or silt fencing, as appropriate. Wetlands will be clearly marked prior to start of construction to prevent vehicle traffic from entering the wetland boundaries. Following the construction phase, temporary access roads and workspaces immediately adjacent to wetlands will be re-vegetated as quickly as feasible to reduce the potential for siltation. Permanent erosion control measures will be employed around turbine locations, the substation, the O&M facility, interconnection poles, and access roads including re-vegetation or placement of large diameter rock on slopes and the installation of permanent berms, as appropriate. All wetland disturbances will follow and comply with the *Water Act* authorizations as required, as well as the Alberta Wetland Policy (GOA 2013).

Prior to construction activities occurring within 100 m of all Class III-VI wetlands, a non-intrusive field survey will be conducted by an experienced wildlife biologist to determine the presence of breeding amphibians and, if necessary, mitigation will be applied to reduce any effects to breeding amphibians as per Appendix A in the Directive. For all species not listed in Appendix A of the Directive a 100 m setback from any active house, nest or den will be applied (AEP 2018a). The Proponent will discuss findings and the need for additional mitigation with AEP-FWS so that potential residual effects on amphibians are acceptable. The Proponent will schedule construction within setbacks with the potential to support amphibian populations outside of the breeding period or

will commit to having an experienced wildlife biologist onsite if construction during the breeding period is necessary.

If construction is scheduled during the migratory bird nesting period, nest searches will be performed by an experienced wildlife biologist to identify breeding birds or their nests. If breeding activity is identified then appropriate setback buffers will be applied to the suspected nest location to minimize the risk of disturbing birds, nests or eggs in accordance with the *Migratory Bird Convention Act* and the Alberta *Wildlife Act*.

20) Named Lake or Water Body

Within ? If the project is sited within a waterbody setback, provide the details of the project infrastructure (location, type of infrastructure, and amount of area impacted) within the setback and the rationale for siting the project in an area identified as higher risk by AEP-FWS policy. Provide details of any proposed alternative mitigation(s) the proponent will implement to meet the intent of the Directive.

No, the Project is not sited within 1,000 m of a named lake or waterbody.

21) Amphibian Surveys

Were amphibian surveys completed? If no, continue to question 22.

No amphibian surveys were completed in the Project Study Area; therefore, questions a) through k) are not applicable.

22) Identify any project infrastructure sited within:

a) 45 metres from the top of the break of intermittent watercourses or springs?

The Project is not sited within 45 metres from the top of the break of intermittent watercourses or springs.

b) 45 metres from the top of the break of small permanent watercourses?

The Project is not sited within 45 metres from the top of the break of small permanent watercourses.

c) 100 metres from the top of the break of large permanent watercourses?

The Project is not sited within 100 metres from the top of the break of large permanent watercourses.

If the project is sited in any of the above setbacks, provide the details of the project infrastructure (location, type of infrastructure, and amount of area impacted) within the setback of a watercourse and rationale for siting the project in an area deemed higher risk by AEP-FWS policy. Provide details of any proposed alternative mitigation(s) the proponent will implement to meet the intent of the Directive.

5.0 PRE-ASSESSMENT WILDLIFE SURVEYS

23) Qualified Professionals

Were all wildlife surveys completed by an experienced wildlife biologist as defined by the Directive?

Yes

24) Research and Collection Licenses

Provide all Research and Collection license numbers that apply to this project.

Data was collected under Research and Collection license numbers 18-801 and 20-061.

25) FWMIS Submission

Has all pre-assessment wildlife survey data been submitted to AEP-FWS in a FWMIS load form? Provide the date(s) of FWMIS Submission to AEP-FWS.

Pre-assessment wildlife survey data collected in 2018 for the Project was submitted in a loadform on April 12, 2019. Data were collected in 2020 under Permit 20-061 which covers all Golder projects in southern Alberta. As such, data will be compiled and submitted to the Online Permitting and Clearing (OPAC) site before February 15, 2021.

6.0 REQUIRED SURVEYS

26) Spring Migration Bird Surveys

a) **Provide details of survey protocols including the search area, the survey duration, how survey points were chosen, and the number of visits to each survey point. In addition, describe what was considered an incidental observation and if these observations were recorded and reported. Clearly state adherence to existing AEP survey protocols. If alternative survey methods were used provide details of the survey methods with justification and rationale for using alternative methods.**

Bird migration data were collected to estimate temporal and spatial use of the Project Study Area by migratory birds during the spring migration season. Five circular point count plots of 800 m radius and eight stopover count plots were surveyed in 2020. Point count locations were spaced a minimum of 1,000 m apart and placed to capture various land cover types within the Project Study Area while optimizing spatial coverage of the Project Study Area. Point count locations were positioned near features that may concentrate birds such as riparian areas or wetlands while taking into consideration access, health and safety and field of view (i.e., 360 degree [°] view of the entire 800 m radius point count plot). The plots were established at locations that provided the greatest opportunity to view the entire 800 m radius plot; however, in some cases, a 360° view was not possible due to terrain features and/or trees. Point count location plot centers were geo-referenced with hand-held global positioning system (GPS). Where possible, calibration of distance classes was completed through landmarking. Stopover count locations were considered during a desktop assessment to identify potential stopover locations (i.e., large wetlands, lakes, reservoirs, Important Bird Areas) within the Project Study Area and a 1 km buffer. Additional stopover count locations were identified by observers in the field where locations were identified with high potential for resting, feeding, or staging migratory birds.

During point count surveys, all birds observed were recorded during 20-minute sample events, conducted twice daily (morning and afternoon). Observations were recorded in one of three distance classes (i.e., 0 to 400 m, 400 to 800 m and greater than 800 m). Each observation was assigned a unique observation number, and consisted of species (or species group), number of individuals, sex and age class, distance from plot centre (first observed and closest), altitude above-ground (first observed, lowest, and highest), activity, and habitat(s). During stopover count surveys, all birds observed were recorded.

For both point count and stopover count surveys, activity categories include perching, flapping, soaring, circle soaring, and hovering. When the species could not be positively identified, often due to distance from the observer, brief observation, mixed species flocks and/or poor light conditions, the birds were identified to species group alone (e.g., unidentified passerine, unidentified duck). At each plot, the date, plot number and the start/end times were recorded along with weather information, including temperature, wind speed (low and high) and direction, cloud cover and precipitation. All observations were recorded on Project specific data sheets.

Data collected during the surveys represent an index of the birds present within the Project Study Area and not a complete census of all birds within the plots; this is due to limitations on detecting smaller birds at longer distances, and because a 360º view was not present at all plots.

Spring migration bird surveys were conducted by experienced wildlife biologists familiar with the survey methods and identification of bird species encountered during the study.

Any provincially or federally designated bird species of concern seen outside of the 20-minute timing interval of point count surveys or between plot locations within the Project Study Area were recorded as incidental observations. Other wildlife observations, including mammals and amphibians, and provincially or federally listed species observed while traveling between specific survey locations were recorded, and the habitats in which they were observed were noted. Uncommon species and species of interest were also recorded as incidentals. Species of concern included those listed federally under the SARA or designated by the *Committee on the Status of Endangered Wildlife in Canada* (COSEWIC) (Government of Canada 2020) or provincially by AEP (AEP 2015).

b) Provide the survey dates.

Spring migration bird surveys for the Project were completed on the following dates:

- April 4, 2020
- April 19, 2020
- May 12 to 13, 2020

c) Provide the time of day surveys were conducted.

The morning point count surveys began no earlier than sunrise and ended by no later than four hours after sunrise. The afternoon point count surveys began no earlier than four hours before sunset and ended before sunset.

The stopover count surveys were conducted between 11:00 am and 3:10 pm between the morning and afternoon point count surveys to document nocturnal migrants resting from their overnight flights. The timing of these surveys is consistent with the Draft Bird Migration Survey Protocols (AEP 2019).

d) Provide the number of survey points.

Five (5) point count survey locations and eight (8) stopover count survey locations were surveyed in the Project Study Area and a 1 km buffer (refer to Figure A-6 in Appendix A).

e) Provide the total survey time (time spent actively conducting survey).

Each point count survey location was surveyed twice (morning and afternoon) during each round. Overall, 30 spring point count plot visits were conducted, which equates to 600 minutes (10.0 hours) of direct observation.

Each stopover count survey location was surveyed between 2 and 21 minutes once during each round. One plot (RESH20LHSPC08) was surveyed during the first and second survey rounds only. A total of 212 minutes (3.5 hours) of total direct observation was conducted.

A total of 812 minutes (13.5 hours) was spent actively conducting spring bird migration surveys.

f) The location of survey points must be provided in a map (refer to the *Maps and Figures* section below); provide the name of this map.

The location of the point count survey and stopover count survey locations is presented on Figure A-6 (refer to Appendix A).

g) Provide weather conditions during each survey date and time in a table with the following headings.

The weather conditions during each survey date are provided in Table 8.

Table 8: Weather Conditions During Spring 2020 Migration Surveys

Survey Date (2020)	Weather Conditions				Comments
	Temperature [°C]	Wind Speed [km/h]	Precipitation	Cloud Cover [%]	
April 14	-7 to -2	1 to 11	None	100	water frozen in wetlands and waterbodies
April 19	1 to 19	10 to 40	None	10 to 80	water level in multiple wetlands low
May 12	0 to 9	10 to 30	None to drizzle	20 to 100	-
May 13	8 to 11	5 to 10	None	90 to100	water level in multiple wetlands low or dry

- = no comments; km/h = kilometres per hour;°C = degrees Celsius; % = percent.

h) Describe the habitat type or land use within the surveyed area.

The land cover types within the surveyed areas are provided in Table 9. All plots were primarily located in cultivation with the exception of one plot (RESH20LHSPC04) which has slightly more native grassland and wetland land cover than cultivation within its 800 m radius. Small areas of developed land cover (i.e., farmyards, small industrial facilities and roads) as well as remnant native habitat (i.e., wetlands, native grassland) and tame pasture or hay occurred within an 800 m radius of some survey locations. Treed habitat was noted in the field as secondary land cover but was limited to shrubby habitat surrounding wetlands, or treed land cover associated primarily with farmyards.

Table 9: Spring Migration Bird Point Count and Stopover Count Location Descriptions

Survey Location	Predominant Land Cover	Secondary Land Cover
Stopover Count Locations		
RESH20LHSPC01	cultivation	wetland, road
RESH20LHSPC02	cultivation	native grassland, wetland, treed, road
RESH20LHSPC03	cultivation	wetland (open water), road
RESH20LHSPC04	native grassland	wetland, cultivation, road
RESH20LHSPC05	cultivation	wetland, native grassland, road
RESH20LHSPC06	cultivation	tame pasture or hay, wetland, road
RESH20LHSPC07	cultivation	wetland, native grassland, road
RESH20LHSPC08	cultivation	farmyard, tame pasture or hay, wetland, treed, road
Point Count Locations		
RESH18LVAUS13	cultivation	wetland, road, native grassland, tame pasture or hay
RESH18LVAUS23	cultivation	native grassland, treed, wetland, farmyard, developed, road
RESH18LVAUS26	cultivation	tame pasture or hay, treed, wetland, native grassland, road
RESH18LVAUS32	cultivation	native grassland, wetland, tame pasture or hay, treed, road
RESH20DCAUS41	cultivation	tame pasture or hay, treed, farmyard, road

i) **Results: Provide the survey results in tables using the following format. The tables must provide an understanding of the number of observations at each survey location and during each round of surveys, a list of the species observed and a summary of the observations per bird guild. Provide a brief written description of the results.**

The number of individuals at each stopover count and point count locations observed during each round of spring migration bird surveys in 2020 is summarized in Table 10. A total of 1,380 individuals were observed over three survey rounds with the highest level of activity recorded during the first round of surveys (Table 10). The most abundant species observed was Canada goose (*Branta canadensis*; 571 individuals), followed by red-winged blackbird (*Agelaius phoeniceus*; 162 individuals), and tundra swan (*Cygnus columbianus*; 159 individuals) (Table 11). The most abundant bird guild observed was waterfowl (914 individuals; 66.2% of all observations) followed by passerines (422 individuals; 30.6% of all observations) (Table 12). Four provincially listed species, barn swallow (*Hirundo rustica;* 5 individuals), chestnut-collared longspur (*Calcarius ornatus*; 5 individuals), purple martin (*Progne subis;* 5 individuals), and sharp-tailed grouse (2 individuals) were observed. Barn swallow, purple martin and sharp-tailed grouse are listed provincially as Sensitive while chestnut collared longspur is listed as At Risk. Of these, two species are listed federally under Schedule 1 of the SARA including barn swallow (Threatened) and chestnut-collared longspur (Endangered) (Government of Canada 2020).

Table 10: Observations by Survey Location: Number of Individuals Detected at Each Survey Location During Each Spring Survey Round

Survey Location	Round 1	Round 2	Round 3	Total Number of Individuals Detected
Stopover Count Locations				
RESH20LHSPC01	2	6	12	**20**
RESH20LHSPC02	10	1	9	**20**
RESH20LHSPC03	4	2	10	**16**
RESH20LHSPC04	0	234	43	**277**
RESH20LHSPC05	3	19	6	**28**
RESH20LHSPC06	0	3	6	**9**
RESH20LHSPC07	15	2	6	**23**
RESH20LHSPC08	19	2	-	**21**
Point Count Locations				
RESH18LVAUS13	219	19	39	**277**
RESH18LVAUS23	6	18	16	**40**
RESH18LVAUS26	15	28	140	**183**
RESH18LVAUS32	82	17	38	**137**
RESH20DCAUS41	280	21	28	**329**
Total	**655**	**372**	**353**	**1,380**

- = not surveyed.

Table 11: Observations by Species During Spring 2020 Migration Surveys

Species	Provincial General Status[a]	Stopover and Point Count Surveys		Point Count Surveys				Number of Individuals Recorded During Stopover Count Surveys[c]
		Number of Individuals	Number of Flocks[b]	Number of Individuals Observed within 0-400 m	Number of Individuals Observed within 400-800 m	Number of Individuals Observed >800 m	Number of Individuals with No Distance Recorded	
American crow	Secure	11	2	0	0	6	0	5
American robin	Secure	1	0	0	0	0	0	1
American tree sparrow	Secure	1	0	1	0	0	0	0
American wigeon	Secure	12	2	2	0	0	0	10
barn swallow	Sensitive	5	2	5	0	0	0	0
black-billed magpie	Secure	8	2	0	0	5	0	3
Brewer's blackbird	Secure	14	4	8	0	4	0	2
Canada goose	Secure	571	23	73	0	459	27	12
canvasback	Secure	5	1	0	0	0	0	5
chestnut-collared longspur	At Risk	5	2	3	0	0	0	2
common redpoll	Secure	2	1	2	0	0	0	0
European starling	Exotic/Alien	17	3	8	0	0	0	9
great horned owl	Secure	1	0	0	0	0	0	1
horned lark	Secure	77	22	47	0	0	2	28
killdeer	Secure	7	2	4	0	0	0	3
mallard	Secure	44	11	12	0	7	0	25
northern harrier	Secure	4	0	1	0	2	0	1
northern pintail	Secure	76	7	12	0	0	0	64
northern shoveler	Secure	15	5	2	0	0	2	11
purple martin	Sensitive	5	1	0	0	0	0	5
red-tailed hawk	Secure	1	0	0	0	0	0	1
red-winged blackbird	Secure	162	13	140	0	6	0	16

Table 11: Observations by Species During Spring 2020 Migration Surveys

Species	Provincial General Status[a]	Stopover and Point Count Surveys		Point Count Surveys				Number of Individuals Recorded During Stopover Count Surveys[c]
		Number of Individuals	Number of Flocks[b]	Number of Individuals Observed within 0-400 m	Number of Individuals Observed within 400-800 m	Number of Individuals Observed >800 m	Number of Individuals with No Distance Recorded	
ring-billed gull	Secure	1	0	1	0	0	0	0
rough-legged hawk	Secure	1	0	0	0	1	0	0
Savannah sparrow	Secure	7	0	3	0	0	0	4
sharp-tailed grouse	Sensitive	2	1	0	0	0	0	2
Swainson's hawk	Secure	1	0	0	0	0	0	1
tundra swan	Secure	159	4	2	0	7	0	150
unidentified blackbird	n/a	7	2	3	0	0	0	4
unidentified duck	n/a	32	5	0	0	17	0	15
unidentified gull	n/a	25	4	0	0	25	0	0
unidentified longspur	n/a	9	1	0	0	0	0	9
unidentified passerine	n/a	8	4	0	0	8	0	0
vesper sparrow	Secure	26	7	18	0	0	0	8
western meadowlark	Secure	52	8	39	0	0	0	13
willet	Secure	1	0	0	0	0	0	1
yellow warbler	Secure	1	0	0	0	0	0	1
yellow-headed blackbird	Secure	2	1	2	0	0	0	0
yellow-rumped warbler	Secure	2	1	0	0	0	0	2
Total		**1,380**	**141**	**388**	**0**	**547**	**31**	**414**

(a) AEP 2015.
(b) Flocks = a group of greater than 1 bird of the same species gathered or moving together.
(c) Distance not recorded during stopover count surveys.
m = metres; > = greater than; n/a = not applicable.

Table 12: Bird Guild Summary for 2020 Spring Migration Surveys

Bird Guild	Stopover and Point Count Surveys		Point Count Surveys				Number of Individuals Recorded During Stopover Count Surveys[(b)]
	Number of Individuals	Number of Flocks[(a)]	Number of Individuals Observed within 0-400 m	Number of Individuals Observed within 400-800 m	Number of Individuals Observed >800 m	Number of Individuals with No Distance Recorded	
Grouse and Allies	2	1	0	0	0	0	2
Gulls, Terns and Allies	26	4	1	0	25	0	0
Passerines	422	76	279	0	29	2	112
Raptors	8	0	1	0	3	0	4
Shorebirds	8	2	4	0	0	0	4
Waterfowl	914	58	103	0	490	29	292
Total	**1,380**	**141**	**388**	**0**	**547**	**31**	**414**

(a) Flock = a group of greater than 1 bird of the same species gathered or moving together.
(b) Distance not recorded during stopover count surveys.
m = metres; > = greater than.

j) Provide the total number of individuals observed during the surveys.

a) Point count

A total of 966 individuals were observed during spring migration point count surveys.

b) Stopover count

A total of 414 individuals were observed during spring migration stopover count surveys.

c) Combined

A total of 1,380 individuals were observed during spring migration point count and stopover count surveys.

k) Provide the number of species observed.

a) Point count

A total of 24 species were observed during spring migration point count surveys.

b) Stopover count

A total of 28 species were observed during spring migration stopover count surveys.

c) Combined

A total of 34 species were observed during spring migration point count and stopover count surveys.

l) Provide the number of bird observations per minute of survey time.

The number of bird observations per minute of survey time for the spring point count and stopover count surveys is summarized in Table 13.

Table 13: Number of Birds Observed per Minute during Spring Migration Bird Surveys

Survey	Survey Rounds	Survey Visits per Round	Number of Plots	Total Number of Plot Visits	Survey Minutes	Number of Individuals	Number of Bird Observations / Minute of Survey Time
Point Count	3	2	5	30	600	966	1.61
Stopover Count	3	1	8	23[(a)]	212	414	1.95
Combined	3	n/a	13	53	812	1,380	1.70

(a) One plot was surveyed during round one and two only.
n/a = not applicable.

m) Discussion of results–Provide additional information such as the spatial or temporal trends of bird observations. Other relevant information may include average flight height, notes on behaviour (long distance flight, short distance flights between local features or foraging in area), if there were certain survey points with more bird activity than others or habitat features that may have attracted (or reduced) activity and a summary of incidental observations including total numbers and species.

During point count surveys, locations with the highest numbers of birds observed were RESH20DCAUS41 (54.8 individuals/plot visit), followed by plot RESH18LVAUS13 (46.2 individuals/plot visit). Both plots are located in the west half of the Project Study Area (refer to Figure A-6 in Appendix A) and contain large Class IV or V wetlands surrounded primarily by cultivated upland habitat. At both plots the most observations were of waterfowl (46.7 individuals/plot and 38.3 individuals/plot, respectively) followed by passerines (7.2 individuals/plot and 6.7 individuals/plot, respectively). Gulls, terns and allies were observed at both plots and raptors were observed at plot RESH20DCAUS41. Plot RESH20DCAUS41 is located over 2,500 m from the nearest turbine location. Plot RESH18LVAUS13 is located approximately 1,000 m from the nearest turbine location.

Migrating waterbirds may be associated with the South Saskatchewan River located west of the Project Study Area. The Suffield Important Bird Area (IBA; Site AB007) is located approximately 9.3 km west of the Project Study Area and west of the South Saskatchewan River. Important Bird Areas are discrete sites that support either listed avian species, large groups of birds, or avian species that are restricted by either their population range or habitat requirements (IBA 2020). The Suffield IBA is within the Suffield Military Range and has been identified as large, high quality remnants of mixed grassland and sand hills with intermittent saline lakes and springs in the area (IBA 2020). The Proponent adhered to the mitigation hierarchy by avoiding areas of high bird activity within the Project Study Area. Turbines are sited greater than 2,500 m from the plot location with the highest level of bird activity (i.e., RESH20DCAUS41) and more than 1,000 m from the plot location with the second highest level of bird activity during spring surveys (i.e., RESH18LVAUS13). Turbines were sited greater than 10 km away from the IBA and South Saskatchewan River. No turbines are located west of either plot RESH20DCAUS41 or RESH18LVAUS13 between these plot locations and the South Saskatchewan River or IBA (refer to Figure A-6 in Appendix A).

Plot RESH18LVAUS26 had the highest numbers of passerines (26.3 individuals/plot visit) and is located approximately 1,300 m from the nearest turbine.

No observations were made in the 400-800 m distance range (Table 11). While unusual, this result was consistent among observers and is relatively consistent with observations recorded during fall surveys in the same distance category (Table 17). Observations are more easily made when closer to the observer, but large flocks (e.g., geese) can still be observed at distances greater than 800 m, which is an unlimited distance range. During stopover count surveys, plot RESH20LHSPC04 had the highest numbers of birds observed (92.3 individuals/plot visit). Most observations were of waterfowl (86.3 individuals/plot visit) including 150 tundra swan individuals and 45 northern pintails (*Anas acuta*) observed at this plot during the second round of surveys. Habitat within this plot consisted predominantly of native habitat including a Class III wetland and native grassland. Plot RESH20LHSPC04 is located greater than 1,100 m from the nearest turbine. The second highest number of birds observed during stopover count surveys was at plot RESH20LHSPC08 (10.50 individuals/plot visit) which is located over 900 m from the nearest turbine location.

During point count surveys, the average number of birds observed per plot visit was greatest during round one of surveys (36.4 individuals/plot visit) which primarily consisted of waterfowl (32.1 individuals/ plot visit) followed by passerines (3.5 individuals/plot visit). Bird activity dropped after the first round of surveys but was similar for the second (20.7 individuals/plot visit) and third (20.8 individuals/plot visit) rounds. Passerines were observed at relatively higher numbers during the third round of surveys (15.3 individuals/plot visit) than the first or second (4.4 individuals/plot visit) round of surveys. Waterfowl were observed to have the highest number of birds observed per plot visit during the first round of surveys. Gulls, terns and allies had similar relatively higher numbers during the first and second round of surveys and shorebirds during the second and third rounds. Raptors were observed in low numbers (2 or 3 individuals) across all survey rounds. Grouse and allies were only observed during the third round of surveys.

Four provincially listed species, barn swallow (5 individuals), chestnut-collared longspur (5 individuals), purple martin (5 individuals), and sharp-tailed grouse (2 individuals) were observed. Barn swallow, purple martin and sharp-tailed grouse are listed provincially as Sensitive while chestnut collared longspur is listed as At Risk. Of these, two species are listed federally under Schedule 1 of the SARA including barn swallow (Threatened) and chestnut-collared longspur (Endangered) (Government of Canada 2020).

Incidental and listed species observations from all survey years are summarized in Section 13.0.

27) Fall Migration Bird Surveys

a) Provide details of survey protocols including the search area, the survey duration, how survey points were chosen, and the number of visits to each survey point. In addition, describe what was considered an incidental observation and if these observations were recorded and reported. Clearly state adherence to existing AEP survey protocols. If alternative survey methods were used provide details of the survey methods with justification and rationale for using alternative methods.

The fall migration bird survey protocol was the same as that described for the spring bird migration surveys; however, forty (40) circular bird migration point count plots of 800 m radius were surveyed in fall 2018 as part of surveys for a larger area prior to the Project Study Area being defined. Of these 40 plots, 25 overlap the Project Study Area and the 2018 data from these plots have been included in the analysis. No stopover counts were completed in 2018. Eight stopover count survey plots were surveyed in spring 2020 and one additional plot was surveyed in fall 2020. As such, five circular point count plots (four of

which were surveyed in 2018) of 800 m radius and nine stopover count plots were surveyed in fall 2020. Refer to the response to Question No. 26a for details surrounding collection of point count survey data.

b) Provide the survey dates.

Fall migration bird surveys for the Project were completed on the following dates:

- September 7 to 11, 2018
- September 20 to 23, 2018
- October 17 and 19 to 22, 2018
- September 2 and 3, 2020
- October 4 and 5, 2020
- October 30 and 31, 2020

c) Provide the time of day surveys were conducted.

In 2018, the morning point count surveys began no earlier than sunrise and ended no later than 11:00 am, with the exception of two plot visits which began before 11:00 am but extended past 11:00 am and one plot visit that ended at noon. In 2018 the afternoon point count surveys began at 11:00 am and were completed by 3:30 pm.

In 2020, the morning point count and stopover count surveys began no earlier than sunrise and ended no later than four hours after sunrise. The afternoon point count and stopover count surveys began four hours before sunset and were completed by sunset.

d) Provide the number of survey points.

A total of 26 unique point count locations and nine (9) stopover count locations were surveyed in 2018 and 2020 in the Project Study Area and a 1 km buffer (refer to Figure A-6 in Appendix A).

e) Provide the total survey time (time spent actively conducting survey).

Each point count survey location was surveyed twice (morning and afternoon) during each round. In 2018, 150 fall point count visits were conducted, and 30 fall point count visits were conducted in 2020. Overall, 3,600 minutes (60 hours) of direct observation was completed.

Each stopover count survey location was surveyed between 2 and 10 minutes once during each round. One plot (RESH20LHSPC09) was surveyed during the first and third survey rounds only. A total of 115 minutes (1.9 hours) of total direct observation was conducted.

A total of 3,715 minutes (61.9 hours) was spent actively conducting spring bird migration surveys.

f) Location of survey points must be provided in a reference map (refer to the *Maps and Figures* section below). Provide name of reference map.

The locations of the AUS plots are presented on Figure A-6 (refer to Appendix A).

g) Provide weather conditions during each survey date and time in a table with the following headings.

The weather conditions during each survey date are provided in Table 14.

Table 14: Weather Conditions During Fall 2018 and 2020 Migration Surveys

Year	Survey Date	Weather Conditions				
		Temperature [°C]	Wind Speed [km/h]	Precipitation	Cloud Cover [%]	Comments
2018	September 7	8 to 28	6 to 28	None	0 to 60	-
	September 8	16 to 30	1 to 28	None	20 to 90	smoky
	September 9	14 to 23	1 to 11	None	40	-
	September 10	8 to 26	1 to19	None, drizzle	40 to 90	-
	September 11	10 to 11	1 to 11	None	50 to 100	-
	September 20	1 to 15	0 to 6	None, fog	40 to 80	-
	September 21	6 to 13	1 to 11	None, fog	40 to 100	-
	September 22	1 to 2	1 to 28	None, drizzle	100	-
	September 23	3 to 7	0 to 11	None, fog	100	-
	October 17	6 to 15	1 to 11	None	0	-
	October 19	0 to 14	1 to 11	None	0	-
	October 20	3 to 21	1 to 19	None	0	-
	October 21	-1 to 16	0 to 11	None	0 to 10	-
	October 22	10 to 16	1 to 19	None	0	-
2020	September 2	15 to 19	6 to 28	None	10 to 70	-
	September 3	7 to 17	0 to 11	None	30 to 90	-
	October 4	13 to 22	5 to 25	None	20 to 80	-
	October 5	10 to 15	10 to 20	None	10	-
	October 30	8 to 14	12 to 38	None	10 to 100	-
	October 31	-2 to 2	1 to 19	None	0 to 10	-

- = no comments; km/h = kilometres per hour;°C = degrees Celsius; % = percent.

h) Provide a description of the habitat type or land use within the surveyed area.

The land cover types within the surveyed areas are provided in Table 15. The majority of plots were primarily located in cultivation with one stopover count location and three point count locations having slightly more native grassland and wetland land cover than cultivation within their 800 m radii. Small areas of development (i.e., farmyards, small industrial facilities and roads) as well as remnant native habitat (i.e., wetlands, native grassland) and tame pasture or hay occurred within an 800 m radius of some survey locations. Treed habitat was noted in the field as secondary land cover but was limited to shrubby habitat surrounding wetlands, or treed land cover associated primarily with farmyards.

Table 15: Fall Migration Bird Point Count and Stopover Count Location Descriptions

Survey Location	Predominant Land Cover	Secondary Land Cover
Stopover Count Locations		
RESH20LHSPC01	cultivation	wetland, road
RESH20LHSPC02	cultivation	native grassland, wetland, treed, road
RESH20LHSPC03	cultivation	wetland (open water), road
RESH20LHSPC04	native grassland	wetland, cultivation, road
RESH20LHSPC05	cultivation	wetland, native grassland, road
RESH20LHSPC06	cultivation	tame pasture or hay, wetland, road
RESH20LHSPC07	cultivation	wetland, native grassland, road
RESH20LHSPC08	cultivation	farmyard, tame pasture or hay, wetland, treed, road
RESH20LHSPC09	cultivation	tame pasture or hay, road
Point Count Locations		
RESH18LVAUS09	cultivation	wetland, farmyard, treed, road
RESH18LVAUS12	cultivation	native grassland, tame pasture or hay, road
RESH18LVAUS13	cultivation	wetland, road, native grassland, tame pasture or hay
RESH18LVAUS14	cultivation	farmyard, road
RESH18LVAUS15	cultivation	treed, wetland, farmyard, road
RESH18LVAUS16	native grassland	cultivation, tame pasture or hay, treed, farmyard, road
RESH18LVAUS17	cultivation	native grassland, wetland, farmyard, road
RESH18LVAUS19	cultivation	developed, treed, road
RESH18LVAUS20	cultivation	farmyard, wetland, treed, road
RESH18LVAUS21	cultivation	farmyard, wetland, road
RESH18LVAUS22	native grassland	tame pasture or hay, farmyard, cultivation, wetland, road
RESH18LVAUS23	cultivation	native grassland, treed, wetland, farmyard, developed, road
RESH18LVAUS25	cultivation	tame pasture or hay, native grassland, wetland, road
RESH18LVAUS26	cultivation	tame pasture or hay, treed, wetland, native grassland, road
RESH18LVAUS27	cultivation	wetland, road
RESH18LVAUS28	cultivation	wetland, road
RESH18LVAUS29	cultivation	Road
RESH18LVAUS31	cultivation	native grassland, road
RESH18LVAUS32	cultivation	native grassland, wetland, tame pasture or hay, treed, road
RESH18LVAUS36	cultivation	Road
RESH18LVAUS37	cultivation	Road
RESH18LVAUS38	cultivation	farmyard, road
RESH18LVAUS39	native grassland	cultivation, road
RESH18LVAUS40	cultivation	treed, wetland, road
RESH18LVAUS41	cultivation	tame pasture or hay, developed, road
RESH20DCAUS41	cultivation	tame pasture or hay, treed, farmyard, road

i) **Results: Provide the survey results in tables using the following format. The tables must provide an understanding of the number of observations at each survey location and during each round of surveys, a list of the species observed and a summary of the observations per bird guild. Provide a brief written description of the results.**

The number of individuals at each stopover count and point count locations observed during each round of spring migration bird surveys in 2020 is summarized in Table 16. A total of 38,092 individuals were observed over three survey rounds with the highest level of activity recorded during the third round of surveys (Table 16). The most abundant species observed was Canada goose (6,767 individuals), followed by greater white-fronted goose (*Anser albifrons*; 5,503 individuals), and yellow-rumped warbler (*Setophaga coronata*; 1,167 individuals) (Table 17). Two flocks of unidentified geese consisting of an estimated 12,000 and 5,000 individuals were also observed. The most abundant bird guild observed was waterfowl (31,627 individuals; 83.0% of all observations) followed by passerines (5,127 individuals; 13.5% of all observations) (Table 18). Eleven provincially listed species including: American kestrel (*Falco sparverius*; 4 individuals), bald eagle (*Haliaeetus leucocephalus*; 2 individuals), bank swallow (*Riparia riparia;* 10 individuals), barn swallow (83 individuals), broad-winged hawk (*Buteo platypterus*; 1 individual), eastern kingbird (*Tyrannus tyrannus*; 1 individual), lark bunting (*Calamospiza melanocorys*; 1 individual), McCown's longspur (*Rhynchophanes mccownii*; 10 individuals), prairie falcon (*Falco mexicanus*; 5 individuals), sandhill crane (*Antigone canadensis;* 496 individuals) and sharp-tailed grouse (47 individuals) were observed. All species are provincially listed as Sensitive except McCown's longspur which is listed as May Be at Risk (AEP 2015). Of these, four species are listed federally under Schedule 1 of the SARA as Threatened including barn swallow, bank swallow, lark bunting, and McCown's longspur (Government of Canada 2020).

