

Environmental Assessment for the St. Brendan's 100KW Wind Power Project



Presented to:

**The Department of the
Environment**



Project Proponent:

Unity Bay Energy Ltd.
Power generation through renewable resources.

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PROJECT RELATED DOCUMENTS

1.0 Company Profile

1.1 Unity Bay Energy Ltd.

Unity Bay Energy Ltd. (UBEL) is a privately owned Newfoundland and Labrador energy company which was incorporated on June 24th, 2003. Unity Bay Energy Ltd. is 100% owned by Patrick John Daley, a resident of Mt. Pearl, Newfoundland and Labrador.

UBEL's main business is power generation through renewable resources, such as wind, solar and hydro. UBEL focuses on constructing, owning, and operating wind farms, and supplying solar power systems. UBEL designs power systems for any application and the products range from 50watt solar panel systems for cabins to 2MW turbines for wind farms. UBEL also supplies all the integrated components of a system such as the supervisory control system, electrical components, towers and transmission lines.

UBEL's key customers are:

- Commercial enterprises that have large power requirements, manufacturing facilities and processing plants.
- Utility companies, such as Newfoundland and Labrador Hydro and Newfoundland Power
- Remote Off-Grid Communities.

Presently there is a growing awareness and demand in Canada for renewably sourced energy, thanks in part to The Kyoto Accord and The Canadian Federal Government's commitment to it. Canada has approximately 210 MW of wind power in place; the wind energy potential in Canada is about 10,000MW of power! Unity Bay Energy Ltd. forecasts strong growth in the wind energy market with a focus on remote communities who receive power from diesel generators. Unity Bay Energy Ltd. sees advancements being made in the size of wind farms and the supervisory control systems that monitor the flow of electricity.

UBEL's mission is to have installed 100MW of renewably sourced energy by 2008. Unity Bay Energy Ltd. is committed to developing two types of projects here in Canada.

- Developer/Operator Projects. Energy farms that sell electricity to utilities and large commercial buyers

- Research and Development Projects. Technological innovations that can be sold domestically and abroad.

2.0 Project Overview

Unity Bay Energy Ltd. is proposing to construct and operate a 100 KW wind turbine farm in St. Brendan's, Newfoundland, Canada. (See map #1).

Unity Bay Energy Ltd. is planning to install two 50 kilowatt wind turbines which will generate 100 kilowatts of electrical power. This power will be used to complement the power already produced at the St. Brendan's Newfoundland and Labrador Hydro (NLHydro) diesel generating plant. This renewably sourced electrical power will be used to reduce green house gas emissions (GHG's) that are emitted from the plant, and help reduce the amount of diesel fuel used and its associated costs.

The turbines are to be located at the North West side of the bay approximately 400 meters from the Hydro plant. The turbine bases will be at approximately 35 meters above sea level. Please refer to "Aerial Map of St. Brendan's" located in the Appendix for complete plan details.

3.0 Name of Undertaking

**St. Brendan's Wind Power Project
St. Brendan's, Newfoundland and Labrador, Canada**

3.1 Proponent

3.1.1 Name of Corporate Body

Unity Bay Energy Ltd.

3.1.2 Address

50 Hamlyn Rd. Plaza
Suite #111
St. John's, NL
A1E 5X7
Canada

3.1.3 Contact for Environmental Purposes.

Name: Patrick John Daley

Official Title: President

Address: 47 First St.

Mount Pearl, NL

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Canada

Phone #: (709) 745-3855

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4.0 The Undertaking:

4.1 Nature of the Undertaking

To construct and operate a 100 kilowatt wind turbine farm. The electrical energy produced by the turbines will be sent to the Newfoundland and Labrador Hydro (NLHYDRO) diesel generating plant in St. Brendan's and used to complement the energy being generated at the plant. The energy from the plant will then be used to supply the community of St. Brendan's.

4.2 Purpose/Rationale for the Undertaking

4.2.1) To reduce the real and associated costs of diesel fuel at the HYDRO diesel generating plant by providing lower cost renewably sourced electrical energy.

4.2.2) To reduce carbon dioxide, sulfur dioxide, nitrous oxide and all other associated hydrocarbon emissions.

4.2.3) The global wind energy potential, excluding environmentally sensitive areas, is roughly five times the current global electricity use.

4.2.4) Wind power is the fastest growing energy source with sustained growths of over 30% per year. One year ago world wide wind generated capacity exceeded 31,000 megawatts.

4.2.5) Presently Canada has just over 300 megawatts of electricity generated from wind turbines installations. This equals 673,000 megawatt hours annually, enough electricity to power 84,000 homes. This electricity, avoids discharging about 675,000 tons of carbon dioxide into the atmosphere annually.

4.2.6) The benefits of wind energy are very long term. The average lifespan of a wind project is in the range of 20-25 years.

4.2.7) The cost to produce wind generated electricity is established at the outset of a project. Fossil fuel generated electricity fluctuates with market conditions. Wind energy ensures electrical energy price stabilization and predictability.

5.0 Description of the Undertaking

5.1 Geographic Location:

The proposed location of this project is located in the rural municipality of St. Brendan's, Newfoundland and Labrador, Canada. St. Brendan's is located on the eastern coast of Newfoundland, which is the island portion of the province, just off Bonavista Bay on Cottell Island. St. Brendan's can be found on the northern point of Cottell Island. Please refer to map # 1 and map # 2 located in The Appendix.

The exact location of the wind turbine site is E 255400 and N 5414200. The area to be used is estimated at 120 meters wide by 550 meters long, which is equal to just over 14 acres.

5.2 Physical Features:

5.2.1) Wind Turbine Generators. The proponent plans to erect two 50 kilowatt turbines on the site. Each turbine will sit on a 24-30 metre high, galvanized steel, 3 legged, bolted lattice self supporting triangular based tower that is 15 feet from leg to leg. A full description of this tower is provided in The Appendix. Each WTG has 15 meter diameter 3 rotor blade with a total swept area of 1902ft².

Key Specifications of turbines:

1. Rated electrical power: 50 kilowatts at 12 meters/second.
2. Cut in speed is 4.6m/s (10.2mph)
3. Shut down is at 22.4 meters/second. (50 mph).
4. Survival peak is at 59.5 m/s (13mph).
5. Rotor speed is 65 rpm at 12 m/s (25.3mph).

