2.0 PROJECT DESCRIPTION

This section provides background information about the overall Kent Hills Wind Project and a detailed description of activities for Kent Hills 3 Wind Project.

2.1 BACKGROUND OF PROJECT

The original Kent Hills Wind Project involved the construction of 32 wind turbines and ancillary facilities. Each turbine in Kent Hills 1 has a nameplate power generation capacity of 3.0 MW, totaling 96 MW. The facility was expanded in 2010 by 18 wind turbines, Kent Hills 2, for a total of 50 turbines and a total wind farm power generation capacity of 150 MW, using the existing 138 kV transmission line built for Kent Hills 1 to connect into the New Brunswick electrical grid.

Construction of the first 32 turbines was commissioned to meet the late 2008 deadline for start-up. The addition of another 18 turbines in 2010 was commissioned for a late 2010 start up. Follow-up environmental monitoring and implementation of environmental management planning during both phases was conducted and confirmed that there were no significant issues during construction, and mitigation measures were effectively implemented. For example, caretakers of the Turtle Creek Protected Watershed recorded no sedimentation problems during construction within the protected watershed (C. Macy, pers. comm., 2017). Additional information on environmental performance at the existing wind farm is provided in Section 2.6.

2.2 PURPOSE OF PROJECT

The purpose of the Project is to expand production of the Kent Hills Wind Farm to meet electricity supply shortfall realized under TransAlta's original supply agreements with NB Power due to lower than expected energy production from the former phases. The Project will fulfill that deficiency by supplying electricity directly to the New Brunswick electrical grid and will be additionally contracted to NB Power Distribution & Customer Service Corporation under a long-term Power Purchase Agreement.

NB Power is mandated to supply energy to help meet New Brunswick's existing and growing electricity needs, and to address the consumer demand for cleaner energy sources. The electrical energy from the project is expected to be sold to government, residential and commercial electricity customers across New Brunswick. The Kent Hills 3 Wind Project can help TransAlta meet its obligations, with no requirement for additional transmission line infrastructure, and near an approved, operating facility.

2.3 SITING CONSIDERATIONS

The following information summarizes the major aspects of the layout and design process leading to the identification of the nine proposed turbine locations and highlighting the selection process of the five preferred turbine locations providing the lowest impact for the KH3 project.

2.3.1 Constraints and Setbacks

The first step in the design and layout process was to determine the remaining land suitable for development once all known constraints were identified. Since the construction of Kent Hills 1 and Kent Hills 2, provincial turbine siting guidelines have been updated to include new setback requirements and environmental attributes that TransAlta has taken into consideration for the design and layout of the Project. At this stage in the development process, most constraints and associated setbacks have been confirmed through environmental studies, engineering design and stakeholder consultation. These constraints have been incorporated in the project layout and are likely to be representative of the final setbacks after the full permitting process has been completed.

Setbacks from roads have been identified by the Greater Moncton District Planning Commission (GMDPC). The roadway right-of-way extends 10 metres from the centre of a road, and the required setback is 7.5 metres from the edge of the right-of-way. Therefore, the total setback from the centre of roads is 17.5 m. Based on consultations, a setback of 100 m from official snowmobile trails and the Dobson Trail has been identified and used when siting the turbines. Additional constraints and setbacks include shadow flicker and noise which are discussed in Sections 5.2.1.3 and 5.2.1.4, respectively.

2.3.2 Wind Map

An updated wind map was created to identify the available area with the strongest wind resource. This wind model was created at the representative hub height of the new turbine model being evaluated (117 m) and based on the wind data available on site. The constraints map and wind map were combined to identify the top nine turbine locations and ranked based on their energy production potential.

2.3.3 Balance of Plant Design

To leverage the existing infrastructure from the Kent Hills 1 and Kent Hills 2 phases and minimize potential impacts from new Balance of Plant (BOP) infrastructure (e.g., access roads, collection line), Project turbines are strategically located where the collector system and transformer have additional capacity without the need for major upgrades or a transformer acquisition. Stantec provided TransAlta with the potential capacity on the feeders and transformer from the Kent Hills 1 and Kent Hills 2 phases. These assumptions influenced the way turbines were selected. New access roads and collector length upgrades were analyzed for each scenario.