Table 16: Observations by Survey Location: Number of Individuals Detected at Each Survey Location During Each Fall Survey Round

Survey Location	Round 1	Round 2	Round 3	Total Number of Individuals Detected
Stopover Count Locations				
RESH20LHSPC01	0	1	0	**1**
RESH20LHSPC02	12	156	0	**168**
RESH20LHSPC03	4	2	0	**6**
RESH20LHSPC04	0	9	0	**9**
RESH20LHSPC05	0	8	0	**8**
RESH20LHSPC06	0	16	0	**16**
RESH20LHSPC07	0	1	0	**1**
RESH20LHSPC08	197	135	0	**332**
RESH20LHSPC09	263	-	0	**263**
Point Count Locations				
RESH18LVAUS09	271	1,173	5,646	**7,090**
RESH18LVAUS12	2	82	1	**85**
RESH18LVAUS13	254	1,573	4,795	**6,622**
RESH18LVAUS14	2	73	2	**77**
RESH18LVAUS15	13	189	28	**230**
RESH18LVAUS16	17	30	13	**60**
RESH18LVAUS17	12	137	12,002	**12,151**

Table 16: Observations by Survey Location: Number of Individuals Detected at Each Survey Location During Each Fall Survey Round

Survey Location	Round 1	Round 2	Round 3	Total Number of Individuals Detected
RESH18LVAUS19	25	282	4,239	**4,546**
RESH18LVAUS20	34	1,130	63	**1,227**
RESH18LVAUS21	12	91	1	**104**
RESH18LVAUS22	46	225	20	**291**
RESH18LVAUS23	35	103	21	**159**
RESH18LVAUS25	43	94	11	**148**
RESH18LVAUS26	159	86	78	**323**
RESH18LVAUS27	8	10	10	**28**
RESH18LVAUS28	39	57	11	**107**
RESH18LVAUS29	68	94	34	**196**
RESH18LVAUS31	20	172	85	**277**
RESH18LVAUS32	411	263	1,306	**1,980**
RESH18LVAUS36	4	281	1	**286**
RESH18LVAUS37	12	97	2	**111**
RESH18LVAUS38	22	33	29	**84**
RESH18LVAUS39	32	61	6	**99**
RESH18LVAUS40	155	401	265	**821**
RESH18LVAUS41	8	78	25	**111**
RESH20DCAUS41	50	15	10	**75**
Total	**2,230**	**7,158**	**28,704**	**38,092**

- = not surveyed.

Table 17: Observations by Species During Fall 2020 Migration Surveys

Species	Provincial General Status[a]	Stopover and Point Count Surveys		Point Count Surveys				Number of Individuals Recorded During Stopover Count Surveys[c]
		Number of Individuals	Number of Flocks[b]	Number of Individuals Observed within 0-400 m	Number of Individuals Observed within 400-800 m	Number of Individuals Observed >800 m	Number of Individuals with No Distance Recorded	
American crow	Secure	14	4	4	1	4	5	0
American goldfinch	Secure	59	14	52	0	0	7	0
American green-winged teal	Secure	7	1	7	0	0	0	0
American kestrel	Sensitive	4	0	4	0	0	0	0
American pipit	Secure	221	23	210	0	0	11	0
American redstart	Secure	4	2	4	0	0	0	0
American robin	Secure	9	2	7	0	0	2	0
American tree sparrow	Secure	148	4	148	0	0	0	0
American wigeon	Secure	3	1	3	0	0	0	0
Baird's sandpiper	Secure	32	2	32	0	0	0	0
bald eagle	Sensitive	2	1	2	0	0	0	0
bank swallow	Sensitive	10	1	10	0	0	0	0
barn swallow	Sensitive	83	8	83	0	0	0	0
black-billed magpie	Secure	43	12	31	0	6	5	1
black-capped chickadee	Secure	1	0	0	0	0	1	0
blue-winged teal	Secure	7	2	7	0	0	0	0
Brewer's blackbird	Secure	442	10	292	0	0	0	150
broad-winged hawk	Sensitive	1	0	1	0	0	0	0
cackling goose	Accidental/Vagrant	1,101	3	601	500	0	0	0
Canada goose	Secure	6,767	33	2,412	3,635	702	18	0
chipping sparrow	Secure	8	2	8	0	0	0	0
cinnamon teal	Secure	2	1	2	0	0	0	0
clay-colored sparrow	Secure	99	12	98	0	0	1	0
common goldeneye	Secure	3	1	3	0	0	0	0
common grackle	Secure	22	2	22	0	0	0	0
common loon	Secure	2	1	2	0	0	0	0

Table 17: Observations by Species During Fall 2020 Migration Surveys

Species	Provincial General Status[a]	Stopover and Point Count Surveys		Point Count Surveys				Number of Individuals Recorded During Stopover Count Surveys[c]
		Number of Individuals	Number of Flocks[b]	Number of Individuals Observed within 0-400 m	Number of Individuals Observed within 400-800 m	Number of Individuals Observed >800 m	Number of Individuals with No Distance Recorded	
common raven	Secure	27	3	13	0	1	13	0
dark-eyed junco	Secure	20	6	20	0	0	0	0
eastern kingbird	Sensitive	1	0	1	0	0	0	0
Eurasian Collared-Dove	Exotic/Alien	1	0	1	0	0	0	0
European starling	Exotic/Alien	287	22	276	0	0	11	0
gadwall	Secure	4	1	4	0	0	0	0
gray partridge	Exotic/Alien	32	5	32	0	0	0	0
great horned owl	Secure	7	2	5	0	2	0	0
greater white-fronted goose	Secure	5,503	14	1,685	3,816	0	2	0
greater yellowlegs	Secure	71	9	70	0	0	1	0
hermit thrush	Secure	3	0	3	0	0	0	0
horned lark	Secure	491	51	457	0	0	20	14
house sparrow	Exotic/Alien	52	8	47	0	0	5	0
house wren	Secure	1	0	1	0	0	0	0
killdeer	Secure	164	14	163	0	0	1	0
Lapland longspur	Secure	16	3	8	0	0	0	8
lark bunting	Sensitive	1	0	0	0	0	1	0
lark sparrow	Secure	1	0	1	0	0	0	0
least sandpiper	Secure	48	3	48	0	0	0	0
lesser yellowlegs	Secure	8	2	7	0	0	1	0
Lincoln's sparrow	Secure	18	4	18	0	0	0	0
mallard	Secure	740	19	699	40	0	0	1
marbled godwit	Secure	2	1	2	0	0	0	0
McCown’s longspur	May Be at Risk	10	3	10	0	0	0	0
merlin	Secure	4	0	4	0	0	0	0
mourning dove	Secure	30	5	28	0	0	2	0

Table 17: Observations by Species During Fall 2020 Migration Surveys

Species	Provincial General Status[a]	Stopover and Point Count Surveys		Point Count Surveys				Number of Individuals Recorded During Stopover Count Surveys[c]
		Number of Individuals	Number of Flocks[b]	Number of Individuals Observed within 0-400 m	Number of Individuals Observed within 400-800 m	Number of Individuals Observed >800 m	Number of Individuals with No Distance Recorded	
northern flicker	Secure	8	1	7	0	0	1	0
northern harrier	Secure	28	2	22	5	1	0	0
northern pintail	Secure	1	0	0	0	0	1	0
northern shoveler	Secure	44	7	42	0	0	0	2
northern waterthrush	Secure	1	0	1	0	0	0	0
orange-crowned warbler	Secure	5	1	5	0	0	0	0
palm warbler	Secure	1	0	1	0	0	0	0
pectoral sandpiper	Secure	31	4	31	0	0	0	0
pine siskin	Secure	2	1	0	0	0	2	0
prairie falcon	Sensitive	5	0	4	1	0	0	0
red-eyed vireo	Secure	1	0	0	0	0	1	0
redhead	Secure	20	2	20	0	0	0	0
red-tailed hawk	Secure	6	2	6	0	0	0	0
red-winged blackbird	Secure	267	4	141	0	0	0	126
ring-billed gull	Secure	11	1	11	0	0	0	0
ring-necked duck	Secure	4	2	4	0	0	0	0
rock dove	Exotic/Alien	35	3	20	0	3	0	12
sandhill crane	Sensitive	496	16	276	147	64	9	0
Savannah sparrow	Secure	199	30	196	0	0	2	1
sharp-tailed grouse	Sensitive	47	4	40	0	7	0	0
snow goose	Secure	402	4	121	281	0	0	0
song sparrow	Secure	64	11	64	0	0	0	0
Swainson's hawk	Secure	24	5	18	5	0	1	0
Swainson's thrush	Secure	2	1	2	0	0	0	0
swamp sparrow	Secure	3	1	3	0	0	0	0
Tennessee warbler	Secure	10	2	10	0	0	0	0

Table 17: Observations by Species During Fall 2020 Migration Surveys

Species	Provincial General Status[a]	Stopover and Point Count Surveys		Point Count Surveys				Number of Individuals Recorded During Stopover Count Surveys[c]
		Number of Individuals	Number of Flocks[b]	Number of Individuals Observed within 0-400 m	Number of Individuals Observed within 400-800 m	Number of Individuals Observed >800 m	Number of Individuals with No Distance Recorded	
tree swallow	Secure	11	1	11	0	0	0	0
tundra swan	Secure	19	1	19	0	0	0	0
unidentified bird	n/a	83	3	83	0	0	0	0
unidentified blackbird	n/a	513	9	20	10	49	0	434
unidentified corvid	n/a	2	0	1	0	1	0	0
unidentified goose	n/a	17,000	2	0	0	17,000	0	0
unidentified longspur	n/a	18	1	1	0	0	0	17
unidentified passerine	n/a	47	10	36	1	10	0	0
unidentified raptor	n/a	2	0	0	1	1	0	0
unidentified sparrow	n/a	23	4	5	0	0	0	18
unidentified warbler	n/a	48	3	46	0	0	2	0
vesper sparrow	Secure	273	38	271	0	0	2	0
western meadowlark	Secure	234	50	142	0	0	73	19
white-crowned sparrow	Secure	61	6	60	0	0	1	0
Wilson's phalarope	Secure	1	0	0	0	0	0	1
Wilson's snipe	Secure	153	2	152	0	0	1	0
Wilson's warbler	Secure	31	1	31	0	0	0	0
yellow warbler	Secure	39	4	39	0	0	0	0
yellow-headed blackbird	Secure	14	2	14	0	0	0	0
yellow-rumped warbler	Secure	1,167	66	1,163	0	0	4	0
Total		**38,092**	**624**	**10,787**	**8,443**	**17,851**	**207**	**804**

(a) AEP 2015.
(b) Flocks = a group of greater than 1 bird of the same species gathered or moving together.
(c) Distance not recorded during stopover count surveys.
m = metres; > = greater than; n/a = not applicable.

Table 18: Bird Guild Summary for 2020 Fall Migration Surveys

Bird Guild	Stopover and Point Count Surveys		Point Count Surveys				Number of Individuals Recorded During Stopover Count Surveys[b]
	Number of Individuals	Number of Flocks[a]	Number of Individuals Observed within 0-400 m	Number of Individuals Observed within 400-800 m	Number of Individuals Observed >800 m	Number of Individuals with No Distance Recorded	
Grouse and Allies	79	9	72	0	7	0	0
Gulls, Terns and Allies	11	1	11	0	0	0	0
Near Passerines	8	1	7	0	0	1	0
Passerines	5,127	442	4087	12	71	169	788
Pigeons and Doves	66	8	49	0	3	2	12
Raptors	83	12	66	12	4	1	0
Shorebirds	510	37	505	0	0	4	1
Waterbirds	498	17	278	147	64	9	0
Waterfowl	31,627	94	5629	8272	17,702	21	3
Unknown Bird	83	3	83	0	0	0	0
Total	**38,092**	**624**	**10,787**	**8,443**	**17,851**	**207**	**804**

(a) Flock = a group of greater than 1 bird of the same species gathered or moving together.
(b) Distance not recorded during stopover count surveys.
m = metres; > = greater than.

j) Provide the total number of individuals observed during the surveys.

d) Point count

A total of 37,288 individuals were observed during fall migration point count surveys.

e) Stopover count

A total of 804 individuals were observed during fall migration stopover count surveys.

f) Combined

A total of 38,092 individuals were observed during fall migration point count and stopover count surveys.

k) Provide the number of species observed.

d) Point count

A total of 88 species were observed during fall migration point count surveys.

e) Stopover count

A total of 11 species were observed during fall migration stopover count surveys.

f) Combined

A total of 89 species were observed during fall migration point count and stopover count surveys.

l) Provide the number of bird observations per minute of survey time.

The number of bird observations per minute of survey time for the fall point count and stopover count surveys is summarized in Table 19.

Table 19: Number of Birds Observed per Minute during Fall Migration Bird Surveys

Survey	Survey Rounds	Number of Plots (2018)	Number of Plots (2020)	Survey Visits per Round	Total Number of Plot Visits	Survey Minutes	Number of Individuals	Number of Bird Observations / Minute of Survey Time
Point Count	3	25	5	2	180	3,600	37,288	10.35
Stopover Count	3	-	9	1	26[(a)]	115	804	6.99
Combined	3	25	14	n/a	206	3,715	38,092	10.25

(a) One plot was surveyed during round one and three only.
n/a = not applicable.

m) Discussion of results–Provide additional information such as the spatial or temporal trends of bird observations. Other relevant information may include average flight height, notes on behaviour (long distance flight, short distance flights between local features or foraging in area), if there were certain survey points with more bird activity than others or habitat features that may have attracted (or reduced) activity and a summary of incidental observations including total numbers and species.

During point count surveys, locations with the highest numbers of birds observed were RESH18LVAUS17 (2,025.2 individuals/plot visit), followed by RESH18LVAUS09 (1,181.67 individuals/plot visit). Plot RESH18VAUS17 is located approximately 340 m outside of the northwest portion of the Project Study Area (refer to Figure A-6 in Appendix A) and contains a large Class IV wetland surrounded by native grassland. Portions of the Project Study Area falling within the 800 m plot radius consists primarily of cultivated upland habitat. The most observations at this plot were of waterfowl (2,000.0 individuals/plot visit) followed by waterbirds (13.2 individuals/plot visit). A single flock of approximately 12,000 geese consisting of Canada geese, greater white-fronted geese, snow geese (*Anser caerulescens*), and cackling geese (*Branta hutchinsii*) were observed during the third round of surveys in 2018, contributing to the high numbers at this plot location. Plot RESH18LVAUS17 is located over 1,200 m from the nearest turbine location. Plot RESH18LVAUS09 is located approximately 800 m west of the southwest corner of the Project Study Area (refer to Figure A-6 in Appendix A). The plot is primarily located in cultivated upland habitat but also consists of a large wetland and large active farmyard. Number of individuals at this plot were largely driven by waterfowl (1,053.0 individuals/plot visit), passerines (73.8 individuals/plot visit), and shorebirds (45.5 individuals/plot visit). A single flock of 5,000 unidentified geese were observed during the third round of surveys, contributing to the high numbers at this plot location. Plot RESH18LVAUS09 is located over 4,200 m from the nearest turbine location.

Higher numbers of migrating waterbirds may be associated with the South Saskatchewan River and the Suffield IBA located west of the Project Study Area. No turbines are located west of either plot RESH18LVAUS17 or RESH18LVAUS09 between these plot locations and the South Saskatchewan River and IBA (refer to Figure A-6 in Appendix A). The Proponent adhered to the mitigation hierarchy by avoiding areas of high bird activity within the Project Study Area. Turbines are sited greater than 1,200 m from the plot location with the highest level of bird activity (i.e., RESH18LVAUS17) and more than 4,200 m from the plot location with the second highest level of bird activity during spring surveys

(i.e., RESH18LVAUS09). Turbines were sited greater than 10 km away from the IBA and South Saskatchewan River.

Plot RESH18LVAUS40 had the highest numbers of passerines (133.3 individuals/plot visit) and is located greater than 2,700 m from the nearest turbine location.

During stopover count surveys, plot RESH20LHSPC09 had the highest numbers of birds observed (131.5 individuals/plot visit) followed by plot RESH20LHSPC08 (110.67 individuals/plot visit). Only passerines were observed at both plot locations. Habitats within these plots were primarily cultivated cropland with some tame pasture or hay associated with each. Both plots are located at the southwest portion of the Project Study Area greater than 3,000 m (RESH20LHSPC09) and 900 m (RESH20LHSPC08) from the nearest turbine location. No turbines are located west of either plot RESH18LVAUS17 or RESH18LVAUS09 between these plot locations and the South Saskatchewan River or IBA (refer to Figure A-6 in Appendix A). During point count surveys, the average number of birds observed per plot visit was greatest during the third round of surveys (416.0 individuals/plot visit) driven by waterfowl (401.9 individuals/plot visit) followed by passerines (11.3 individuals/plot visit). Overall bird activity was lowest during the first round of surveys (31.9 individuals/plot visit), followed by the second round (102.3 individuals/plot visit) and the third, consistent with waterfowl activity. Guilds with the highest number of birds during the second round of surveys included passerines (40.8 individuals/plot visit), shorebirds (6.4 individuals/plot visit), and waterbirds (5.8 individuals/plot visit). Pigeons and doves, and raptors in relatively small numbers were observed most during the first round of surveys while grouse and allies were observed most during the third round of surveys. Gulls, terns and allies and near passerines were only observed during the second round of surveys.

Eleven provincially listed species including: American kestrel (4 individuals), bald eagle (2 individuals), bank swallow (10 individuals), barn swallow (83 individuals), broad-winged hawk (1 individual), eastern kingbird (1 individual), lark bunting (1 individual), McCown's longspur (10 individuals), prairie falcon (5 individuals), sandhill crane (496 individuals) and sharp-tailed grouse (47 individuals) were observed. All species are provincially listed as Sensitive, except McCown's longspur which is listed as May Be at Risk (AEP 2015). Of these, four species are listed federally under Schedule 1 of the SARA as Threatened including barn swallow, bank swallow, lark bunting, and McCown's longspur (Government of Canada 2020).

Incidental and listed species observations from all survey years are summarized in Section 13.0.

28) Breeding Bird Surveys

a) Were the established survey protocols within the AEP-FWS *Sensitive Species Inventory Guidelines* followed? Provide details of the survey protocol including the search area, the survey duration, how survey points were chosen, and the number of visits to each survey point. In addition, describe what was considered an incidental observation and if these observations were recorded and reported.

Breeding bird surveys were completed in 2020 following Alberta's *Sensitive Species Inventory Guidelines* (ESRD 2013a). These data are valid for a five-year period as per clauses 100.2.4 and 100.2.10 of the Directive (AEP 2018a), as well as Question No. 39 in the Renewable Energy Project Submission template (AEP 2020a).

The location of each point count was pre-selected so that all land cover types within the Project Study Area were sampled, and plots were spaced approximately 800 m apart. Data included were restricted to breeding songbirds only. Woodpeckers, corvids (jays, crows, ravens), hummingbirds, marshbirds, shorebirds, raptors, and owls were excluded. Individuals that occurred beyond 100 m of the plot centre as well as individuals flying through or over the plot were also excluded. Species excluded from analysis were recorded and are reported as incidental observations (Section 13.0).

b) Provide the survey dates.

Breeding bird surveys for the Project were completed on the following dates:

- June 3 to 6 and 8, 2020
- June 25 to 27, 2020

c) Provide the time of day surveys were conducted.

In 2020, each plot was visited twice (except for one plot location) between one-half hour before sunrise until 10:00 am.

d) Provide the number of survey points.

Forty (40) breeding bird survey plots were surveyed within the Project Study Area in 2020 (refer to Figure A-7 in Appendix A).

e) Provide the total survey time (time spent actively conducting survey).

In 2020 the total breeding bird survey time was 395 minutes (6.6 hours).

f) Location of survey points must be provided in a reference map (refer to the *Maps and Figures* section below). Provide name of reference map.

The locations of the breeding birds survey points are presented on Figure A-7 (refer to Appendix A).

g) Provide weather conditions during each survey date and time in a table with the following headings.

The weather conditions during each survey date in 2020 are provided in Table 20.

Table 20: Weather Conditions During Breeding Bird Surveys

Survey Date (2020)	Weather Conditions			
	Temperature [°C]	Precipitation	Wind Speed [km/h]	Cloud Cover
June 3	9 to 16	none	12 to 28	clear/few clouds
June 4	5 to 16	none	1 to 19	clear/few clouds to partly cloudy
June 5	5 to 16	none	1 to 11	clear/few clouds
June 6	13 to 16	none	12 to 19	partly cloudy to cloud/overcast
June 8	6 to 8	none	6 to 19	cloud/overcast
June 25	13 to 20	none	1 to 11	partly cloudy to cloud/overcast
June 26	14 to 22	none	6 to 28	clear/few clouds
June 27	16 to 20	none	1 to 19	partly cloudy to cloud/overcast

km/h = kilometres per hour;°C = degrees Celsius.

h) Provide a description of the habitat type or land use within the surveyed area.

In 2020, breeding bird survey plots were located in plots predominantly consisting of cultivated cropland (n=27), wetland (n=4), native grassland (n=4), tame pasture or hay (n=4), and deciduous treed habitat (n=1). The most common land cover type in the Project Study Area is cultivation. Native grassland is the second most common land cover type, followed by the tame pasture or hay and wetlands (refer to Table 5). Treed habitat is not described in Section 2.0 but was limited to shrubby habitat surrounding wetlands, or treed land cover associated primarily with farmyards. Breeding bird surveys were completed in plot locations chosen to be representative of the Project Study Area.

i) Results: Provide the survey results in tables using the following format. Provide a brief written description of the results.

The number of individuals detected at each breeding bird survey location is provided for the 2020 breeding bird surveys in Table 21. The species observed in 2020 are provided in Table 22.

Table 21: Number of Observations by Breeding Bird Survey Location in 2020

Survey Location	Round 1	Round 2	Total Number of Individuals Detected
Reshbb01	3	3	6
Reshbb02	5	8	13
Reshbb03	2	8	10
Reshbb05	8	10	18
Reshbb06	3	3	6
Reshbb07	3	0	3
Reshbb08	5	3	8
Reshbb09	2	4	6
Reshbb10	3	4	7
Reshbb11	2	4	6
Reshbb12	3	4	7
Reshbb13	3	1	4
Reshbb14	3	5	8
Reshbb15	2	4	6
Reshbb16	2	4	6
Reshbb17	7	3	10
Reshbb18	3	3	6
Reshbb19	7	3	10
Reshbb20	4	3	7
Reshbb21	1	1	2
Reshbb22	5	2	7
Reshbb23	4	6	10
Reshbb24	6	3	9
Reshbb25	6	4	10
Reshbb26	4	4	8
Reshbb27	2	2	4
Reshbb28	2	2	4
Reshbb29	4	6	10

Table 21: Number of Observations by Breeding Bird Survey Location in 2020

Survey Location	Round 1	Round 2	Total Number of Individuals Detected
Reshbb30	7	5	12
Reshbb31	4	3	7
Reshbb32	4	4	8
Reshbb33	2	3	5
Reshbb34	2	6	8
Reshbb35	5	3	8
Reshbb36	4	2	6
Reshbb37	10	6	16
Reshbb38	6	8	14
Reshbb39	8	5	13
Reshbb40	3	8	11
ReshBO08	2	0	2
Total	**161**	**160**	**321**

Table 22: 2020 Breeding Bird Species Observations

Species	Provincial General Status[(a)]	Number of Individuals
American robin	Secure	2
Brewer's blackbird	Secure	3
clay-colored sparrow	Secure	9
common grackle	Secure	2
eastern kingbird	Sensitive	6
eastern phoebe	Sensitive	1
horned lark	Secure	98
mourning dove	Secure	3
Nelson's sharp-tailed sparrow	Secure	3
red-winged blackbird	Secure	59
Savannah sparrow	Secure	31
Sprague’s pipit	Sensitive	4
tree swallow	Secure	1
unidentified blackbird	n/a	3
vesper sparrow	Secure	40
western meadowlark	Secure	55
yellow-headed blackbird	Secure	1

(a) AEP 2015.
n/a = not applicable.

j) Provide of the total number of individuals observed during the surveys.

In 2020, a total of 321 individuals were observed during the breeding bird surveys.

k) Provide the number of species observed.

In 2020, a total of 16 breeding bird species were observed during the breeding bird surveys.

l) Provide the number of bird observations per minute of survey time.

In 2020, an average of 0.81 birds per minute of survey time were observed during the breeding bird surveys.

m) Discussion of results–Provide additional information such as the spatial or temporal trends of bird observations. Other relevant information may include if there were certain survey points with more bird activity than others or habitat features that may have attracted or detracted activity and a summary of incidental observations including total numbers and species.

In 2020, observations of individual breeding birds were consistent across rounds with 161 individuals (4.0 individuals/plot visit) observed during round one and 160 individuals (4.1 individuals/plot visit) observed during round two (Table 21).

Species were most commonly observed in deciduous treed habitat (7.0 individuals/plot visit), followed by wetland (5.9 individuals/plot visit) and tame pasture or hay (5.9 individuals/plot visit). The lowest number of breeding birds per plot visit were recorded in cultivation (3.4 individuals/plot visit).

The most common species observed during the breeding bird surveys were horned lark (*Eremophila alpestris*), red-winged blackbird, and western meadowlark (*Sturnella neglecta*) (Table 22). Three provincially listed species were identified including: eastern kingbird, eastern phoebe (*Sayornis phoebe*), and Sprague's pipit (*Anthus spragueii*). Of these, Sprague's pipit is federally listed as Threatened under Schedule 1 of the SARA. Sprague's pipit were observed at six plot locations (Reshbb02, Reshbb14, Reshbb17, Reshbb24, Reshbb26 and Reshbb35; refer to Figure A-5 in Appendix A) including incidental observations during breeding bird surveys. At their closest, Sprague's pipit were observed 780 m from the nearest turbine location at plot Reshbb17. Eastern kingbird and eastern phoebe were both observed approximately 650 m away from the nearest turbine location (Reshbb20).

Plot Reshbb05 saw the greatest level of bird activity with 18 individuals observed over two rounds (9.0 individuals/plot visit), of which red-winged blackbird (8 individuals) and Savannah sparrow (4 individuals) made up the majority of observations. This was followed by plot Reshbb37 where 16 individuals were observed over two rounds (8.0 individuals/plot visit), of which red-winged blackbird made up the majority of observations. The remaining plots had observations of between two and 14 individuals. Plots Reshbb05 and Reshbb37 are 4,200 m and 2,800 m from the nearest turbines, respectively (refer to Figure A-7 in Appendix A).

Incidental observations recorded during breeding bird surveys included 522 individuals of 46 species. Incidental observations are provided in Section 13.0.

n) If the project is sited within native habitats, such as native grassland or parkland, identify if construction activities will avoid the restricted activity period for breeding birds (April 1st- July 15th)? If no, detail any proposed alternative mitigation(s) the proponent will implement to meet the intent of the Directive.

Yes, approximately 1.7 ha of the Project is sited within native grassland, of which 1.2 ha is temporary disturbance during construction associated with temporary workspace for road construction or improvements, and the installation of the underground collection system, and 0.5 ha is permanent Project footprint associated with a turbine access road crossing native grassland (Table 7).

For temporary Project construction footprint on native grassland, a protective layer (e.g., matting, geo-textile) will be placed directly onto the surface to protect the native vegetation and topsoil layer where vegetation removal and soil manipulation is not required. To limit vegetation removal and soil disturbance in native grassland the Proponent will use the direct plough technique for installing the collection system within native grassland. Vegetation removal, soil disturbance, and grading within native grassland during construction will be scheduled outside of the grassland breeding bird season (April 1 to July 15; AEP 2018a) and the migratory bird nesting period for nesting Zone B3 (April 12 to August 23; ECCC 2018). Disturbing vegetation outside of the breeding period will minimize the risk of disturbing birds, their nests or young. The Proponent will also attempt to schedule other construction activities in native grassland outside of the April 1 to July 15 restricted activity period to minimize the potential for noise to disturb wildlife using adjacent native grassland. Where this is not possible, and when there is potential for construction activities to pose an elevated risk to wildlife, an experienced wildlife biologist will be on site to monitor wildlife behaviour and to propose on site mitigation actions that should be implemented to reduce risk to wildlife (as per Standard 100.3.16 of the Directive). Additional mitigation to minimize disturbance to native grassland is presented in response to Question 15.

29) Raptor Nest Surveys

Raptor nest surveys must be conducted for the entire project area plus 1000m from the edge of the project boundary.

a) Were the established survey protocols within the *AEP-FWS Sensitive Species Inventory Guidelines followed*? Provide details of the survey protocol including the search area, the survey duration, time of day and search method.

Raptor nest surveys were conducted in 2020 using a standardized grassland raptor nest survey, as outlined in Alberta's *Sensitive Species Inventory Guidelines* (ESRD 2013a).

The first round of surveys involved searching the Project Study Area and a 1 km buffer prior to leaf out for the presence of raptor nests. The activity status of all nests identified during the first round, was re-checked during the second round on June 3 to 6, 2020. Thus, each nest identified during the first round of surveys was checked twice to confirm occupancy.

Nest searches were conducted by driving all roads within the Project Study Area and surrounding 1 km buffer. Where landowner access had been granted (i.e., within the Project Study Area), the biologist surveyed potential nesting habitat on foot with binoculars and recorded locations of active nests with a handheld GPS. Where land access had not been obtained (i.e., within the 1 km Project Study Area buffer), potential nesting habitat was surveyed from the roadside with binoculars and a spotting scope,

and active nest waypoints were projected (i.e., azimuth direction and estimated distance from point of observation) to their approximate location.

Nest surveys occurred during daylight hours. If nest occupation was suspected, the observer would remain at the nest site or return on a subsequent day until occupation status and species was confirmed.

b) Provide the survey dates.

Raptor nest surveys for the Project were completed on the following dates:

- April 20 to 26 and 29, 2020
- June 3 to 6, 2020

According to the Sensitive Species Inventory Guidelines (ESRD 2013a) a minimum of one survey at each site during the nesting season (May 1 to June 30) is required. The first round of surveys was completed prior to leaf out to determine the presence of raptor nests and minimize the risk of missing a nest during the nesting season, including active nests of early nesters such as great-horned owls. Nests were then visited a minimum of once between June 3 to 6, 2020 to determine if they were active.

c) Provide weather conditions during each survey in a table using the following format.

The weather conditions during each survey date 2020 are provided in Table 23.

Table 23: Weather Conditions During 2020 Raptor Nest Surveys

Survey Date (2020)	Weather Conditions				Comments
	Temperature [°C]	Precipitation	Wind Speed [km/h][(a)]	Cloud Cover	
April 20	5 to 20	None	6 to 11	mostly cloudy	wind speed recorded as “light wind”; Beaufort 2 (light breeze) estimated
April 21	12 to 18	None	20 to 28	clear or few clouds	-
April 22	12 to 15	None	6 to 19	partly cloudy	-
April 23	12 to 17	None	12 to 19	partly cloudy	-
April 24	4 to 15	None	0 to 5	partly cloudy	wind speed recorded as “calm”; Beaufort 0 (calm) and 1 (light air) estimated
April 25	10	None	12 to 19	clear	-
April 26	10 to 12	None	20 to 28	clear	-
April 29	9	None	6 to 11	partly cloudy	-
June 3	17 to 18	None	12 to 28	clear or few clouds	-
June 4	17 to 18	None	12 to 19	partly cloudy	-
June 5	17 to 19	None	6 to 11	clear or few clouds	-
June 6	20	None	12 to 19	mostly cloudy	-

(a) Surveys were discontinued during periods of high wind gusts
‘–‘ = no comments; km/h = kilometres per hour;°C = degrees Celsius.

d) Survey Results: Were raptor nests found?

Yes, raptor nests were found during surveys in the Project Study Area.

e) If raptor nests were found, provide locations of all raptor nests detected in a table using the following format. Identify if the required setback is met and the distance in metres from the edge of the nest to the nearest edge of project related disturbance.

The raptor nest observations and their proximity to proposed Project infrastructure are provided in Table 24.

Table 24: Raptor Nesting Locations and Proximity of Project Infrastructure

Nest ID	Species	Location of Nest (UTM Zone 12U, NAD 83)		The required setback is met (Y/N)	Proposed Infrastructure Type within Setback	Distance from Setback to Nearest Project Related Disturbance [m][(a)]	Comments
		Easting	Northing				
RESHSN01	ferruginous hawk	567331	5595115	Y	n/a	29	-
RESHSN02	great horned owl	567395	5596623	Y	n/a	619	-
RESHSN04	great horned owl, Swainson's hawk	562629	5601864	Y	n/a	180	great horned owl observed on nest during Round 1 of surveys (April 21) and Swainson's hawk observed during Round 2 of surveys (June 5)
RESHSN05	great horned owl	568067	5601861	Y	n/a	735	-
RESHSN07	ferruginous hawk	567262	5599967	N	collector lines, turbine access roads	0	ferruginous hawk flushed from nest while observer drove by during Round 1 surveys; during Round 2 the nest was observed to be falling apart and not found to be active at the time of survey
RESHSN09	ferruginous hawk	570483	5601448	Y	n/a	1,537	-
RESHSN12	Swainson's hawk	567226	5601328	Y	n/a	302	-
RESHSN13	Swainson's hawk	570518	5598451	Y	n/a	2,663	-
RESHSN15	great horned owl	556279	5595991	Y	n/a	3,641	-

(a) Distance is measured from the nearest edge of the nest setback to the nearest edge of Project related limit of disturbance.

– = no comments; ID = Identification; m = metres; UTM = Universal Transverse Mercator; N = no; NAD = North American Datum; n/a = not applicable; Y = yes.

f) Nest locations and associated setbacks must be provided in a map (refer to the *Maps and Figures* section below). Provide name of reference map.

The raptor nest locations and their associated setbacks are provided on Figure A-5 (refer to Appendix A).

g) If a required setback is not being met, provide the details (location, type of infrastructure, and amount of area impacted), rationale for siting decision and any proposed alternative mitigations identified. For the purpose of AEP-FWS review, infringement from any temporary workspace must be included.

The Project infringes on one ferruginous hawk nest setback (RESHSN07, refer to Figure A-5 in Appendix A). The ferruginous hawk nest is located immediately adjacent Range Road 12 and it is expected that if the nest remains active throughout a breeding season, the ferruginous hawk may be accustomed to local traffic including large farm equipment. During the first round of surveys the ferruginous hawk was observed flushing off the nest during the observer's travel along Range Road 12. Flushing of a bird is an indicator of the level of stress or anxiety beyond which the hawks can no longer tolerate the presence of the disturbing factor (White and Thurow 1985). During the second round of surveys the nest was observed to be falling apart and not found to be active. Though the nest may have been abandoned after the first round of surveys, the nest is considered active and a precautionary 1,000 m setback buffer has been applied.

