

## **6.5 COMMUNITY HEALTH & SAFETY**

### **6.5.1 Existing Conditions, Potential Impacts and Proposed Mitigation**

This section discusses potential community/human health risks and safety concerns that may result from the construction and operation of the Project. The concerns identified here are specific to the public and communities in the local and regional study areas, and are in addition to those addressed elsewhere in the Application.

Community health and safety concerns that will be addressed in this section include:

- Country foods;
- Electromagnetic fields; and
- Personal safety.

Effects addressed in other sections of the Application include:

- air quality, Section 5.2,
- sound, Section 6.7, and
- potable water Section 6.2

#### **6.5.1.1 Country Foods**

Country foods are defined as traditional foods from the land, such as wild animals, birds, fish and berries (Wein *et al* 1991). The use of country foods in a community is influenced by resource availability, and food preference. Heavy consumption of large game is characteristic of an example of country food consumed in northern aboriginal and rural communities. A study in northern Alberta showed that country foods were frequently (more than six times per week on average) consumed by aboriginal communities, even in areas which had easy access to store-bought foods (Wein *et al* 1991). Protein sources (large mammals, birds, and fish) were the most frequently consumed (one third of the consumption was protein). The presence of a hunter, trapper or fisherman in the household, as well as age and gender (elders and males tended to consume more country foods than youth and females (in general)), typically increase the frequency and amount of country foods consumed by a household (Wein *et al* 1991).

A summary of hunting activity for big game in the Peace region for the years 2000 - 2006 shows that a variety of game are harvested, including black and grizzly bears, caribou, elk moose, goats and sheep (**Table 6.1 2**, Section 6.1.1.7). Traditionally, large game (moose, caribou, deer, bison, bears and mountain goats) were hunted for food, as were smaller fur-bearers as supplementary supplies, and these animals continue to be considered a country food. Plant resources available to and used by northern

communities include highbush cranberry, Saskatoon berry, chokecherry, Indian-potato, and avalanche lily. The cambium of lodgepole pine may also be considered a country food in some communities (further discussion is available in Section 6.4).

### **Potential Effects**

Industrial development has contributed to a decline in the availability of country foods (Wein, *et al* 1991). For example, upstream oil and gas and forest industrial development has impacted the quality and quantity of country foods available in many northern communities (Wein *et al* 1991). Impacts to country foods as a result of the Project may include vegetation removal, or habitat alteration, and displacement of wildlife (some of it temporary) during Project construction. In addition, construction activities in or around water bodies may have the potential to impact fish habitat, which may in turn impact fish harvest. Air quality impacts such as dust or water quality effects from run off or dust may also have a potential impact on country foods.

Newly built or upgraded roads will result in increased access to remote sites, including access to country foods, which may result in increased harvest of country foods. The potential impacts to country foods as a result of direct or indirect habitat removal or alteration are assessed to be negligible, if proper mitigation measures are in place. Potential effects to fish, vegetation and wildlife are addressed in more detail in Sections 5.5, 5.6 and 5.7 of the Application.

### **Mitigation**

Mitigation measures to avoid or minimize impacts to country foods may include design phase provisions to avoid (whenever possible) areas that are known sources of country foods or habitat of country foods. The Traffic Management Plan will address dust, erosion, and sedimentation impacts as a result of increased traffic and activity on unpaved roads. Mitigation will include avoidance of disturbance to fish habitat, where possible, and road designs to avoid sedimentation and erosion, and if necessary, wetting road surfaces so that airborne dust is minimized. The Traffic Management Plan will be prepared once road use and construction activities have been finalized. Mitigation measures to avoid or minimize effects to wildlife and habitat areas are included in Sections 5.5, 5.6 and 5.7. Such measures will be included in the Construction Environmental Management Plan. Negligible to low residual levels of effect on country foods in the local and regional study area are expected as a result of the Project.