5.2.2) Electrical Control Room. The electricity from the turbines will be entering this control room where it will be monitored and controlled to the desired quality before being sent to the transmission lines. There will be readout panels and transformer equipment at the ECR. The ECR will also house spare parts and equipment for the turbine. This room will approximately 12' wide x 54' long x 8' high metal trailer that sits on the ground. Wiring between the turbines will be underground.

5.2.3) Transmission lines. Transmission lines will be used to bring power generated by the turbines to the diesel generating plant. Single pole transmission poles will be used and are approximately 10-15 meters high. Poles are made of untreated wood. Three phase wires will be used approximately 1 meter from the top of the poles. The cleared right of way is approximately 5.4 meters. The poles will be dug into the ground where possible or attached to the bedrock and supported with guy wires. The line will travel along the North to South ridge to the diesel plant which is approximately 400 meters from the site.

5.2.4) The Physical and Biological Environment. St. Brendan's is a coastal community on an island. The island is granite bedrock and covered with coniferous trees such as fir, spruce and pine; grass and moss cover the barren areas. The topsoil is dark brown and ranges from barren outcrops to a .5 meter depth. See "Views of The Environment" in The Appendix for several color views of the proposed site's environment.

5.2.5) Environmental intrusions of the physical attributes.

5.2.5a) Cleared turbine area. There is an area of approximately 96 meters by 87 meters that will need to be cleared of trees during the Pre-Turbine Installation phase of the project. Anchor bolts will be drilled through the bedrock to secure the foundations of each leg. In two 11m² areas, cement foundations (30cm by 30cm) will be created for each leg of the lattice tower. These cement foundations are directly above the anchor bolts that support the tilt-up turbine tower. See "The Turbine Tower Description-3 Pages" located in The Appendix for plan views.

5.2.5b) Transmission line poles. Poles will be dug into the ground or bolted to the bedrock, then secured with guy wires. Poles will be installed according to the normal practices of the provincial building trades. Poles are normally dug anywhere from .5 meters to 3 meters into the ground, depending on the terrain.

5.2.5c) Electrical Control Room. The Electrical Control Room will be approximately 3.8 meters by 17.4 meters. The ECR will be a metal construction trailer.

5.2.5d) Underground electrical cables. The ECR will be located near the two turbines. The electrical cables that run from the turbines to the ECR will be underground. A trench of about 25 cms deep will be dug from the bases of the towers to the ECR

5.2.6) Present Land Uses. The proposed site does not lie within municipal boundaries. However the proponent has forwarded the site and development plan to the Town Council of St. Brendan's. The town is in favour of the project and will be participating in the project.

Presently, the proposed area is being used for local wood cutting, walking, rabbit snaring and snowmobiling in the winter. The land area is wooded and only approximately 1.5 acres will be cleared. During the construction phase of the project the proposed site will be off limits to the general public. However, after the construction period, which is expected to last one month, hiking, snaring, berry picking and other recreational activities can be resumed and be permitted on the proposed site if necessary. It is being requested that no hunting be permitted on or near the site as there will be a site manager who will maintain the turbines and the general site area.

5.3 Construction

5.3.1) Three Phase construction.

Construction will occur in three phases and will be carried out by contract forces managed by Labrador Coastal Equipment Ltd. Please refer to Site Plan located in the Appendix

5.3.1a) Phase I: Pre Turbine Installation. This is tentatively set for September 2004. Phase I will consist of clearing the construction area of trees and shrubs. The cleared area of the proposed site is approximately 310 feet by 280 feet. Phase I will also see the preparing of the foundations of the wind turbine towers and Electrical Control Room. This will take approximately 14 days.

5.3.1b) Phase II: Wind Turbine Installation. This stage is tentatively set for Mid September 2004 and will take approximately 14 days. Depending on delivery factors this could move ahead from 1 to 6 months. Presently there is no road to the site; it is the proponent's plan to use ATV's and a tractor to bring equipment to the site. There are no plans to put a road into the site. Phase II will

begin with bringing the equipment to the site. This will consist of the tower, the turbine, ECR construction material, and the electrical wiring from the turbines to the Electrical Control Room. The towers are assembled first and attached to the foundation lying parallel to the ground, then the turbine is bolted to the top of the tower and the blades are attached. A gin pole and a hydraulic winch is used to place the tower in an upright position.

5.3.1c) Phase III: Transmission lines installation. This phase will take seven days and will commence at the end of Phase II. Poles will be installed 3 meters into the ground or bolted to the bedrock. Approximately 18 poles will be used to bring electricity from the ECR to the NLHydro diesel generating plant. Final construction of all on-site structures and commissioning of electrical hook-up to Newfoundland and Labrador Hydro will be completed during Phase III.

5.3.2) Construction Activities.

The major construction activities of the installation of the Wind Turbines are as follows:

- Surveying
- Clearing
- Foundation preparation
- Tower installation
- Building and framing of structures
- Material handling
- Pole installations
- Laying of wire
- Clean up/rehabilitation

5.3.3) Potential Sources of Pollutants.

The potential sources of pollutants will be from hydrocarbon leakage from equipment. All equipment will be inspected routinely to ensure that no hydrocarbon (i.e.: gasoline, diesel fuel, and lubricating oils) leaks occur. Appropriate buffer zones will be maintained between equipment and any environmentally sensitive areas. The contractor will be responsible for restoring and cleaning the site to a level that is acceptable to Unity Bay Energy Ltd. and to all necessary Federal, Provincial and Municipal Government department officials.

5.3.4) Potential Resource Conflicts.

5.3.4a) There are no protected water supply areas in the construction area.

5.3.4b) St. Brendan's is on Cottell Island, one of many islands located in the area. St. Brendan's and the surrounding area is not a legally protected Ecological Reserve, however, in Shalloway Bay there is an important tern colony. Shalloway Bay is 2.5 Kilometres away from the site. This stretch of islands is also used by over wintering sea ducks. The proponent has been notified by The Environmental and Land Use Program of The Inland Fish and Wildlife Division that there are Osprey and Eagle nests "in the general vicinity of the proposed site". These two birds have not been designated at risk, or threatened, or endangered by the Species at Risk Act (SARA). However, The Inland Fish and Wildlife Division require an 800 meter buffer zone between any active Eagle or Osprey nests and the turbines. The proponent has surveyed the site and surrounding area and will conform to these requirements. The nearest nest is over 1 kilometre away from the southern tip of the proposed site. The turbines will be located approximately 100 m from shore and the hub will be 200-250 feet above sea level.