2.3.4 Site Visits and Stakeholder Consultation

Multiple site visits were performed by TransAlta personnel accompanied by various consultants and service providers to validate the feasibility of each of the turbine locations. As a result of the site visits and consultation, TransAlta was able to:

- Eliminate several turbine locations from the first desktop prospection
- Confirm the access and suitability for all turbine locations (i.e. preferred, alternate)
- Confirm the existence of no major sensitive environmental attributes

- Micro-site the most valuable locations for next steps
- Gather comments from the community and other land users to integrate into the design (where applicable)

After taking the information listed above into consideration, the five preferred turbine locations offering the best value to the Project while minimizing the environmental and social impacts were selected. These preferred locations include T3, T4, T5, T7, and T9, for which detailed engineering is being pursued.

Although the four alternate turbine locations (T1, T2, T6, and T8) are considered viable locations, they present minor disadvantages including visual impacts (e.g., proximity to Hayward Pinnacle), more timber harvesting, trail crossings (e.g., Dobson Trail and snowmobile trails), engineering inefficiencies (e.g. isolated turbines), and higher wind speeds causing potential curtailment.

Based on the environmental studies, detailed engineering and stakeholder consultation accomplished to date, TransAlta is confident the five preferred turbine locations are the most suitable for development.

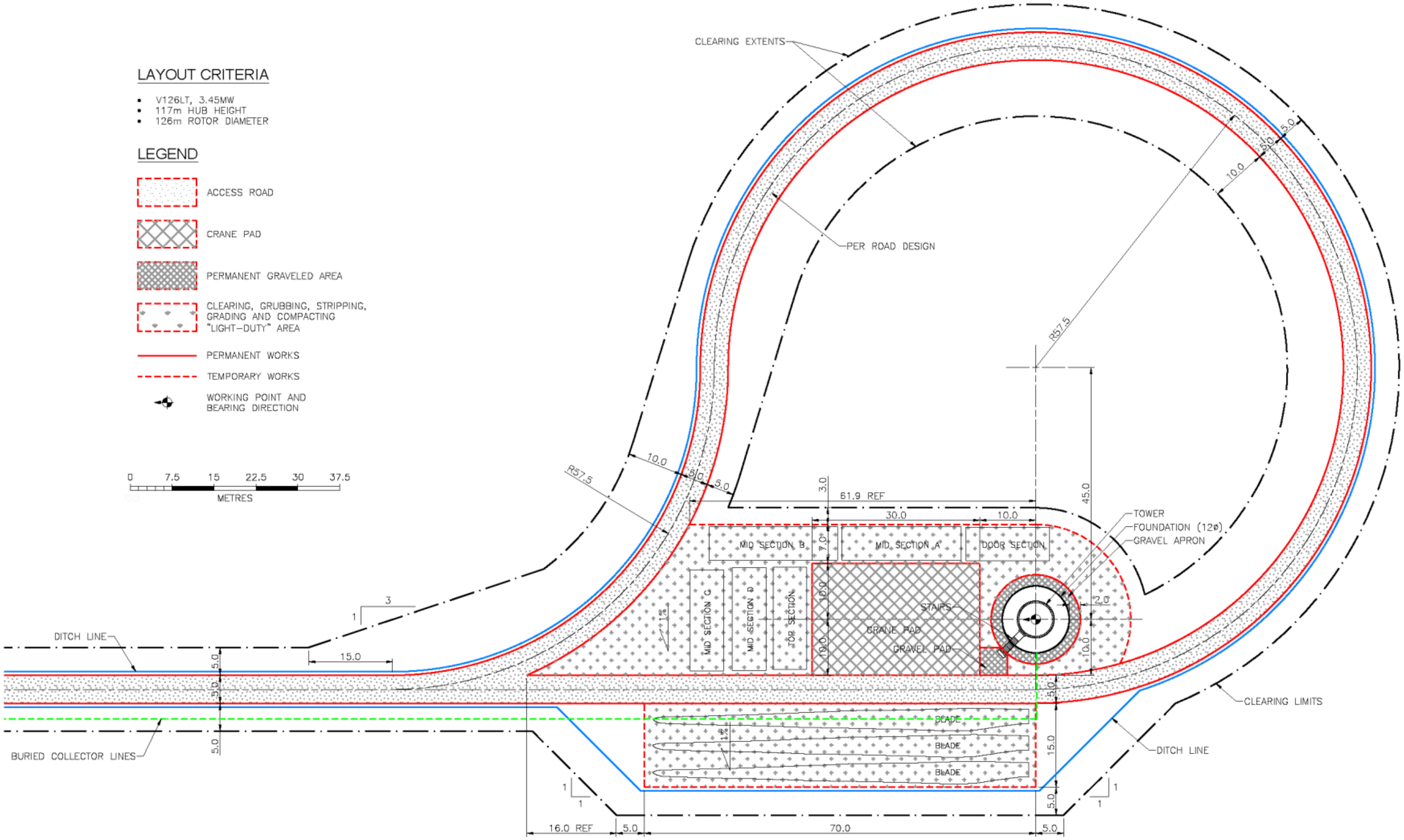
2.4 PROJECT COMPONENTS

Descriptions of Project components are summarized in Table 2.1. Note, only preferred turbine sites have undergone preliminary design.