The nest setback infringement is associated with two turbine access roads and sections of three collector lines as outlined in Table 25. A total of 901 m of turbine access road is proposed within the 1,000 m setback buffer of the ferruginous hawk nest resulting in 0.45 ha of permanent disturbance and 2.36 ha of temporary disturbance. A total of 4,762 m of collector line is proposed within the 1,000 m setback buffer of the nest resulting in 5.7 ha of temporary disturbance. Collector lines within the nest setback will use plough-in installation techniques using a single cut tooth that splits the earth apart and allows the cables and sand bedding along with warning tape to be installed and no backfilling or compaction is required. Given the proposed installation method of the collector line within the nest setback, no permanent disturbance due to collector line installation is anticipated. A total of 0.5 ha of permanent disturbance and 8.1 ha of temporary disturbance, for a maximum disturbance of approximately 8.5 ha within the 1,000 m nest setback is anticipated. Construction of the road segments and installation of the collector line within the nest buffer will follow mitigation measures outlined in Table 25.

Table 25: Project Infrastructure Sited within the 1,000 m Ferruginous Hawk Nest (RESHSN07) Nest Setback

Infrastructure Type within Nest Setback	Infrastructure Detail[(a)]	Infrastructure Location (W4M)	Distance from Nest to Infrastructure Nearest the Nest [m]	Length of Disturbance within Nest Setback [m]	Area Within Nest Setback [ha]		Construction and Operation Detail	Avoidance and Mitigation Measures
					Temporary Disturbance	Permanent Disturbance		
Collector Line	between turbine T12 and T13	NE 27 and NW 26-18-1	692	1,140	1.4	0.0	The underground collection system will consist of medium-voltage (34.5 kV) of standard utility cable and a fibre optic communication cable buried to a depth of approximately 1 m as per the Canadian Electrical Code. Collector lines within the nest setback will use plough-in installation techniques using a single cut tooth that splits the earth apart and allows the cables and sand bedding along with warning tape to be installed. No backfilling or compaction is required. The construction disturbance footprint of the collection system has been conservatively assumed to be within a work area of an approximately 12 m wide right-of-way.	■ Collection line installation within the nest setback will be scheduled outside of the raptor breeding period (March 15 to July 15; AEP 2020b; GOA 2018).
	between turbine T13 and T14	NW and SW 26, and NW 23-18-1	468	1,835	2.2	0.0		
	between turbine T16 and the Project substation	SW and SE 27, SW 26, and NW 23-18-1	354	1,787	2.1	0.0		
Turbine Access Road	to turbine T12	NE 27-18-1	598	686	1.7	0.3	The temporary workspace required for access roads will require a conservative width of approximately 30 m (i.e., including operations footprint). Wider access roads are required during construction to move the assembled crane from turbine location to turbine location, and to deliver turbine components, construction materials, and equipment to the turbine locations. Permanent turbine access roads will consist of a 5 m wide gravel capped road that will be maintained for use during operations.	■ All access road construction within the nest setback will be scheduled outside of the raptor breeding period (March 15 to July 15; AEP 2020b; GOA 2018). ■ To eliminate traffic on turbine access roads within the nest setback construction of turbines T11, T12, and T13 will be scheduled outside of the raptor breeding period. ■ No delivery of equipment or materials to turbine sites T11, T12, or T13, or other sites within the nest setback will occur during the raptor breeding period.
	to turbine T13	NW 26-18-1	814	215	0.7	0.1		

(a) Refer to Figure A-5, Appendix A.
W4M = West of the Fourth Meridian; m = metres; ha = hectares; NE = northeast; NW = northwest; SE = southeast; SW = southwest; kV = kilovolts.

h) Discussion of results–Provide additional information such as a description of the habitat/ land use that may attract or detract raptor activity in the area and a summary of incidental observations of raptors including total numbers, behaviour and species.

Nine active nests were identified and surveyed in the Project Study Area and surrounding 1,000 m buffer (refer to Figure A-5 in Appendix A) during wildlife field surveys in 2020. Three of the active nests were occupied by great horned owl (*Bubo virginianus*), three by ferruginous hawk, two by Swainson's hawk (*Buteo swainsonii*) and one was occupied by both great horned owl (first visit) and Swainson's hawk (second visit). Ferruginous hawk nest RESHSN09 was discovered during the first round of raptor surveys and was found to be active during both survey rounds. Ferruginous hawk nest RESHSN01 was identified during the first round of raptor surveys but was not identified as an active ferruginous hawk nest until the second round of surveys. Ferruginous hawk nest RESHSN07 was observed as an active ferruginous hawk nest during the first round of surveys when an adult was flushed off the nest during travel along Range Road 12. During the second round of raptor surveys this nest was found to be falling apart and not active. Nest destruction is common on the prairies due to wind blowout. The setback buffer has been maintained for this nest as hawks will often rebuild a destroyed nest the following year. Subsequent surveys are recommended to determine if this nest will be reused in the future. Ferruginous hawk is provincially listed as At Risk and is federally listed under Schedule 1 of the SARA as Threatened (Government of Canada 2020; AEP 2015).

Active ferruginous hawk nests have a required setback of 1,000 m following the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a; refer to Figure A-5 in Appendix A). Active Swainson's hawk and great horned owl nests are not specifically listed in Appendix A of the Wildlife Directive for Alberta Wind Energy Projects; therefore, a setback of 100 m is applied (AEP 2018a; refer to Figure A-5 in Appendix A).

A red-tailed hawk (*Buteo jamaicensis*) was observed incidentally circling over the Project Study Area during the first round of raptor surveys. No red-tailed hawk nests were recorded within the Project Study Area and a 1 km buffer. Incidental raptors observed during other wildlife field surveys are provided in Section 13.0.

30) Acoustic Bat Surveys

WIND PROJECTS ONLY

a) Were the established AEP-FWS survey protocols followed? Provide details of survey protocols including the detector locations, the detector deployment duration, how detector locations were chosen, and a brief description of the analysis of the audio files.

Bat activity monitoring followed recommendations within the Bats and Wind Turbines – Pre-Siting and Pre-Construction Survey Protocols (Lausen et al. 2008). The Lausen et al. (2008) protocol was updated in 2010 (Lausen et al. 2010) and is endorsed by the Alberta Bat Action Team.

Detector locations were chosen based on the following criteria:

- the Project Study Area
- existing met towers
- habitat and terrain features that may attract bats (i.e., trees, abandoned buildings, wetlands)
- access and other logistics required for installing equipment (e.g., fence posts)

To assess the level of fall bat activity within the Project Study Area, six Wildlife Acoustic Songmeter SM4BAT® detectors were deployed in the Project Study Area during the spring 2020 migration period, and seven SM4BAT® detectors were deployed in the Project Study Area in fall 2020 as outlined in Table 26. Five of these detectors were deployed approximately 3 m above the ground (ground detectors) and one detector was deployed approximately 30 m above ground on a met tower (raised detector) in spring. For fall surveys, a second raised detector was deployed at 30 m using a temporary tower unit for deployment. The raised detectors were each paired with a ground detector, as this paired design permits comparison of bat activity between the two recording heights (refer to Figure A-6 in Appendix A). Baerwald and Barclay (2009) found no clear relationship between activity of migratory bats recorded at ground level and fatality rates observed at nine wind power facilities in southern Alberta, but did find a relationship between fatality rates and bat activity levels recorded at heights of 30 m. Therefore, estimates of migratory bat fatality can be made based on 30 m high acoustic data. Detectors deployed at a 30 m height in the Project Study Area can be used to better understand risk of migratory bat fatality rates for the Project.

The omnidirectional ultrasonic microphones on the ground based detectors were affixed to a polyvinyl chloride (PVC) pipe, which was attached to a firm vertical structure (e.g., fence post) to limit microphone movement and pointed horizontal at 180° (Siders 2005). The microphone was attached to the met tower using a pulley system and to the temporary tower unit using various fastening devices in a manner that would reduce excess recorded noise.

Bat activity (i.e., high frequency auditory signals) was digitally recorded by the detector onto compact flash 32-gigabyte (GB) memory cards. Data from the memory cards were downloaded to a laptop computer during scheduled maintenance checks and then further backed up to an external hard drive and a Golder network drive. Maintenance checks were spaced approximately 10 days apart and included checking the detectors for microphone placement, malfunctions (and to replace units if this occurred), and battery voltage levels (and replaced if levels were low). Detectors were programmed to operate nightly from at least one half-hour after sunset until one half-hour before sunrise.

Data analysis was conducted by Dan Coffen (Biologist, Adv.Dip., Golder) and reviewed by Mitch Firman (Wildlife Biologist, Golder), who have extensive experience analyzing bat acoustic signals and who has received formal training in the identification of bat echolocation auditory signatures using Sonobat. The analysis was completed using Sonobat software and consisted of a tally of all bat passes, where a bat pass is attributed to a bat flying through the detection radius of the bat detector and assigning the passes to bat species or species group based on characteristics of the echolocation recording (Lausen 2010).

The analysis consisted of a tally of all bat ‘passes’ and assigning the passes to bat species or species group based on characteristics of the echolocation recording. A bat ‘pass’ is attributed to a bat flying through the detection radius of the bat detector. Because an individual bat may be recorded making multiple passes, the data presented are a measure of bat activity in the vicinity of the bat detectors, not a direct measure of the numbers of bats within or passing through the Project Study Area.

b) Migratory species calculations include silver-haired bat, hoary bat and eastern red bat. In addition, unspecified low frequency and big brown/silver-haired bat species groupings were included in calculations because they have the potential to contain migratory species. Survey dates, provide the acoustic survey period for both the spring and fall surveys.

The 2020 bat acoustic surveys were completed to meet the spring and fall survey requirements of the Directive. In spring, the detectors were deployed before sunset on April 28, 2020 and detectors were collected on June 3, 2020. In fall, deployment of detectors occurred before sunset on July 14, 2020 and detectors were collected on October 17, 2020.

c) Provide the total number of detectors during spring and fall surveys.

A total of six SM4BAT® detectors were distributed throughout the Project Study Area in the spring of 2020 and seven were distributed in the fall of 2020 (refer to Figure A-6 in Appendix A).

d) Provide the number of raised detectors (30 m) during spring and fall surveys.

During spring surveys, one detector was raised to a 30 m height on an existing met tower within the Project Study Area. During fall surveys, two detectors were raised to a 30 m height, one on a temporary tower unit and one on the existing met tower used in the spring.

e) Provide the total number of detector nights (i.e., excluding nights that a detector malfunctioned) during spring and fall surveys.

In the spring, the detectors were deployed before sunset on April 29, 2020, and were collected on June 3, 2020 for a total of 35 potential nights of recording at each location or a total of 210 active detector nights across all detectors. During the spring migration survey period (May 1 to 31) each unit had a total of 31 potential nights of recording for a total of 186 active detector nights across all detectors. All detectors were operational over the entire spring migration survey period.

In the fall, seven detectors were deployed before sunset on July 14, 2020 and retrieved on October 17, 2020, for a total of 95 potential nights of recording at each location. One detector did not work for one night on October 16, 2020 (RESHBAT03R) (Table 26), which resulted in 94 potential nights of recording at this location, and a total of 664 active detector nights across all detectors deployed in fall 2020. During the fall migration survey period (August 1 to September 10) each unit had a total of 41 potential nights of recording or a total of 287 active detector nights across all detectors. All detectors were operational over the entire fall migration survey period.

f) Provide location of survey points in a map (refer to the *Maps and Figures* section below). Detector location must be included and the detector height must be identified. Provide name of reference map.

The bat acoustic survey locations used in 2020 are presented on Figure A-6 (refer to Appendix A).

g) Describe the habitat type or land use near each detector location.

Table 26 details the set-up specifics for 2020, adjacent habitat and terrain features of each detector location.

Table 26: Bat Detector Locations and Surrounding Habitat

Detector ID	Location (UTM Zone 12U, NAD 83)		Set-up Details		Surrounding Land Cover	Proximity to Roosting Habitat [c] [m]	Proximity to Water [d] [m]
	Easting	Northing	Height[a] [m]	Aspect[b]			
RESHBAT01	562355	5601805	3	90	cultivation/native grassland	300	150
RESHBAT02	566717	5599418	3	90	Cultivation/tame pasture or hay	150	300
RESHBAT03G	564529	5595904	3	90	Cultivation/wetland	>1,000	150
RESHBAT03R	564522	5595907	30	180	Cultivation/wetland	>1,000	150
RESHBAT04G	555983	5598260	3	0	Cultivation/native grassland	>1,000	50
RESHBAT04R[e]	555983	5598260	30	0	Cultivation/native grassland	>1,000	50
RESHBAT05	560167	5599331	3	90	Cultivation	150	250

(a) Approximate detector microphone height in metres above ground level.
(b) Direction in which the detector was pointed (varied depending on wind direction at deployment).
(c) Approximate distance to features that could provide roosting habitat for bats (i.e., trees, buildings).
(d) Approximate distance to open water available for foraging bats.
(e) Deployed in fall 2020 only.
ID = identification; NAD = North American Datum; m = metres; UTM = Universal Transverse Mercator; > = greater than.

h) Identify any issues encountered during the survey or analysis that impacted the results.

Detector RESHBAT03R was non-operational on one detector night outside of the fall migration period (October 16, 2020). No other issues were encountered during the survey or analysis.

i) Survey Results: Provide details of the survey results in tables using the following format.

Bat acoustic survey results for the spring and fall 2020 surveys are provided in Table 27 and Table 28, respectively.

Table 27: 2020 Spring Bat Acoustic Survey Results

Detector ID	Detector Effort	Total Bat Passes	Total Bat Passes/ Detector Night	Migratory Detector Effort[a]	Migratory Bat Passes (May 1 to 31)[a]	Migratory Bat Passes/ Migratory Detector Night[a]	Migratory Bat Passes (Total Survey Period)	Migratory Bat Passes (Total Survey Period/ All Detector Nights)
Description or Calculation:	Total # of Nights with Operational Detectors	Total # of Bat Passes for all Species Over all Detector Nights	=Total Bat Passes ÷ Detector Effort	Total # of Nights with Operational Detectors from May 1 to 31[a]	Total # of Bat Passes for Migratory Species from May 1 to 31	=Migratory Bat Passes (May 1 to 31)[a] ÷ Migratory Detector Effort	Total # of Bat Passes for Migratory Species Over all Detector Nights	=Migratory Bat Passes (Total Survey Period) ÷ Detector Effort
RESHBAT01	35	42	**1.2**	31	7	**0.2**	8	0.2
RESHBAT02	35	114	**3.3**	31	7	**0.2**	13	0.4
RESHBAT03G	35	70	**2.0**	31	7	**0.2**	13	0.4
RESHBAT03R[b]	35	14	**0.4**	31	10	**0.3**	14	0.4
RESHBAT04G	35	337	**9.6**	31	10	**0.3**	19	0.5
RESHBAT05	35	40	**1.1**	31	11	**0.4**	15	0.4

(a) As per the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a).
(b) Detector deployed to 30 m height.

Table 28: 2020 Fall Bat Acoustic Survey Results

Detector ID	Detector Effort	Total Bat Passes	Total Bat Passes/ Detector Night	Migratory Detector Effort[a]	Migratory Bat Passes (August 1 to September 10)[a]	Migratory Bat Passes/ Migratory Detector Night[a]	Migratory Bat Passes (Total Survey Period)	Migratory Bat Passes (Total Survey Period)/ All Detector Nights
Description or Calculation:	Total # of Nights with Operational Detectors	Total # of Bat Passes for all Species Over all Detector Nights	=Total Bat Passes ÷ Detector Effort	Total # of Nights with Operational Detectors from August 1 to September 10[a]	Total # of Bat Passes for Migratory Species from August 1 to September 10	=Migratory Bat Passes (August 1 to September 10)[a] ÷ Migratory Detector Effort	Total # of Bat Passes for Migratory Species Over all Detector Nights	=Migratory Bat Passes (Total Survey Period) ÷ Detector Effort
RESHBAT01	95	715	**7.5**	41	236	**5.8**	306	3.2
RESHBAT02	95	847	**8.9**	41	279	**6.8**	399	4.2
RESHBAT03G	95	481	**5.1**	41	258	**6.3**	313	3.3
RESHBAT03R[b]	94	283	**3.0**	41	225	**5.5**	273	2.9
RESHBAT04G	95	3,354	**35.3**	41	406	**9.9**	507	5.3
RESHBAT04R[b]	95	486	**5.1**	41	276	**6.7**	337	3.6
RESHBAT05	95	874	**9.2**	41	220	**5.4**	271	2.9

(a) As per the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a).

(b) Detector deployed to 30 m height.

j) Results Graphs: Provide a bar or line graph of bat activity by night with the date on the x-axis and mean number of bat passes on the y-axis. Data must include all bat passes per detector night and migratory bat passes per detector night.

Bat activity by night for the spring and fall 2020 surveys are provided in Figures 1 and 2, respectively.

Figure 1: Spring 2020 Bat Passes per Detector Night

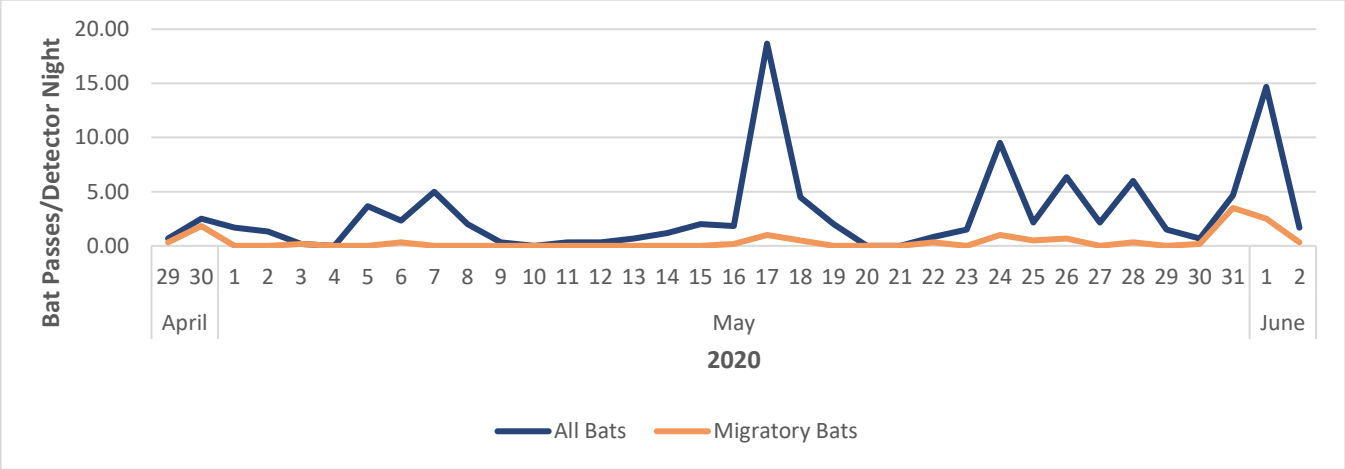
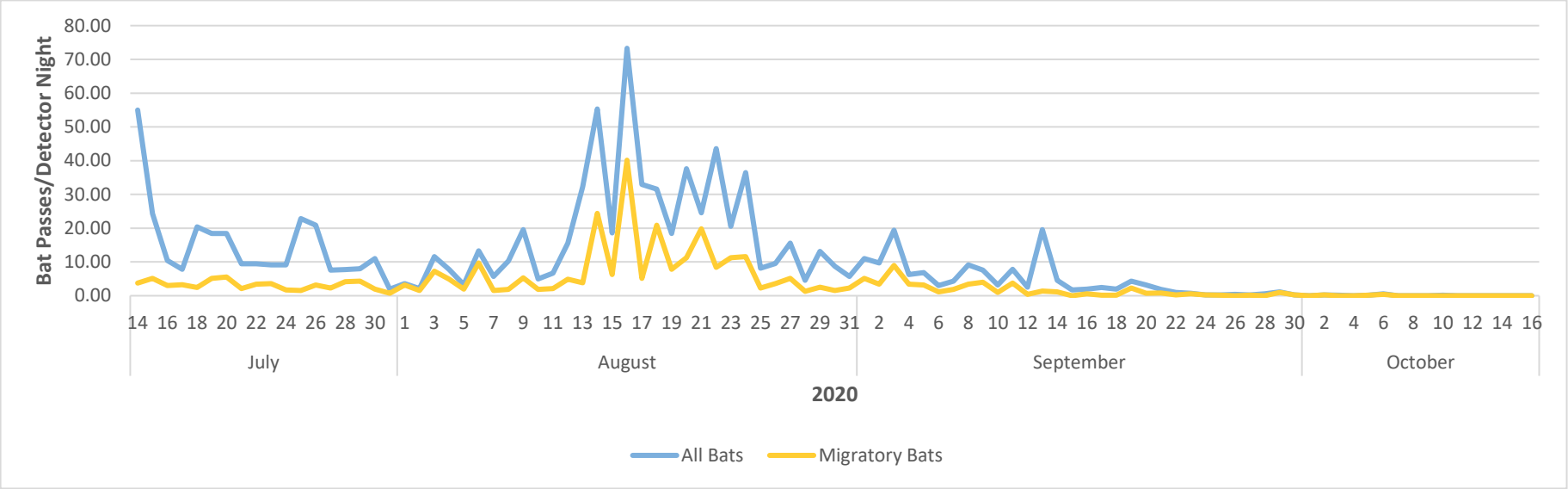


Figure 2: Fall 2020 Bat Passes per Detector Night



k) Results Summary: Provide a brief written summary of the results including, total bat passes, mean bat passes per detector night, a subset of the migratory bat passes per detector night and a list of species that were detected. Provide other relevant information such as the spatial or temporal trends of bat activity or if there were certain survey points with more bat activity than others or habitat features that may have attracted or reduced activity.

Results of the bat surveys indicate that multiple bat species pass through and/or use the Project Study Area. Based on recorded echolocation signatures, seven species of bats were positively identified, including big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), western small-footed myotis (*Myotis ciliolabrum)*, long-eared myotis (*Myotis evotis),* and little brown myotis (*Myotis lucifugus).*

Silver-haired bat and eastern red bat are migratory species that are listed provincially as Sensitive and are susceptible to fatality associated with wind power facilities (AEP 2015). Western small-footed bat is also listed provincially as Sensitive; however, this species is not migratory and the reason for the listing is due to its localized distribution, lack of population information and concerns regarding habitat security (AEP 2015). Little brown myotis is listed provincially as May Be at Risk and federally as Endangered (Government of Canada 2020) due to the recent decimation of populations particularly in the eastern portion of the species' range from the fatal white-nose syndrome, which to date has not been recorded in Alberta populations (GOA 2020).

Since echolocation calls could not always be positively identified to the species level, an additional four species groups were identified including:

- Big brown / silver-haired.
- *Myotis* species, which most likely includes western small-footed bat (listed as Sensitive provincially [AEP 2015]), long-legged bat (*Macrophyllum macrophyllum*), and little brown myotis, listed as May be at Risk provincially, but listed as Endangered federally and is on Schedule 1 of the SARA due to large population declines particularly in the eastern part of its range as a result of White-nose Syndrome (GOA 2020). Long-legged bat is listed provincially as Secure (AEP 2015).
- High frequency, which may include various species of *Myotis* and eastern red bat.
- Low frequency, which may include hoary bat, silver-haired bat, and big brown bat.

An additional two categories were included during transcription and omitted during analysis. These categories include:

- Non-bat, which includes all non-bat animal species detected on the detector recordings (e.g., birds, rodent species).
- Noise, which includes recordings of ambient ultrasonic sound that count not be identified as a bat or other animal species due to poor recording quality, weather events (e.g., rain, high winds), or because the characteristic frequency fell between 30 and 35 kilohertz (kHz).

Over the entire spring 2020 survey period, a total of 617 bat passes (2.9 bat passes/detector night) were recorded. Most passes were of unspecified *Myotis* and high frequency bats, which represented 45.4% and 23.8% of total bat passes, respectively. This level of bat activity is within the range of bat activity reported at other wind power facilities in southern Alberta (0.78 to 14.81 bat passes/night; Baerwald and

Barclay 2009). However, direct comparison with that range may be limited because the Baerwald and Barclay (2009) analysis is based on acoustic data collected and analyzed using Anabat detectors and software, whereas data for this Project were collected and analysed using SM4BAT® detectors and Sonobat software. Comparative studies have found Anabat detectors to record fewer passes than newer detector models (e.g., Adams et al. 2012).

Bat activity had a prominent peak on May 17 (18.7 passes/detector night). A second smaller peak occurred on June 1 (14. 7 passes/detector night). These peaks were predominantly driven by activity of high frequency bats which were highest on May 17 (17.5 passes/detector night) and June 1 (12.0 passes/detector night). Low frequency bat activity was relatively low across all detectors, with the highest activity recorded on May 31 (3.5 passes/detector night) and June 1 (2. 7 passes/detector night).

Bat passes per detector night ranged from 0.4 to 9.6 passes/detector night across all detectors combined. The highest activity levels were recorded at detector RESHBAT04G. Approximately 54.0% of the activity at RESHBAT04G was by unspecified *Myotis* species and 24.0% was by unspecified high frequency bats. RESHBAT04G is located in cultivated cropland and native grassland habitat, approximately 50 m from a water source and greater than 1,000 m from potential roosting habitat (Table 26). To the northwest of the plot location native grassland dominated habitat extends to the South Saskatchewan River between which no turbines are located. The second highest activity levels were recorded at RESHBAT02 (3.26 passes/detector night). Turbines are sited greater than 4,000 m from detector RESHBAT04G) and more than 1,000 m from detector RESHBAT02.

Over the entire fall 2020 survey period, a total of 7,040 bat passes (10.6 bat passes/detector night) were recorded. Most passes were of unspecified *Myotis* species and high frequency bats, which represented 35.2% and 16.9% of total bat passes, respectively. This was followed by unspecified low frequency bats which represented 13.7% of total bat passes. This level of bat activity is within the range of bat activity reported at other wind power facilities in southern Alberta (0.78 to 14.81 bat passes/night; Baerwald and Barclay 2009).

Bat activity had a prominent peak on August 16 (73.3 passes/detector night). Two other peaks occurred on August 14 (55.3 passes/detector night) and July 14 (55.0 passes/detector night).

Activity of low frequency bats was highest on August 16 (42.9 passes/detector night). Three other smaller peaks in low frequency activity were observed on August 14 (27.4 passes/detector night), August 18 (24.3 passes/detector night), and August 21 (20.1 passes/detector night). Activity of high frequency bats was highest on July 14 (51.0 passes/detector night). A mid-July peak coincides with the post-volant period when young of the year are capable of flight and begin to forage. Roosting habitat was not identified within 1 km of the detector location. Two smaller peaks in high frequency bat activity were observed on August 22 (35.0 passes/detector night) and August 16 (30.4 passes/detector night).

The number of bat passes recorded per detector night ranged from 3.0 to 35.3 depending on the detector location. The highest activity levels were recorded at detector RESHBAT04G. Approximately 47.5% of the activity at RESHBAT04G was by unspecified *Myotis* species and 19.6% was by unspecified high frequency bats. RESHBAT04G is located in cultivated cropland and native grassland habitat, approximately 50 m from a water source and greater than 1,000 m from potential roosting habitat. To the northwest of the plot location native grassland dominated habitat extends to the South Saskatchewan River between which no turbines are located. The second highest activity levels were recorded at

RESHBAT05 (9.2 passes/detector night). Turbines are sited greater than 4,000 m from detector RESHBAT04G and more than 1,000 m from detector RESHBAT05.

A recently released study by Solick et al. (2020) found that there is no significant relationship between measured bat activity and bat fatality rates at wind energy facilities. While bat activity measurements are found to be reliable predictors as to when bats are most likely to be killed by wind turbines (i.e., during fall migration), Solick et al. (2020) argues that pre-construction bat activity rate measurements are not reliable predictors of the magnitude of post-construction bat fatalities and explains that bat species most often detected as fatalities of wind turbines are not the species most frequently acoustically detected (e.g., hoary bats). Hoary bats and other species most often found as fatalities at wind facilities may not consistently echolocate during flight (Corcoran and Weller 2018). A study in northern California that used infrared video simultaneously with acoustic recordings found that only half of hoary bats detected on camera produced echolocation calls, and over 40% of those detections were inconspicuous micro calls that have not previously been recorded on bat detectors (Corcoran and Weller 2018).

The *Bat Mitigation Framework for Wind Power Development* (ESRD 2013b) recommends calculating a precautionary estimate of migratory bat passes by grouping low frequency observations with those of hoary, silver-haired and eastern red bats collected from August 1 to September 10 at raised detectors. As a result, a total of 501 migratory bat passes, or 6.1 migratory bat passes/detector night were detected at the detectors deployed at a 30 m height in 2020 during the migratory survey periods (August 1 to September 10). During the 2020 fall migratory period, 6.7 migratory bats/detector night were recorded at RESHBAT04R and 5.5 migratory bats/detector night were recorded at RESHBAT03R. Numbers of migratory bats were primarily driven by low frequency bats (40.5% of all bat species/species groups), which may include hoary bat, silver-haired bat, and big brown bat. Based on the thresholds defined in the *Bat Mitigation Framework for Wind Power Development* (ESRD 2013b), the Project Study Area is rated as having “potentially high risk” to migratory bats.

l) Provide a summary of the survey results in a table using the following format.

A summary of the total bat passes and migratory bat passes per detector night is provided for each survey period in Table 29.

Table 29: Summary of Bat Acoustic Survey Results

Season (2020)	Bat passes/detector night	Migratory bat passes/ detector night
Spring	2.9	0.3
Fall	10.6	6.6

m) Based on the risk of bat mortality, as per AEP-FWS policy, is pre-emptive mitigation being applied to the project? If yes, provide the details of any proposed alternative mitigation(s) the proponent will implement to meet the intent of the Directive.

The Proponent applied pre-emptive mitigation by siting turbines away from areas confirmed to have high bat activity during baseline surveys. The highest levels of overall bat activity and migratory bat activity were recorded at detector RESHBAT04G. Turbines are sited greater than 4,000 m from this detector location. Turbines are also sited more than 1,000 m from the detector locations with the second highest level of recorded bat activity during both spring (i.e., RESHBAT02) and fall surveys (i.e., RESHBAT05). This demonstrates successful avoidance of areas that currently support high bat activity within the Project Study Area.

Should bat mortalities exceed acceptable levels, the Proponent will notify the local AEP-FWS Wildlife Biologist in accordance with Standard 100.4.7 in the Directive, to discuss mitigation measures consistent with the options outlined in the *Bat Mitigation Framework for Wind Power Development* (ESRD 2013b) or other adaptive management alternatives that are considered acceptable following discussions with AEP-FWS, depending on the nature and locations of the observed bat mortalities. The Proponent will work with AEP-FWS to determine adaptive mitigation options if elevated bat mortality rates are identified during operations.

The Proponent expects the mitigation options would be consistent with those outlined in the Directive and the *Bat Mitigation Framework for Wind Power Development* (ESRD 2013b), and in consideration of specific portions of the site that may be contributing to the elevated mortality rates due to localized conditions. These may include options such as increasing wind cut-in speed, feathering or altering the pitch angle of turbine blades, or introducing seasonal shutdowns at night during high migration periods. Mitigation options would be considered on a case-by-case basis in consultation with AEP-FWS, pending the post-construction monitoring results, to determine the site-specific causes of elevated mortality rates.

n) Discussion of results–Provide additional information such as a description of the habitat/ land use that may attract or reduce bat activity in the area, interpretation of the data collected or general information on bat activity and the proposed project.

The highest activity levels in spring 2020 were recorded at detector RESHBAT04G (9.6 passes/detector night; refer to Figure A-6 in Appendix A). Approximately 54.0% of the activity at RESHBAT04G was by unspecified *Myotis* bats, which most likely included little brown myotis and western small-footed bat, but possibly also long-legged bat. Little brown myotis, western small-footed bat, and long-legged bat are not considered migratory species. This detector was deployed in cultivated cropland and native grassland habitat, approximately 50 m from a water source and greater than 1,000 m from potential roosting habitat. Two dugouts are located within 200 m of the detector location and native grassland habitat is located to the east of the detector, outside of the Project Study Area. The high activity recorded at this detector suggest bats may forage over the dugouts in proximity of the detector. This is supported by the fact that the other detector location with a dugout within 500 m of the detector (i.e., RESHBAT02) had the second highest levels of bat activity during spring surveys with 31.6% of activity at this plot by unspecified *Myotis* bats. Turbines are sited greater than 4,000 m from RESHBAT04G and more than 1,000 m from RESHBAT02./ Turbines are also sited more than 1,000 m from RESHBAT05, which recorded the second highest levels of fall bat activity.

The highest activity levels in fall 2020 were recorded at detector RESHBAT04G (35.3 passes/detector night). Approximately 47.5% of the activity at RESHBAT04G was by unspecified *Myotis* species and 19.6% was by unspecified high frequency bats. Unspecified bats were likely little brown myotis, but possibly other *Myotis* species and red bat, which is considered a migratory species.

Bat activity levels were lowest in spring 2020 at RESHBAT03G (0.40 passes/detector) and in fall 2020 at RESHBAT03R (3.01 passes/detector). RESHBAT03G and RESHBAT03R were paired detectors (i.e., one raised to a 30 m height and one deployed at 3 m) and were located in cultivated cropland adjacent to a large Class II wetland.

Refer to the Post-Construction Monitoring and Mitigation (Section 11.0) for details on the Proponent's commitments to monitor and report on bat activity and fatality during Project operation, and if necessary, to mitigate the risk of bat fatalities.

7.0 SITE SPECIFIC WILDLIFE SURVEYS

31) Burrowing Owl

a) Is any part or portion of the project within Burrowing owl range?

Yes, the Project Study Area is located within burrowing owl range.

b) If yes, were surveys conducted following the established survey protocols within the AEP- WM Sensitive Species Inventory Guidelines? Provide details of the burrowing owl surveys completed including search area, survey duration, time of day, how survey points were chosen, and the number of visits to each survey point.

Surveys for burrowing owls used standardized survey methods as outlined in the Sensitive Species Inventory Guidelines (ESRD 2013a). Survey plot locations were chosen prior to field surveys and distributed throughout the Project Study Area and a 500 m buffer (to account for the sharp-tailed grouse lek setback distance [AEP 2018a]) to maximize spatial coverage with the goal of completing approximately one plot per quarter section with potential to contain a turbine location. Observers adjusted plot locations in the field as appropriate to focus on habitat types with moderate to high potential for burrowing owl (e.g., suitable terrain, burrows, vegetation cover, and soil types). Survey plot locations were spaced a minimum of 800 m apart to avoid double counting individuals (refer to Figure A-8 in Appendix A).