5.3.4c) Avian collisions: There has never been a turbine on this site, the actual amount of avian collisions, if any, is unpredictable at this point of the project. Historically, birds are not often affected by wind turbines. Certain species adapt quickly to turbines others do not, it depends on the species and the environment.

5.3.4ci) Some wind farms have no avian fatalities:

- 156 wind turbines were studied at Tehachapi Pass in California in 1999 (Orloff 1992). No Avian Fatalities
- 9 month study of 3 wind turbines in Algona Iowa (Demastes and Trainor 2000) No Fatalities.
- No raptor fatalities were recorded during a 2 year study at Seawest's Mojave Park Windplant. (Colson and associates 1995)

5.3.4cii) Other wind farms have recorded fatalities.

- In a 2002 study of 360 turbines in San Gorgonio, 42 fatalities occurred over a 15 month period.
- In a 2002 study of 3 wind farms in Belgium (Joris Evaraeart, Institute of Nature Conservation 2002). 27 fatalities per turbine were recorded. See Project Related Document "2002 Belgian Avian Study" in the Appendix for study details.

- At Montezuma Hills 13 fatalities were recorded during a 10 month study of 76 turbines.

Identified areas of concern have been with those wind farms or turbines that are close to shore as this is where waterfowl and sea bird mortality has been present. It is important to note that wind turbines **reduce GHG emissions** and therefore improve the environment and survival rate of all species. Unity Bay Energy Ltd. is committed to recording all avian collisions and provisions for the avian monitoring have been set forth under the guidance of The Canadian Wildlife Service of the Department of The Environment. This includes recording any and all avian collisions and documenting them to The Canadian Wildlife Services. The proponent will also add a searcher efficiency program and scavenger rate component to the Avian Monitoring Program. The complete Avian Monitoring program is detailed in the Appendix under the section "Avian Monitoring Program". Please also refer to the Project Related Document entitled "*Wind Turbines and Birds-A Guidance Document for Environmental Assessment*". -Bird Studies Canada.

The proponent is committed to conforming to The Migratory Bird Conservation Act and the Species at Risk Act and Provincial Wildlife Legislation during all phases of the Project.

5.4.3d) Wind Noise: The proposed site is 400 meters away from the nearest home. No mechanical sound emanates from the wind turbine. Humans can have a conversation at the base of the turbine. According to the Canadian Wind Energy Association, at the base of the turbine is about the same as a household clothes dryer. The proponent has taken the liberty to access a wind noise study that illustrates how much noise is given off from two turbines. Please refer to "The 15 Meter Diameter Rotor Wind Noise Decibel Chart" Located in the Appendix. This simulation demonstrates how the sound from the proposed 50 kilowatt turbine with a rotor diameter of 15 meters and with a 100db sound level at hub height will dampen with ground distance from the turbine. Any person standing 350 meters away from the turbines will receive, according to the chart, 30-39 dbs of noise which is considered negligible. I.e.: the same as the rustling of leaves.

5.4.3e) Access to the site: During the construction phase of the project equipment and supplies will be brought to the site via a Muskeg which will approach the site through a field then follow up through to the site on an recognized trail. There will be some clearing of trees and small bushes. There is no planned operational access road to the site. After the construction phase is over the path will be naturally re-vegetated.

5.4.3f) Steps taken by proponent:

- Marked blades for birds.
- Newfoundland and Labrador Department of Tourism, Culture and Recreation/Inland Fish and Wildlife Division have been contacted and have received our area and site plan. Their advice has been requested concerning Important Bird Areas, migratory birds, breeding areas and wintering areas, mitigation will be applied.
- Canadian Wildlife Service has been contacted and an avian monitoring program will be put in place. See appendix for a copy of the program.
- The proponent will use mitigation where requested by Government Departments.
- Re-vegetation plans are put in place for cleared or topically damaged areas.
- No Hazardous materials will be stored onsite
- No roads to be built over the landscape.
- Lights upon the turbine according to the guide lines set out by Transport Canada, which are as follows:
 - Any obstacle 90 meters Above Ground Level (AGL) and within 2 nautical miles of a Visual Flight Rules route must have a flashing red beacon mounted on its highest practical point.
 - Or, any obstacle over 150 meters AGL must have red flashing beacons mounted on its highest practical point.

5.4 Operation of Site

The average lifespan of a typical wind farm is about 25 years. This project is considered to be a “lifetime project”.

5.4.1) Description of the Operation: The wind turbines will be operating on a 24 hours per day, 365 days per year basis. The amount of energy created is dependent on the rated wind power of a turbine. Generally, the amount of energy “captured” by the turbine is determined by the wind swept area, or the area the blades cover when they turn a complete revolution. The next biggest factor is the speed of the wind. When the wind goes faster more energy is produced.

The proposed turbine is rated at 50 kilowatts (KW). This means that when the wind is blowing at an average speed of 12 meters per second (m/s) or 25 mph, the turbine will produce 50 KWs of electricity every hour. The electricity produced by the turbines is sent to the ECR where it is combined with the electricity from the other turbine then sent to the transmission lines where it will travel to the NLHydro diesel generating station. The amount of power travelling to the plant is recorded. The turbines in themselves are self sufficient but need monitoring.

5.4.2) Monitoring Devices:

5.4.2a) A PLC based control system will be used to inform the owner/operator of the turbine’s statistics regarding the present status of the turbine such as: blade speed, generator shaft speed, lightning strikes or any other turbine malfunction. A telecommunication line is connected from the turbine to a remote operator.

5.4.2b) Human Observance: The proponent will be employing a site manager who will be responsible for monitoring the on site operation of the turbine as well as carrying out the avian monitoring program.

5.4.3) Maintenance Schedules: The turbines need fluid maintenance every 6 months. Major maintenance is every 5 years where gears, blades, shafts, electrical wiring, generators, drive trains, etc... are checked. The proponent will ensure the safe delivery of environmentally sensitive fluids through proper storage and handling.