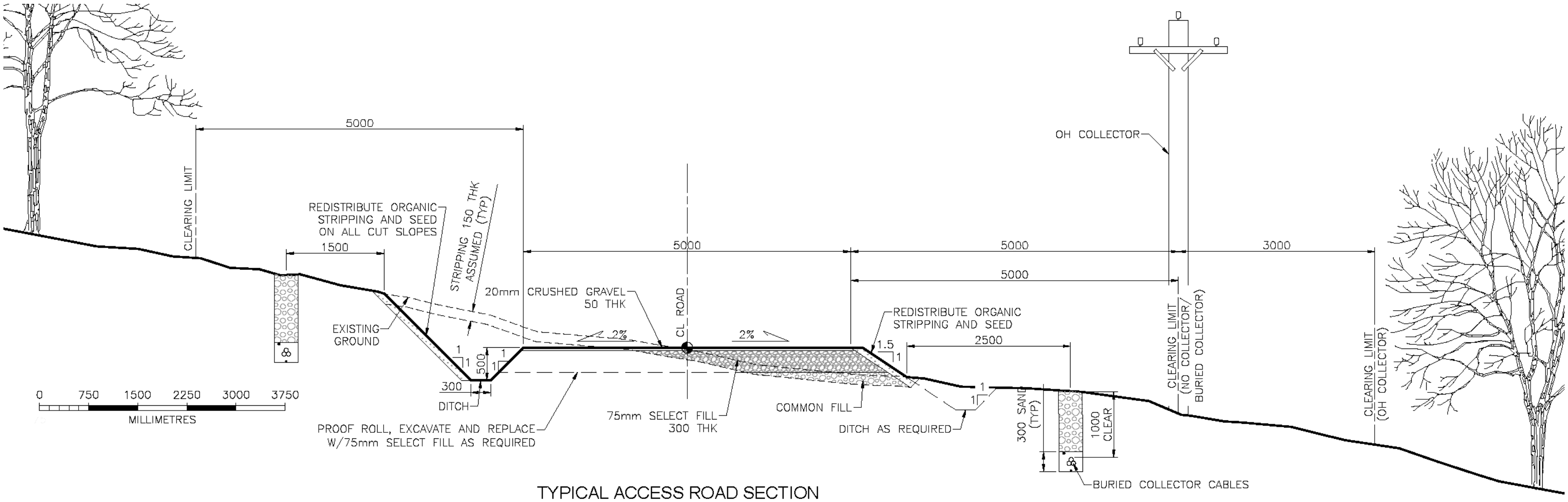
Table 2.1 Project Components

Component/Structure	Description
Wind Turbines	• Vestas 126 turbine (3.45 MW) with a 117m hub height and 60 m blade • Five turbines proposed (T3, T4, T5, T7, T9), with four alternate locations (T1, T2, T6, T8) also assessed. Typical clearing limits around turbines is 0.25 ha (Figure 2.1) • Further details on the turbines are presented in Appendix A.
Upgraded and New Access Roads	• Nine km of additional access roads (seven km of upgrades and two km new roads) for preferred and alternate sites; preferred turbine locations require five km of road upgrades and one km of new road • Figure 2.2 shows typical clearing limits for roads if paralleled by overhead or underground lines.
34.5 kV Electrical Collection System	Seven km of overhead and two km of underground lines proposed for both proposed and alternate locations combined.
Staging Areas for Turbine Assembly	At each turbine location, an additional area of approximately 0.25 ha will be cleared (if not already cleared) and used for temporary storage and installation of each turbine (Figure 2.1). In addition, a 3.4 ha temporary staging area used for Kent Hills 1 and 2 will be used for the Project.
Turning Areas	Turning areas will be required for turbines located at the end of roads, which is the case for all five preferred locations and one alternate location. This requires enlarging the footprint around the distal turbine during construction on each road by up to 0.5 ha each, and leaving an un-cleared area (if not already cleared) of approximately 0.5 ha (Figure 2.1).

Figure 2.1 Typical Turbine Construction Pad (Laydown Phase)



Source: Canadian Projects Limited



Source: Canadian Projects Limited

Figure 2.2 Typical Access Road and Collector System (Section View)

2.5 DETAILED PROJECT ACTIVITIES

The following section provides details on the planning, construction, operation, maintenance and decommissioning of the project. Activities that have the potential for environmental effects at the project site are addressed in Section 5.

2.5.1 Construction Phase

Table 2.2 presents the construction activities associated with the Kent Hills 3 Wind Project.

Table 2.2 Project Construction Activities

Site Preparation and Construction	