#### **6.5.1.2 Electromagnetic Fields**

Electromagnetic fields (EMF) are produced by any device that consumes or conducts electricity (for example electrical transmission and distribution lines, televisions, lights, radios, cellular phones, computers), and therefore, EMF are present everywhere in the built environment. EMF are produced by

the presence and movement of electrical energy. There has been concern expressed by residents living near transmission line routes (or other sources of EMF such as power lines, cellular antennas and towers, radar, transformers, pad-mounted transformers, and electric transportation systems) regarding the potential impact EMF may have on the health of humans, pets, or livestock. To date, no adverse health effects from low level, long term exposure to radiofrequency or power frequency fields have been confirmed, though research in this field remains active (WHO 2000; BCTC 2008; Health Canada 2006). Exposure to higher EMF levels that might be harmful is restricted by national and international guidelines set out by the World Health Organization (WHO 2009; ICNIRP 1998).

Power line magnetic fields are in the extremely low frequency (ELF) range of the electromagnetic spectrum. EMF from electricity is 60 Hz in North America (Smith, date unknown; BC Hydro 2009) and is classified as extremely low frequency (ELF) (the ELF range is 3 to 3000 Hz). Electric fields are produced by voltage (measured in v or kv/m); and magnetic fields are produced by currents and are measured in mili-gauss (mG) or micro-tesla ( $\mu$ T). Around generating stations and substations, electric fields up to 16 kV/m and magnetic fields up to 270  $\mu$ T (or 2700 mG) are common. There have been no confirmed effects on reproduction or development in animals around electric fields greater than 100 kV/m, which is far higher than the 16 kV/m levels associated with electric fields produced by generating stations and substations. Experimental evidence linking ELF magnetic fields to adverse affects on human physiology and behaviour at field strengths found in the home or the environment is inconclusive (ICNIRP 1998; WHO 2007; Health Canada 2006; BCTC 2009).

A 230 kV transmission line may produce approximately 38 mG near the line, which may be reduced to 5 mG 40m away from the line (for comparison, a washing machine in the home produces 20 mG; and a vacuum cleaner produces 300 mG). However, the magnitude of the current or electric load is dependant on how much electricity is being used at any given time. In BC, variations in the electrical loads follow a pattern which peaks in the morning and evening, and during winter months (BCTC 2009).

A study conducted by the BC Hydro Power Authority using a common transmission line design tool (PLS CADD) modelled six different types of transmission and distribution lines. For a 230 kV line, the maximum peak loading (150 MW) created the highest level of EMF. The peak EMF produced from a double circuit line (at 150 MW) was approximately 11 mG, the average (at 102 mW) was approximately 7 mG, and the minimum EMF produced (at 69.0 MW) was approximately 4 mG. These values were taken directly under the centre line. EMF values got considerably lower with distance from the centre line, and values reached zero at approximately 150 feet from the centre line (BC Hydro Power Authority 2005).

## **Potential Effects**

Currently there are no provincial or federal regulations on residential exposure to EMF in Canada. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) recommends a residential magnetic field exposure limit of 833 mG and an occupational exposure limit of 4,200 mG for addressing short-term exposure to EMF (ICNIRP 1998). The WHO (2008) states that EMF exposures below these limits do not appear to have any consequence on health. Based on the proximity of the Project from the nearest residences (and residentially zoned parcels), and on approximate values of 38 mG for a 230 kV transmission line, the potential effects of EMF exposure to the local study area is expected to be negligible.

## **Mitigation**

Applicable BC Transmission Corporation health and safety guidelines will be followed by construction crews involved in transmission line installation and will be provided in the Health and Safety Plan which will be prepared prior to construction. Mitigation will include following the CanWEA Best Practices for transmission line setbacks, and will be finalized during the detailed design phase.

### ***6.5.1.3 Personal Safety***

A survey conducted by Halseth and Ryser in Tumbler Ridge in 2001, reported that residents were generally satisfied with the level of community safety, and community safety was a feature identified by property purchasers as an attraction to Tumbler Ridge (Halseth and Ryser 2002). Community safety is currently addressed by the local RCMP detachment in Tumbler Ridge and by members of the community through volunteer and community-based programs (see Section 6.2). Safety concerns specific to the Project construction and operation activities are further addressed in Section 9.0.