5.4.4) Ice loads and De-icing: During the winter months ice may form on the tower. The tower is over designed to handle the extra weight associated with ice loading. The tower that is proposed is of the same design used in other remote northern climates such as Kotzebue and Selawik, Alaska, Isle of Luing, Scotland and Iqualuit. The blades are made of a poly carbonate composite that resists ice build up plus the rotor hub is electronically heated to prevent shaft disturbance.

5.4.5) Sources of pollution: There are no sources of pollution from the operation of this site. It is important to note here that each turbine carries 9 gallons of lubricant. This lubricant is environmentally friendly, 95% synthetic and is housed in sealed casings. Used lubricant is removed from the site and disposed of in an oil recycling program. The proponent and the supplier, Texaco, do not foresee any environmental damage from the use of this particular lubricant. The eco-toxicology reports on the proposed lubricant rate the lubricant as "nil, having no measurable effect on the environment. Maintenance programs are professionally monitored by the proponent and the appropriate supplier.

5.4.6) Resource conflicts during operation: The same conflicts that occur during construction will apply during operation.

5.4.6a) Avian Collisions: The proponent is aware of a tern colony in Shalloway Cove approximately 2.5 kilometres away. This colony is not a legally protected Endangered Species or an Important Bird Area. There are wintering sea ducks along the many islands in this region. The proponent has a monitoring and collection program put in place for the retrieval of avian data such as sightings, of Endangered and Important species, and collisions. See Appendix "Avian Monitoring Program". The proponent will apply mitigation during all phases of this project.

5.4.6b) The proponent has sent the Inland Fish and Wildlife Division of The Department of Tourism, Culture and Recreation a copy of the proposed site. As of the date of this document there are no known wildlife conflicts in the area of the turbines.

5.4.6c) Vegetation: Approximately 25% of the site will be cleared for the installation of the turbines. During the operation phase the vegetation will be allowed to grow back. There will be an area directly around the turbine will be fenced in. This area is expected to be about 6.5 meters by 6.5 meters by 2 metres.

5.4.6d) Solid Waste: None Planned.

5.4.7) Anti-climbing device: The proponent will be constructing a 6.5 m² fence around the perimeter of both turbine bases. The fence will be 6 plus 1 BWO (6 feet high plus one foot of barbed wire overhang). There will be a locked entrance gate on each turbine's fence for safety and operational use.

6.0 Occupations

The following is a list of the occupations involved in the proposed project:

- General labourers
- Construction workers
- Millwrights
- Engineers
- Concrete workers
- Transmission line workers
- Riggers
- ATV operators
- Safety personnel
- Iron workers

7.0 Project Related Documents

7.1) *"Wind Turbines and Birds-A Guidance document for Environmental Assessment"*- Bird Studies Canada, Andrea Kingsley and Becky Whittam.

7.2) *"2002 Belgian Avian Study."*

7.3) *"Putting Wind Power's Effect on Birds into Perspective."*

8.0 Approval of the Undertaking

The following is a list of permits that are needed for this project:

8.1) Crown Land Lease Agreement from the Department of Government Services and Land.

8.2) Environmental Permit from the Department of the Environment.

8.4) Application to Construct a Right of Way for Transmission Lines on Crown Land-from the Department of Government Services and Lands.

9.0) The Schedule:

The earliest project start date for this project is August 2004. Phase I of this project, Pre Turbine Installation, would commence while the turbines are being shipped. The turbines would not arrive until approximately late October 2004. The soonest operational start date would be early November 2004. Depending on several factors such as the availability of supplies and components, the operational start could happen in May 2005.

10.0) Funding

Presently no grants, loans or funds have been officially requested. Several Federal and Provincial Government agencies have been contacted. The proponent's tentative funding plan is 30 % privately, 20% from financial institutions, and 50% from public institutions.

Appendix

- 1. General Maps of location**
- 2. Topographic View of Proposed site**
- 3. Aerial view of Site**
- 4. Site Plan**
- 5. Views of the Environment**
- 6. The Turbine Tower Specifications -3 pages**
- 7. Avian Monitoring Program**
- 8. 15 Meter Diameter Rotor Wind Noise Decibel Chart**

General Maps



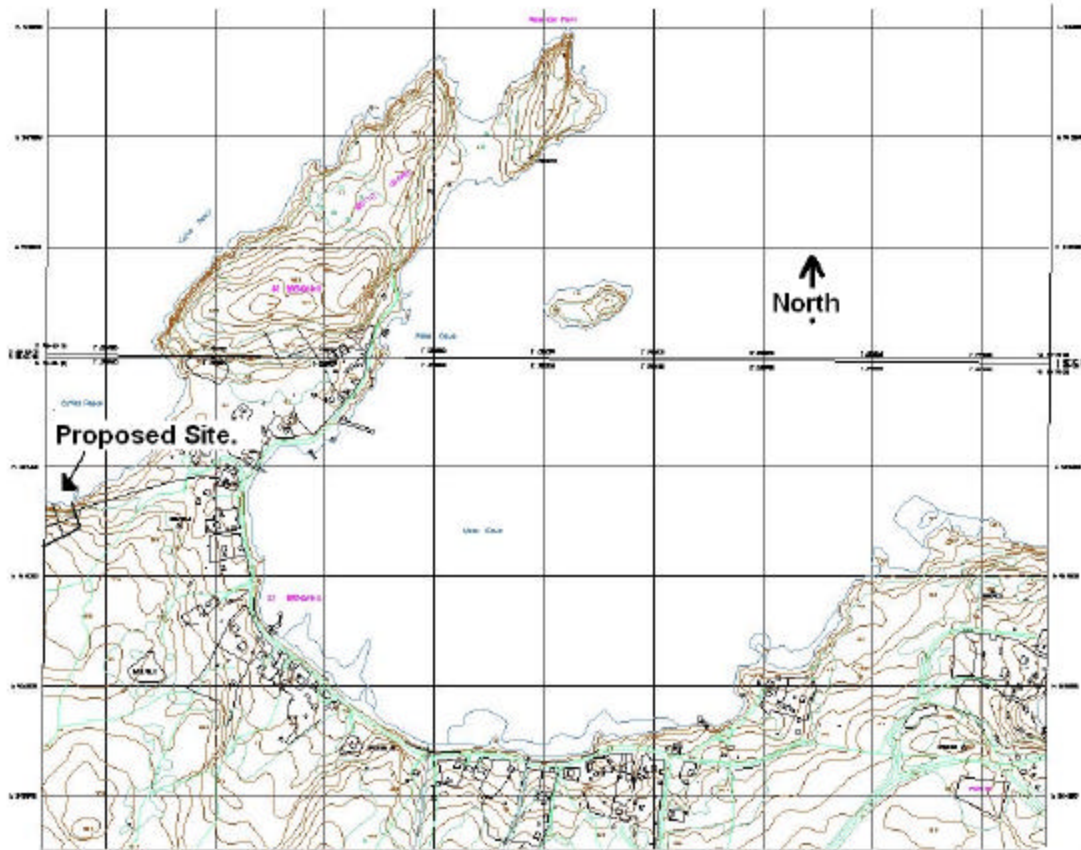
Map #1. Map Of Eastern Canada.