Clearing	Where present and not previously cleared, vegetation will be cleared from the construction areas. Non-merchantable timber may be chipped (no burning is proposed). Clearing may be required, in areas not already recently logged, to allow for development of access roads, widening of existing roads, installation of power lines and creation of lay down areas at each turbine location.
Topsoil stripping and salvage	Graders, bulldozers, and backhoes will be used to strip and stockpile topsoil. Topsoil will be stockpiled for use during clean-up and reclamation.
Grading	Following topsoil stripping and salvage, grading is conducted on irregular ground surfaces to provide a safe and clean work surface. A 0.25 ha area is levelled at each turbine location using a standard grader. Material removed is redistributed in leveling of the site or stockpiled for reclamation. The grader is transported by flatbed truck.
Road Construction/ Modification	Surface soils will be scraped and pushed to the sides for banking, and the surface will be graded. No additional material will be added to new or existing roads, unless widening is required. Granular material may be imported to the site from a local licensed borrow for road construction, followed by granular topping during reclamation.
Ploughing and trenching for underground power lines, and pole placement for aerial system	The 34.5 kV collection system within the wind farm will be both overhead and underground. An aerial 34.5 kV system will transport the energy from the turbine rows to connect to the existing overhead system, that leads to the existing central substation, which will transform the electricity to transmission voltage (138 kV). Cable will be trenched into place using a backhoe. Topsoil and subsoil will be separated at the time, and the trench will be back filled. Aerial lines will be run along the access roads, installed by first drilling and placing poles, then stringing each phase of wire. Trenching will typically be a one-worker operation; pole installation will require two to three workers.
Foundation	While rock anchors were used for the current wind farm, a second option (spread foundation) is possible, pending the results of geotechnical drilling. Rock Anchors • Rock hollow anchors (24 or more per turbine) will be drilled to a depth of 40 ft or 12 m and grout will be poured into each hole to bond the anchor to the rock. • The rest of the foundation area will be excavated with a backhoe to the specifications of the geotechnical report and will be removed from site or used for back fill material if suitable. Minimum depth of the excavation will