## **Potential Effects**

The potential for accidents (involving the public) to occur as a result of Project activities may be related to the construction or operation phase of the Project. Accidents and malfunctions as they relate to on-site construction and maintenance personnel are discussed in Section 9.0 of the Application. Increased traffic on local and rural roads may increase the potential for traffic and vehicle-related accidents, and there is the potential for accidents to occur on-site during construction activities. Once road building and construction is complete, it is expected that the local and rural roads which have been added or upgraded for the Project will enhance safety to road users. Permanent roads used for the Project during operations will be regularly maintained and monitored.

## **Mitigation**

In order to minimize and best avoid the potential for accidents during road sharing, a Traffic Management Plan will be in place.

A Health and Safety Plan will be prepared and followed for all crews involved in the construction and operation phases of the Project. Safety during Project related activities will be a priority to address accidents and malfunctions, as they relate to the public, and minimize or avoid them as much as possible. Trained personnel will be in place to address issues as they may arise during the construction phase (Table 6.5-2).

Conclusions in Section 6.2 provide more details on the potential impact of accidents in the local area and the capacity of local and regional emergency services to address accidents involving the public. Accidents and malfunctions as they relate to on-site activities and construction/maintenance personnel are discussed in Section 9.0 of the Application.

### 6.5.2 Residual Effects and Monitoring

No residual effects have been identified for community health and safety (i.e. negligible level of effect) and no monitoring is recommended (Table 6.5-1).

**Table 6.5-1 Assessment of residual environmental effects**

Potential Effect	Contributing Project Activity	Adverse or Positive	Explanation	Mitigation or Measures	Level of Effect
Country foods	Construction	Adverse	Vegetation and wildlife habitat removal resulting in decline or disruption of country food sources	Implement vegetation and wildlife mitigation measures from Sections 5.6 and 5.7; and 6.4 for Traditional Use Sites as appropriate	Negligible
Country foods	Operation	Positive	Increased access to country food sources	Positive effect anticipated; no mitigation required	Negligible
EMF	Operation	Adverse	Potential human interaction with EMF	Electrical infrastructure is outside of recommended zone of possible concern; no mitigation required.	Negligible
Personal Safety (Community/stakeholders)	Construction and Operation	Positive / Adverse	Potentially safer upgrade roads/ temporary increases in construction traffic	Positive effect anticipated for improved roads; no mitigation required Implement Traffic Management Plan	Negligible

**Level of Effect Key:** Negligible – No change over the baseline (not significant)

## **6.6 NAVIGABLE WATERS AND AIR TRAFFIC**

This section identifies potential areas of effect associated with the Project in terms of transportation, considering local airports and aircraft navigation in the general vicinity of the Project, and navigable waters. No VSCs for either navigable waters or air traffic are proposed.

The local study area for navigable waters is the IUP areas, plus the infrastructure (feeder lines, transmission lines, roads) with a 300 m buffer either side. As the potential effects are site specific, relating to the water crossings only, no regional study area is defined. For air traffic, the local study area is the IUP areas and the regional study area includes the District of Tumbler Ridge.

### **6.6.1 Navigable Waters**

The Navigable Waters Protection Act (NWP) protects the public's right to navigation on waterways in Canada (Transport Canada 2008a). The NWP defines a navigable waterway as "any body of water capable of being navigated by floating vessels of any description for the purpose of transportation, commerce or recreation". Both inland and coastal waters are included in this definition. The authority to determine the navigability of a waterway rests with the federal Minister of Transport or his/her designated representative. The types of works subject to approval under this Act are described as:

- Any bridge, boom, dam, wharf, dock, pier, tunnel or pipe and the approaches or other works necessary or appurtenant thereto;
- Any dumping of fill or excavation of materials from the bed of a navigable water;
- Any telegraph or power cable or wire; and
- Any structure, device or thing, whether similar in character to anything referred to in this definition or not, that may interfere with navigation.