The St. Brendan's area is denoted by the black square. A detailed view is offered in the following map.



Map #2. St. Brendan's Area

Topographic Map of St. Brendan's

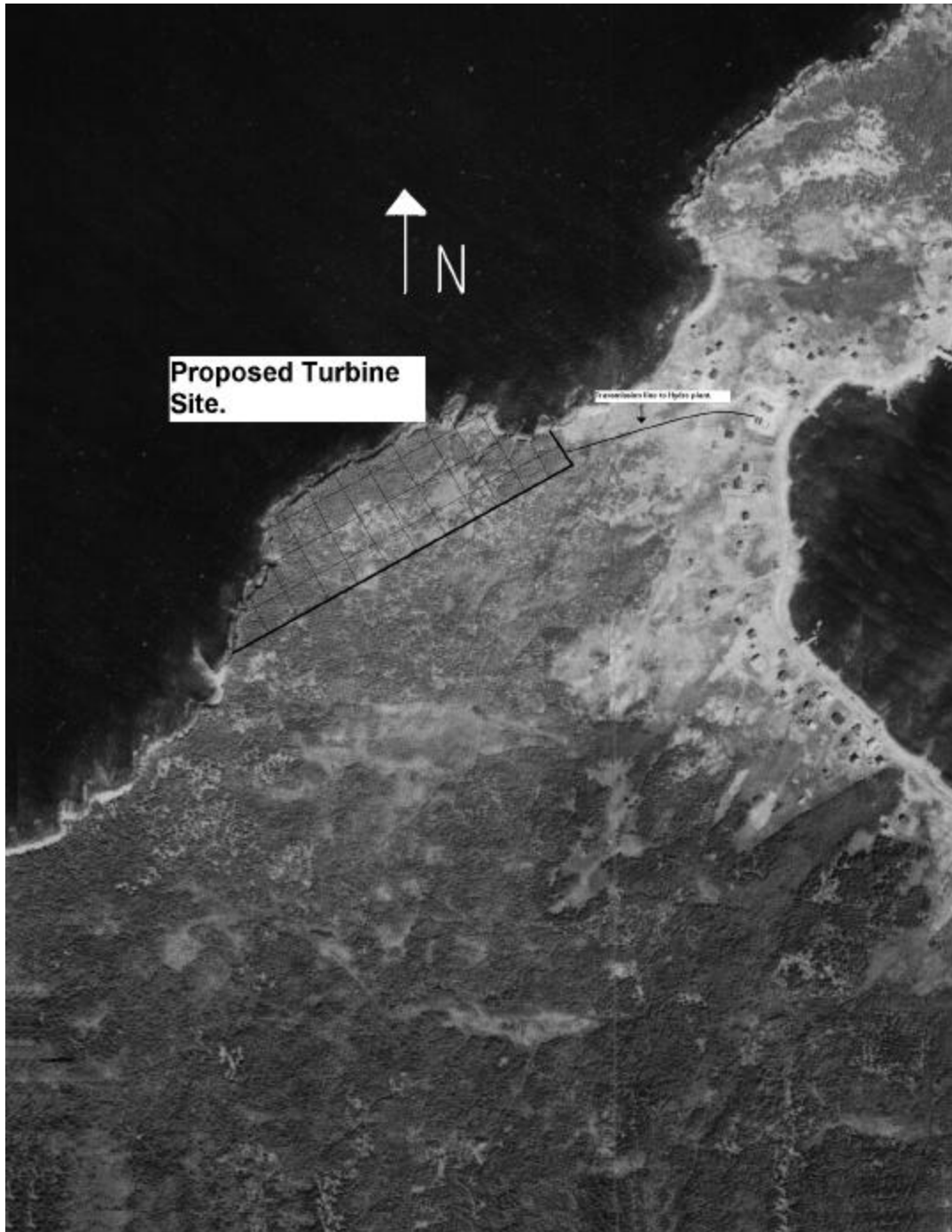


**St. Brendan's, Terra Nova District, NL
Department of Lands and Services.**

Scale: 1 cm=100 meters

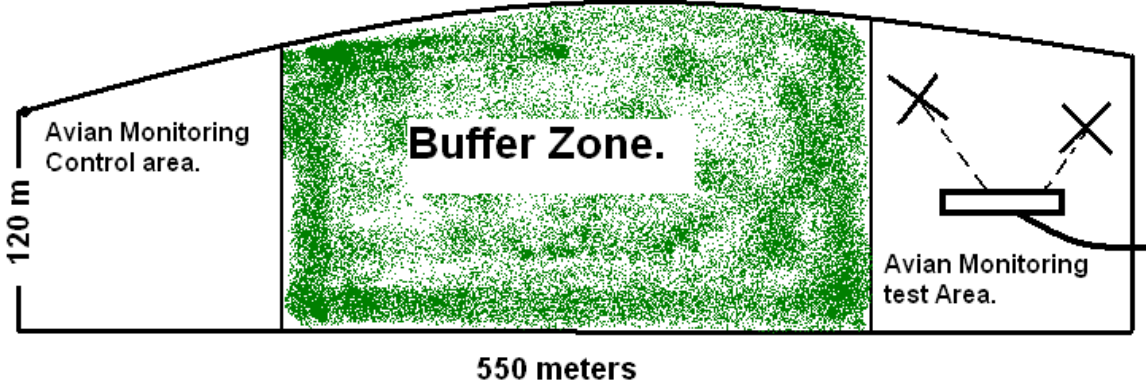
Please Note: The Department of Lands and Services does not presently have a 1:50,000 topographic map of the complete proposed area. The proponent was however supplied with this digitized map from The Department of Government Services, Survey and Mapping Division. Topographic lines are marked every 25 feet in height.