Table 2.2 Project Construction Activities

Site Preparation and Construction	
	be 6.6 ft or 2.0 m by a diameter of 47.2 ft or 14.4 m with an area of 163 m². Some additional depth and area of excavation may be required if rock encountered is unsuitable for basing the foundation on and more competent rock needs to be exposed. A leveling material will be used on top of the rock before the concrete is poured. Spread Foundation (if rock anchors are not suitable) • Topsoil will be scraped from the foundation area and stored on site for future use, site restoration or for back fill material if suitable. • The rest of the foundation area will be excavated with a backhoe to the specifications of the geotechnical report and removed from site or used for back fill material if suitable. • Total target depth of excavation will be 2400- 2500 mm below grade and the total target height of the foundation will be 3050 mm. The bearing surface will be inspected and dewatered if necessary. • After the foundation concrete has cured, the back fill will be compacted before the topsoil is placed. The foundation will be octagonal with total size measuring approximately 17.4 m per side, roughly 245 m² in area • An embedment ring will be placed inside the foundation which uses anchor rods to bolt the tower section. NOTE: • Each foundation will take about three to four days to complete. An estimated three to four weeks of curing will required prior to turbine installation.
Delivery of Equipment*	• Tower sections, the nacelle (which houses the generator and gearbox), and rotor parts are moved to the turbine site by flatbed truck, and placed into an exact position for 'picking' using a combination of cranes ranging from 50 tonne to 700 tonne capacity. • Trucking requirements for the turbine site are as follows: 1 truck for each of the 6 tower sections, 1 flatbed truck for the nacelle, 3 truckloads for the rotor (one for each blade), 3 truckloads for the rotor hub, small parts and for the erection equipment for the turbine. • This operation typically requires 10 people and 5 days of work/turbine. • All equipment and the site is cleaned using pressure washing equipment and a biodegradable truck wash (KO 431 or equivalent). * Some road improvements may be undertaken to facilitate safe transportation of the turbine components to the site. Typical road improvements might include widening of intersections to accommodate turning circles required by truck transports, upgrade of culverts may be required due to heavy loads, and grading of the gravel roads will be undertaken to ensure smooth and safe surfaces. Note that improvements for the constructed Kent Hills Wind Farm included the placing of steel plates across several watercourse crossings. A detailed transportation study was undertaken by Vestas for Kent Hills 3 and is provided in Appendix A. Consultation with NBDTI on the transportation study will be undertaken once complete to ensure local requirements are met. The transportation routes will likely be the same as used for the original and expanded wind farm.

Table 2.2 Project Construction Activities

Site Preparation and Construction	
Tower, generator, and rotor assembly	• Control and switching equipment is placed on the pad by the crane. • Typically, a 300-tonne crane, with a smaller support crane, is used to install the lower tower sections. • Each tower section is lifted and bolted to the section below. • A 700-tonne crane is used to install the remaining parts. • The top tower section is lifted and bolted to the section below. • The nacelle is lifted and secured to the tower. • Each rotor blade is lifted and attached to the nacelle. • This work takes 1-2 days. Work may be delayed by high wind conditions, in which case work is delayed until conditions allow work to continue. Fifteen to twenty workers are usually involved. Wind Turbine Completion • The turbines require 1-2 weeks with 8-10 workers for completion of all wiring; full torqueing of bolts; and cleanup of the interior and exterior construction area. • All disposable material is collected and moved to the local landfill. All re-usable material is collected and returned to suppliers. • Once power is supplied to the turbine, making it operational requires 2-5 days and approximately three workers. • Information and warning signs will be erected adjacent to the wind farm facilities, to provide public information about the facility and discouraging trespassing on the facilities.
Clean-up and reclamation	Garbage and debris will be removed and deposited at an approved location. All equipment and vehicles will be removed from the construction area. The temporary laydown areas and disturbed areas around the foundation of each turbine will be graded and the stockpiled topsoil replaced. All disturbed areas (including trenches) will be stabilized and left to regenerate naturally if conditions warrant (i.e., low potential for erosion and sedimentation). Access roads will be maintained as is for access during operations and maintenance, and to permit other uses including forestry access.
Turbine commissioning	Commissioning involves testing and inspection of electrical, mechanical, and communications operability. A detailed set of operating instructions is followed in order to connect with the electrical grid. Turbines will be lit in accordance with Transport Canada recommendations.