Transport Canada does not require an application under the NWP for "minor works" if they are positioned and constructed in accordance with specific known standards and criteria. Aerial cables (includes hydro power lines and communication cables only) may be considered a "minor work" (Transport Canada, 2008b). An aerial cable is not considered a minor work, however, if it meets any of the following criteria and standards. An application for review and approval under the NWP would be required if:

- The project is located on a charted waterway;
- The project is crossing a lake, tidal waters, man-made public canal, or portion thereof;
- The project is located within 1000m of a lake or tidal waters; or
- The project includes towers or poles within the limits of the waterway.

To determine which streams should be considered for navigability assessment, a basic criterion has been created (Pers. comm. J. Mackie, 2008). The triggers for determining a “Navigable Waterway”, specifically streams, include:

- A stream that is 3 meters in width or greater;
- A stream that has a gradient of 5% or less; and
- A stream channel that is at least 0.5 m in depth.

If these triggers are met, then the stream has the potential to be navigable and must be submitted for an assessment. If the result of this assessment determines the waterway is navigable, then approval under the NWPA is required for the works.

Possible restrictions on the engineering design of the crossing structure due to the NWPA mean that an evaluation of the basic triggers determining navigability should occur during field layout and surveying prior to any design work. At the time of submission of this Application, no navigable water triggers have been identified for the Project.

**6.6.1.1 Existing Conditions**

Within the local study area, the following information on boat use of waterways is available (from Helm, 2001):

- Quality Lake – accessible by kayak and canoe
- Murray River from Tumbler Ridge to the East Pine – accessible by kayak and canoe
- Murray River by jet boat; can travel up and downstream from the boat launch at Hwy 29 bridge.

As the final locations for the transmission line and road crossings will be determined during the detailed design phase, exact widths of crossings have not been determined. However, there are several potentially navigable waters in the local study area that are expected to be crossed by the transmission lines or roads (**Table 6.6.1**).

**Table 6.6.1 Potentially navigable waters**

Potentially Navigable Waters	Crossing	Width	Assessment to Date
Quality Lake	none		n/a
Murray River	Transmission line	Greater than 3m	Minor work
Bullmoose Creek	Transmission line	Greater than 3m	Minor work
Thunder River At Gap Lake	Transmission line	tba	Minor work

### **6.6.1.2 Assessment of Potential Effects**

At this point the existing bridges within these routes have unconfirmed load bearing capacities. These need to be verified by a detailed bridge inspection, accurate load rating or existing design drawings for each. Once that information is obtained, it can be determined which structures will need to be upgraded or repaired (a “work”, potentially subject to the NWPA). These, in addition to any new structures, could require approval under the NWPA.

Where transmission line crossings meet the standards and criteria to be considered a “minor work” they will not require application under the NWPA (Transport Canada 2008b). This will be assessed on a case-by-case basis for each potential crossing.

Assessment of potential effects to navigational waters will be undertaken during the design phase.

### **6.6.1.3 Mitigation Measures**

Assessment of navigable waters is ongoing. Where road and/or transmission line crossings are deemed to occur across navigable waters, and are not considered to be a “minor work”, mitigation measures will be undertaken as appropriate.

### **6.6.1.4 Summary of Residual Effects and Monitoring**

Where road and/or transmission line crossings are deemed to occur across navigable waters, and are not considered to be a “minor work”, residual effects will be evaluated and monitoring will be undertaken as appropriate.

## **6.6.2 Air Traffic**

Aviation safety must be considered when planning construction of tall structures, including WTGs. Transport Canada requires obstructions, that are likely to be hazardous to aviation safety because of their height and location (Transport Canada, 2008c), be marked and lighted in accordance with the standards specified in the Standards Obstruction Markings Manual (Transport Canada 2008d). These standards include specifics for day marking and lighting of wind turbines. The marking and lighting standards are aimed at ensuring that an obstruction to air navigation remains visible at a range sufficient to permit a pilot to take appropriate action in order to avoid the obstruction by not less than 305 m (1,000 feet) vertically within a horizontal radius of 610 m (2,000 feet) from the obstruction (Transport Canada, 2008d).