Aerial Map of Proposed Site



Department of Lands and Services Aerial Photo.
Scale: 1cm~70 meters.

Proposed Site Plan



Legend

Turbines: X

Transmission Line: —————

Underground Cable: - - - - -

Electronic Control Room:

Site plan with West-Northwest towards the top of the page.

Views of the Environment



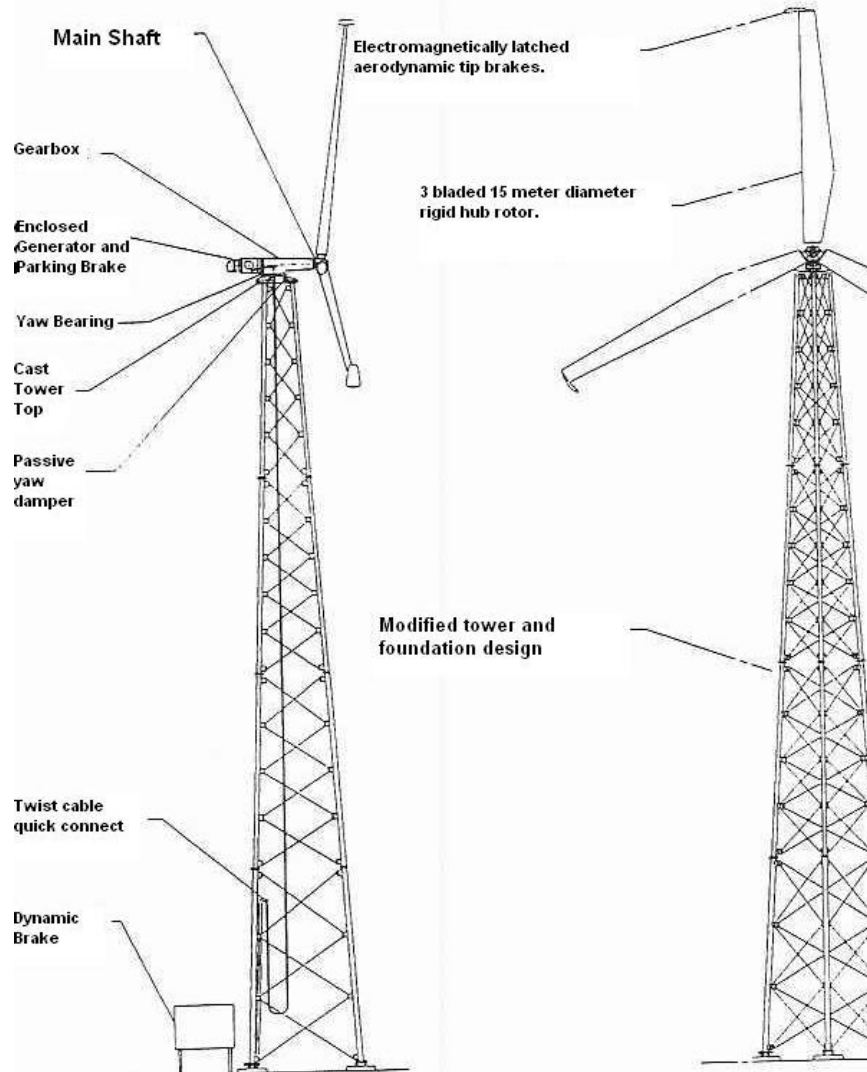
Photo 1: West facing view



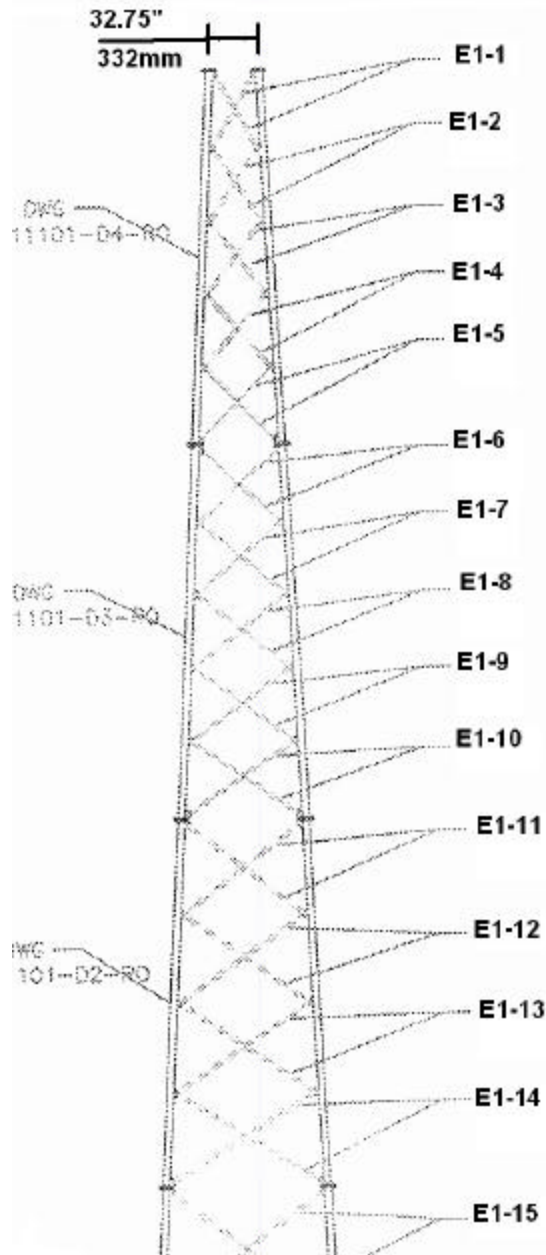
Photo 2: View facing south

THE TURBINE TOWERS DESCRIPTION
Next 3 Pages...