The following environmental protection measures will be put into place during construction of the Project (as applicable).

- Clearing activities will be scheduled around the critical life-cycle periods for wildlife and will be located away from sensitive features.
- Current forest roads have been considered to the extent practicable as access roads to turbine locations.
- Compaction of soil will be minimized to the extent practicable, with compacted soil recovered following turbine installation.
- Silt fencing will be erected, if required, to help prevent erosion of bare lands caused by construction activities.

- Watercourses and wetlands will be avoided to the extent practicable. Where construction is necessary in or near watercourses or wetlands (i.e., for road access), sediment control measures will be put in place for the duration of construction in that area. These control measures will include the installation of silt fences and straw bales, and the storage of construction materials and equipment at least 30 m away from a watercourse or wetland. Where applicable, a Watercourse and Wetland Alteration (WAWA) permit will be obtained, and the conditions of approval followed.

2.5.2 Operation and Maintenance Activities

Activities associated with the operation and maintenance of the Kent Hills Wind Farm will not be as extensive as during the construction phase, and will be similar to current operation and maintenance activities. TransAlta aims to produce energy when the resource is available, to maximize the life of the equipment, to maximize facility efficiency and to reduce production lost to equipment downtime.

Maintenance services are required approximately annually for routine servicing and lubricant replacement. Light-duty 4x4 trucks and ATVs may be used to access the wind turbines. Larger trucks and cranes may be required infrequently for larger repairs.

Equipment availability during windy periods is much more important than just having high availability figures. To this end, TransAlta focuses on scheduling, planning, and staffing to ensure that equipment is available to operate when the resource is available.

The Project will include a sophisticated and wind energy oriented Supervisory Control and Data Acquisition (SCADA) system with a back-office data analysis program, as well as alarm and notification protocols. With such a system, faults can be instantly detected and addressed, operations can be monitored, equipment performance can be analyzed, trend analysis performed and long term records kept.

The turbine model selected for the project, are equipped with ice detecting sensors and in blade heaters to mitigate icing conditions and minimize down time due to icing. Additionally, Low Temperature package allows the turbine to continue to operate down to temperatures of -30°C and structural endurance down to -40°C. In general, all steel, welds, casts, and cables are specified to meet these requirements; this also includes hydraulic oils and lubricants.

The Project will follow a preventative maintenance program, which covers all the standard checks, tests, measurements and lubrication for optimum operation, long equipment life, and early detection of service issues. This program constantly evolves as the characteristics of each site and turbine are learned. Typically, each wind turbine is visited as needed, with scheduled preventative maintenance visits once per year.

2.5.3 Decommissioning

The facility is expected to have a lifetime of at least 25 years, and TransAlta would consider re-powering the facility on an on-going basis (i.e., not decommissioning). However, if decommissioning and abandonment is necessary, the activities associated with the Project will be:

- Rotor, generator and tower disassembly
- Removal of access roadways
- Removal of concrete foundation
- Removal of collection system

Table 2.3 discusses these decommissioning activities in more detail.

Table 2.3 Typical Project Decommissioning Activities

Decommissioning and Abandonment	
Rotor, generator and tower disassembly	The rotor, generator and towers will be disassembled using a crane and removed from the site for re-use, reconditioning or disposal using a flatbed truck.
Removal of access	All permanent access roads will be left intact for forestry use or removed as per the Crown's preference. If removed, the road will be graded as appropriate, to restore terrain profiles, and seeded with a recommended wild seed mixture.
Removal of concrete foundation	The foundations will be removed to a depth of approximately 1 m below grade and filled with subsoil to rebuild the grade. Stockpiled topsoil will be replaced over the area to approximate depth of adjacent horizons and the area will be seeded depending on the preference of the Crown Land Branch.
Removal of collection system	The collection lines will be terminated and removed from the ground, to a depth of 1 m, or for aboveground facilities, cable and poles removed and recycled/disposed of as required.