Each burrowing owl point count survey was conducted between one-half hour before sunrise and 10:00 am or between 7:15 pm and sunset. Each point count consisted of a 7-minute call playback survey and involved broadcasting primary burrowing owl song calls. The area was visually scanned for individuals and/or burrows while the observer listened for auditory responses to projected calls.

c) Provide the survey dates.

One round of burrowing owl surveys for the Project was completed on May 31, June 2 to 6, and 8, 2020.

d) Provide the time of day each survey was conducted.

Burrowing owl plots were visited once and surveys occurred between one-half hour before sunrise and 10:00 am or between 7:15 pm and sunset.

e) Provide the number of survey points.

Sixty-one (61) burrowing owl survey points were completed in 2020.

f) Provide the total survey time (time spent actively conducting survey).

The total time spent actively conducting burrowing owl surveys was 309 minutes (5.2 hours).

g) The location of survey points must be provided in a map (refer to the Maps and Figures section below); provide the name of this map.

The locations of the burrowing owl survey points are presented on Figure A-8 (refer to Appendix A).

h) Provide weather conditions during each survey date and time in a table using the following format.

The weather conditions during each survey date are provided in Table 30.

Table 30: Weather Conditions During Burrowing Owl Surveys

Survey Date (2020)	Weather Conditions				Comments
	Temperature [°C]	Precipitation	Wind [km/h]	Cloud Cover	
May 31	11	None	12 to 19	clear or few clouds	-
June 2	18 to 21	None	6 to 11	Overcast	-
June 3	9 to 16	None	12 to 28	clear or few clouds	-
June 4	4 to 16	None	1 to 19	clear to partly cloudy	-
June 5	5 to 16	None	1 to 11	clear or few clouds	-
June 6	13 to 19	None	12 to 28	mostly cloudy to overcast	-
June 8	6 to 10	None	6 to 19	Overcast	-

'-' = no comments; km/h = kilometres per hour;°C = degrees Celsius.

i) Describe the habitat type or land use within the surveyed area.

In 2020, burrowing owl survey plots were located in plots predominantly consisting of cultivated cropland (n=39), native grassland (n=6), and tame pasture or hay (n=16). The most common land cover type in the Project Study Area is cultivation. Native grassland is the second most common land cover type, followed by the tame pasture or hay and wetlands (refer to Table 5). Burrowing owl surveys were completed in plot locations representative of habitat within the Project Study Area. One plot (RESHBO07) located outside of the Project Study Area but within 500 m of the Project Study Area was noted in the field to have very good potential burrowing owl habitat.

j) Survey Results: Was there burrowing owl activity—nests or individuals present?

No burrowing owl nests or individuals were observed during any of the surveys completed for the Project or incidentally since surveys were initiated in the Project Study Area. Therefore, Questions k) through n) are not applicable for this Project.

32) Sharp-tailed Grouse

a) Is any part or portion of the project within Sharp-tailed Grouse range?

Yes, the Project Study Area is located within sharp-tailed grouse range.

b) If the project is proposed in the Sharp-tailed Grouse range, were Sharp-tailed Grouse lek surveys conducted? If surveys were not conducted, provide justification and rationale for why surveys were not conducted.

Sharp-tailed grouse lek surveys were conducted in 2020.

c) If Sharp-tailed Grouse lek surveys were conducted, were surveys conducted following the established survey protocols within the AEP-FWS Sensitive Species Inventory Guidelines? Provide details of the surveys completed including search area, survey duration, time of day, how survey points were chosen, and the number of visits to each survey point.

In 2020 sharp-tailed grouse surveys were completed following the *Sensitive Species Inventory Guidelines* (ESRD 2013a). Survey plot locations were chosen to maximize spatial coverage within the Project Study Area and a 500 m buffer (to account for the sharp-tailed grouse lek setback distance [AEP 2018a]).

Surveys began a half-hour before sunrise and continued until approximately 09:40 am. Each plot was spaced a minimum of 600 m apart and consisted of listening for vocalizing grouse and scanning the landscape with binoculars, recording all active lek locations and non-lekking sharp-tailed grouse. Plots were visited twice for five to 10 minutes for each visit during 2020 field surveys.

d) Provide the survey dates.

Sharp-tailed grouse surveys for the Project were completed from April 20 to 29, 2020.

e) Provide the time of day surveys were conducted.

Sharp-tailed grouse surveys began a half hour before sunrise and continued until approximately 09:40.

f) Provide the number of survey points.

One hundred and eight (108) early morning lek surveys were conducted at 54 survey plot locations over two rounds within the Project Study Area plus a 500 m buffer.

g) Provide the total survey time (time spent actively conducting survey).

The total time spent actively conducting burrowing owl surveys was 716 minutes (11.9 hours). Sharp-tailed grouse survey duration is not standardized in Alberta's *Sensitive Species Inventory Guidelines* (ESRD 2013a); however, if an active lek was found a minimum of 15 minutes would be spent at the location to get an accurate count of individuals.

h) The location of survey points must be provided in a map (refer to the Maps and Figures section below); provide the name of this map.

The locations of sharp-tailed grouse survey points are presented on Figure A-9 (refer to Appendix A).

i) Provide weather conditions during each survey date and time in a table using the following format.

The weather conditions during each survey date in 2020 are provided in Table 31.

Table 31: Weather Conditions During Sharp-tailed Grouse Surveys

Survey Date (2020)	Weather Conditions				Comments
	Temperature [°C]	Precipitation[(a)]	Wind[(a)] [km/h]	Cloud Cover	
April 20	5 to 11	None	6 to 19	overcast	-
April 21	3 to 10	None	12 to 28	clear to partly cloudy	-
April 22	6 to 11	None	0 to 19	partly cloudy to overcast	-
April 23	1 to 10	None	1 to 19	partly cloudy	-
April 24	4 to 6	None	0 to 19	partly cloudy to overcast	-
April 25	1 to 8	None	1 to 19	clear or few clouds	-
April 26	3 to 9	None	20 to 28	clear to partly cloudy	-
April 27	6 to 10	None	6 to 19	partly cloudy to overcast	-
April 28	2 to 10	None	6 to 19	clear or few clouds	-
April 29	7 to 9	None	1 to 19	partly cloudy	-

(a) Surveys were discontinued during high winds to the extent possible.

"-" = no comments; km/h = kilometres per hour;°C = degrees Celsius.

j) Describe the habitat type or land use within the surveyed area.

In 2020, sharp-tailed grouse survey plots were located in plots predominantly consisting of cultivated cropland (n=41), tame pasture or hay (n=7), and native grassland (n=6). The most common land cover type in the Project Study Area is cultivation. Native grassland is the second most common land cover type, followed by the tame pasture or hay and wetlands (refer to Table 5). Sharp-tailed grouse survey plots were selected to be representative of habitat within the Project Study Area and to achieve spatial coverage of the Project Study Area.

k) Survey Results: Were sharp-tailed grouse leks found?

No sharp-tailed grouse leks were confirmed during surveys in the Project Study Area. One lek was suspected north of plot RESHSTGR42 (refer to Figure A-9 in Appendix A) and outside of the Project Study Area where sharp-tailed grouse were heard but not observed. No land access was available at the time of survey for confirmation of the lek. Plot RESHSTGR42 is located approximately 700 m north of the nearest Project infrastructure (i.e., turbine T8) and active sharp-tailed grouse leks have a required setback of 500 m following the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a). As such, no infringements on the suspected lek setback are anticipated.

l) If sharp-tailed grouse leks were found, provide the location of leks detected in a table using the following headings. Identify if the required setback is met and the distance in meters from the edge of the lek to the nearest edge of project related disturbance.

The unconfirmed lek observation and its proximity to proposed Project infrastructure is provided in Table 32.

Table 32: Sharp-tailed Grouse Lek Locations and Proximity of Project Infrastructure

Sharp-tailed grouse lek ID number	Location (UTM Zone 12U, NAD 83)[a]		The required setback is met (Y/N)	Distance from lek to nearest project related disturbance (m)[a]	Comments
	Easting	Northing			
RESHLEK01	561847	5603027	Y	1,128	Lek was suspected but not confirmed. The suspected location was outside of the Project Study Area.

(a) UTM location unconfirmed; potential lek recorded north of plot location RESHSTGR42. Lek is plotted at the center of the quarter section
ID = Identification; m = metres; UTM = Universal Transverse Mercator; N = no; NAD = North American Datum; Y = yes.

m) Lek locations and associated setbacks must be provided in a map (refer to the *Maps and Figures* section below). Provide name of reference map.

The unconfirmed sharp-tailed grouse lek and its associated precautionary setback is provided on Figure A-5 and A-9 (refer to Appendix A).

n) If a setback is being infringed upon, provide the details (location, type of infrastructure, and amount of area impacted), rationale for siting decision and details of any proposed alternative mitigation(s) the proponent will implement to meet the intent of the Directive.

Though the exact location of the suspected lek was not confirmed, the suspected lek was heard north of plot RESHSTGR42. This plot is located approximately 700 m north of the nearest Project infrastructure (i.e., turbine T8) and active sharp-tailed grouse leks have a required setback of 500 m following the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a). Therefore, the required setback has been met for this Project.

o) Discussion of results including any incidental sharp-tail grouse observations that were not associated with a lek.

One suspected but unconfirmed lek was identified outside of the Project Study Area (refer to Figure A-5 in Appendix A) during wildlife field surveys in 2020. A precautionary 500 m setback was applied to the estimated location of the lek. The Project footprint will not infringe on the setback.

During 2020 field surveys, sharp-tailed grouse were observed during walk-ins to three plot locations: RESHSTGR14, RESHSTGR29, and RESHSTGR12 (refer to Figure A-9 in Appendix A). Two sharp-tailed grouse were observed in each instance for a total of six individuals observed during sharp-tailed grouse surveys. Incidental sharp-tailed grouse observed during other wildlife field surveys are provided in Section 13.0.

33) Eastern Short-horned Lizard

a) Is any part or portion of the project within 200m of Eastern Short-horned Lizard range?

No, the Project is not sited within 200 m of eastern short-horned lizard (*Phrynosoma douglassii brevirostre*) range. Therefore, Questions b) through m) are not applicable for this Project.

34) Sensitive Snakes

a) Is any part or portion of the project sited within 500m of sensitive snake range?

No, the Project is not sited within 500 m of sensitive snake range. Therefore, Questions b) through n) are not applicable for this Project.

35) Ord's Kangaroo Rat

a) Is any part or portion of the project within 250m of Ord's Kangaroo Rat range?

No, the Project is not sited within 250 m of Ord's kangaroo rat (*Dipodomys ordii*) range. Therefore, Questions b) through m) are not applicable for this Project.

36) Swift Fox

a) Is any part or portion of the project within Swift Fox range?

No, the Project is not sited within swift fox (*Vulpes velox*) range. Therefore, Questions b) through n) are not applicable for this Project.

37) Endangered and Threatened Plants

a) Is any part or portion of the project within Endangered and Threatened Plant range?

Yes, the northern portion of the Project Study Area falls within the slender mouse-ear cress (*Halimobos virgata*) range, a biennial plant listed on Schedule 1 of the *SARA*. However, limited native grassland area occurs within the portion of the Project Study Area that overlaps with the range, and most land cover types been previously disturbed by agricultural practices (i.e., cultivation and tame or hay land cover types).

b) If yes, were surveys conducted following the established survey protocols within the AEP-FWS Sensitive Species Inventory Guidelines? Provide details of the surveys completed including target species, search area, survey duration, how survey points were chosen, and the number of visits to each survey point.

Listed plant surveys were completed within the Project Study Area as per the Alberta Native Plant Council (ANPC) rare plant survey guidelines (ANPC 2012). A desktop assessment was conducted to determine the historical occurrence and potential occurrence of listed plant species and ecological communities in the Project Study Area, and to identify potential mitigation and reclamation strategies to protect tracked or watched plant species and natural communities in the Project Study Area.

The ANPC requires listed plant surveys to be completed during the time of the growing season when potentially occurring rare species are most likely to be identifiable (ANPC 2012). Surveys were scheduled to capture seasonal and ephemeral habitats, during the growing season.

Minimum requirements for a listed plant survey indicate that the Project Study Area be surveyed with reasonable geographic coverage of each representative plant community. Cultivation, tame pasture or hay land and native grassland land cover types were surveyed using GPS units and using a random meander search pattern (ANPC 2012). This search pattern was used to cover microhabitats within survey areas.

If a listed plant species (ACIMS 2015 [updated in 2018]; COSEWIC 2016; Government of Canada 2020) or listed ecological community (ACIMS 2017a) was identified at a survey site, the following information was collected:

- UTM waypoint at the location of the listed species or community occurrence.
- One or more digital photographs of the occurrence.
- The approximate area covered by the listed species.
- Count or estimate of the number of individuals of the listed species.
- The current vegetative and/or reproductive state of the listed species.
- Notes on micro-habitat of the listed species occurrence.

Vegetation communities were evaluated for potential listed plants as the vegetation team travelled on foot throughout the survey areas. The Proponent is committed to conducting listed plant surveys in areas of native upland landcover types and wetland vegetation that overlap with the Project footprint prior to construction.

Minimum requirements for a listed plant survey indicate that the Project Study Area be surveyed with reasonable geographic coverage of each representative plant community.

See Figures A-4a to Figure A-4g.

Provide the survey dates.

Early and late listed plant meanders were conducted within the Project Study Area. Early meanders occurred between June 3 to 9, 2020, and late meanders occurred between August 18 to 20, 2018 and September 8 to 10, 2020.

c) Describe the search area or distance between transects.

According to the ANPC guidelines (ANPC 2012) rare plant surveys use systematic search patterns to minimize overlap and maximize coverage. Rare plant surveys should be floristic, all plants are noted as encountered, to allow for greater spatial coverage. Meander survey types focused mainly on native grassland land cover and involve walking purposefully though the designated site listing all plant species observed along the meander. They help to locate vegetation patterns and their boundaries. Due to the nature of the Project site, meander surveys were used to focus on irregular areas with rare plant potential within the Project Study Area, such as wetland and native grassland land cover types.

d) Provide the total survey time (time spent actively conducting survey).

Total survey time for listed plant meander surveys was 54 hours. Survey efforts for each meander varied depending on habitat.

e) The location of survey transects/area(s) must be provided in a map (refer to the Maps and Figures section below); provide the name of this map.

See Figures A-4a to Figure A-4g.

f) Provide weather conditions during each survey date and time in a table using the following format.

Table 33: Weather Conditions during Endangered and Threatened Plants

Survey Date (2020)	Weather Conditions	Comments
2020		
June 3	Morning Temperature: 14ºC. High of 22 ºC expected, sunny, windy	gusts up to 50km/hr expected
June 4	Morning Temperature: 9:30 am 11 ºC. High of 18 ºC expected	slight chance of rain, windy in the afternoon
June 5	Morning Temperature: 8 ºC. High of 23 ºC expected	chance of precipitation later in the day. Winds from 20 to 30 km/h
June 6	Morning Temperature: 16 ºC. High of 22 ºC expected, cloudy, windy.	Rain expected, possible afternoon thunderstorms
June 7	Morning Temperature: 8 ºC. High of 14 ºC expected, rainy and windy.	Rain expected throughout the day
June 8	Morning Temperature: 6 ºC. High of 14 ºC expected.	Mix of sun and cloud in the morning, chance of thunderstorms in the afternoon
June 9	Morning Temperature: 9 ºC. High of 20 ºC expected.	Sun and clouds in the morning, sun in the afternoon
September 8	Afternoon temperature: 14 ºC, windy	-
September 9	High of 24 ºC expected, sunny	-
September 10	High of 24 ºC expected, sunny	-
2018		
August 18	High of 24 ºC expected, cloudy	Poor air quality, partly cloudy.
August 19	High of 23 ºC expected, cloudy	Poor air quality, partly cloudy.
August 20	High of 24 ºC expected	partly sunny

"-" = no comments; km/h = kilometres per hour;°C = degrees Celsius.

g) Describe the habitat type or land use within the surveyed area.

Listed plant surveys were targeted primarily within the native grassland and wetland land cover types within the Project Study Area, although cultivated and tame pasture hay types were surveyed as well. Native grassland in the Project Study Area is dominated by native grass species and a diversity of forb species with some non-native species present. Native grasslands were interspersed with cultivated and hayed areas. Dominant native grass species observed included blue grama (*Bouteloua gracilis*), Canada wild rye (*Elymus canadensis*), thickspike wheatgrass (*Elymus lanceolatus*), Kentucky blue grass (*Poa pratensis*), slender wheatgrass (*Elymus trachycaulus*), needle and thread grass (*Heterostipa comata*), Northern reedgrass (*Calamagrostis stricata* spp. *inexpansa*) and western wheatgrass (*Pascopyron smithii*).

Common non-native/invasive grass species include crested wheatgrass (*Agropyron cristatum)* and foxtail barley (*Hordeum jubatum*). Native forb species include death camus (*Zigadenus venenosus*), dotted blazingstar (*Liatris punctata*), Gardner's saltbrush (*Atriplex gardneri*), gumweed (*Grindelia squarrosa*), golden aster (*Heterotheca villosa*), little leaf pussytoes (*Antennaria microphylla*), Missouri goldenrod (*Solidago missouriensis*), narrow-leaved milkvetch (*Astralalgus pectinatus*), northern spikemoss

(*Selaginella selaginoides*), scarlet mallow (*Sphaeralcea coccinea*), skeleton weed (*Lygodesmia juncea*), small flowered rocket (*Erysimum inconspicum*), slender milkvetch (*Astralagus flexuosus*), three flowered avens (*Geum triflorum*), pincushion cactus (*Coryphantha vivpara*), poverty weed (*Iva axillaris*), pygmy flower (*Androsace septentrionalis*), and prairie clubmoss (*Selaginella densa*).

Shrub species include pasture sagewort (*Artemisia frigida*), prairie rose (*Rosa arkansana*), prairie sage (*Artemesia ludoviciana*), and western snowberry (*Symphoricarpous occidentalis*). Non-native weed species commonly found in native upland areas include flixweed (*Descurainia sophia*), common dandelion (*Taraxacum officinale*) and perennial sow thistle (*Sonchus arvensis*).

Plant species associated with the wetlands in the Project Study Area included common cattail (*Typha latifolia*), dock species (*Rumex* sp.), foxtail barley (*Hordeum jubatum*), reed canary grass (*Phalaris arundinacea*), slough grass (*Beckmannia syzigachne*), needle spike rush (*Eleocharis acicularis*), manna grasses (*Glyceria* spp.), and sedge (*Carex* sp.) species. Weed species observed in the transition zone between wetland vegetation and adjacent, upland vegetation (often cultivated or tame/modified pasture or hay) included Canada (creeping) thistle (*Cirsium arvense*), perennial sow thistle, summer-cyprus (*Kochia scoparia*), dandelion, and common goat's beard (*Tragopogon dubius).*

Tame and hay land cover types are dominated with agronomic species that are highly palatable to livestock and able to withstand grazing, e.g., smooth brome (*Bromus inermis*), crested wheatgrass, occasionally alfalfa (*Medicago sativa*), sweet clover (*Melilotus* spp.). Cultivation in the Project Study area is dominated by monocultures of food crop such as canola, barley, and legumes.

h) Survey Results: Were any Endangered or Threatened plant populations identified?

No.

i) If any Endangered or Threatened plant populations were identified, provide the locations, population extents and species of all Endangered and Threatened plants detected in a table using the following format. Identify if the required setback is met and the distance in meters from the edge of the nest to the nearest edge of project related disturbance.

Not applicable.

j) Plant population locations and associated setbacks must be provided in a map (refer to the *Maps and Figures* section below). Provide name of reference map.

Not applicable.

k) If a required setback is not being met, provide the details (location, type of infrastructure, and amount of area impacted), rationale for siting decision and details of any proposed alternative mitigation(s) the proponent will implement to meet the intent of the Directive.

Not applicable.

l) Discussion of results including description of habitat (soil characteristics, slope, and vegetation details).

Not applicable.

38) Current Wildlife Surveys

The proponent must commit to ensuring that wildlife data is kept current as per the *Directive*. Confirm that the following surveys will be repeated at a minimum once every two years until the project is commissioned by indicating yes, no, or not applicable by each:

a) Burrowing owl

Yes.

b) Sensitive raptors

Yes.

c) Sharp-tailed grouse

Yes.

d) Swift fox

Not applicable for this Project.

e) Ord's kangaroo rat

Not applicable for this Project.

f) Grizzly bear den surveys

Not applicable for this Project.

g) Endangered and Threatened Plants

Yes.

Provide details of the proposed surveys and what process will be followed if a new wildlife site is identified and how it will be mitigated.

The burrowing owl, sharp-tailed grouse and raptor surveys will be kept current, and survey methods will follow the protocols outlined in Alberta's Sensitive Species Inventory Guidelines (ESRD 2013a). If a new wildlife feature with an applicable setback that overlaps with the Project footprint is identified, the Proponent will notify AEP-FWS to discuss mitigation options appropriate for the specific circumstances.

39) Repeat Wildlife Surveys

Projects for which construction has not begun within 5 years of the completion of the AEP-FWS Renewable Energy Referral Report must repeat all surveys and a new AEP-FWS Renewable Energy Referral Report will be completed. Confirm this process will be followed.

Yes, the process described above will be followed.

8.0 CONSTRUCTION AND OPERATION WITHIN OTHER KEY WILDLIFE ZONES

40) Wildlife Zones

As per the Directive is the project sited in any of these wildlife zones:

a) Special Access Zones?

No

b) Key Wildlife and Biodiversity Zones?

No

c) Grizzly Bear Zones?

No

If yes, will the project meet the required standards identified in the Directives for the associated zone? Provide details of the proposed standard or alternative mitigations if proposed.

Not applicable for this Project.

41) Grizzly Bear Zones

If the proposed project is sited within the Grizzly Bear Zones, do the project related access roads in addition to the existing roads in the area meet with the open road thresholds defined within the Alberta Grizzly Bear Recovery Plan? If no has been selected, provide a summary of the details (location, type of access roads, and amount of area impacted), rationale for siting decision and any proposed alternative mitigation to meet the intent of the Directive.

Not applicable for this Project.

9.0 MINIMIZING IMPACTS ON WILDLIFE AND WILDLIFE HABITAT

42) Guy Wire

Have guy wires been designed to meet the requirements outlined in the *Directive*. Provide details of mitigation that is proposed.

Guy wires for the permanent MET tower will be equipped with markers specifically designed to reduce the potential for bird collision following the marker standards provided by Power Line Sentry (Power Line Sentry 2019, internet site).

43) Collection Line

Are all collection lines sited underground? Provide details of construction techniques and how impacts to wildlife and wildlife habitat will be minimized.

All collection lines for the Project will be sited underground. The collection system will be installed to a depth of 1 m as per the Canadian Electrical Code by ploughing or trench excavation. Trench excavation technique will backfill soil immediately following placement of the collection cable, or as soon as practical. Collection line installation will be completed as quickly as possible to minimize the duration of the disturbance.

The Project design stage incorporated a number of approaches to avoid and minimize impacts to wildlife and wildlife habitat. The proposed Project layout has sited the collection system to meet AEP setback distances for Class III and higher wetlands. Where native grassland cannot be avoided the Proponent will schedule collection line installation outside of recommended restricted activity periods (April 1 to July 15 [AEP 2018a] and April 12 to August 23 [ECCC 2018]). Where this is not possible, and when there is potential for construction activities to pose an elevated risk to wildlife, an experienced wildlife biologist will be on site to monitor wildlife behaviour and to propose on site mitigation actions that should be implemented to reduce risk to wildlife (as per Standard 100.3.16 of the Directive). Disturbing vegetation outside of the breeding period will minimize the risk of disturbing birds, their nests or young. Where setbacks from the active ferruginous hawk nest cannot be met, collection line installation within the nest setback will be scheduled outside of the raptor breeding period (March 15 to July 15; AEP 2020b; GOA 2018).

The Proponent will use the plough-in technique for installing the collection system within native grassland and within the active ferruginous hawk setback. The plough-in installation technique uses a single cut tooth that splits the earth apart and allows the cables and sand bedding along with warning tape to be installed. No backfilling or compaction is required. The construction disturbance footprint of the collection system has been conservatively assumed to be within a work area of an approximately 12 m wide right-of-way. No permanent disturbance footprint is associated with the collection system.

44) Other Risks

Provide details on any other wildlife or wildlife habitat risk identified by the proponent and proposed mitigations to reduce this risk. This may include mitigations for the reduction of noise and light pollution, prevention of predator nests on anthropogenic features, minimization of collision risk or other project associated wildlife risks.

Noise and light pollution were considered as a constraint during planning and design to minimize potential impact to wildlife and wildlife habitat. Project design features have been incorporated to limit noise and light emissions from the turbines and includes sound reduced gear box, sound insulated nacelle, adjustable rotor blades, and installation of the minimum number of lights required by Transport Canada. During construction, vehicle and equipment will be well maintained to limit engine noise. In addition, the lights at the substation including operation and maintenance building will be minimized, down-shielded and controlled by proximity sensors to minimize impacts to wildlife.

Wildlife mortality or injury related to traffic collisions has a potential to occur during Project construction and operations. The potential for vehicle-wildlife collisions will be reduced by avoiding access road construction during non-daylight periods, as many species of concern are nocturnal. In addition, a reduced traffic speed on access roads is expected to reduce the potential for vehicle-wildlife collision. Vehicle speeds on access roads will be limited to 30 km/h.

The construction activities associated with the Project are anticipated to temporarily increase the production of fugitive dust. The access roads and construction workspaces will be lightly wetted, if needed, to minimize the creation of dust. During dry and/or high wind conditions, construction activities will be halted, or the areas will be lightly wetted to prevent the generation of excessive dust.

Mortality due to foundation construction activities, while not expected, may occur if wildlife falls into or becomes trapped within foundation excavations. To prevent wildlife from inadvertently falling in, open excavations or auger holes will be temporarily fenced off. Open excavations or auger holes left unsupervised will be checked daily to ensure no wildlife is trapped.

Construction waste and debris will be collected and disposed of at an approved facility. A waste management program including waste minimization, material reuse, recycling of packaging materials and waste metals will be developed by the Proponent and implemented by Project personnel including contractors. Domestic garbage will be properly stored and disposed of to avoid attracting wildlife. All hazardous materials stored on the Project site (e.g., fuel) will be labelled, stored and handled according to Workplace Hazardous Materials Information System (WHMIS) regulations. All hazardous material will be disposed of through licenced contractors. During Project clean-up, waste will be removed from the Project site, recycled if possible, or disposed of at an approved facility.

Measures will be taken to prevent the release of fuel, lubricating fluids, hydraulic fluids, antifreeze or any other chemicals onto the ground or into waterbodies. The Proponent will develop and implement standard fueling procedures that minimized the risk of spills and leaks, and include spill containment, reporting and clean-up measures. An adequate supply of spill prevention and emergency response equipment will be on the Project site at all times, and personnel will be trained in hazardous materials handling and emergency response procedures.

45) Fence

SOLAR PROJECTS ONLY: Provide details of the proposed fence including type, shape, height, ground clearance and layout. Provide any wildlife mitigations that are proposed as per the requirements in the Directive. Refer to Maps and Figures for information on required map submissions.

Not applicable for this Project.

10.0 CONSTRUCTION AND OPERATION MITIGATION PLAN

46) Sensitive Snake Range

For projects sited in the Sensitive Snake Range or in close proximity of the range, provide details of the project's Snake Protection Plan to protect snakes and on-site worker safety. This is a requirement for solar projects, but is strongly recommended for wind projects as well.

Not applicable for this Project.

47) Injured or Dead Wildlife

Provide details about how injured or dead wildlife observed by on-site workers during construction or operation will be reported.

During construction and operation, Project personnel will report wildlife issues, incidents with wildlife, nuisance wildlife, injured or dead wildlife as soon as it is safe to do so to the Proponent's on-site Project Manager, who will determine in collaboration with the Proponent's environmental representative corrective and/or emergency action to be taken in the field and what regulatory reporting is required.

If an injured or dead species listed provincially at the time of discovery and/or federally (Government of Canada 2020) is observed on-site, the Proponent will notify the local AEP-FWS Wildlife Biologist as per Standard 100.4.7 of the Directive within 24 hours of finding the individual. In addition, the Proponent will collect, identify, label, freeze and submit the carcasses of species at risk and sensitive species to the AEP-FWS wildlife lab in Edmonton as per Standard 100.4.9 in the Directive.

48) Reclamation

Provide details of the proposed reclamation of the project area, both temporary and long-term disturbances that will occur. Include information of the amount of area that will be reclaimed or restored following construction, methods that will be used and details of seed mixes if working in areas of native grasslands. Will an approved native seed mix be used to revegetation disturbed native habitats?

The Project construction footprint (i.e., temporary footprint) that is not part of the operational footprint (i.e., permanent footprint) of the Project will be reclaimed to equivalent land use (e.g., cultivation). This will include temporary access roads, temporary workspaces at the turbine locations, the linear land disturbance created by the underground collection system, and temporary laydown area required for the storage of equipment during construction.

Prior to Project construction, the Proponent will conduct a pre-disturbance site assessment (PDSA) as per the C&R Directive and follow the guidelines in the *Principals for Minimizing Surface Disturbance in Native Grasslands* (AEP 2016) to determine appropriate site-specific protection and mitigation measures for soil, vegetation and wetland management to facilitate site reclamation. The goal of the reclamation will be to stabilize and revegetate disturbed areas while maintaining access and appropriate drainage to support operation and maintenance standards outlined below.

Site preparation will include vegetation removal, stripping and grading, subsurface compaction and/or infill of a gravel base, depending on site-specific conditions. Topsoil will be stored separately from subsoils to prevent admixing and redistributed around the temporary impact areas following construction. Areas outside of the permanent footprint will be reclaimed immediately following completion of construction activities. Interim reclamation activities will take place throughout the construction of the Project. These activities will include, but

not be limited to, grading disturbed areas, contouring disturbed slopes to a stable profile, and re-establishing natural drainage patterns. Revegetation of the temporary Project construction footprint will follow the C&R Directive, landowner specifications and seed available at the time of reclamation. Following Project's construction, the Proponent will conduct Interim Monitoring Site Assessment (IMSA) for a minimum of three growing seasons after reclamation as per the C&R Directive.

In the 1.7 ha of native grassland where the primary mitigation of avoidance was not possible, minimal disturbance construction practices as outlined in Question 15 will be implemented. Site preparation (e.g., vegetation removal, stripping and grading) will be limited to the area necessary to excavate and construct the access roads. The road surface must meet stringent vertical and horizontal curve radius requirements to ensure the long turbine components can travel to the site. While use of the cut and fill technique will be minimized, if there is an elevation change, cut and fill may be required to ensure the vertical curve radius is met and to ensure safe construction practices. However, cut and fill will be avoided along native grassland where possible.

For other temporary Project construction footprint on native grassland (i.e., installation of collection lines), a protective layer (e.g., matting, geo-textile) will be placed directly onto the surface to protect the native vegetation and topsoil layer. Following Project construction, areas where a protective layer could not be applied will be re-vegetated as soon as reasonably possible to limit the potential establishment of weeds on disturbed ground. Only certified native seed mixes will be used, and these will be selected in consultation with the appropriate landowners. The Project footprint will be regularly monitored for weed infestations during operation, and plant species designated as prohibited noxious or noxious (Province of Alberta 2016) will be eliminated or controlled.

Of the 107.0 ha of total disturbance during construction, 97.8 ha will be temporary disturbance reclaimed as soon as practicable after construction and 9.2 ha will be permanently disturbed during operations. At the end of the Project life, anticipated to be approximately 20 to 50 years, a one year to 18-month decommissioning program will occur to remove the turbines and turbine foundations to a 1.2 m depth. All access roads (not including the permanent road access) will be removed and the soil and land cover reclaimed to its original land use. The underground collection system will be left in place to minimize soil disturbance.

49) Construction Schedule

Provide the proposed construction schedule for the project.

Construction of the Project is anticipated to commence in Q4 2021 when conditions are suitable for construction, assuming that required regulatory approvals are in place. Construction will continue in 2022 within suitable timing windows, until an anticipated commercial operations date (COD) of in December 2022.

Vegetation clearing or application of a protective layer (e.g., matting, geo-textile) in native grassland will be scheduled outside the grassland bird breeding season (April 1 to July 15; AEP 2018a) and the migratory bird nesting period for nesting Zone B3 (April 12 to August 23; ECCC 2018, internet site). If these activities are required during the bird breeding period, an experienced wildlife biologist will be on site to conduct pre-disturbance surveys, or to monitor wildlife behaviour and to propose on site mitigation actions that should be implemented to reduce risk to wildlife (as per Standard 100.3.16 of the Directive). Where setbacks from the active ferruginous hawk nest cannot be met, construction activity within the nest setback will be scheduled outside of the raptor breeding period (March 15 to July 15; AEP 2020b; GOA 2018). To eliminate traffic on turbine access roads within the nest setback, construction of turbines T11, T12, and T13 will be scheduled outside of the raptor breeding period and no delivery of equipment or materials to these turbine sites or other sites within the nest setback will occur during the raptor breeding period.

The Project has an expected 20 to 50 year operating life. At the end of life, decommissioning activities are anticipated to take approximately 6 months to one year to complete, followed by a post closure reclamation period.

50) Construction and Operation Mitigations

Provide details of any construction and operation mitigations or methods to reduce the impact to wildlife or wildlife habitat not identified in an above section.

The Proponent has prepared the following Construction and Operation Mitigation Plan (COMP) that complies with the Standards and Best Management Practices (BMPs) outlined in the Directive. In addition to these Standards and BMPs, the environmental protection and mitigation measures outlined in Table 34 will be implemented during the construction and operation phases of the Project to reduce potential impacts to environmentally sensitive features.