Turbine towers...pg. 1

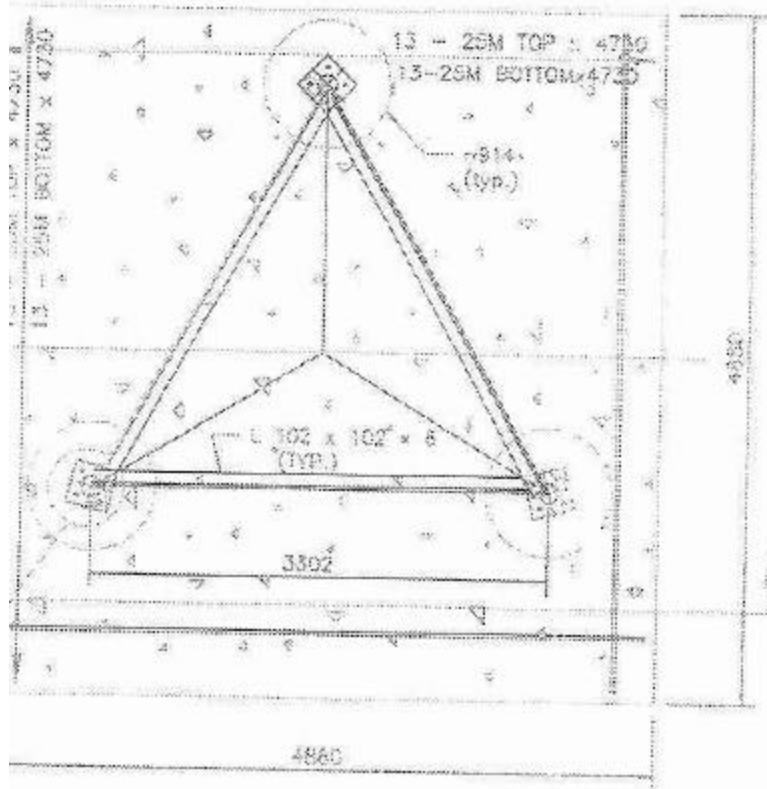


Turbine towers...pg. 2



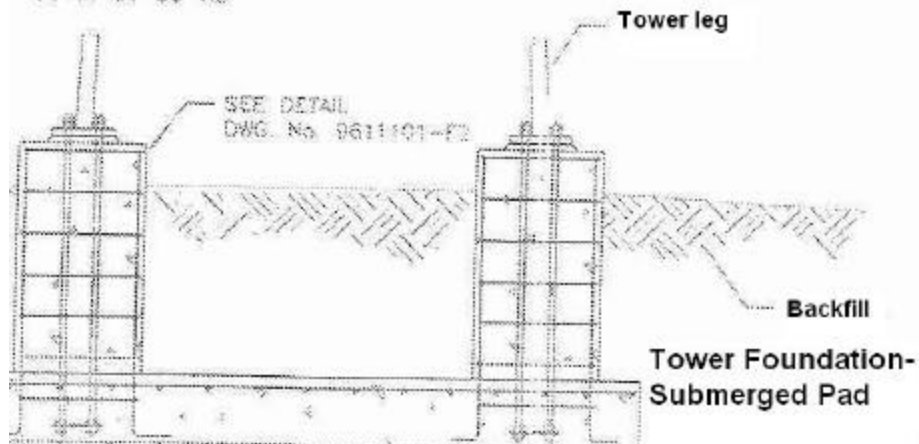
Please Note: 80 foot tower has 10'10" leg to leg measurement. 120 foot tower has 15' leg to leg measurement at base. All welds are E480XX electrodes. All pipe sections are to ASTM A618, Grade 350W. Other steel members are to CSA G40 21-M, Grades 300W. All bolts are ASTM A325 galvanized U/N.

Turbine towers...pg.3



PLAN

FOR DETAIL SEE DWG.
98411101-06-00



Tower Foundation/Base-Aerial and Side views.

St. Brenda's towers will be anchor bolted to granite bedrock.

Avian Monitoring Program

Bird Monitoring Program to Assess Impacts of the Wind Turbine on Birds At St. Brendan's, NL

Prepared by: Martha Robertson
Environmental Assessment Biologists, Canadian Wildlife Service
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This monitoring program has been designed using 'Wind Turbines and Birds: A Guidance Document for Environmental Assessment. Phase II Report. Draft (Kinsley and Whittam, 2003)'.

The book: Peterson's Field Guide to the Birds of Eastern and Central North America will help with bird identification.

Methods

Bird utilization rates and bird mortality rates need to be measured every week during migration and breeding periods (April 1 – October 31) and monthly for the remainder of the year (November 1 – March 31). These surveys must be conducted at the turbine site (impact site) and a control site (no impact site). The control site should be located in an area with similar landscape and habitat characteristics as the turbine site. The control site should also be located at a sufficient distance (~ 250 m) from the turbine site so that bird carcasses found within this site can't be attributed to the turbine.

The proposed site at Nain will contain 15 turbines. For the purposes of this monitoring program, every other turbine (7) will be considered a single survey point. Therefore, 7 control points on the control site should be spaced at distances similar to those of the turbines being surveyed. The control points are flagged and geo-referenced with a GPS and on an aerial photograph. A total of 14 points (7 turbines and 7 control points) will be surveyed.

Bird Utilization Rate

Bird utilization rate is measured using stationary point counts where all birds seen passing through each turbine and control point are counted according to their zone of passage (**Table 1**). The Observers should sit or stand quietly at any location that optimizes data recording. Movement should be minimized to avoid influencing bird behaviour. The number of birds seen passing the turbine and control points should be recorded for 8 minute periods at dawn, midday and dusk (Total observation period for 14 points = 112 minutes). Data collected includes date, observation start and end times,

location (turbine number 1, 2, 3 etc. or control point 1, 2, 3 etc.), current weather conditions, bird species, number of birds, behaviour, height (zone a-d, **Table 1**), and distance and direction from observer (see sample **Data Form A** below for layout and details). The points are visited randomly, although each turbine and its associated control point are visited successively (e.g. turbine 6, control point 6, turbine 2, control point 2, etc.).