Well-designed and constructed wind energy facilities may be operated for decades. Individual wind turbines are expected to perform for 25 to 35 years with an appropriate service and maintenance program. Transformer facilities, underground wiring and substation facilities are designed for at least a 50-year life span. Individual wind turbines may be replaced or repaired as their useful life comes to an end, or if more efficient and cost-effective technology becomes available.

Upon a decision to decommission a single wind turbine or the entire wind farm, all equipment above ground, including towers, nacelles, transformers and controllers will be removed. Wind turbines that are operational and have market value would be carefully removed using a crane, essentially in a reverse process to assembly and installation. The resale value of such equipment typically covers the cost of removal in such a case. A market for good, used wind turbines has developed in North America.

Wind turbines that are no longer operational may also be removed by crane, but with less attention to preserving individual components, labelling them and storing them. Inoperative wind turbines have high salvage value. Steel and copper components are easily recycled, and there is a ready market for such materials. The remaining materials are primarily fibreglass and plastic. These may be sold to recycling facilities, or crushed and deposited in landfill sites. Experience in the U.S. with decommissioning of wind turbines has shown that the salvage value of wind turbines typically exceeds the costs of decommissioning (Gipe 1995).

Other above-ground equipment in the wind farm, including transformers and wiring, has a ready market in either used equipment sales or in salvage. Transformers will be simply removed and sold. Wiring will be removed and sold to metal salvage companies.

Wind turbine foundations are composed of ferro-concrete. Where foundations must be removed, standard demolition practices will be employed to remove the foundations to a depth that is well below active agricultural activity or depths with potential for future erosion and exposure. Resulting material will be removed for appropriate disposal. Similarly, underground cabling will be removed to suitable depths.

Wind energy facilities do not use or produce harmful waste products. There is no need for concern about residual toxic chemicals or exhaust products. Aside from normal recovery of lubricants from the gearbox and yaw mechanism, decommissioning activities are not required for waste. Lubricants will not contain any PCBs.

Where necessary, topsoil and re-grading of access roads will occur as per the Crown's requirements. Temporary fencing will be used during decommissioning to exclude wildlife.

2.6 ENVIRONMENTAL HISTORY TO DATE

The Kent Hills Wind Farm has operated since December 2008 with 32 turbines and since December 2010 with the addition of 18 turbines for a total of 50 turbines resulting in relatively few environmental issues recorded to date. The Kent Hills Wind Farm recently underwent an independent audit by UL (Underwriters Lab) Ecologo® Verification Program to verify compliance against this program's most recent standard CCD-003 (2010) for Low Impact Renewable Electricity. The Kent Hills Wind Farm has been verified to carry this 3rd party Certification mark. An Operations Environment Management Plan (OEMP) was developed and is in place for the site.

The following is a summary of environmental issues and resolutions recorded during construction and operation.

2.6.1 Construction Issues

During former phases of development weather conditions were the only events impacting construction, by slowing site preparations and creating site access difficulty. Construction activities were halted during the winter months and high wind events. Construction scheduling for the project contemplates these issues in scheduling. No other instances relating to environmental concerns or regulatory compliance were presented during construction in former phases and are not anticipated for this phase.

2.6.2 Operations Issues

There have been only two safety incidents that are categorized under TransAlta's incident management protocols as meeting the criteria for significant wind farm events in TransAlta's reporting systems. Under these protocols these incidents were reported to the appropriate agencies identified below:

- August 8, 2009 a single turbine fire occurred. The fire was contained in the nacelle, there were no workers present at the turbine and no injuries resulted from the fire. Access to the site area was

restricted and there was no third-party damage to property. An investigation into the cause of the fire was conducted by the equipment manufacturer and was determined to be equipment defect. The incident was reported to New Brunswick Occupational Health and Safety authorities.
- June 6, 2013 - There was a substation breach and copper theft. RCMP investigated and the culprit has not been identified. The incident was reported in compliance with North American Electric Reliability Corporation (NERC) standards and additional security measures were employed including the installation of video cameras to monitor the substation.

No chemical or petroleum spills have been recorded during operations, nor have there been any significant vehicle accidents recorded. There was one incidental wildlife mortality discovered and recorded in TransAlta's Environment Health and Safety database – Long tailed duck, Nov 5, 2015.