### **6.6.2.1 Baseline Conditions**

The Tumbler Ridge airport (International Airport Transportation Association code TUX) is located approximately 11 km south of town and approximately 2.4 km from the closest portion of the Project site (see **Figure 6.1-2**). It features a 4,000' paved runway, taxiway, Precision Approach Path Indicator, lighted windsocks and non-directional beacon. The unmanned airport is used year round, primarily by small planes and helicopters. It is also used for periodic emergency medical evacuation flights, by various industries conducting work in the area, or for other private purposes (such as by local flying club). The closest commercial airports are located at Dawson Creek, Fort St. John and Grande Prairie, Alberta (District of Tumbler Ridge, 2008).

A private air facility is noted on the south side of Northland Gas Road, approximately 3 km west of Gap Lake.

There are existing communications towers in the vicinity of the Project site (Helimax 2008) as well as 12 meteorological towers with heights of either 50 or 60 m at the Project site, which are currently used for data collection purposes (Aeolis 2008).

### **6.6.2.2 Assessment of Potential Effects**

WTGs will be constructed in clusters, located within 100 m wide ribbons (Section 2.2). The maximum height of the WTGs including the blades is approximately 119 m in height above ground level. Due to their height and elevation on Thunder Mountain, without mitigation, the WTGs could be potential obstruction hazards for air traffic in the area.

All Project WTGs will be connected by overhead feeder cables to the substations by a network of 34.5 kV distribution lines (Section 2.2.2). The preferred route for the transmission line connects the substations of the Project and then follows a corridor from the north end of the IUPs, along the east side of Tumbler Ridge, across Murray River, and thence west to the existing BC Hydro Tumbler Ridge substation (Section 2.2.3, **Figure 2.1.3**). Obstruction marking and lighting will not be required for transmission lines and their supporting structures provided they do not exceed 90 m (300 feet) above ground level, although the Minister may perform an Aeronautical Evaluation of any structure to determine whether or not it is likely that an obstruction to air navigation is a likely hazard to aviation safety (Transport Canada, 2008d).

### **6.6.2.3 Mitigation Measures**

Transport Canada requires an aeronautical obstruction clearance application to be submitted for new structures exceeding 20 m in height.

The Proponent has ongoing dialogue with Transport Canada and has received guidance for marking and lighting of WTGs for high visibility to air traffic. The Proponent will follow standards for marking and lighting WTGs as set out in the Obstruction Marking Standards. Marking and lighting of the WTGs in accordance with Transport Canada Standards will ensure visibility to aircraft in visible meteorological conditions.

**6.6.2.4 Summary of Residual Effects and Monitoring**

The Proponent will comply with all applicable rules and regulations. No residual effects on air traffic or traffic control are anticipated. **Table 6.6-1** presents a summary of the assessment of environmental effects of the Project on navigable waters and air traffic.

**Table 6.6-1 Assessment of residual environmental effects**

Potential Effect	Adverse (A) or Positive (P) Effect	Contributing Project Activity or Physical Works	Proposed Mitigation Measures	Residual Environmental Effects Characterization					Level of Effect
				Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological Context	
Navigable Waters	A	Construction and Operation	Ongoing assessment of potential effects to navigable waters during design phase. Ongoing consultation with federal regulators (Transport Canada)	1	2	3 / 3	R	2	Negligible
Air Traffic	A	Construction and Operation	Lighting will be in accordance with federal lighting guidelines for wind turbines and as approved under a Transport Canada permit for the Project.	1	2	3 / 3	R	2	Negligible

## 6.7 SOUND

The following section addresses potential sound effects to human receptors (places of permanent residence) as a result of construction and operation of the Thunder Mountain Wind Project. The assessment of sound receptors is focused on permanent residences and residentially zoned properties, as outlined in the ILMB operational policy for sound for wind turbines on Crown land (Section 6.2.1 of BC MAL and MEMPR 2007).