Table 34: Environmental Protection and Mitigation Measures for Project Construction and Operation

Standards	BMP	Commitment
Planning and Development Phase		
100.3.1	–	■ The Proponent prepared this environmental protection and mitigation measures table as part of their COMP for the Project.
100.3.3 100.3.5 100.3.6 100.3.7 100.3.8 100.3.9 100.3.10 100.3.11 100.3.17	200.3.5 200.3.6 200.3.7 200.3.8	■ The Project has been sited outside Grizzly Bear Zones, Key Wildlife and Biodiversity Zones (KWBZ), or Special Access Zones.
–	200.3.4 200.3.13	■ The Project has been designed to minimize the extent of new access roads to the extent practicable. ■ Where new access roads are required, alignment with and utilization of existing trails and designated rights-of-way (e.g., County road allowances, agricultural access roads) has been maximized to the greatest extent feasible.
–	200.3.11	■ The collection system circuits have been collocated to run in parallel along portions of their lengths, where possible. Temporary crane paths will follow access roads or collection system to the extent practicable.
–	200.3.9 200.3.13	■ The Project has been designed to reduce the overall footprint to the smallest area practicable while maintaining safe construction and operation practices and conforming to landowner requests, engineering requirements and environmental regulatory requirements. ■ A conservative estimate of the maximum construction footprint has been used in the evaluation of Project effects.
100.3.12	200.3.10	■ The Project has been designed with no new permanent waterbody crossings.
100.3.13	–	■ The selected turbine technologies incorporate tubular tower structure.
100.3.14	–	■ Guy wires on permanent met tower will be equipped with markers specifically designated to reduce the potential for bird collision.
100.3.15	–	■ The Project has been designed to use an underground collection system which consists of standard utility cable buried to a minimum depth of approximately 1 m as per the Canadian Electrical Code. ■ The Project was designed to minimize the length of the overhead transmission line interconnection. The overhead lines will be marked in accordance with the Avian Power Line Interaction Committee (APLIC) guidance.
–	200.3.3	■ Lighting for on-the-ground Project infrastructure will use down-shielded lamps controlled by proximity sensors where feasible.
–	200.3.12	■ The access roads have been designed as dead-end roads to be used for turbine access only, so are not expected to provide through passage to dissuade use by the public.

Table 34: Environmental Protection and Mitigation Measures for Project Construction and Operation

Standards	BMP	Commitment
Construction Phase		
General		
100.3.2	–	■ The Project has been designed to avoid environmentally sensitive features or their associated setbacks. Where avoidance was not possible, the activities will be scheduled outside the sensitive timing periods (refer to Appendix A of the Directive), or alternatively an experienced wildlife biologist will be on site to conduct pre-disturbance surveys for active nests, dens, breeding sites, or other sensitive wildlife habitat. Where setbacks from the active ferruginous hawk nest cannot be met, construction activity within the nest setback will be scheduled outside of the raptor breeding period (March 15 to July 15; AEP 2020b; GOA 2018). ■ In the event that a previously unidentified sensitive wildlife feature is suspected or identified and/or if adherence to the timing and/or setback restrictions is not possible, site-specific mitigation and monitoring plan will be developed in consultation with AEP-FWS.
100.3.4	200.3.13	■ Construction activities will be scheduled during dry or frozen ground conditions. ■ Vegetation removal, soil disturbance and grading will be limited to smallest area practicable while maintaining safe construction and operation practices, especially near waterbody setbacks and areas prone to erosion.
100.3.16	200.3.13	■ Where avoidance of environmentally sensitive features or their associated setbacks was not possible during Project design, a resource specialist (e.g., experienced wildlife biologist) will be present on-site, as required, to assess the features and to inspect or monitor construction activities at or near sensitive areas.
–	200.3.2	■ Construction equipment will enter the Project site in clean condition (i.e., free of soils and vegetative debris) and in good working order (i.e., no oil or hydraulic fluid leaks). Equipment will be visually inspected and cleaned off-site as needed. ■ The Proponent will develop and implement a vegetation management plan as per the C&R Directive to prevent and control the spread of invasive species. ■ The Proponent will abide by the *Alberta Weed Control Act* and Regulations (GOA 2010) and eradicate prohibited noxious weed species populations and control any noxious weed species populations on the Project site.
–	–	■ Prior to construction activities occurring within 100 m of all Class III-VI wetlands, a non-intrusive field survey will be conducted by an experienced wildlife biologist to determine the presence of breeding amphibians and, if necessary, mitigation will be applied to reduce any effects to breeding amphibians as per Appendix A in the Directive. The Proponent will discuss findings and the need for additional mitigation with AEP-FWS so that potential residual effects on amphibians are acceptable.
–	–	■ The Proponent will schedule construction within setbacks or direct disturbances to wetlands with the potential to support amphibian populations outside of the amphibian breeding period or will commit to having an experienced wildlife biologist onsite if construction during the breeding period is necessary.
–	–	■ If construction is scheduled during the migratory bird nesting period, nest searches will be performed by an experienced wildlife biologist to identify breeding birds or their nests. If breeding activity is identified then appropriate setback buffers will be applied to the suspected nest location to minimize the risk of disturbing birds, nests or eggs in accordance with the Migratory Bird Convention Act and the Alberta Wildlife Act. ■ Construction of access road segments and collection line installation within the active ferruginous hawk nest setback will be scheduled outside the raptor breeding period (March 15 to July 15; AEP 2020b; GOA 2018).
–	–	■ Construction activities will be confined to designated Project sites.

Table 34: Environmental Protection and Mitigation Measures for Project Construction and Operation

Standards	BMP	Commitment
–	–	■ Environmentally sensitive features (e.g., nest, wetlands) or their associated setback will be clearly marked prior to start of construction. ■ Project personnel will avoid areas that are flagged or temporarily fenced and abide by restrictions on in/out privileges that are implemented in areas requiring special protection due to environmentally sensitive features.
–	–	■ The direct plough technique will be used for installing the collection system within native grassland and within the active ferruginous hawk nest setback.
–	–	■ Erosion and sedimentation controls will be installed to prevent sediment and other material entering any waterbodies, as necessary.
–	–	■ Speed limits will be established to minimize dust and collision risk for wildlife.
–	–	■ Noise abatement, emission and pollution control equipment on machinery will be in place, properly maintained and in good working order.
–	–	■ Washing, re-fueling or equipment maintenance activities will not occur within 100 m of a waterbody or wetland or within native grassland at the Project site.
–	–	■ The access roads and construction workspaces will be lightly wetted, if needed, to minimize the creation of dust. ■ During dry and/or high wind conditions, construction activities will be halted, or the areas will be lightly wetted to prevent the generation of excessive dust.
–	–	■ When fire hazard exists, appropriate mitigation measures will be used to reduce risk of fire such as wetting surrounding areas, having water trucks on standby and use fire resistant mats.
–	–	■ The Proponent will train a member of the onsite construction staff in protocols to respond to and report environmental and wildlife issues identified onsite.
–	–	■ If necessary, the Proponent will employ the services of qualified environmental monitors to guide implementation, monitor, and report on the effectiveness of any mitigation measures implemented during construction to minimize potential impacts.
–	–	■ In the event that an injured or dead species listed provincially (AEP 2015) and/or federally (Government of Canada 2020) is observed on-site, the Proponent will notify the local AEP-FWS Wildlife Biologist within 24 hours of finding the individual.
Access Control		
–	200.3.12	■ The turbine sites or access roads will generally not be fenced or gated, unless requested by landowners. The Proponent will place signs on the entrances of these roads indicating that they are on private lands and do not provide through access. Where the Project's access roads intersect public roads, gates may be installed as per landowner request. ■ The Project substation will be fenced to limit uncontrolled access and for public safety. Fencing will have squared corners and will be embedded into the ground to stop wildlife from entering as is standard practice for other transmission facility operators in Alberta. The fence design has not been finalized and will be completed closer to construction of the Project; however, if AEP has fencing specification guidelines, the Proponent is committed to following these guidelines.
Vegetation Clearing		
100.3.2	–	■ Vegetation clearing or application of a protective layer (e.g., matting, geo-textile) in native grassland will be scheduled outside the grassland bird breeding season (April 1 to July 15; AEP 2018a) and the migratory bird nesting period for nesting zone B3 (April 12 to August 23; ECCC 2018, internet site). If these activities are required during the bird breeding period, an experienced wildlife biologist will be on site to conduct pre-disturbance surveys, or to monitor wildlife behaviour and to propose on site mitigation actions that should be implemented to reduce risk to wildlife.

Table 34: Environmental Protection and Mitigation Measures for Project Construction and Operation

Standards	BMP	Commitment
Stripping, Grading and Pad/Road Construction		
100.3.4	–	■ The integrity of the sod, topsoil and subsoil *in situ* will be conserved where stripping is not required. ■ The area requiring topsoil stripping and grading will be limited to the extent practicable by using a protective layer such as matting, geo-textile, frost packing or snow to prevent ground disturbance. ■ Topsoil will be stripped from areas to be graded, which correspond to the areas required for permanent access road and turbine foundation, and safe construction and operation practices. ■ Existing vegetation will be cleared and grubbed with the topsoil, which will be stockpiled separately from subsoil to minimize mixing of topsoil with excavated subsoils and graded material. ■ Soil will be removed in lifts. ■ Soil stockpiles will be low profile and stabilized to prevent erosion. ■ Salvaged topsoil will be stored adjacent to temporary Project construction footprint for use during reclamation and clean-up and in such a way as to not interfere with Project activities. ■ Equipment that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tires, or wide pad tracks) will be used to the extent practicable. ■ The activity of heavy equipment will be restricted if wet soil conditions occur. ■ Project personnel will drive at reduced speeds and avoid unnecessary wheel spin. ■ Soil handling and soil conditions will be monitored throughout construction to assess whether topsoil is being subject to degradation that will eventually impact soil capability.
100.3.4	200.3.13	■ On native grassland, vegetation removal, soil disturbance and grading will be limited to the area of the construction access roads, and areas that are for the underground collection system. While use of the cut and fill technique will be minimized, if there is an elevation change, cut and fill may be required to ensure the vertical curve radius is met and to ensure safe construction practices. However, cut and fill will be avoided along native grassland where possible. Soil salvage will follow mitigation and protection measures described above under Standard 100.3.4. ■ In areas of native grassland, the width of disturbance for the construction of access roads will be limited to no more than 20 m; ■ For temporary Project construction footprint on native grassland, a protective layer (e.g., matting, geo-textile) will be placed directly onto the surface to protect the native vegetation and topsoil layer. Vegetation clearing or application of a protective layer (e.g., matting, geo-textile) in native grassland will be scheduled outside the grassland bird breeding season (April 1 to July 15; AEP 2018a) and the migratory bird nesting period for nesting zone B3 (April 12 to August 23; ECCC 2018, internet site). If these activities are required during the bird breeding period, an experienced wildlife biologist will be on site to conduct pre-disturbance surveys, or to monitor wildlife behaviour and to propose on site mitigation actions that should be implemented to reduce risk to wildlife. ■ The direct plough technique will be used for installing the collection system within native grassland.
Turbine Foundation and Erection		
–	–	■ Open excavations or auger holes left unsupervised will be temporarily fenced off to prevent wildlife mortality. ■ Open excavations or auger holes left unsupervised will be checked daily to ensure no wildlife is trapped.

Table 34: Environmental Protection and Mitigation Measures for Project Construction and Operation

Standards	BMP	Commitment
–	–	■ Concrete work areas will be isolated, if necessary, from adjacent waterbodies or wetlands to prevent uncured or partly cured concrete from coming in contact with waterbodies and wetlands. No turbines are located within 100 m of any Class III or higher wetlands.
Interim Reclamation		
–	200.3.13	■ The Proponent will conduct pre-disturbance site assessments (PDSA) as per the C&R Directive and determine appropriate site-specific protection and mitigation measures for soil, vegetation and wetland management to facilitate site reclamation. ■ Temporary Project construction footprint will be reclaimed as per the C&R Directive, landowner specifications and based on the availability of seed at the time of the reclamation. ■ Temporary access roads and collection system will be reclaimed immediately after they are no longer required for construction of the Project. ■ Areas prone to erosion will be seeded with a native cover crop or certified seed mix that meets C&R Directive requirements and is approved by the landowners, as soon as feasible after construction.
–	200.3.13	■ Subsoil throughout stripped areas and soils damaged during wet weather will be de-compacted using stripping or other appropriate method. ■ Disturbed areas will be recontoured to restore drainage patterns and the approximate pre-construction profile. Areas with vehicle ruts and erosion gullies will be regraded to conform to the local topography to maintain drainage patterns.
–	200.3.13	■ Topsoil will be placed as evenly as possible over the replaced subsoil. ■ Soil handling will be postponed during wet conditions to prevent damaging soil structure and erosion of topsoil. ■ Soil handling will be postponed in high winds when wind erosion is evident to prevent the erosion of topsoil.
–	200.3.13	■ Revegetation and/or seeding will follow as close as possible to topsoil material replacement pending seasonal or weather conditions.
–	200.3.13	■ The Proponent will conduct a final site inspection to assess that decommissioning, reclamation, and erosion and sedimentation controls are complete and satisfactory before equipment is removed from the Project site. ■ The Proponent will conduct Interim Monitoring Site Assessments (IMSA) for a minimum of three growing seasons after reclamation as per the C&R Directive. ■ Erosion and sedimentation control measures will remain in place until the construction activities are completed and the disturbed area has been stabilized, restored and revegetated.
Operation and Maintenance Phase		
–	–	■ Operation and maintenance activities will be confined to the designated Project site (e.g., developed gravel pads and access roads). In the event that operation and maintenance activities occur outside the designated Project site, the applicable pre-construction and construction protection and mitigation measures described above will be implemented.

Table 34: Environmental Protection and Mitigation Measures for Project Construction and Operation

Standards	BMP	Commitment
100.3.2	–	■ Operation and maintenance activities that occur outside the designated Project site (e.g., developed gravel pads or access roads) and within environmentally sensitive features or their associated setback will be scheduled outside the sensitive species timing period (refer to Appendix A of the Directive). If activities must be completed during the sensitive species timing periods (e.g., emergency maintenance work), a pre-disturbance assessment for active nests, dens, burrows, or other sensitive wildlife habitat will be conducted experienced wildlife biologists. ■ In the event that previously unidentified sensitive wildlife habitat is suspected or identified and/or if adherence to the timing and/or setback restrictions is not possible, site-specific mitigation and monitoring plan will be developed in consultation with AEP-FWS.
–	200.3.1	■ During sensitive species timing periods, the number of Project personnel, vehicle or dailies activities will be minimized where the Project site is located within an environmentally sensitive feature setback.
–	200.3.2	■ Vehicle and equipment that enter the designated Project site (e.g., developed gravel pads or access roads) will be clean (i.e., free of soils and vegetative debris) and in good working order (i.e., no oil or hydraulic fluid leaks). ■ Equipment will be visually inspected and cleaned off-site as needed. ■ The Proponent will develop and implement a vegetation management plan as per the C&R Directive to prevent and control the spread of invasive species. ■ The Proponent will abide by the *Alberta Weed Control Act* and Regulations (GOA 2010) and eradicate prohibited noxious or noxious weed species populations and control any noxious weed species populations on the Project site.
–	200.3.12	■ The Proponent will consult with landowners or appropriate regulatory agency about ongoing access control requirements during operations. ■ The turbine sites or access roads will generally not be fenced or gated, unless requested by landowners. The Proponent will place signs on the entrances of these roads indicating that they are on private lands and do not provide through access. Where the Project's access roads intersect public roads, gates may be installed as per landowner request.
–	–	■ The post-construction surveys will be completed as directed by the AEP "Post Construction Survey Protocols for Wind and Solar Energy Projects" (AEP 2020c) or the version that is in effect at the time the Project commences operations.
–	–	■ The Proponent will train a member of the onsite operations staff in protocols to respond to and report environmental and wildlife issues identified onsite.
–	–	■ Speed limits will be established to minimize dust and collision risk for wildlife.
–	–	■ Appropriate erosion and sedimentation control measures will be installed, monitored and managed. ■ Erosion and sediment control mitigation measures and bank stabilization features will be routinely inspected (e.g., after spring freshet) to verify effectiveness.
–	–	■ Washing, re-fueling or equipment maintenance activities are not to occur within 100 m of a waterbody or wetland or within native grassland at the Project site.

– = not applicable.

SOLAR PROJECTS ONLY: Questions 51 to 54 are specific to solar energy projects only.

51) Use of Pilings

SOLAR PROJECTS ONLY: Will pilings be used to install the solar panels? Provide details of the type of pilings that will be used and installation techniques.

Not applicable for this Project.

52) Site Levelling and Grading

SOLAR PROJECTS ONLY: Will there be levelling or grading of the project site? If yes, provide details.

Not applicable for this Project.

53) Soils and Vegetation Disturbance

SOLAR PROJECTS ONLY: Will the ground under solar panels be stripped or vegetation removed? If yes, provide details of the methods, wildlife mitigations and if areas will be revegetated, including type of seed mix.

Not applicable for this Project.

54) Vegetation Maintenance

SOLAR PROJECTS ONLY: If there is vegetation under the panels, provide details about how and when it will be maintained. Detail all mitigation measures that will used during vegetation maintenance to protect wildlife and wildlife habitat (e.g., survey sweeps for ground nesting birds).

Not applicable for this Project.

11.0 POST-CONSTRUCTION MONITORING AND MITIGATION PLAN

55) Post-Construction Monitoring Plan

State that the post-construction surveys will be completed as directed by the AEP "Post-Construction Survey Protocols for Wind and Solar Energy Projects"?

The post-construction surveys will be completed as directed by the AEP "Post Construction Survey Protocols for Wind and Solar Energy Projects" (AEP 2020c) or the version that is in effect at the time the Project commences operations. Fatality monitoring surveys will be conducted at all turbine locations, as outlined in the Protocol (AEP 2020c).

56) Mortality

If mortality is deemed higher than acceptable by AEP-FWS, the proponent will be required to mitigate the mortality to acceptable levels as per AEP-FWS Policy. Identify the proposed mitigation methods that will be implemented by the proponent if mortality is determined to be high.

Due to thoughtful and iterative planning and Project design, it is anticipated that operational mitigation will not be required. However, if the mortality rate threshold is exceeded, mitigation measures will be investigated and implemented as deemed acceptable through consultation with AEP-FWS. Following discussions with AEP-FWS, the Proponent understands that a mortality rate threshold of four (4) bat mortalities, per turbine, per year is based on the *Bat Mitigation Framework for Wind Power Development* (ESRD 2013b) and will become a standard threshold for mortality rates at wind power projects that will trigger implementation of mitigation. Currently there is no standard mortality rate threshold for bird mortalities at wind power projects.

Should bat mortalities exceed acceptable levels, the Proponent will notify the local AEP-FWS Wildlife Biologist in accordance with Standard 100.4.7 in the Directive, to discuss mitigation measures consistent with the options outlined in the *Bat Mitigation Framework for Wind Power Development* (ESRD 2013b) or other adaptive management alternatives that are considered acceptable following discussions with AEP-FWS, depending on the nature and locations of the observed bat mortalities. The Proponent will work with AEP-FWS to determine adaptive mitigation options if elevated bird mortality rates are identified during operations.

RES expects the mitigation options would be consistent with those outlined in the Directive and the *Bat Mitigation Framework for Wind Power Development* (ESRD 2013b), and in consideration of specific portions of the site that may be contributing to the elevated mortality rates due to localized conditions. These include options such as increasing wind cut-in speed, feathering or altering the pitch angle of turbine blades, introducing seasonal shutdowns or in the case for bats, shutdowns at night. Mitigation options would be considered on a case-by-case basis in consultation with AEP-FWS, pending the post construction monitoring results, to determine the site-specific causes of elevated mortality rates.

The effectiveness of mitigation measures on reducing observed bird and/or bat mortality will be assessed, if required, through an operational mitigation study, which will be conducted in conjunction with the post-construction monitoring program. Turbines selected for operational mitigation (i.e., the experimental group) will be located throughout the Project footprint, including a mix of footprint edge and internal turbines. It is expected that an operational mitigation study, with experimental and control turbines, will reduce the influence of annual bat and/or bird activity variability on the assessment of operational mitigation measures. Carcass searchers will not be informed of the ongoing operational mitigation study nor which specific turbines are included, to avoid any potential bias in search effort at experimental or control turbines during the study.

Results of the operational mitigation study, if required, will be included in the annual post-construction monitoring report and will be submitted to the AUC and AEP-FWS for review. The Proponent will consult with the AUC (and AEP-FWS, as appropriate) to determine whether additional or different mitigation measures are warranted.

12.0 MAPS AND FIGURES

57) Project Area Map

Map and a KMZ file of the overall project area: map must include project boundary line, photo imagery, boundary line for the 1000m setback of the project boundary, identification of all wildlife habitat types as identified in this submission (i.e., native grassland, cultivation, etc.). Provide the name of the file(s).

The Project Study Area is shown on Figure A-1 (refer to Appendix A).

58) Survey Locations Map

Map and a KMZ file of survey locations: Map must include project boundary line, photo imagery, and each wildlife survey point for all required surveys. To enable AEP-FWS review, if the map is cluttered it is recommended that multiple maps be used with files labelled appropriately. Depending on the size of the project, it may improve clarity of information by providing a separate map for the survey locations of each type of survey conducted. Provide the name of the file(s).

- The bird and bat migration survey locations are shown on Figure A-6 (refer to Appendix A).
- The breeding bird survey locations are shown on Figure A-7 (refer to Appendix A).
- The burrowing owl survey locations are shown on Figure A-8 (refer to Appendix A).
- The sharp-tailed grouse survey locations are shown on Figure A-9 (refer to Appendix A).

59) Project Layout Map

Map and a KMZ file of the project layout: Map must include project boundary line, photo imagery, infrastructure locations including but not limited to turbines or solar arrays, access roads, collections lines, substations, temporary work spaces and fences. To enable AEP-FWS review, if the map is cluttered it is recommended that multiple maps be used with files labelled appropriately. Provide the name of file(s).

The Project footprint is shown on Figure A-2 (refer to Appendix A).

60) Water Bodies Map

Map and KMZ file of of Lake/Wetland/Waterbody/Watercourse Features: Map must include project boundary line, photo imagery, all classified wetlands and setback distance from nearest project infrastructure. To enable AEP-FWS review, if the map is cluttered it is recommended that multiple maps be used with files labelled appropriately. Provide the name of file(s).

The wetlands and land cover are shown on Figures A-4a to Figure A-4g (refer to Appendix A).

61) Wildlife Features Map

Map and KMZ file of Wildlife Features: Map must include project boundary line, photo imagery, all identified wildlife features (house, nests, dens, leks, etc.) and associated setback boundary line, and setback distance from nearest project infrastructure. Labelling of wildlife features must match identification number of feature referenced in above section(s) of this submission. To enable AEP-FWS review, if the map is cluttered it is recommended that multiple maps be used with files labelled appropriately. Provide the name of file(s).

The wildlife features are shown on Figure A-5 (refer to Appendix A).

62) Other Maps and Figures

Other associated maps and figures: (insert jpeg/pdf map file). Provide any other maps referenced by the proponent in the body of this submission. To enable AEP-FWS review, if map is cluttered it is recommended that multiple maps be used with files labelled appropriately. Provide the name of file(s).

- The absence of critical habitats under the SARA in proximity to the Project location is shown on Figure A-3 (refer to Appendix A).

13.0 OTHER COMMENTS

63) Additional Wildlife Information

If there is any additional wildlife related information that the proponent would like to include in the submission, provide the information here (e.g., photographs).

Incidental wildlife observations from all survey years are summarized in Table 35.

During fall 2018 field surveys, one plains garter snake (*Thamnophis radix*) hibernaculum was recorded (refer to Figure A-5 in Appendix A). The hibernaculum was located in bushes with rocks and two possible fissures. One adult plains garter snake was observed at the location. Hibernacula of plains garter snake have a year-round 500 m setback following the Wildlife Directive for Alberta Wind Energy Projects (AEP 2018a). The required setback has been met for this Project. One other plains garter snake individual was observed incidentally, crossing a gravel road in the southern portion of the Project Study Area during 2018 field surveys. Plains garter snake is provincially listed as Sensitive (AEP 2015; Table 36).

Table 35: Incidental Wildlife Observations in the Project Study Area and 1 km Buffer

Species[a]	Number of Individuals[b]
Birds	
American avocet	2
American crow	21
American goldfinch	1
American kestrel	1
American robin	28
American wigeon	1
barn swallow	2
black-billed magpie	1
black-necked stilt	1
blue-winged teal	5
Brewer's blackbird	3
brown-headed cowbird	53
California gull	2
Canada goose	12
cedar waxwing	1
chestnut-collared longspur	5
clay-coloured sparrow	2
common grackle	1
common raven	4
common yellowthroat	3
Cooper's hawk	2
eastern kingbird	2
ferruginous hawk	3
Gadwall	6
golden eagle	1
gray partridge	38
great blue heron	1
great horned owl	1
horned lark	175
house sparrow	3
Killdeer	16
Lapland longspur	25
lark bunting	1
least flycatcher	1
lesser scaup	1
loggerhead shrike	2
Mallard	20
marbled godwit	11

Table 35: Incidental Wildlife Observations in the Project Study Area and 1 km Buffer

Species[a]	Number of Individuals[b]
McCown's longspur	5
Merlin	1
mourning dove	7
northern harrier	5
northern pintail	4
northern shoveler	14
peregrine falcon	1
red-tailed hawk	4
red-winged blackbird	40
ring-billed gull	3
sandhill crane	85
Savannah sparrow	14
sharp-shinned hawk	1
sharp-tailed grouse	8
Sora	3
Sprague's pipit	5
Swainson's hawk	12
upland sandpiper	1
vesper sparrow	60
western kingbird	3
western meadowlark	60
Whimbrel	5
Willet	11
Wilson's phalarope	1
Wilson's snipe	3
yellow warbler	1
yellow-headed blackbird	5
Mammals	
American badger	**1**
Coyote	**2**
mule deer	**1**
Pronghorn	**2**
Richardson's ground squirrel	**1**
white-tailed deer	**7**
Reptiles	
plains garter snake	**2**
Total	**952**

(a) Species in italics and bold = provincially (AEP 2015) or federally (Government of Canada 2020) listed. Refer to Table 36 for species-specific status.

(b) Species incidentally recorded with no number of individuals was included as one individual.

Listed wildlife recorded in and around the Project Study Area during targeted wildlife surveys or incidentally are summarized in Table 36

Table 36: Listed Wildlife Species Observed within the Project Study Area

Species	Provincial General Status[a]	COSEWIC Status[b]	SARA Status[b]
Birds			
American kestrel	Sensitive	-	-
bald eagle	Sensitive	Not at Risk	-
bank swallow	Sensitive	Threatened	Schedule 1: Threatened
barn swallow	Sensitive	Threatened	Schedule 1: Threatened
black-necked stilt	Sensitive	-	-
broad-winged hawk	Sensitive	-	-
chestnut-collared longspur	At Risk	Endangered	Schedule 1: Threatened
common yellowthroat	Sensitive	-	-
eastern kingbird	Sensitive	-	-
eastern phoebe	Sensitive	-	-
ferruginous hawk	At Risk	Threatened	Schedule 1: Threatened
golden eagle	Sensitive	Not at Risk	-
great-blue heron	Sensitive	-	-
lark bunting	Sensitive	Threatened	Schedule 1: Threatened
loggerhead shrike	Sensitive	Threatened	Schedule 1: Threatened
McCown's longspur	May Be at Risk	Threatened	Schedule 1: Threatened
peregrine falcon	At Risk	Not at Risk	Schedule 1: Special Concern
prairie falcon	Sensitive	Not at Risk	-
purple martin	Sensitive	-	-
sandhill crane	Sensitive	-	-
sharp-tailed grouse	Sensitive	-	-
sora	Sensitive	-	-
Sprague's pipit	Sensitive	Threatened	Schedule 1: Threatened
upland sandpiper	Sensitive	-	-
Mammals			
American badger	Sensitive	Special Concern	Schedule 1: Special Concern
little brown myotis	May Be at Risk	Endangered	Schedule 1: Endangered
Myotis bats[a]	n/a	n/a	n/a
pronghorn	Sensitive	-	-
red bat	Sensitive	-	-
silver-haired bat	Sensitive	-	-
western small-footed bat	Sensitive	-	-
Reptiles			
plains garter snake	Sensitive	-	-

(a) AEP 2015
(b) Government of Canada 2020
(c) Myotis species, most likely include western small-footed bat (listed as Sensitive provincially) long-legged bat, and little brown myotis (listed as May be at Risk provincially and listed as Endangered federally and is on Schedule 1 of SARA).
n/a = not applicable; '-' = species not assessed; COSEWIC = Committee on the Status of Endangered Wildlife in Canada; SARA = Species at Risk Act.

14.0 FINAL STATEMENT OF COMPLIANCE

I, Patrick Henn, as an authorized representative of Renewable Energy Systems Canada Inc., ensure that this application meets the AEP requirements as detailed in the Wildlife Directive for Alberta Wind Energy Projects. Deviations from the Directive (if any) are outlined in this submission form and include proposed mitigations and any formal discussions or agreements with AEP-Wildlife. All other supporting documents and materials for this project will abide with the statements made in this submission form.

Signature:  Date: January 22, 2021

Patrick Henn, Development Manager

15.0 CLOSURE

GOLDER ASSOCIATES LTD.

Jamie Sparrow, BSc.
Ecologist

Trevor Cuthbert, MSc, PMP
Associate, Project Manager

16.0 REFERENCES

Adams, A.M., M.K. Jantzen, R.M. Hamilton and M.B. Fenton. 2012. Do you hear what I hear? Implications of detector selection for acoustic monitoring of bats. Methods in Ecology and Evolution 3: 992-998.

AEP (Alberta Environment and Parks). 2015. The General Status of Alberta Wild Species 2015. Alberta Environment and Sustainable Resource Development. Fish and Wildlife Service. [updated March 1, 2017; accessed 15 January 2021]. http://esrd.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx.

AEP. 2016. *Principles for Minimizing Surface Disturbance in Native Grassland*-Principles, Guidelines, and Tools for All Industrial Activity in Native Grassland in the Prairie and Parkland Landscapes of Alberta. September 1, 2016, Edmonton, Alberta PP34.

AEP. 2018a. Wildlife Directive for Alberta Wind Energy Projects. Wildlife 2016 No.6. January 2017; September 17, 2018.

AEP. 2018b. Conservation and Reclamation Directive for Renewable Energy Operations. Land Policy 2018 No.4. September 14, 2018.

AEP. 2019. DRAFT Bird Migration Survey Protocols. Released November 21, 2019. [accessed 10 August 2020]. https://talkaep.alberta.ca/ASPB-Renewables.

AEP. 2020a. Renewable Energy Project Submission Template. Alberta Environment and Parks – Wildlife Management. March 2020.

AEP. 2020b. Bird Migration Survey Protocol. January 2020 updated in June 2020. [accessed January 2021]. https://open.alberta.ca/publications/bird-migration-survey-protocol.

AEP. 2020c. Post Construction Survey Protocols for Wind and Solar Energy Projects. Contracted to: Stantec Consulting Ltd. January 2020. [accessed January 2021]. https://open.alberta.ca/publications/post-construction-survey-protocols-for-wind-and-solar-energy-projects.

ANPC (Alberta Native Plant Council). 2012. ANPC Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update. Alberta Native Plant Council. Edmonton AB. [accessed May 2020]. http://anpc.ab.ca/wp-content/uploads/2015/01/Guidelines-For-Rare-Plant-Surveys-in-AB-2012-Update.pdf.

AUC (Alberta Utilities Commission). 2018. Rule 007. Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments. Approved March 21, 2018, Effective April 2, 2018. [accessed January 2021]. http://www.auc.ab.ca/Shared%20Documents/rules/Rule007.pdf.

Baerwald E.F. and R.M.R. Barclay. 2009. Geographic Variation in Activity and Fatality of Migratory Bats at Wind Energy Facilities. Journal of Mammalogy. 90:1341-1349.

BBOP (Business and Biodiversity Offset Programme). 2019. Biodiversity Offsets. Mitigation Hierarchy. [accessed January 2021]. https://www.cbd.int/kb/record/sideEvent/1431?FreeText=%22biodiversity%20offset%22&SearchWebContent=true..

Corcoran, A.J., and T.J. Weller. 2018. Inconspicuous echolocation in hoary bats (Lasiurus cinereus). Proceedings of the Royal Society of London, 285B: 20180441.

ECCC (Environment and Climate Change Canada). 2018. General Nesting Periods of Migratory Birds. Nesting Zones and Periods. Last updated October 30, 2018. [accessed 15 January 2021] https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html.

ESRD (Alberta Environment and Sustainable Resource Development). 2013a. Sensitive Species Inventory Guidelines April 2013. Government of Alberta, ESRD – Wildlife Management. 128 p. [accessed 15 January 2021]. https://open.alberta.ca/dataset/93d8a251-4a9a-428f-ad99-7484c6ebabe0/resource/f4024e81-b835-4a50-8fb1-5b31d9726b84/download/2013-sensitivespeciesinventoryguidelines-apr18.pdf.

ESRD. 2013b. Bat Mitigation Framework for Wind Power Development. Revised June 19, 2013.Government of Canada. 2016. Canadian Wildlife Species at Risk.

ESRD. 2015. Alberta Wetland Classification System. Water Policy Branch, Policy and Planning Division, Edmonton, AB.

GOA (Government of Alberta). 1996. Code of Practice for Concrete Producing Plants. Made under the Environmental Protection and Enhancement Act, RSA 2000, cE-12. Effective September 30 ,1996.

GOA. 2010. *Weed Control Act and Regulations.* [accessed January 2019]. Available at: http://www.qp.alberta.ca/1266.cfm?page=W05P1.cfm&leg_type=Acts&isbncln=9780779760602

GOA. 2013. Alberta Wetland Policy. [accessed January 201] http://aep.alberta.ca/water/programs-and-services/wetlands/documents/AlbertaWetlandPolicy-Sep2013.pdf

GOA. 2018. Master Schedule of Standards and Conditions. Environment and Parks, Government of Alberta. December, 2018. [accessed January 2021]. https://open.alberta.ca/publications/master-schedule-of-standards-and-conditions.