Discussion of potential sensory disturbance effects to wildlife, such as those associated with construction and operation activities are addressed in more detail in Section 5 of this assessment.

### 6.7.1 Existing Conditions

#### 6.7.1.1 Overview

The basic unit of measurement in acoustics is the decibel (dB), which represents a logarithmic ratio of the pressure variation in air relative to a reference pressure. Measurements of environmental sound are usually made in dBA. This 'A-weighted' measurement includes a correction for the range of sound that can be heard by the human ear, and most accurately reflects the level of sound normally heard by humans. The degree to which any sound is bothersome to people is subjective; generally an abrupt change in a level of 3 dBA will be noticed; a change of 6 dBA is clearly noticeable; and an increase of 10 dBA is generally perceived as being twice as loud (Rogers *et al* 2004). To put sound levels in context, levels from several common sources are listed on a sound scale below (**Table 6.7-1**).

Sound energy is lost through geometric spreading, which is the reduction in the intensity of sound waves as they move away from the source due to the spreading of their energy over progressively larger and larger areas. Attenuation, caused by destructive interference of sound waves that travel close to acoustically soft ground (covered by vegetation), and atmospheric absorption, the extraction of energy from sound waves as they pass through the atmosphere, both play a role in reducing the level of sound intensity at a distance from the source.

**Table 6.7-1 Sound levels of common activities**

Home activities		Work Activities		Recreation Activities	
dBA	Activity	dBA	Activity	dBA	Activity
10	Normal breathing	30	Broadcasting studio	40	quiet residential area
20	Whispering at 5 feet	40	quiet office, library, home	70	freeway traffic
30	Soft whisper	50	large office	85	heavy traffic, noisy restaurant
50	Rainfall	65 - 95	power lawn mower	90	truck, shouting
50	refrigerator	85	handsaw	95-110	motorcycle

Home activities		Work Activities		Recreation Activities	
dBA	Activity	dBA	Activity	dBA	Activity
60	Normal conversation	90	tractor	100	snowmobile
50-60	electric toothbrush	95	electric drill	100	school dance, boom box
50-75	washing machine	105	snow blower	110	disco
50-75	air conditioner	110	power saw	110	busy video arcade
50-80	electric shaver	110	leaf blower	110	symphony concert
55-70	dishwasher	110	woodworking class	110	car horn
60-85	vacuum cleaner	110	power saw	110-120	rock concert
60-95	hair dryer	120	chain saw, hammer & nail	112	walkman on high
65-80	alarm clock	120	pneumatic drill, heavy machine	117	football game (stadium)
70	tv audio	120	jet plane (at ramp)	120	band concert
70 - 80	coffee grinder	120	ambulance siren	125	auto stereo
75-85	flush toilet	125	chain saw	130	stock car races
80	pop-up toaster	130	jackhammer, power drill	143	bicycle horn
80	doorbell	130	percussion section at symphony	150	firecracker
80	ringing telephone	150	artillery fire at 500 ft		
80	whistling kettle	150	jet engine taking off		
80-90	food processor				
80-95	garbage disposal				
110	baby crying				
135	Noisy squeeze toys				

Source: Phoenix Engineering Inc. *pers. comm.* 2006

### 6.7.1.2 Existing Acoustic Conditions and Receptors

The predominant wind direction in the Project area, which affects both the level of ambient noise and the potential for noise to be louder or quieter depending on the location of the receptor relative to the source, is strong, unidirectional and perpendicular from the southwest.

Currently the environment surrounding the Project is subject to background sound from climate conditions (i.e., wind and rain) highway traffic (Heritage Highway #52), aircraft, and other activities in the area including forestry, oil and gas activities and recreational activities (such as recreational vehicles).

Resource and recreational users of the area were not considered receptors for this assessment. Many of the resource extraction users (e.g., forestry and oil and gas), and recreational users (e.g., ATV and four-wheel drive users) who access the area are involved in inherently noisy operations, many of which generally require workers to use safety equipment to prevent damage to hearing.