GOA. 2020. White-nose Syndrome. [accessed 14 December 2020]. https://www.alberta.ca/white-nose-syndrome.aspx.

Government of Canada. 2020. Species at Risk Public Registry. [accessed January 2021]. https://species-registry.canada.ca/index-en.html#/species?sortBy=commonNameSort&sortDirection=asc&pageSize=10.

IBA (Important Bird Areas). 2020. Important Bird Areas. [accessed January 2021] http://www.ibacanada.com/explore_how.jsp?lang=en

Lausen, C., Baerwald, E., Gruver, J. and R. Barclay. 2008. Bats and Wind Turbines. Pre-Siting and Pre-Construction Survey Protocols. University of Calgary. May 2008; Updated May 2010.

Lausen, C., E. Baerwald, J. Gruver and R.Barclay. 2010. Bats and Wind Turbines - Pre-siting and Pre-construction Survey Protocols. Appendix to: Vonhof, M. 2002. Handbook of Inventory Methods and Standard Protocols for Surveying Bats in Alberta (Alberta Sustainable Resource Development). Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, Alberta.

Power Line Sentry. 2019. [accessed January 2021]. https://powerlinesentry.com/wp-content/uploads/2018/03/line-markers-for-guy-wires.pdf.

Province of Alberta. 2016. Alberta Weed Regulatory Advisory Committee 2014 Recommendations for Prohibited Noxious, Noxious or Do Not Regulate species. Submitted to Alberta Agriculture Minister (2014) for updates to the Alberta Weed Act Regulation.

Siders, M.S. 2005. Bat Inventory of Grand Staircase-Escalante National Monument Using Mist Nets and Acoustic Monitoring. Gsenm Bat Inventory: Status 2005. Available online at: http://www.blm.gov/pgdata/etc/medialib/blm/ut/grand_staircase-escalante/programs/fish___wildlife.Par.92419.File.dat/GSENM%20Bat%20Inventory%202005.pdf.

Solick, D., D. Pham, K. Nasman and K. Bay. 2020. Bat activity rates do not predict bat fatality rates at wind energy facilities. Acta Chiroptera 22(1): 135-146.

Stewart, R.E., and H.A. Kantrud. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Resource Publication 92, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. [accessed January 2021] Available at: http://www.npwrc.usgs.gov/resource/wetlands/pondlake/index.htm.

White, C.M., and T.L. Thurow. 1985. Reproduction of ferruginous hawks exposed to controlled disturbance. The Cooper Ornithological Society 1985. *The Condor* 87:14-22.

16.1 Personal Communication

Harder, Jeffery. (GIS Technician, Canadian Wildlife Services, Environment and Climate Change Canada). Personal Communication with Jamie Sparrow (Ecologist, Golder Associates Ltd.) via email on January 8, 2021.

APPENDIX A

Maps and Figures

555000 560000 565000 570000

5836000

5836000

5830500

TWP 19

TWP 18

TWP 17

RGE 2 W4M

RGE 1 W4M

RANGE ROAD 20

RANGE ROAD 15

RANGE ROAD 23

RANGE ROAD 21

RANGE ROAD 24

RANGE ROAD 22

RANGE ROAD 12

RANGE ROAD 11

TOWNSHIP ROAD 190

TOWNSHIP ROAD 184

TOWNSHIP ROAD 182

TOWNSHIP ROAD 180

41

HILDA

ALBERTA

SASKATCHEWAN

LEGEND

- PROJECT STUDY AREA[1]
- PROJECT STUDY AREA - 1,000 M BUFFER

BASE FEATURES

- HAMLET
- PRIMARY HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE
- SENSITIVE SNAKE RANGE

LAND COVER[2]

- CULTIVATED
- FARM YARD
- NATIVE GRASSLAND
- TAME PASTURE OR HAY
- DISTURBED[3]

0 1,500 3,000

1:60,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 M BUFFER AROUND THE PROPOSED PROJECT LAYOUT.
2. LAND COVER TYPES MAY BE DESKTOP OR FIELD-VERIFIED.
3. DISTURBED LAND COVER MAY INCLUDE ROADS, TRAILS, TRANSMISSION LINES, RAILWAYS, AND DEVELOPED AREAS.

REFERENCE(S)

PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
PROJECT STUDY AREA

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
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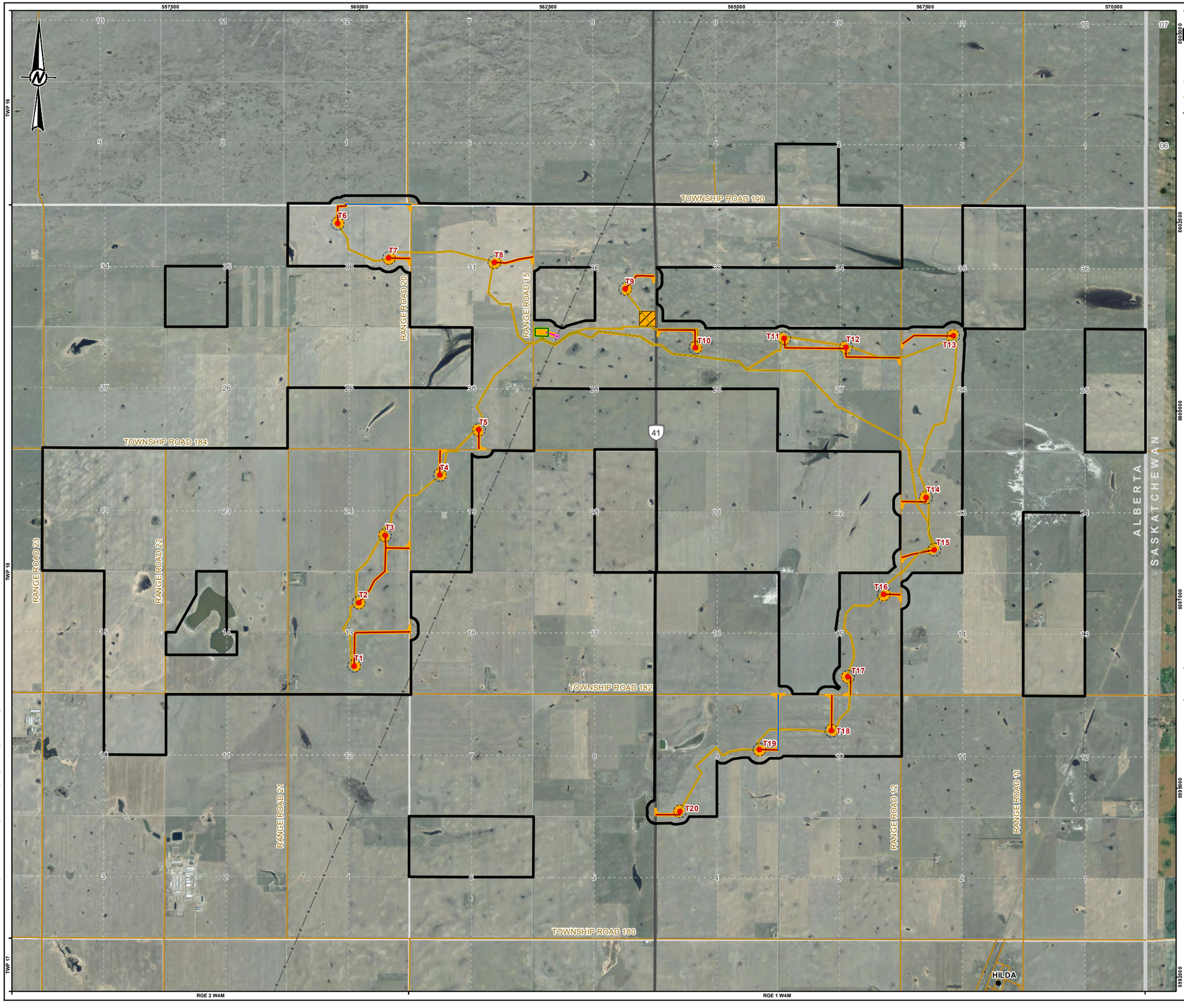

LEGEND

- PROJECT STUDY AREA[1]
- ROTOR-SWEPT AREA

BASE FEATURES

- HAMLET
- PRIMARY HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- TRANMISSION INTERCONNECTION
- COLLECTOR SYSTEM
- TRANSMISSION INTERCONNECTION (OVERHEAD LINE)
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

0 1,000 2,000

1:50,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 M BUFFER AROUND THE PROPOSED PROJECT LAYOUT.

REFERENCE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
PROJECT LAYOUT

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
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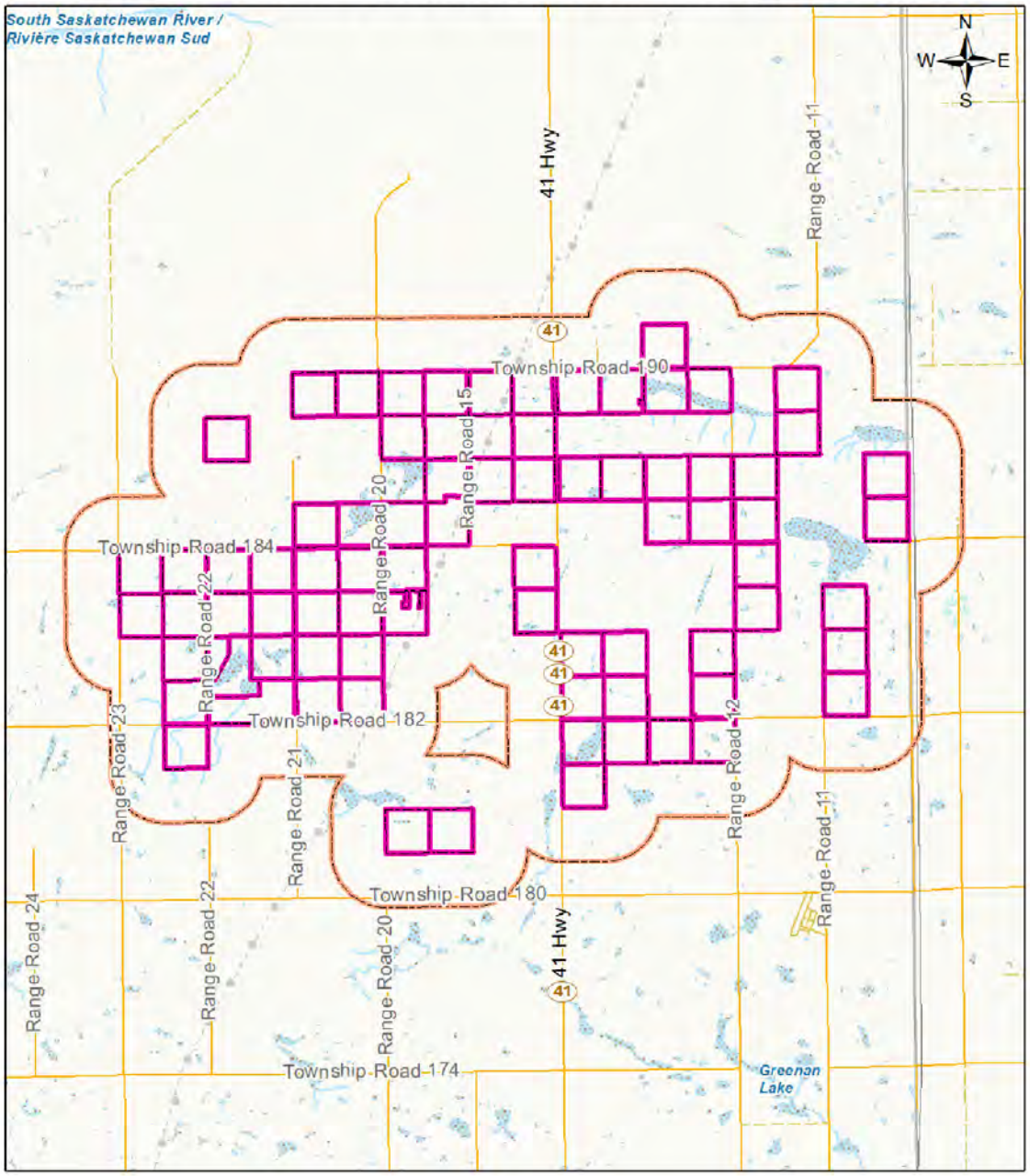

0 2 4 6

Kilometers

Coordinate System: NAD 1983 UTM Zone 12N

Legend

- AOI (Golder_Area_of_Interest_04Jan2021)
- AOI_Buffer_1km
- Critical Habitat (Final or Proposed)

REFERENCE(S)

1. MAP OBTAINED FROM ENVIRONMENT AND CLIMATE CHANGE CANADA, GOVERNMENT OF CANADA, 2021.

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

TITLE
CRITICAL HABITAT INFORMATION REQUEST 2021-01-08

PROJECT NO.	PHASE	REV.	FIGURE
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556000
558000
560000
5604000
5602000
5600000
TWP 19
TWP 18
RGE 2 W4M
RGE 1 W4M
RANGE ROAD 23
RANGE ROAD 21
RANGE ROAD 20
1
2
3
25
26
27
34
35
36
Crossing NG-2
Crossing NG-3
Crossing NG-1
T6
T7

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- LOCAL ROAD

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
- SMALLFLOWERED SANDVERBENA
- TINY CRYPTANTHE

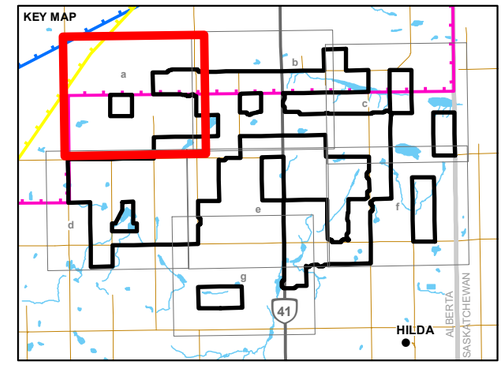
LAND COVER[3]

- CULTIVATED
- FARM YARD
- NATIVE GRASSLAND
- TAME PASTURE OR HAY
- DISTURBED[4]
- RARE PLANT SURVEY - 2018
- RARE PLANT SURVEY - 2020 EARLY SEASON
- RARE PLANT SURVEY - 2020 LATE SEASON
- ANTHROPOGENIC WATER BODY/MODIFIED NATURAL WETLAND
- DESKTOP WETLAND/ WATER BODY
- NATIVE GRASSLAND CROSSING (*NG-#*)

WETLAND AND WATER BODY PERMANENCE

- EPHEMERAL (CLASS I)
- TEMPORARY (CLASS II)
- SEASONAL (CLASS III)
- SEMI-PERMANENT (CLASS IV)
- PERMANENT (CLASS V)
- INTERMITTENT (CLASS VI)
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



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NOTE(S)

1. ***(10 m)*** = DISTANCE TO CLOSEST PROJECT INFRASTRUCTURE FOR IMPACTED WETLANDS.
2. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.
3. LAND COVER TYPES MAY BE DESKTOP OR FIELD-VERIFIED.
4. DISTURBED LAND COVER MAY INCLUDE ROADS, TRAILS, TRANSMISSION LINES, RAILWAYS, AND DEVELOPED AREAS.

REFERENCE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
WETLANDS AND LAND COVER

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
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25mm
0

562000
564000
5640000
5620000
5600000
TWP 19
TWP 18
RGE 2 W4M
RGE 1 W4M
6
5
4
31
32
33
30
29
28
TOWNSHIP ROAD 190
RANGE ROAD 20
RANGE ROAD 15
RANGE ROAD 13
41
Crossing NG-2
Crossing NG-3
Crossing NG-1
T5
T8
T9
T10
T11
5719 (91 m)
5758 (71 m)
5764 (0 m)

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- PRIMARY HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
- SMALLFLOWERED SANDVERBENA
- TINY CRYPTANTHE

LAND COVER[3]

- CULTIVATED
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- ANTHROPOGENIC WATER BODY/MODIFIED NATURAL WETLAND
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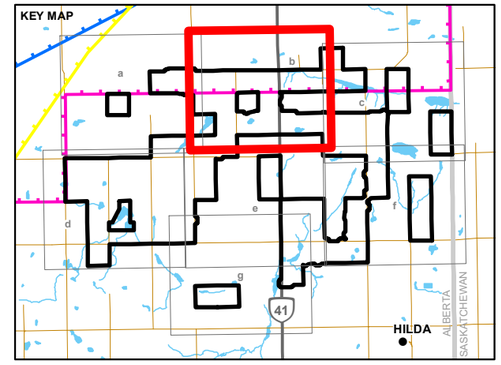
- NATIVE GRASSLAND CROSSING (*NG-#*)

WETLAND AND WATER BODY PERMANENCE

- EPHEMERAL (CLASS I)
- TEMPORARY (CLASS II)
- SEASONAL (CLASS III)
- SEMI-PERMANENT (CLASS IV)
- PERMANENT (CLASS V)
- INTERMITTENT (CLASS VI)
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



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NOTE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
WETLANDS AND LAND COVER

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

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0 25mm

566000 568000 570000

TWP 19

TWP 18

RGE 1 W4M

RANGE ROAD 13

RANGE ROAD 12

RANGE ROAD 11

TOWNSHIP ROAD 190

3 2 1 06

34 35 36 31

27 26 25 30

T11 T12 T13

601 (0 m)

ALBERTA

SASKATCHEWAN

5602000

5600000

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- LOCAL ROAD

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
- SMALLFLOWERED SANDVERBENA
- TINY CRYPTANTHE

LAND COVER[3]

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WETLAND AND WATER BODY PERMANENCE

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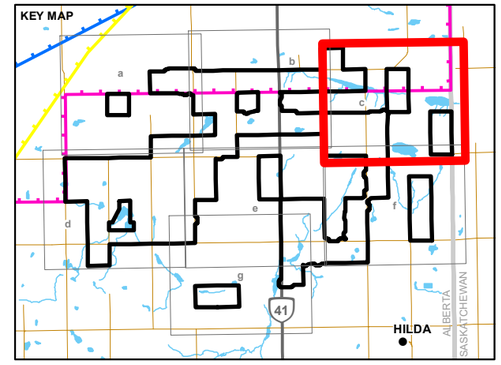
- TEMPORARY (CLASS II)
- SEASONAL (CLASS III)
- SEMI-PERMANENT (CLASS IV)
- PERMANENT (CLASS V)
- INTERMITTENT (CLASS VI)
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



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1. *(10 m)* = DISTANCE TO CLOSEST PROJECT INFRASTRUCTURE FOR IMPACTED WETLANDS.
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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT

RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT

HILDA WIND POWER PROJECT

TITLE

WETLANDS AND LAND COVER

CONSULTANT

GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
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0 25mm

556000
558000
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5598000
5596000
TWP 18
RGE 2 W4M
TOWNSHIP ROAD 184
TOWNSHIP ROAD 182
RANGE ROAD 23
RANGE ROAD 22
RANGE ROAD 21
21
22
23
24
16
15
14
13
9
10
11
12
T1
T2
T3
457 (0 m)

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- LOCAL ROAD
- TRANSMISSION LINE

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
- SMALLFLOWERED SANDVERBENA
- TINY CRYPTANTHE

LAND COVER[3]

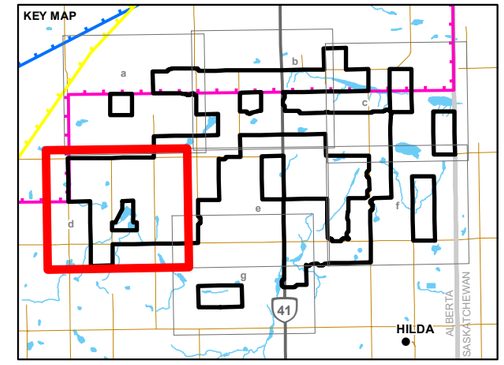
- CULTIVATED
- FARM YARD
- NATIVE GRASSLAND
- TAME PASTURE OR HAY
- DISTURBED[4]

- RARE PLANT SURVEY - 2018
- RARE PLANT SURVEY - 2020 EARLY SEASON
- RARE PLANT SURVEY - 2020 LATE SEASON
- ANTHROPOGENIC WATER BODY/MODIFIED NATURAL WETLAND
- DESKTOP WETLAND/ WATER BODY

WETLAND AND WATER BODY PERMANENCE

- EPHEMERAL (CLASS I)
- TEMPORARY (CLASS II)
- SEASONAL (CLASS III)
- SEMI-PERMANENT (CLASS IV)
- PERMANENT (CLASS V)
- INTERMITTENT (CLASS VI)
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



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NOTE(S)

1. *(10 m)* = DISTANCE TO CLOSEST PROJECT INFRASTRUCTURE FOR IMPACTED WETLANDS.
2. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.
3. LAND COVER TYPES MAY BE DESKTOP OR FIELD-VERIFIED.
4. DISTURBED LAND COVER MAY INCLUDE ROADS, TRAILS, TRANSMISSION LINES, RAILWAYS, AND DEVELOPED AREAS.

REFERENCE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
WETLANDS AND LAND COVER

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	A-4d

PATH: I:\CLIENT\SRES Canada\20138679\Mapping\Products\General\AEP_Submission\Fig\A04_20138679_WetlandMapbook_Rev0.mxd PRINTED ON: 2021-01-22 AT: 11:26:54 AM

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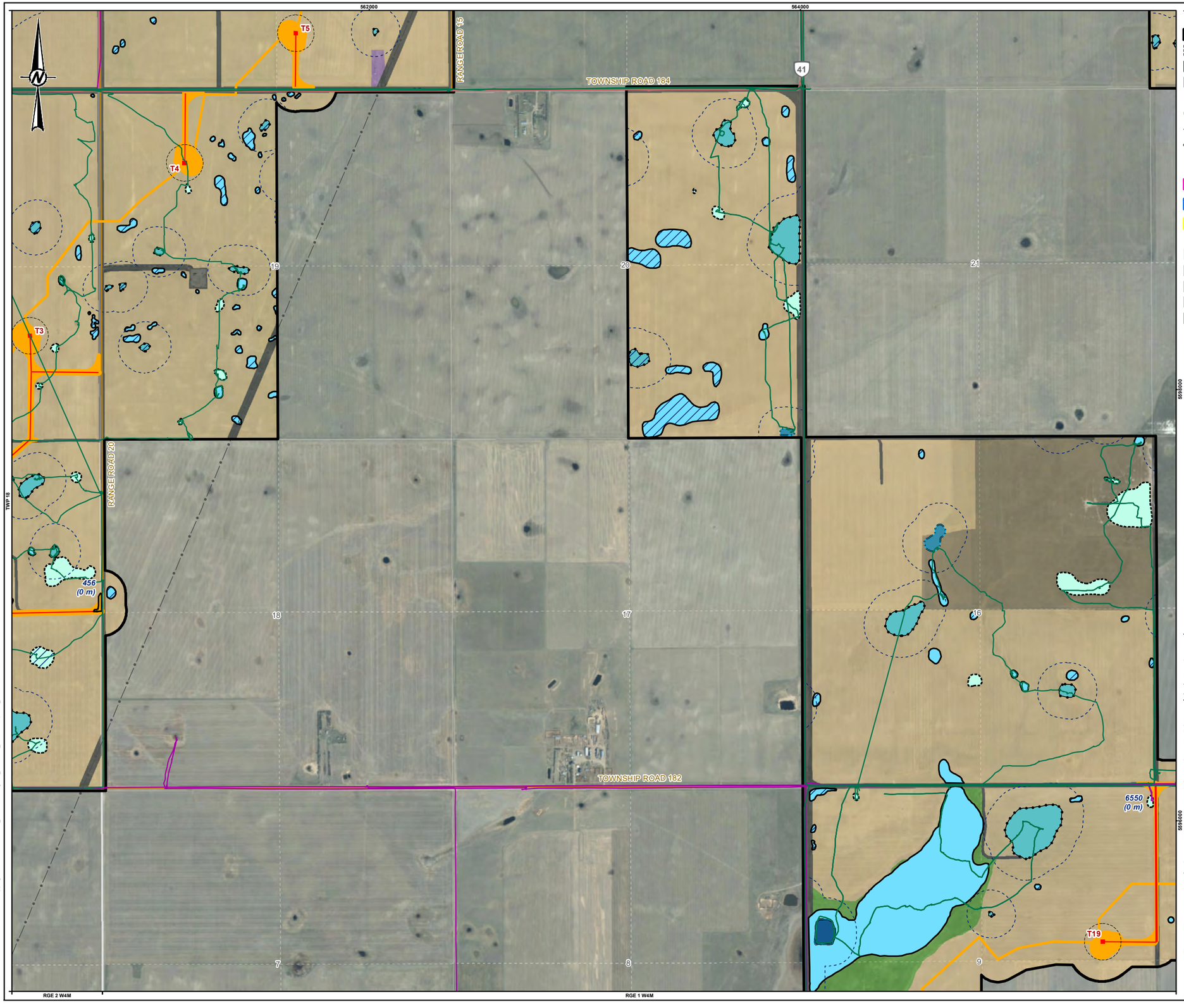

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- PRIMARY HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
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LAND COVER[3]

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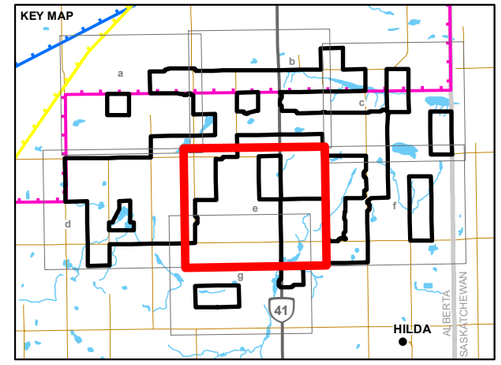
KEY MAP



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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
WETLANDS AND LAND COVER

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	A-4e

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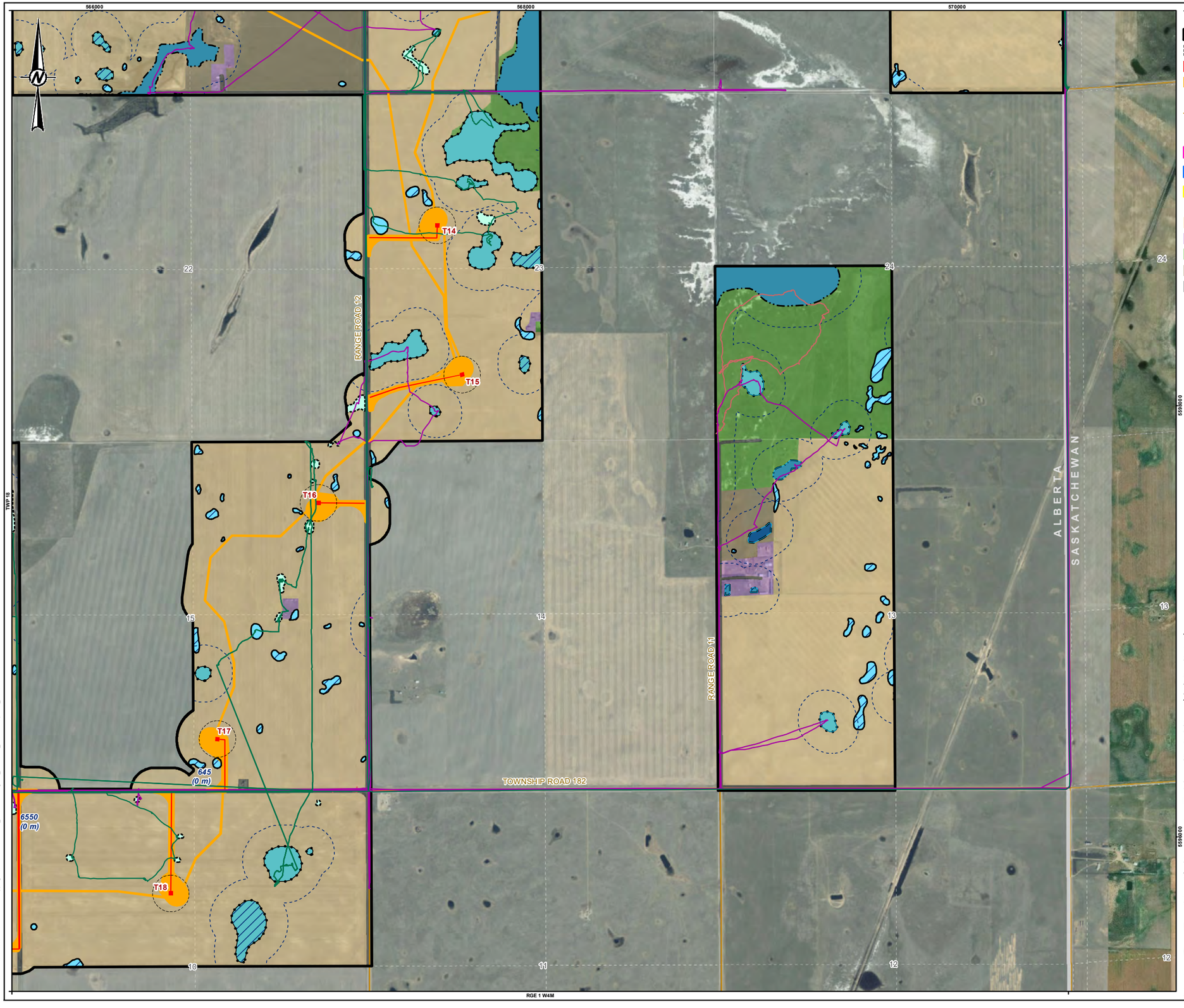

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- LOCAL ROAD

ENDANGERED/THREATENED PLANT RANGE

- SLENDER MOUSE-EAR-CRESS
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LAND COVER[3]

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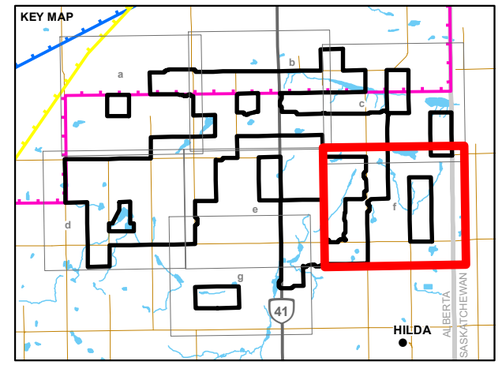
- WETLAND (CLASS III+) SETBACK (100 M)



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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT

RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT

HILDA WIND POWER PROJECT

TITLE

WETLANDS AND LAND COVER

CONSULTANT

GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	A-4f

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25mm

0

560000
562000
564000
5936000
5934000
TWP 18
TWP 17
RGE 2 W4M
RGE 1 W4M
RANGE ROAD 20
TOWNSHIP ROAD 132
TOWNSHIP ROAD 130
457 (0 m)
456 (0 m)
6081 (87 m)
T1
T20
41
1
3
4
5
6
7
8
9
12
16
17
18

LEGEND

- PROJECT STUDY AREA[2]
- ROTOR-SWEPT AREA
- OPERATION FOOTPRINT
- CONSTRUCTION FOOTPRINT

BASE FEATURES

- PRIMARY HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE

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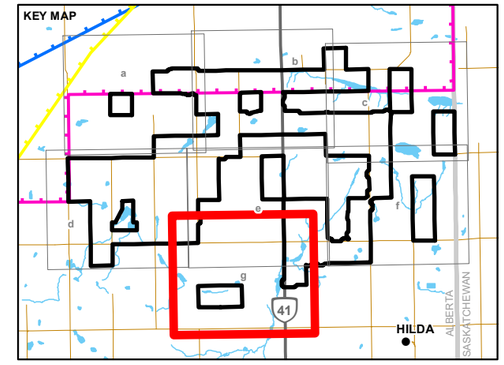
- INTERMITTENT (CLASS VI)
- WETLAND (CLASS III+) SETBACK (100 M)

KEY MAP



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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
WETLANDS AND LAND COVER

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	A-4g

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25mm

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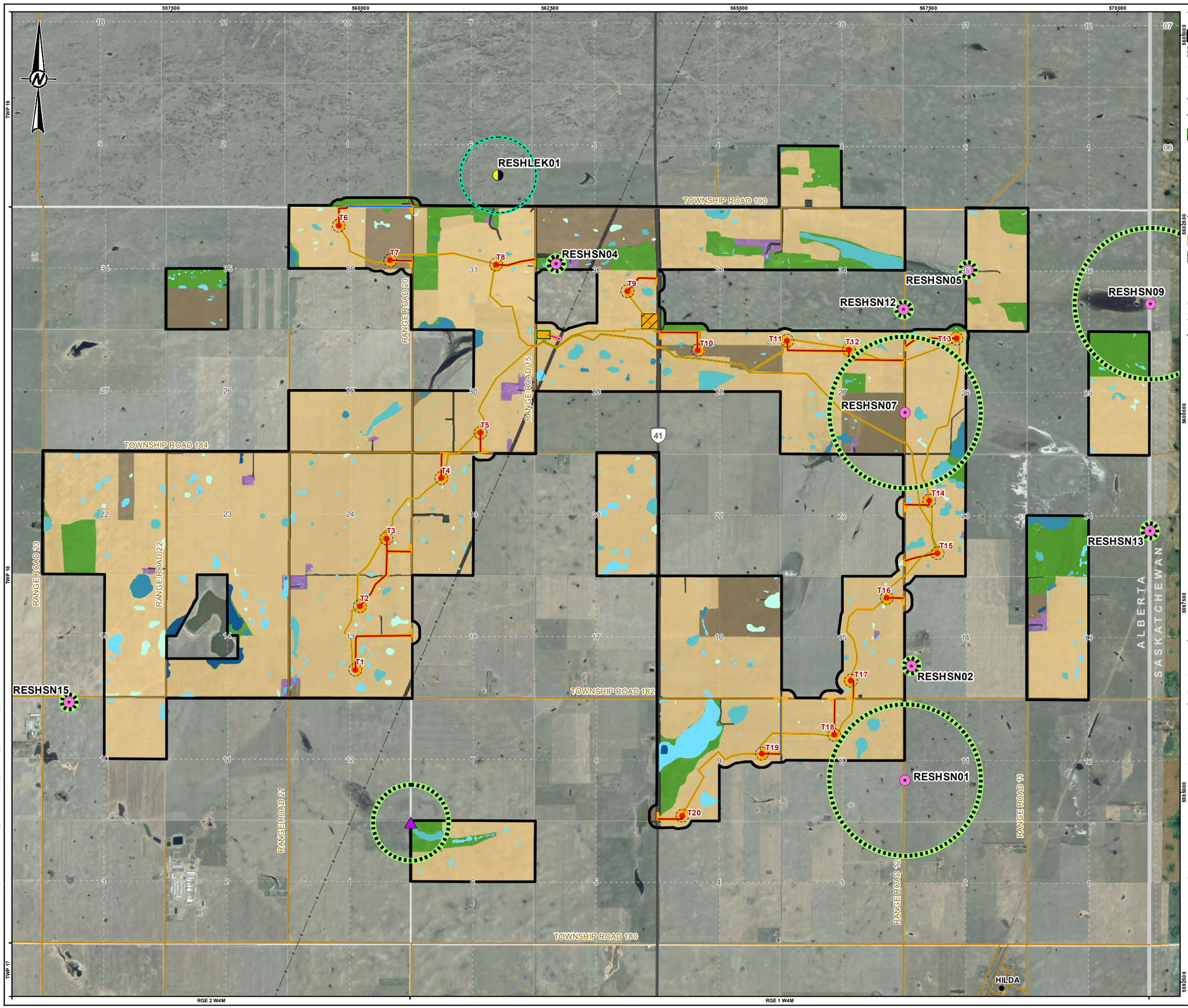