A sound assessment was performed to locate sensitive receptors within the approximate Project area to assess existing and predicted acoustic conditions for those receptors. The Province's Operations Policy for Sound for Wind Turbines requires that, projects must be sited at locations where the wind turbine sound level will be reduced to a maximum of 40 dBA on the outside of an existing permanently-occupied residence (not owned by the proponent) or the closest boundary of existing, undeveloped parcels zoned residential (not owned by the proponent).

For this Project, residential receptor locations were determined using the 911 mapping from the Peace River Regional District. It was determined that the closest permanent residences and residentially zoned land are in the District of Tumbler Ridge, about 11 km from the north end of the Project. The Prince George Fire Center has confirmed that the "residence" or fire tower lookout located on the Thunder IUP noted in the 911 mapping is not a permanent residence and only occupied seasonally as required. It is also scheduled to be demobilized over the next two to three years.

### **6.7.2 Potential Effects and Proposed Mitigation**

The Thunder Mountain Wind Project will produce additional sound both during the construction and operational phases. Construction will create intermittent noise that will be temporary in nature, whereas operational sound will be for the life of Project operations.

Sound from project-related activities is influenced by the following factors:

- Wind speed at the Project site, which affects both the ambient background sound level and the sound emitted by turbine activity,
- Wind direction relative to the source of the sound (turbine locations) and the receptors (closest habitation),
- Topography and cover (vegetation types) between source and receptor, and
- Distance between source and receptor.

#### **6.7.2.1 Construction**

During the construction phase of the Project, noise will be produced due to typical heavy construction activities, e.g., heavy vehicle traffic, heavy equipment use including excavation and blasting. On-site construction for the Project is scheduled to last approximately five to seven years, from brushing and clearing as early as 2010 through to construction completion in 2016. However, construction will not occur continuously during this period. Timing of construction and installation of WTGs is dependent on weather, road upgrades and closures, and work windows for wildlife. Diesel highway trucks will transport the WTG towers, nacelles, blades, substation equipment, and cranes to the Project area during construction.

The noise emitted during construction will likely be similar to the noise of the existing forestry operations, and many of the oil and gas equipment in use in areas surrounding the Project.

The similarity of the construction sound levels with existing oil and gas and forestry operations in the Project area, and the temporary nature of the construction noise, with times of limited activity due to provincially mandated non-work periods, indicates that the effects will be minor.

### **6.7.2.2 Operations**

Operating wind power turbines create sound; the rotating blades create a swishing sound and the mechanical components of the turbine may produce a whine or hum. If loud enough, the sound may be described as unwanted noise, which can be a nuisance and in extreme cases may become a human health issue.

Wind turbine generator manufacturers have made huge advances toward making machines quieter in the last 30 years. Recent improvements in the design of large wind turbines have resulted in significantly reducing the mechanical noise they produce. In addition, the slower rotational speed and computer controlled control systems of modern large turbines emit less noise than older, fast rotating turbines that respond quickly and directly to every change in wind direction. In general, well-designed wind turbines are quieter when compared to the noise of truck traffic (85 dBA at 20 m) or resource extraction activity (e.g., chainsaws and heavy machinery are about 120 dBA). At a distance of 300 m, an operating wind park is no noisier than a kitchen refrigerator (per **Table 6.7-1**, no noisier than 50 dBA) or a moderately quiet room (American Wind Energy Association 2006). It is possible to stand underneath an operating modern-day turbine such as the ENERCON E-82 on a moderately windy day and use a cell phone or hold a conversation without having to raise your voice.

To ensure the most advanced and quiet technology is used for the Thunder Mountain Wind Project, the Proponent proposes using the lowest sound emitting turbines available for the site, ENERCON E-70 and E-82s. These turbines have a blade design that optimizes efficiency and reduces sound emissions, and is a direct drive turbine, that eliminates the need for a gearbox (a source of mechanical noise), and hence the lowers the level of mechanical sound emitted. During operation, these turbines will produce broadband noise as the revolving rotor blades encounter turbulence in the passing air, and as the blades pass the tower. The sound level from a single ENERCON E-70 or E-82 wind turbine at the nacelle (hub) is approximately 100 dBA, depending on wind speed (Sound Power Level E-82, 2007).

The policy for the siting of wind turbines on Crown land states that projects must be sited at locations where the wind turbine sound level will be reduced to a maximum of 40 dB(A weighting) on the outside of an existing, permanently-occupied residence (not owned by the proponent) or the closest boundary of existing, undeveloped parcels zoned residential (not owned by the proponent) (Land Act 1996). A review

of the acoustic modelling using the ISO 9613-2 standard completed for another proposed wind park (Bear Mountain Wind) using the same ENERCON wind turbines indicates that sound levels from the Project will be well below the provincial policy standard.

Sound exposures for the 12 residential receptors between 610 and 2566m from the turbine row at the north end of Bear Mountain were assessed for three mid-range wind speeds (6, 7 and 8 m/s, or 22, 25 and 28 km/h respectively) that are common in the project area (**Table 6.7-2**). The results of this assessment indicated that sound exposure at all receptor locations would be between 22 and 38 dBA at 6m/s, 25 to 41 dBA at 7 m/s and 25 to 42 dBA 8 m/s.

**Table 6.7-2 Hourly sound exposures for receptor locations at different wind speeds – Bear Mountain Wind sound assessment (BMW EA Application, 2006)**

Receptor	Hourly sound exposure (dBA)			
	Distance from closest turbine (m)	6 m/sec	7 m/sec	8 m/sec
R01	2278	29.2	32	32
R02	1721	31.5	34.3	34.5
R03	1093	32.3	35.2	35.4
R04	610	38.3	41.2	41.6
R05	813	36.7	39.6	39.9
R06	918	35.9	38.8	39
R07	971	35.1	37.9	38.2
R08	1028	34.1	37	37.2
R09	1221	32.6	35.5	35.6
R10	1670	24.8	27.5	27.6
R11	2566	22	24.8	24.8
R12	1146	25.2	27.9	28.1

The maximum predicted sound for that 34 turbine Project was approximately 42 dBA at 610 m (only 2 dBA over the threshold). As the nearest residential receptor at the Thunder Mountain Wind Project is located at a distance of 11km from the nearest turbine, the majority of the sound energy generated by operation (and construction) of the Project will be lost through geometric spreading, ground attenuation and atmospheric absorption. It is predicted that the sound output at the nearest receptor will be inaudible. As such, it was determined that further modelling using the methodology outlined in the ISO 9613-2 standard is unnecessary as the operational sound levels will not exceed the 40dBA threshold at the nearest receptor.

Based on the above analysis, no adverse effects to existing human receptor locations are anticipated due to operation of the Thunder Mountain Wind Project.

### 6.7.3 Residual Effects and Proposed Monitoring

The most noticeable sound effect to nearby receptors will occur during construction, generally due to heavy vehicle (truck) traffic transporting materials to the site. To minimize disruption to nearby residents during construction of the Project, the Proponent will implement a Traffic Management Plan. The plan will address speed and timing restrictions on material transport and truck travel in order to reduce noise effects. Avoiding the generation of excessive noise is the primary mitigation measure used for the Project. To this end, the WTGs used for the Thunder Mountain Wind Project (ENERCON E82 and E-70) are the most advanced turbines currently manufactured anywhere, and have been specially designed to minimize mechanical and aerodynamic noise as much as possible. Negligible residual effects are anticipated and no monitoring is proposed (Table 6.7-3).

**Table 6.7-3 Assessment of residual environmental effects**

Potential Effect	Adverse (A) or Positive (P) Effect	Contributing Project Activity or Physical Works	Proposed Mitigation Measures	Residual Environmental Effects Characterization					Level of Effect
				Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological Context	
Increase in sound from construction activity	A	Construction	Traffic management plan	1	2	1 / 3	R	2	Negligible
Increase in sound from turbine operation to residents	A	Operation	Technically advanced turbines	1	1	3 / 3	R	2	Negligible