LEGEND

- PROJECT STUDY AREA[1]
- ROTOR-SWEPT AREA

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- TRANMISSION INTERCONNECTION
- COLLECTOR SYSTEM
- TRANSMISSION INTERCONNECTION (OVERHEAD LINE)
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

BASE FEATURES

- HAMLET
- PRIMARY HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE

LAND COVER[2]

- CULTIVATED
- FARM YARD
- NATIVE GRASSLAND
- TAME PASTURE OR HAY
- DISTURBED[3]
- WETLAND - CLASS I
- WETLAND - CLASS II
- WETLAND - CLASS III
- WETLAND - CLASS IV
- WETLAND - CLASS V

WILDLIFE HABITAT FEATURES

- HIBERNACULA (PLAINS GARTER SNAKE)
- RAPTOR NEST
- SHARP-TAILED GROUSE LEK

WILDLIFE STATUS

- ACTIVE
- UNCONFIRMED
- RESTRICTED ACTIVITY SETBACK
- RESTRICTED ACTIVITY SETBACK - PRECAUTIONARY

0 1,000 2,000

1:50,000 METRES

NOTE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
WILDLIFE FEATURES

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
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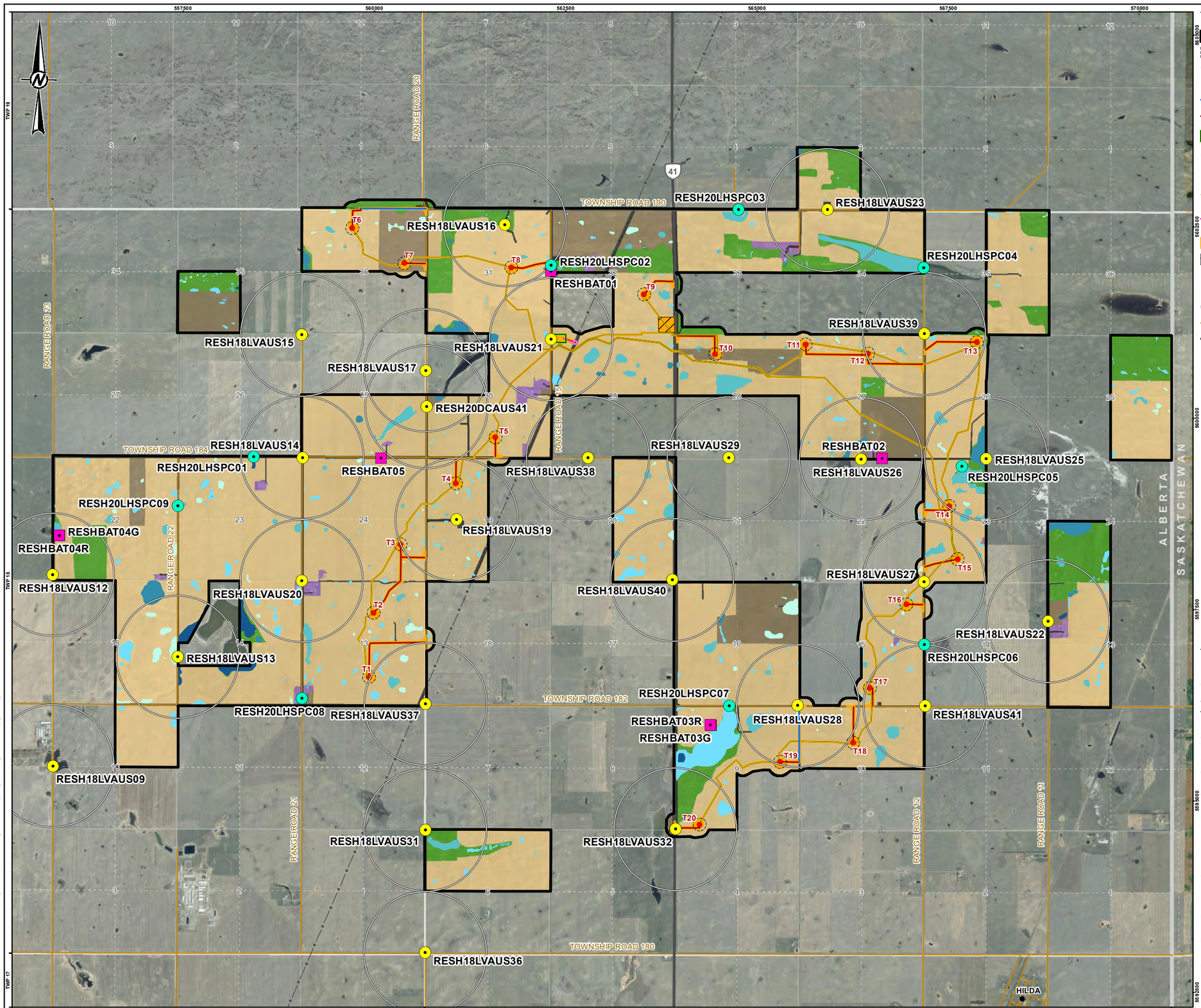

LEGEND

- PROJECT STUDY AREA[1]
- ROTOR-SWEPT AREA

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

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- TRANMISSION INTERCONNECTION
- COLLECTOR SYSTEM
- TRANSMISSION INTERCONNECTION (OVERHEAD LINE)
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

BASE FEATURES

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- PRIMARY HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE

LAND COVER[2]

- CULTIVATED
- FARM YARD
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- TAME PASTURE OR HAY
- DISTURBED[3]
- WETLAND - CLASS I
- WETLAND - CLASS II
- WETLAND - CLASS III
- WETLAND - CLASS IV
- WETLAND - CLASS V

SURVEY LOCATIONS

- BIRD MIGRATION POINT COUNT SURVEY
- BIRD MIGRATION STOPOVER COUNT SURVEY
- BAT DETECTOR
- BIRD MIGRATION POINT COUNT SURVEY - 800 m BUFFER

0 1,000 2,000

1:50,000 METRES

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
BIRD AND BAT MIGRATION SURVEY LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	A-6

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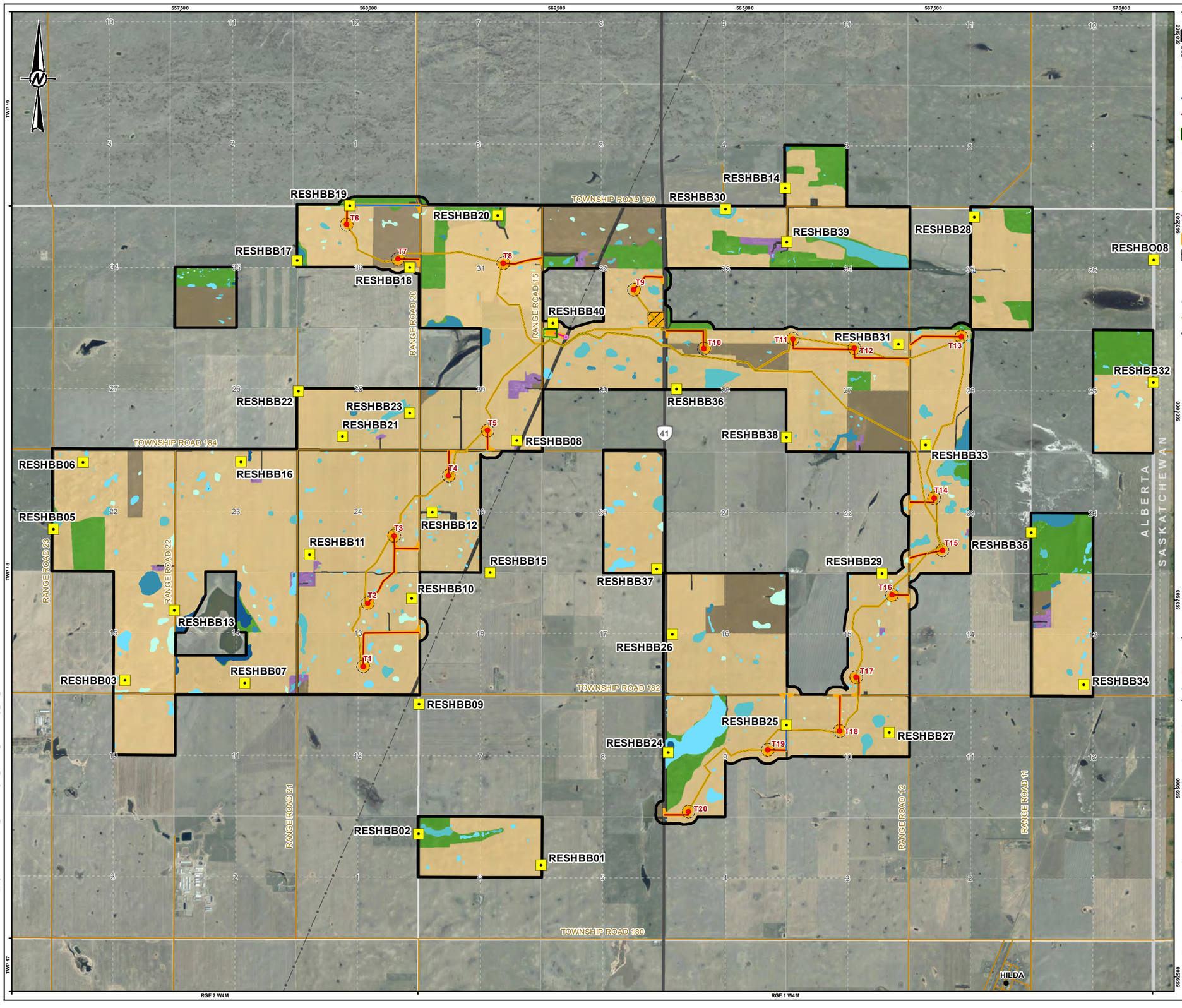

LEGEND

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- ROTOR-SWEPT AREA

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- TRANMISSION INTERCONNECTION
- COLLECTOR SYSTEM
- TRANSMISSION INTERCONNECTION (OVERHEAD LINE)
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- WETLAND - CLASS III
- WETLAND - CLASS IV
- WETLAND - CLASS V

SURVEY LOCATIONS

- BREEDING BIRD SURVEY

0 1,000 2,000

1:50,000 METRES

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
BREEDING BIRD SURVEY LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	A-7

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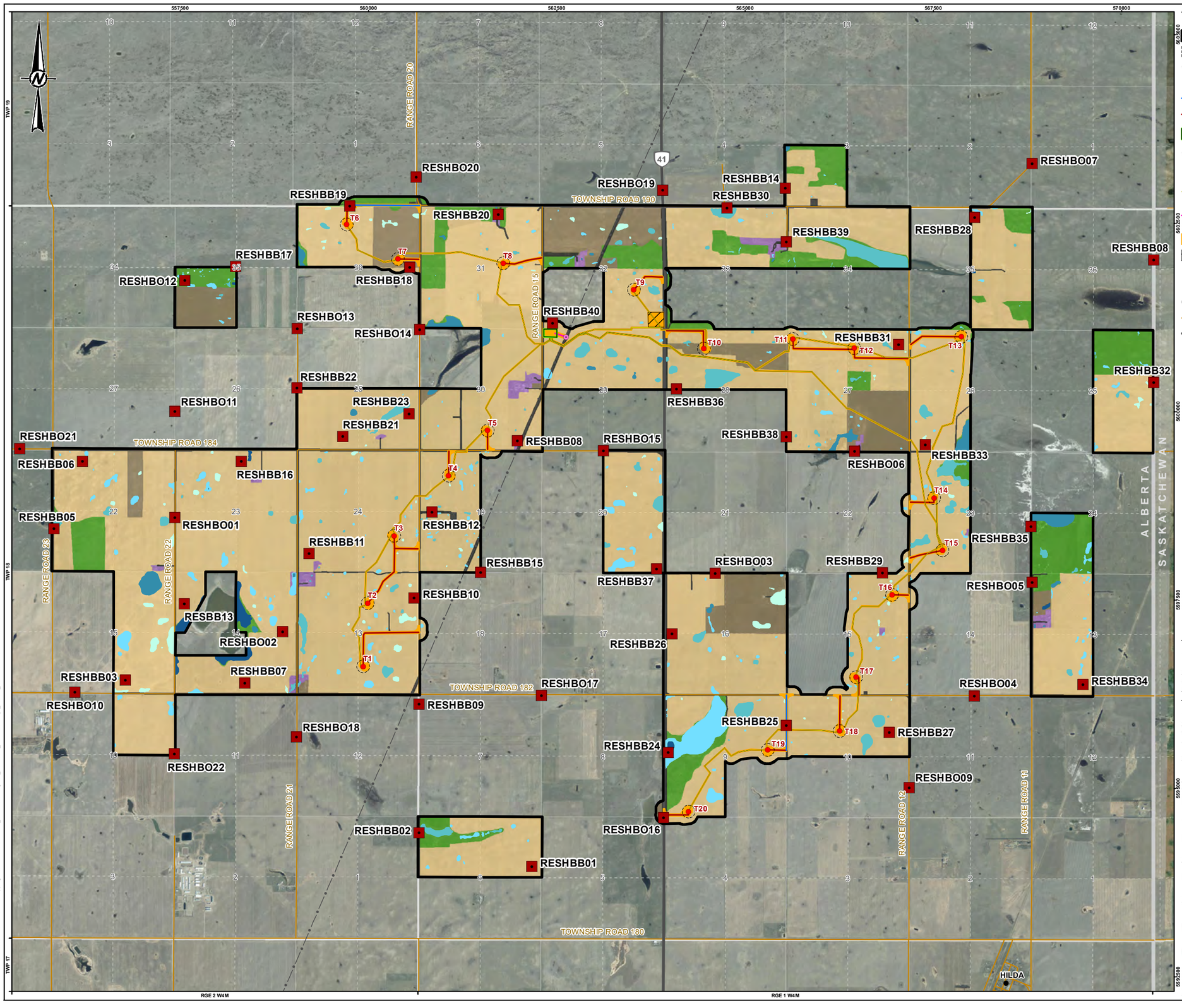

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- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
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- COLLECTOR SYSTEM
- TRANSMISSION INTERCONNECTION (OVERHEAD LINE)
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

BASE FEATURES

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- PRIMARY HIGHWAY
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LAND COVER[2]

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- DISTURBED[3]
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- WETLAND - CLASS II
- WETLAND - CLASS III
- WETLAND - CLASS IV
- WETLAND - CLASS V

SURVEY LOCATIONS

- BURROWING OWL SURVEY

0 1,000 2,000

1:50,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 M BUFFER AROUND THE PROPOSED PROJECT LAYOUT.
2. LAND COVER TYPES MAY BE DESKTOP OR FIELD-VERIFIED.
3. DISTURBED LAND COVER MAY INCLUDE ROADS, TRAILS, TRANSMISSION LINES, RAILWAYS, AND DEVELOPED AREAS.

REFERENCE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
BURROWING OWL SURVEY LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	A-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

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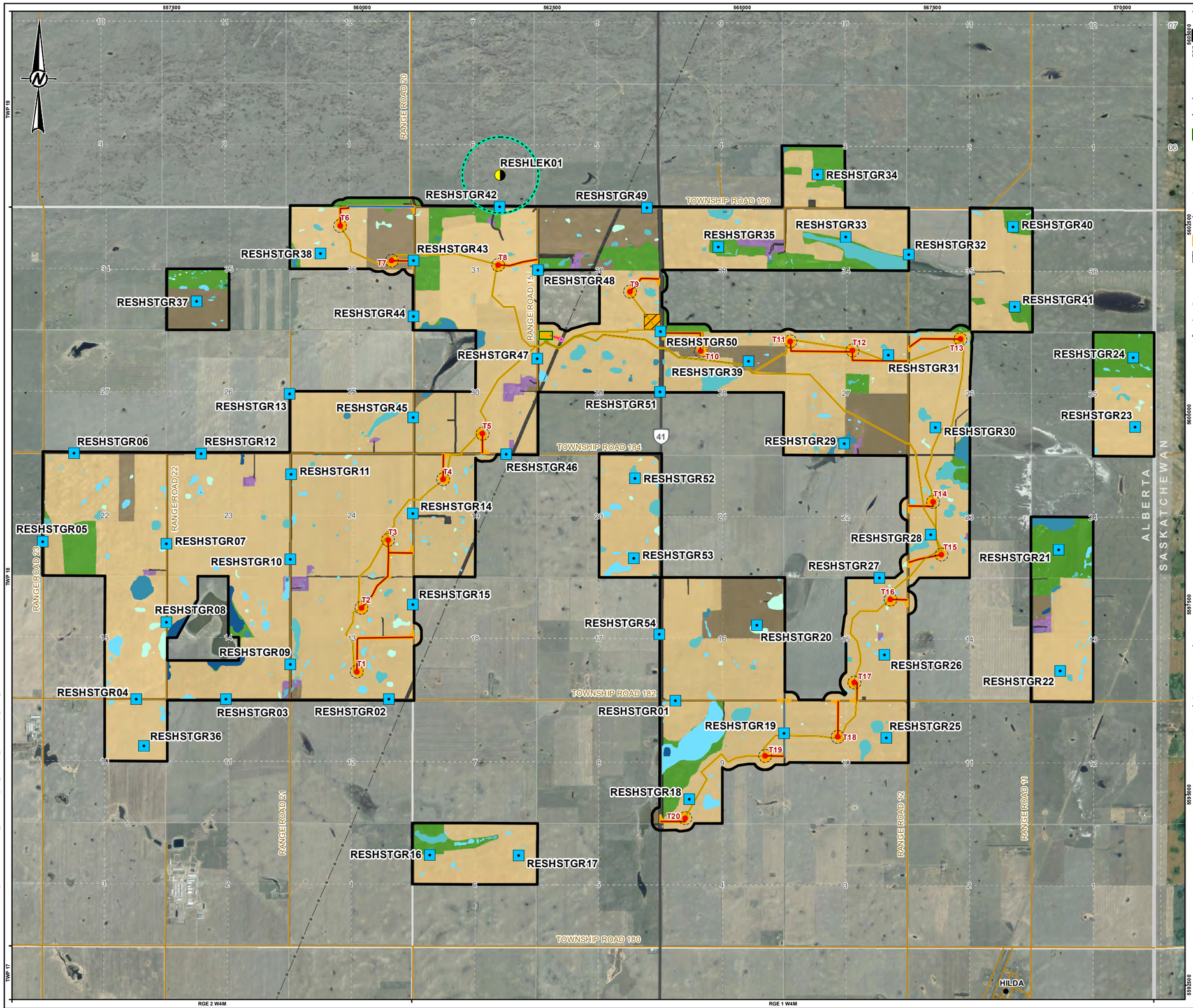

LEGEND

- PROJECT STUDY AREA[1]
- ROTOR-SWEPT AREA

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- TRANMISSION INTERCONNECTION
- COLLECTOR SYSTEM
- TRANSMISSION INTERCONNECTION (OVERHEAD LINE)
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

BASE FEATURES

- HAMLET
- PRIMARY HIGHWAY
- LOCAL ROAD
- TRANSMISSION LINE

LAND COVER[2]

- CULTIVATED
- FARM YARD
- NATIVE GRASSLAND
- TAME PASTURE OR HAY
- DISTURBED[3]
- WETLAND - CLASS I
- WETLAND - CLASS II
- WETLAND - CLASS III
- WETLAND - CLASS IV
- WETLAND - CLASS V

SURVEY LOCATIONS

- SHARP-TAILED GROUSE SURVEY

WILDLIFE HABITAT FEATURES

- SHARP-TAILED GROUSE LEK (UNCONFIRMED)
- RESTRICTED ACTIVITY SETBACK - PRECAUTIONARY

0 1,000 2,000

1:50,000 METRES

NOTE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
SHARP-TAILED GROUSE SURVEY LOCATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2021-01-22
DESIGNED	JS
PREPARED	LMS
REVIEWED	JS
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	A-9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

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APPENDIX H

Information Request Responses for the Renewable Energy Project Submission to AEP-FWS

From: Cuthbert, Trevor
Sent: May 14, 2021 11:06 AM
To: AEP Renewable Energy Submissions-SSR
Cc: Patrick Henn; Sparrow, Jamie; Clark, Sarah; Sammons, Brittney
Subject: RE: RES Canada Inc. Hilda Wind Power Project - AEP-FWS Submission
Attachments: 20210507 AEP Initial Review Questions_Hilda Wind Project_Responses_2021May14.xlsx; 20210507 AEP Initial Review Questions_Hilda Wind Project_Responses_2021May14.pdf

NOTE: This email chain appears to contain email from outside Golder

Good morning Jason,

Thank you very much for your review of the Hilda Wind Power Project submission. On behalf of Renewable Energy Systems (RES) Canada Inc., please find attached responses to AEP-FWS's Information Requests. We trust the responses provide sufficient information to proceed with AEP-FWS's review, but please let us know if anything additional is required.

Assuming no additional information is required, please let us know if you are able to advise on AEP-FWS's expected timelines for issuing the Referral Report? RES Canada Inc. intends to file the Facility Application with the AUC at the end of May, and it would be ideal if AEP-FWS Referral Report could be included with the application package. Any updates you are able to provide would be very appreciated.

Thank you,

Trevor

Trevor Cuthbert (MSc, PMP)
Associate, Project Director
Golder Associates Ltd.
D: +1 403 299 6451 | **C:** +1 403 801-9828 | **E:** tcuthbert@golder.com |

From: AEP Renewable Energy Submissions-SSR <AEP.RenewableSSR@gov.ab.ca>
Sent: May 7, 2021 11:57 AM
To: Sammons, Brittney <Brittney_Sammons@golder.com>; AEP Renewable Energy Submissions-SSR <AEP.RenewableSSR@gov.ab.ca>
Cc: Patrick Henn <Patrick.Henn@res-group.com>; Sparrow, Jamie <Jamie_Sparrow@golder.com>; Cuthbert, Trevor <Trevor_Cuthbert@golder.com>; Clark, Sarah <Sarah_Clark@golder.com>
Subject: RE: RES Canada Inc. Hilda Wind Power Project - AEP-FWS Submission

EXTERNAL EMAIL

AEP-FWS has conducted an initial review of the Hilda Wind Power Project submission. The review generated some questions and requests for further information, which can be found in the attached Excel spreadsheet. Please provide responses to these information requests.

Jason Unruh, M.Sc.
Wildlife Biologist, Renewable Energy Projects
South Region, Fish and Wildlife Stewardship
Alberta Environment and Parks
Provincial Building
#304, 4920 – 51 Street
Red Deer, AB T4N 6K8
Office: 403-755-1496
Jason.Unruh@gov.ab.ca

Classification: Protected A

From: Sammons, Brittney <Brittney_Sammons@golder.com>
Sent: January-22-21 6:09 PM
To: AEP Renewable Energy Submissions-SSR <AEP.RenewableSSR@gov.ab.ca>
Cc: Patrick Henn <Patrick.Henn@res-group.com>; Sparrow, Jamie <Jamie_Sparrow@golder.com>; Cuthbert, Trevor <Trevor_Cuthbert@golder.com>; Clark, Sarah <Sarah_Clark@golder.com>
Subject: RES Canada Inc. Hilda Wind Power Project - AEP-FWS Submission

Hi,

On behalf of Renewable Energy Systems Canada Inc., the renewable energy project submission to Alberta Environment and Parks – Fish and Wildlife Stewardship (AEP-FWS) for the proposed Hilda Wind Power Project is attached for review. Unsecured copies of the submission are included in two file formats to assist with generating a referral letter.

Please reach out should you have any questions.

Regards,
Brittney

Brittney Sammons (BES)
Project Manager

GOLDER

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2800, 700 - 2nd Street SW, Calgary, Alberta T2G 2W2
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Question #	General Issue	Template Question #	Digital Page	Statement from the report	AEP Comment/Concern	AEP Recommendation or Requirement	Proponent Response	References
1	Breeding bird mitigations	28	49	Vegetation removal, soil disturbance, and grading within native grassland during construction will be scheduled outside of the grassland breeding bird season…Where this is not possible, and when there is potential for construction activities to pose an elevated risk to wildlife, an experienced wildlife biologist will be on site to monitor wildlife behaviour and to propose onsite mitigation actions that should be implemented to reduce risk to wildlife.	It is unclear what mitigation actions the experienced wildlife biologist would "propose". Will those mitigation actions be put into effect? Will nest sweeps be conducted in native grassland if construction activities occur within the restricted activity period?	Identify the mitigation actions the onsite monitor will propose, and if they will be followed. Identify if/when nest sweeps will be conducted and the protocol for nest sweeps.	If construction in native grassland is scheduled during the migratory bird nesting period, nest searches will be performed by an experienced wildlife biologist to identify breeding birds or their nests. The Proponent will act in accordance with the *Migratory Bird Convention Act* and the Alberta *Wildlife Act* . If active nests (i.e., nest under construction or constructed, with or without eggs present) are found or suspected to be present based on bird behaviour, then each confirmed or suspected nest location will be buffered by 100 m or a distance appropriate to the species, and according to guidance from Environment and Climate Change Canada (ECCC) and the Canadian Wildlife Service (CWS). Appropriate setback distances are determined on a case-by-case basis, based on distance at which nesting birds react to human disturbance and expert opinion (ECCC 2021). Determining an effective setback is based on two benchmark measurements: alert distance and flush distance, and will be adjusted according to the Proponents activity type with larger minimum setback requirements required in some circumstances.	ECCC. 2021. Guidelines to reduce risk to migratory birds. [updated 19 September 2019, accessed May 12, 2021] https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html#:~:text=To%20prevent%20harming%20migratory%20birds%2C%20nests%20and%20eggs%2C,and%20mitigation%20measures%2C%20such%20as%20beneficial%20management%20practices.
2	Raptor nests	29	51	Table 24 - RESHSN01 states that the nearest distance to the nest setback is 29 m.	It is unclear if this is a mistake.	Provide the correct value for the distance of the nest setback to nearest infrastructure, or identify mitigations for this nest if the setback is not being met.	Distances outlined in Table 24 are measured from the nearest edge of the nest setback to the nearest edge of the Project-related limit of disturbance. As such, Table 24 is correct, the nearest distance to the RESHSN01 nest setback is 29 m (i.e., a total of 1,029 m from the nest itself to Project components). Project components do not overlap the 1,000 m setback on nest RESHSN01. No additional mitigation is considered necessary for RESHSN01 given that setbacks have been met.	-
3	Bat survey results	30	64	Table 29	No summary of bat activity results are given for the fall migratory period of Aug 1 to Sept 10.	Provide summary results for this time period for all detectors combined (not just the 2 raised detectors).	The value presented in migratory bat passes/detector night column in Table 29 is the migratory bat passes/migratory detector night for the fall migratory period of August 1 to September 10 for all detectors, and not just for the 2 raised detectors. A total of 6.6 migratory bat passes/migratory detector night were detected at all detectors combined. Individual detector results for the fall migratory period of August 1 to September 10 are presented in Table 28. Please see tab 'Table 29' for further clarification.	-
4	Injured or dead wildlife	47	79	During construction and operation, Project personnel will report wildife issues, incidents with wildlife, nuisance wildilfe, injured or dead wildlife as soon as it is safe to do so to the Proponent's onsite Project Manager…	Injured or dead wildlife found during operations by staff must be included and reported in the post-construction monitoring report for the first 3 years.	Confirm understanding.	The Proponent understands that injured or dead wildlife found during operations by staff must be included in the post-construction monitoring report for the first three years.	-

Table 29: Summary of Bat Acoustic Survey Results (updated)

Season (2020)	Bat passes/detector night[(a)]	Migratory bat passes/detector night[(b)]	Migratory bat passes/migratory detector night[(c)]
Spring	2.9	0.4	0.3
Fall	10.6	3.6	6.6

[(a)] = total bat passes ÷ detector effort

[(b)] = migratory bat passes (total survey period) ÷ detector effort (total survey period)

[(c)] spring = migratory bat passes (May 1 to May 31) ÷ migratory detector effort (May 1 to May 31); fall = migratory bat passes (August 1 to September 10) ÷ migratory detector effort (August 1 to September 10)

From: Cuthbert, Trevor
Sent: May 26, 2021 6:54 PM
To: AEP Renewable Energy Submissions-SSR
Cc: Patrick Henn; Sparrow, Jamie; Clark, Sarah; Sammons, Brittney
Subject: RE: RES Canada Inc. Hilda Wind Power Project - AEP-FWS Submission

NOTE: This email chain appears to contain email from outside Golder

Good afternoon Jason,

Please see the response below, outlining the mitigation actions and the role of the wildlife biologist to reduce potential effects to amphibians.

Avoidance of wetlands will be the primary mitigation employed during construction and operation of the Project. Direct temporary or permanent impacts to Class III- VI wetlands due to the Project are not anticipated. However, based on desktop mapping three Class III-VI wetland setbacks will be slightly encroached (i.e., 70.8 m, 87.1 m and 90.9 m closest proximity of infrastructure to nearest edge of wetlands) to accommodate corner widening for turbine access roads to T8, T9, and T20. The Proponent will preferentially adjust the work space to avoid infringing on these three wetlands setbacks during construction. Prior to construction activities occurring within 100 m of all Class III-VI wetlands, a non-intrusive field survey will be conducted by an experienced wildlife biologist to determine the presence of breeding amphibians. The Proponent will schedule construction within setbacks with the potential to support amphibian populations outside of the breeding period (April 15 to July 1; ESRD 2013) or will commit to having an experienced wildlife biologist onsite if construction during the breeding period is necessary. Additional mitigation to be implemented when infringing on the 100 m wetland setback of Class III-VI wetlands supporting amphibians includes installation of silt fencing buried to a depth of 10 to 15 cm to prevent amphibians moving into active construction areas. If construction activities are necessary at Class III-IV wetlands supporting amphibians during the amphibian breeding season, an experienced wildlife monitor will monitor silt fencing daily and will monitor construction activities. Written permission to issue a Stop Work Order will be provided to the wildlife monitor in the event that amphibian species listed in Appendix A of the Directive are observed within the work area.

Trevor Cuthbert (MSc, PMP)
Associate, Project Director

GOLDER
MEMBER OF WSP

Golder Associates Ltd.
2800, 700 - 2nd Street SW, Calgary, Alberta, Canada T2P 2W2
T: +1 403 299 5600 | **D:** +1 403 299 6451 | **C:** +1 403 801-9828 |
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From: AEP Renewable Energy Submissions-SSR <AEP.RenewableSSR@gov.ab.ca>
Sent: May 26, 2021 10:30 AM
To: Cuthbert, Trevor <Trevor_Cuthbert@golder.com>; AEP Renewable Energy Submissions-SSR <AEP.RenewableSSR@gov.ab.ca>
Cc: Patrick Henn <Patrick.Henn@res-group.com>; Sparrow, Jamie <Jamie_Sparrow@golder.com>; Clark, Sarah <Sarah_Clark@golder.com>; Sammons, Brittney <Brittney_Sammons@golder.com>
Subject: RE: RES Canada Inc. Hilda Wind Power Project - AEP-FWS Submission

EXTERNAL EMAIL

Hi Trevor,

I have one question regarding mitigation commitments for amphibian breeding ponds during construction. The statement from the project submission reads (p. 15, Q19i):
"The Proponent will schedule construction within setbacks with the potential to support amphibian populations outside of the breeding period or will commit to having an experienced wildlife biologist onsite if construction during the breeding period is necessary."

Please describe the role and mitigation actions the wildlife biologist will use to protect breeding amphibians (e.g. stop work authority, etc).

Jason Unruh, M.Sc.
Wildlife Biologist, Renewable Energy Projects
South Region, Fish and Wildlife Stewardship
Alberta Environment and Parks
Provincial Building
#304, 4920 – 51 Street
Red Deer, AB T4N 6K8
Office: 403-755-1496
Jason.Unruh@gov.ab.ca

Classification: Protected A

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Thank you,

Trevor

Trevor Cuthbert (MSc, PMP)
Associate, Project Director
Golder Associates Ltd.
D: +1 403 299 6451 | **C:** +1 403 801-9828 | **E:** tcuthbert@golder.com |

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Office: 403-755-1496
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Classification: Protected A

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Sent: January-22-21 6:09 PM
To: AEP Renewable Energy Submissions-SSR <AEP.RenewableSSR@gov.ab.ca>
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Please reach out should you have any questions.

Regards,
Brittney

Brittney Sammons (BES)
Project Manager

Golder Associates Ltd.
2800, 700 - 2nd Street SW, Calgary, Alberta T2G 2W2
T: +1 403 299 5600 | **D:** +1 (403) 532-5738 | **C:** +1 (403) 880-7614 | golder.com
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APPENDIX I

Conceptual Conservation and Reclamation Plan

CONCEPTUAL CONSERVATION AND RECLAMATION PLAN

Hilda Wind Power Project

Submitted to:

Patrick Henn, Senior Development Manager
Renewable Energy Systems Canada Inc.
508 - 5605 Gaspe Avenue
Montreal, QC
H2T 2A4

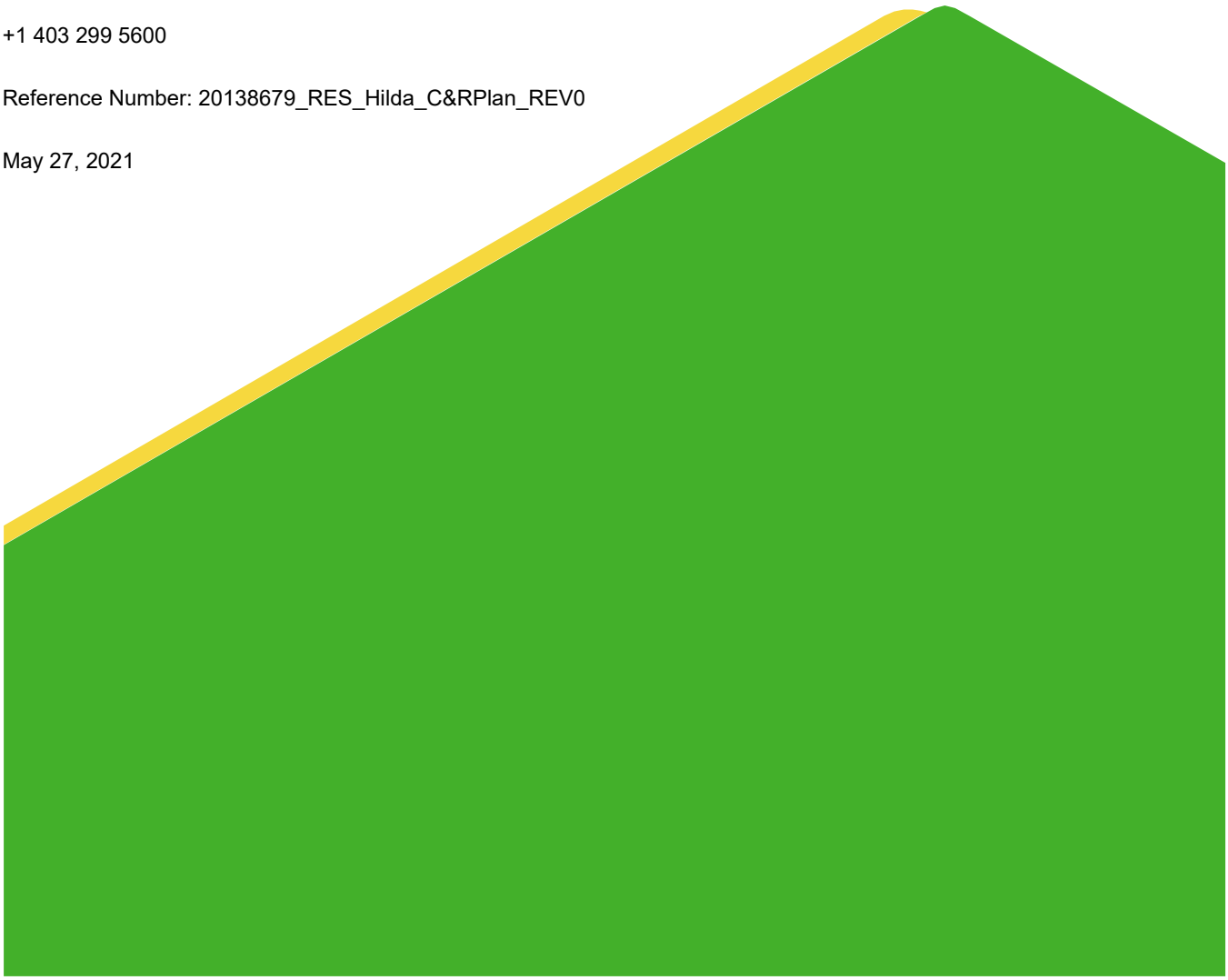
Submitted by:

Golder Associates Ltd.
2800, 700 - 2nd Street SW, Calgary, Alberta, T2P 2W2, Canada

+1 403 299 5600

Reference Number: 20138679_RES_Hilda_C&RPlan_REV0

May 27, 2021



Distribution List

1 Electronic Copy - Renewable Energy Systems Canada Inc.

1 Electronic Copy - Golder Associates Ltd.

Table of Contents

FIGURES

1.0 INTRODUCTION

This Conceptual Conservation and Reclamation (C&R) Plan for the proposed Hilda Wind Power Project (the Project) located approximately three km northwest of the hamlet of Hilda, Alberta, describes the construction and operation practices, and the progressive conservation and reclamation activities that are planned to minimize Project effects and achieve final reclamation targets.

The Project consists of the construction and operation of the Project substation, 20 wind turbines, collection lines, a 138kV transmission line, a permanent meteorological (met) tower, access roads, existing road upgrades and other Project infrastructure. Pending receipt of the required regulatory approvals, construction of the Project is planned to start in Q4 2021 when conditions are suitable for construction, and expected commercial operations commencing in December 2022.

Renewable Energy Systems Canada Inc. (RES) engaged Golder Associates Ltd. (Golder) to prepare the C&R Plan for the Project which is outlined in the following report.

1.1 Reclamation Objectives

Reclamation objectives for the Project include:

- geotechnically stable landforms that are integrated with the surrounding landforms
- drainage systems that are designed to reduce erosion rates
- reclaimed areas that meet the target end land use
- areas with Class III and IV wetlands are left undisturbed to the extent practicable
- areas with native grasses are left undisturbed to the extent practicable
- on-site public health and safety is protected

1.2 Regulatory Framework

The operation of the Project is governed by the provincial *Water Act, Wildlife Act*, and the *Environmental Protection and Enhancement Act* (EPEA). Under the EPEA, after a specified land activity has been decommissioned, operators must obtain a reclamation certificate. Reclamation certificates are managed through Alberta Environment and Parks (AEP).

The Conservation and Reclamation Regulation, Alberta Regulation 115/1993 outlines the operator's obligation to reclaim specified land to equivalent land capability. The *Conservation and Reclamation Directive for Renewable Energy Operations* (C&R Directive; GOA: AEP 2018) provides information on the C&R Plan requirements for renewable energy operations, such as wind power projects.

1.3 Scope of Work

This C&R Plan has been prepared to meet the requirements outlined in the C&R Directive (GOA: AEP 2018), and to provide the tools required to achieve target end land uses after reclamation. As the Project continues to evolve this plan will be amended to meet the Project needs.

2.0 STAKEHOLDER AND INDIGENOUS ENGAGEMENT

Stakeholders within both the Project consultation and notification boundaries have been in discussions with the Proponent since Q1 of 2021.

In general, Cypress County has been supportive of both responsibly developed wind power, and of the Project specifically. Engagement with local residents, occupants, First Nations, municipal governments, governmental ministries and other special interest groups, including the status of any stakeholder concerns regarding the Project has been summarized in the Participant Involvement Program (PIP) Summary submitted as Attachment B of the Alberta Utilities Commission Facility Application. Currently the Proponent is not aware of any outstanding concerns that have not been resolved apart from those raised by certain landowners subject to ongoing engagement.

There are no First Nations Reserves located within the consultation or notification zones for the Project, nor does the Project directly impact any Crown Land. The Government of Alberta Aboriginal Consultation Office (ACO) was directly contacted by RES representatives. The ACO indicated that the ACO consultation process would not apply unless there were public lands being impacted, *Water Act* lands, or EPEA Applications through the AEP. The Project will require *Water Act* Approvals through the AEP, and the Proponent will follow any requirements identified in the ACO process at the time of Water Act Application submissions.

The Proponent will continue to engage regularly throughout the life of the Project with stakeholders who may be impacted as a result of the Project. Additionally, stakeholder input will continue to be considered and incorporated into future iterations of this plan.

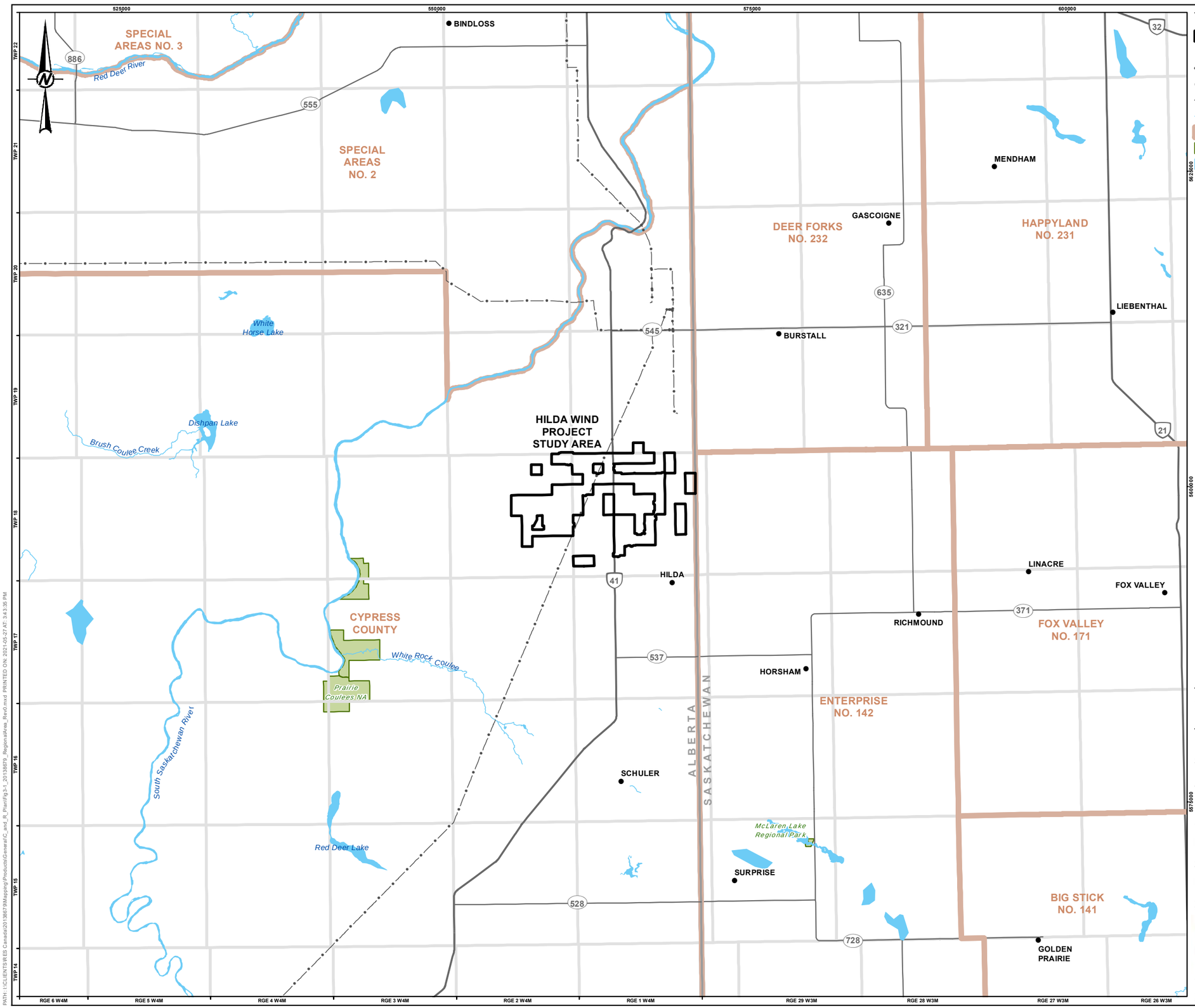
3.0 SITE DESCRIPTION

The Project will be located within Cypress County, approximately three km northwest of the hamlet of Hilda, Alberta, within portions of Township 18, Ranges 1 and 2, west of the fourth meridian (W4M; Figure 3-1). The Project Study Area is approximately 5,246.9 ha of land, representing an area of signed landowner agreements for the Project.

A majority (86%) of the land within the Project Study Area supports some type of development or agricultural land use, in addition to areas of native grassland (8%) and wetlands (6%) where livestock grazing may also occur.

The Project includes a substation, 20 wind turbines, collection lines, a 138kV transmission line, a permanent met tower, access roads, existing road upgrades and other Project infrastructure. The Project layout at the time of developing this document is presented in Figure 3-2. The Project design will be refined to support an additional level of detail required for construction; however, no significant changes are anticipated.

Based on conservative estimates of the area of disturbance associated with Project infrastructure at the time of developing this document, the Project layout has the potential to disturb a total of 107.0 ha of land (2.0% of the Project Study Area) during construction, of which 9.2 ha (0.2% of Project Study Area) will be permanently disturbed through to the operational stage.



LEGEND

- PROJECT STUDY AREA[1]
- POPULATED PLACE
- EXISTING TRANSMISSION LINE
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- WATERCOURSE
- MUNICIPAL BOUNDARY
- PARK / PROTECTED AREA
- WATERBODY

0 7,500 15,000

1:300,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.

REFERENCE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
REGIONAL AREA

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JS
PREPARED	LMS
REVIEWED	KH
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	3-1

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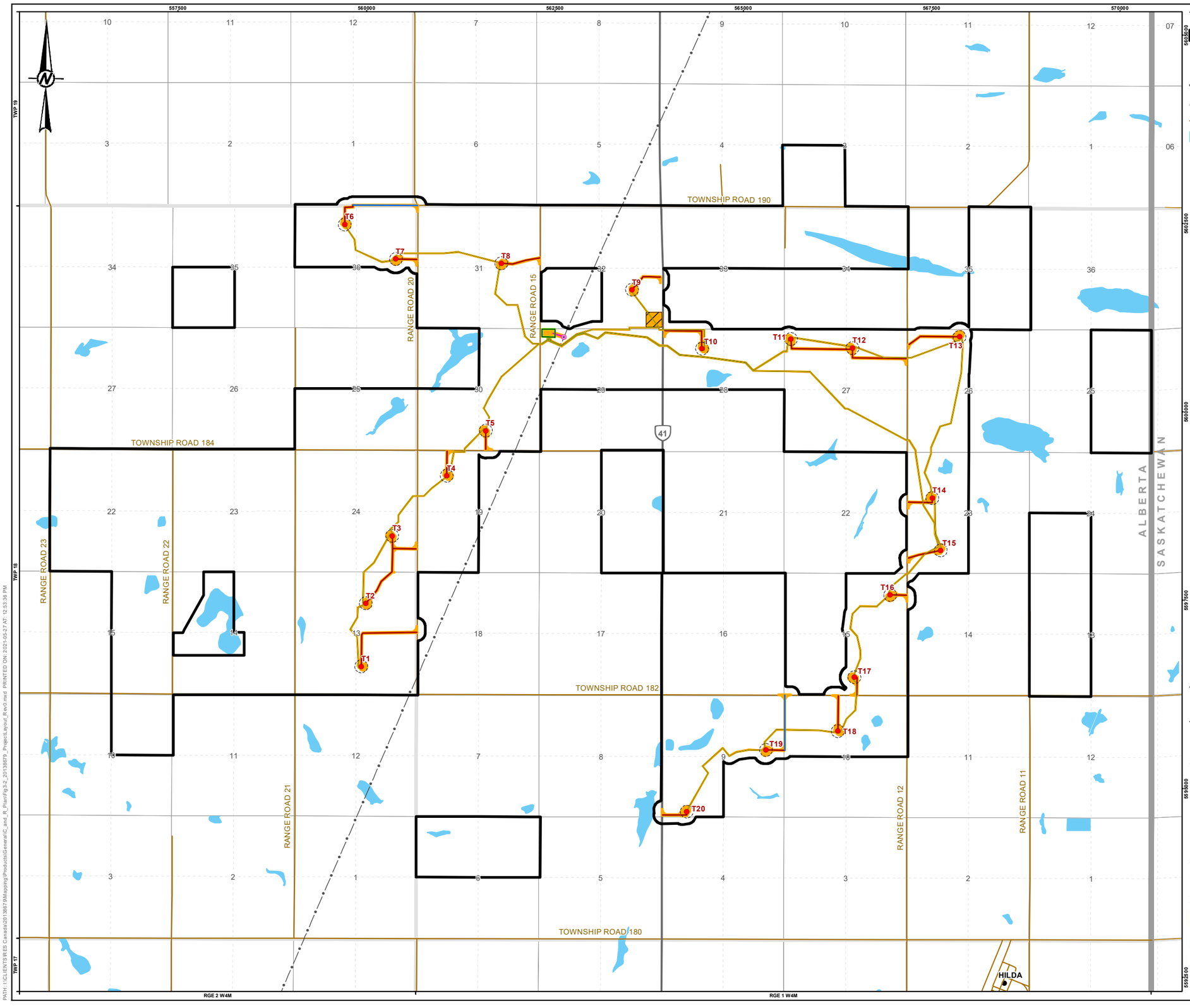

LEGEND

- PROJECT STUDY AREA[1]
- ROTOR-SWEPT AREA

BASE FEATURES

- HAMLET
- EXISTING ALTALINK 138 kV TRANSMISSION LINE
- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERBODY

OPERATION FOOTPRINT

- TURBINE LOCATION
- ROAD UPGRADE
- TURBINE ACCESS ROAD
- SUBSTATION / OPERATION AND MAINTENANCE BUILDING

CONSTRUCTION FOOTPRINT

- POINT OF INTERCONNECTION
- COLLECTOR SYSTEM
- OVERHEAD TRANSMISSION LINE
- LIMIT OF DISTURBANCE
- TEMPORARY LAYDOWN

0 1,000 2,000

1:50,000 METRES

NOTE(S)

1. THE PROJECT STUDY AREA EXTENDS BEYOND QUARTER SECTION BOUNDARIES TO PROVIDE A 100 m BUFFER AROUND THE PROPOSED PROJECT LAYOUT.

REFERENCE(S)

PROJECT FOOTPRINT COMPONENTS DATA OBTAINED FROM RES, DECEMBER 2020.
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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT
RENEWABLE ENERGY SYSTEMS CANADA INC.

PROJECT
HILDA WIND POWER PROJECT

TITLE
PROJECT LAYOUT

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
DESIGNED	JS
PREPARED	LMS
REVIEWED	KH
APPROVED	TC

PROJECT NO.	PHASE	REV.	FIGURE
20138679	2000	0	3-2

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4.0 PROGRESSIVE RECLAMATION

No construction or reclamation has been completed within the Project Study Area to date for this Project. During the life of the Project, progressive reclamation will be completed as areas are no longer required for construction or operations. Timely reclamation of unused areas is a key mitigation to limit erosion and invasive species establishment.

5.0 END LAND USE

Current land uses within the Project Study Area include cultivated crop land, some existing oil and gas activities, pockets of native pasture, wetlands, transmission facilities, communication towers, and railroads. End land use decisions will be made following engagement with stakeholders; however, it is likely that the most suitable end land use for this area is to return it to pre-disturbance land uses.

6.0 RECLAMATION CRITERIA

The *2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands* (ESRD 2013) will be used to monitor reclamation progress and determine reclamation success criteria. The Project footprint will be reclaimed in such a way that it is able to pass the assessments listed below and further described in ESRD 2013:

- Landscape Assessment – does the reclaimed landscape meet or exceed the conditions of the pre-disturbed land, and/or reflect the undisturbed surrounding landscape for parameters such as drainage, erosion, and soil stability?
- Vegetation Assessment – is vegetation in areas that have been reclaimed able to grow with the same vigour as they were prior to disturbance? Key measurable parameters include plant height, density, head length, plant health, and seed quality.
- Soil Assessment – does replaced soil meet pre-disturbance conditions for parameters such as topsoil depth and distribution, topsoil colour, texture, consistence, structure, and rooting restrictions?

7.0 RECLAMATION ACTIVITIES

Conservation and reclamation will be considered throughout the Project life cycle from planning through to closure. The phases of the Project life cycle include:

- **Pre-Construction Phase:** the planning phase of the Project; includes early engagement, baseline environmental field studies, completion of regulatory applications and licensing.
- **Construction Phase**: from vegetation clearing to Project start up, includes delivery and installation of wind turbines and infrastructure construction.
- **Operations Phase:** the active life span of the Project including routine maintenance and monitoring.
- **Repowering Phase:** should the life of the Project be extended past 20 years, the Project will enter this phase and may require switching/updating gearboxes and generators with new equipment, replacing blades, and upgrading electrical equipment.
- **Decommissioning Phase:** the end of the operational life of the Project, or when a portion of the Project Footprint infrastructure is no longer required for the operations or maintenance of the Project.

7.1 Pre-Construction Phase

Completion of this C&R Plan, and development of other environmental management plans (e.g., Pre-Disturbance Site Assessments, Soil and Vegetation Management Plan, Environmental Protection Plan) during this stage will help efficiently manage the site throughout the lifespan of the Project.

7.2 Construction Phase

Infrastructure being constructed during this phase includes access roads, turbine pads, a laydown yard, a substation, collection lines, transmission line, a permanent met tower, and other Project infrastructure. Conservation and reclamation activities will include stripping topsoil and stockpiling (see Section 10.0 for further details).

The temporary laydown yard and other temporary construction disturbance areas around Project infrastructure will undergo remediation, decompaction, soil placement, and revegetation when it is no longer required. Reclamation will be completed in a timely manner to minimize erosion and ingress of invasive plants.

7.3 Operations Phase

No reclamation activities are scheduled during the operating phase of the Project. The Project footprint, including any disturbed sites, ditches, exposed soils, turbine pads, access roads and stockpiles, will be monitored for erosion and invasive plant growth. Erosion and invasive plants will be mitigated as described in Sections 10.0 and 11.0, respectively.

7.4 Decommissioning Phase

The decommissioning phase will begin when a part of the Project footprint infrastructure is no longer required for the operations or maintenance of the Project. Decommissioning of each piece of infrastructure will occur in a timely manner and the following general procedures will be undertaken:

- Equipment, infrastructure, and structures will be removed and will be reused, recycled, or disposed of in a suitable landfill.
- Small or isolated footing foundations will be removed to a depth of 1.2 m below surface to allow for reclamation.
- Large foundations will be cut off and buried by at least 1.2 m of clean soil that will be recontoured to be compatible with the overall landscape and drainage patterns.
- Underground cables will be terminated and capped at connection points and left in place at a depth of 1 m or more.
- Where required, sites will be remediated, and any contaminated soils will be removed such that the site is suitable for reclamation.
- Waste and debris associated with decommissioning will be removed from the development footprint.
- Areas to be reclaimed will be contoured to drain naturally, blend with the surrounding landscape, and provide for the target end land use.

As infrastructure is removed reclamation will be completed progressively. Areas with compacted soils will be ripped, stockpiled soils will be replaced in the order they were salvaged, and areas will be revegetated as required depending on the target end land use.

Temporary access roads will be reclaimed unless a landowner expresses preference to have them left in place. Public roads constructed during the Project, as well the permanent access roads, will remain.

8.0 CONTAMINATED SITES

No contaminated site clean up is anticipated to be required; however, if needed, spills will be contained, and contaminated soil or water will be cleaned up as per the Environmental Protection Plan for the Project (to be developed) and will meet AEP *Tier 2 Soil and Groundwater Remediation Guidelines* (AEP 2019).

9.0 LANDSCAPE

Where feasible, the post-reclamation landscape will mimic the pre-disturbance topography. The land will be reclaimed in a manner that blends into the surrounding landscape allowing for integration of drainage that does not erode more than natural systems or cause unacceptable environmental impacts.

10.0 SOIL HANDLING PLAN

10.1 Soil Salvage Procedure

Topsoil and subsoil will be salvaged prior to construction of infrastructure. The goal for soil salvage is to preserve the quality and quantity of topsoil and subsoil that is available for use in reclamation of disturbed landscapes. Topsoil and subsoil materials will be salvaged to maximize the volume of suitable soil that contains the highest amount of organic matter and is effective for root growth.

Best management practices for soil salvage include:

- An environmental representative will monitor soil salvage by sampling and/or visually identifying materials to be stripped, recommending appropriate depths for stripping, and record keeping.
- Topsoil and subsoil will be stripped in separate lifts and stockpiled separately where feasible.
- Low ground bearing pressure stripping machinery (e.g., scrapers and dozers) will be used.
- Where necessary, low ground bearing pressure haul trucks, such as articulated, all-wheel drive dump trucks, will be used to transport soil to stockpiles.
- Salvaging operations will be suspended if the ground becomes too wet such that stripping causes severe rutting or compaction.

10.2 Soil Stockpiling Procedures

The best management practices for soil stockpiling, if required, that will be implemented for the Project include the following:

- An environmental representative will monitor direct stockpiling activities on site and monitor the effectiveness of mitigation measures implemented to protect stockpiles from erosion, degradation and contamination, recording and signage of stockpile locations, and where necessary, recommend additional mitigation measures.

- Stockpiles will be located in areas near the disturbance and that minimize handling requirements during site preparation.
- Stockpiles will be located away from watercourses, wetlands, and waterbodies (further than 10 m away).
- Topsoil and subsoil stockpiles will be located at least 1 m away (3 m if stored longer than 6 months) from each other and will be recorded, mapped, and signed so it is clear what type of material is present in each stockpile.
- Where possible, stockpiles will be placed in already disturbed and cleared areas to reduce the disturbance footprint.
- Stockpiles will be designed, constructed, and protected to minimize soil erosion (i.e., overall slopes will not exceed 3H:1V if possible).
- Stockpiles will be placed to a maximum height of approximately 5 m.
- Track packing will be used to create rough and irregular surfaces on stockpiles to reduce the potential for erosion and increase the area for seed capture, seed germination, and moisture retention.
- Erosion control techniques will be applied to stockpiles depending on the intended duration of the stockpile. Short term (i.e., less than 6 months) stockpiles may have the addition of cover material (e.g., straw) or track packing. Long term stockpiles (i.e., over 6 months) will be seeded with a rapidly establishing vegetative species.
- Stockpiles will be monitored for erosion and invasive plant establishment on an ongoing basis.

10.2.1 Soil Placement Procedures

Strategic soil placement can encourage plant growth to be similar to the growth observed in adjacent areas. After decommissioning, remediation, recontouring and decompaction is completed salvaged soil will be replaced in the order it was salvaged (i.e., subsoil covered by topsoil) where applicable. Soil placement depths should be as close to pre-disturbance conditions as feasible taking into account soil losses due to handling and long term storage.

Best management practices for soil placement include the following:

- Traffic will be confined to established routes during construction and operation to minimize the number of passes over undisturbed, or newly placed, soil.
- Wheeled or tracked equipment with low ground bearing pressure front ends will be used.
- Placement operations will be suspended if the ground becomes too wet such that activity causes severe rutting or compaction.
- Soil will be spread using low ground bearing pressure scrapers, dozers, and excavators to the required depths.
- Vehicle/ equipment traffic will be minimized on newly spread topsoil and subsoil.
- Soil placement operations will be monitored by an environmental representative (e.g., using a handheld probe) to confirm minimum depths are achieved and soil suitability is maintained during application activities.

- Rough and irregular surfaces will be configured to mimic natural conditions, to the extent feasible.

11.0 REVEGETATION PLAN

A primary goal of reclamation is defined as reclaimed soils and landforms that are capable of supporting the land use previously supported prior to disturbance. The final revegetation plan will depend on the final land use as determined with input from the private landowners.

Best management practices for revegetation include:

- Revegetation will be conducted as soon after subsoil and topsoil placement as possible to control erosion and invasive species establishment. Seeding will be conducted in the spring or fall (after the ground freezes and before snow fall) to allow for good seed to soil contact.
- Commercially sourced seed mixtures will have a "certificate of seed analysis" that confirms no invasive plant species are present as outlined under the Canada *Seeds Act* (Government of Canada 1985).
- Seeding will be conducted using drill seeding or broadcast seeding based on the size of the disturbance, the target end land use, and the equipment available.
- If broadcast seeding is used, the area will be raked or harrowed after application to allow for good seed to soil contact.
- Species mixes will be determined on a site-by-site basis to achieve end land use targets and to blend with the surrounding landscape.
- Class III and IV (Stewart and Kantrud 1971) wetlands will be avoided during construction, operations, and decommissioning of the Project. Class I and II wetlands that are disturbed as a result of the Project will be reclaimed as per the landowner's final decisions.
- Wetlands that will be reclaimed will not be seeded and left to revegetate naturally.

11.1 Invasive Plant Management and Monitoring

Invasive plants can pose a threat to the healthy functioning of ecosystems. They must be appropriately managed to meet end land use targets. Soil stockpiles, exposed soils, ditches, and newly reclaimed areas will be revegetated as soon as possible to limit invasive species establishment.

Soil stockpiles, exposed soils, ditches, and newly reclaimed areas will be monitored for invasive species establishment and appropriate control measures will be implemented as required, as per the Soils and Vegetation Management Plan (to be developed). Control techniques will reflect site conditions and the nature of infestation, and could include a combination of hand pulling, mowing and spot spraying with appropriate herbicides. Noxious and prohibited noxious weeds within reclaimed areas will be controlled primarily by mechanical means (i.e., mowing before seed set, hand pulling and disposal). Soil sterilants will not be used. Mitigation to limit weed ingress during operations will include:

- All construction equipment will be washed or steam cleaned before arriving at the Project site.
- Using weed-free certified reclamation seed mixes on stockpiles stored for longer than 6 months and all reclaimed soils.

Selective non-residual herbicides may be used when appropriate for invasive plant control. Such usage will be by a qualified applicator in accordance with EPEA pesticide regulations (GOA 2009). If problem infestations are identified, mitigation methods appropriate to the site will be determined and applied. Invasive plants will be managed as per the *Weed Control Act* (GOA 2008).

12.0 WILDLIFE

The use of reclaimed landforms by wildlife is an important criterion for successful reclamation. By replicating the pre-disturbance environment to the extent possible, it is expected that the post reclamation landscape will encourage the same amount of wildlife utilization as the landscape prior to the disturbance.

The basis for biodiversity re-establishment on reclaimed areas will depend on terrain design, soil salvage, and reconstruction, revegetation plans, and drainage system establishment. As the reclaimed landscape matures and evolves, it will increasingly resemble conditions found on comparable sites in the surrounding region.

Where appropriate for the designated end land use, biodiversity will be enhanced using special reclamation measures during reclamation. Measures could include spreading topsoil unevenly over disturbed areas to mimic natural variability in the existing landscape and creating micro-hummocky surfaces to enhance moisture diversity. These procedures provide diversity in micro-habitats that concurrently promote species diversity.

12.1 Post-Construction Wildlife Monitoring and Mitigation

The Proponent has committed to undertaking a post-construction monitoring and mitigation program (PCMMP), as required under the Directive (AEP 2018). The purpose of a PCMMP is to document direct effects of Project operation on wildlife (i.e., birds and bats).

The post-construction surveys will be completed as directed by the AEP “Post Construction Survey Protocols for Wind and Solar Energy Projects” (AEP 2020) or the version that is in effect at the time the Project commences operations.

13.0 RECLAMATION MONITORING AND MAINTENANCE

Interim Monitoring Site Assessments (IMSA) are to be conducted following construction and after any temporary/progressive reclamation activities to inform on the status of the Project’s footprints, as described in Section 5.2.3 of the C&R Directive (GOA: AEP 2018). The IMSA are to include documenting the activities that were undertaken at each inspection site and assessing the status of revegetation of the sites during the next full growing season after disturbed sites have been reclaimed.

Monitoring activities will include visual inspection and photographs of the Project footprint. Records of the inspections and the success of reclamation will be maintained and included in a final monitoring report. If issues are encountered mitigations include repair of erosion control measures, re-application of seed mix, and weed control activities. Manual clearing of any encroaching weedy vegetation around the Project footprint may also be recommended to reduce competition.

The objectives of the monitoring program are to evaluate the success of reclamation activities over time and to adjust or modify practices, where necessary, to achieve reclamation objectives. Reclamation monitoring may consist of short-term erosion control monitoring and revegetation success monitoring as well.

Maintenance required during reclamation will comprise the continuation of routine maintenance of any remaining surface water drainage infrastructure, namely culverts and drainage channels, to maintain moisture conditions suitable for vegetation regrowth. This will consist of inspecting the general condition of the infrastructure, including for cracking, erosion and blockages and repairing where required.

Signature Page

We trust the above meets your present requirements. If you have any questions or require additional details, please contact Kyle Hodgson (kyle_hodgson@golder.com; 306-667-1198).

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https://golderassociates.sharepoint.com/sites/141864/project files/6 deliverables/3000 - regulatory applications/3010 - conceptual c&r plan/appendix tbd _hilda_crplan_rev0.docx

14.0 REFERENCES

AEP (Alberta Environment and Parks). 2018. Wildlife Directive for Alberta Wind Energy Projects. Wildlife 2016 No. 6 January 2017; September 17, 2018.

AEP. 2019. Alberta Tier 2 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 150 p.

AEP. 2020. Post-Construction Survey Protocols for Wind and Solar Projects. 40 p. [accessed May 2021]. https://open.alberta.ca/publications/post-construction-survey-protocols-for-wind-and-solar-energy-projects.

ESRD (Environment and Sustainable Resource Development). 2013. 2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands (Updated July 2013). Edmonton, Alberta. 92 p.

GOA: AEP (Government of Alberta – Alberta Environment and Parks). 2018. Conservation and Reclamation Directive for Renewable Energy Operations. Edmonton, Alberta 66 p.

GOA (Government of Alberta). 2008. *Weed Control Act*, Statues of Alberta, 2008 Chapter W-5.1, Current as of December 15, 2017. Edmonton AB. http://www.qp.alberta.ca/documents/Acts/W05P1.pdf.

GOA. 2009. *Pesticide Sales, Handling, Use and Application Regulation.* Alberta Regulation 24/1997. With amendments up to and including Alberta Regulation 222/2009. *Environmental Protection and Enhancement Act*. Alberta Queen's Printer. Edmonton, AB. 24 p. http://www.qp.alberta.ca/574.cfm?page=1997_024.cfm&leg_type=Regs&isbncln=9780779756193.

Government of Canada. 1985. *Seeds Act.* R.S.C. 1985, c S-8. Current to March 5, 2020. Minister of Justice. https://laws-lois.justice.gc.ca/PDF/S-8.pdf.

Stewart, R.E. and H.A. Kantrud. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Bureau of Sports Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C., USA. Resource Publication 92. 57 p.

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