The structure of each turbine surveyed must also be visually searched for bird nests. The location of each nest on the tower and the bird species utilizing the nest must be recorded.

Bird Mortality Rate

Bird mortality rate (usually expressed as birds killed per turbine per time period of interest) is measured at the turbine and control points. Mortality is measured by searching for carcasses after each 8 minute observation period. Carcass searches should occur within a 50 m radius around each of the turbine and control points.

Carcasses, including single or groups of feathers, should be picked up (wearing vinyl or latex gloves) and placed in separate plastic bags which should be labelled with the date, location, observer, and identification number. The identification number should correspond to the same field on the data sheet (sample **Data Form B**) which should also include information on species, sex and age (if known), condition and freshness of the carcass (see **Table 2**), cause of death (turbine strike, shooting, poisoning, unknown) distance and direction from the turbine, and geo-referenced location (latitude and longitude calculated with a GPS). Once carcasses have been fully identified, they should be discarded at least 500 m away from either the turbine or control site. For species that cannot be identified, digital photos could also be taken and sent to the Canadian Wildlife Service for identification.

It is important that the carcass searches occur on the same day as the bird point counts. It is possible to have two different observers conducting the bird point counts and the carcass counts, so long as they are not at the same point at the same time, which would disrupt the bird point counts.

Injured birds should be carefully described on the data form so that it can be recognized if later found dead.

Analyses

The bird utilization rate (# birds observed/unit time) and bird mortality rate (# dead birds/point) can be calculated for each turbine and control point. Utilization rate can also be calculated separately for each passage zone (a-d). An index of risk can then be calculated as the ratio of mortality to utilization. This ratio can be compared for turbine and control sites, to see if the area immediately around turbines is considered to be more risky than the area at some distance from the turbines. This ratio can also be compared across the season to determine if risk is higher during the migration, breeding, or

wintering seasons, and across various weather conditions to determine if risk is higher during periods of low visibility.

Data Forms: Bird Monitoring Program

(Adapted from Kingsley and Whittam 2001, Jacques-Whitford Environment Limited 2003 and James 2002)

A. BASIC INFORMATION

Date: _____ Start time : __:__(use 24-hr clock) End time: __:__ Point

Number: _____ Turbine Control

Observer: _____

Temperature: ____°C Visibility: low medium high Wind speed (km/hr):

____ Cloud Cover (%): _____ Wind direction: _____

Precipitation: none rain snow fog Barometric pressure:

_____ Turbine operating? (Y/N) _____ Rotation Speed: _____ rpm

A. BIRD UTILIZATION POINT COUNT. Use one line per bird or group of birds of the same species. Record information for each bird or group of bird only once (i.e. if a bird or group of birds is known to fly through the point count zone more than once, mark only the first instance of this behavior on a single line).

Species	Number of Birds	Behaviour*	Height (zone a-d) see Table 1	Distance from observer (m)

*Behaviour should be recorded as: **foraging, mobbing** (either an animal predator or the observer), **flying – migration** (purposeful flight southward in the fall, or northward in the spring, **flying – other, perching** or **walking**).

B. CARCASS SEARCH (If conducting carcass search at same location as point count, the same basic information can be collected for both counts; if carcass searches are separate from point counts, basic information should be collected separately for each survey).

ID #	Species	Sex	Age	ID procedure	Carcass location (from GPS)		Carcass condition see Table 2	Pr of
					NAD _____			
					Latitude	Longitude		

The identification procedure should be recorded as Observer ID, Collected, or Photographed (if one of the latter two, identification may take place sometime after the carcass has been found). Carcass condition should be recorded

according to Table 2. Cause of death should be noted as turbine strike, shooting, poisoning, or unknown, and can be filled out after a necropsy if deemed necessary.

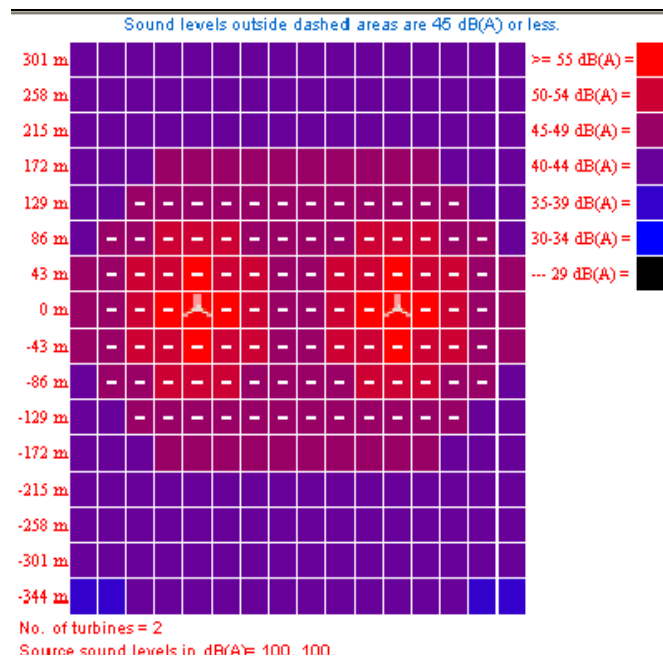
Table 1. Bird height categories used at turbine (impact) sites.

Zone	Description
A	Within the blade sphere
B	Close to the blades, including passes that are along the edge of rotation
C	Not in the blade sphere but below the bottom tip of the blade
D	Out of and well above the top of the blade.

Table 2. Categories of carcass condition (from Jacques-Whitford Environment Limited 2003).

Code	Description
I	Injured or dying.
F	Freshly dead with little or no decay or scavenging by insects; likely died within 48 hours.
R	Recently dead but with noticeable decay or scavenging; likely died within 2-7 days.
D	Decomposed carcass, may not be identifiable to species; likely died more than 1 week ago.
U	Unknown; impossible to determine because only feathers remain.

“The 15 Metre Diameter Rotor Wind Noise Decibel Chart”



This Chart shows what the decibel level will be at certain distances from the turbine. The following information is to be understood

- 15 metres is the rotor diameter of the proponents proposed wind turbine.
- 2) The acceptable decibel level for hearing is 45dbs.
- 3) All areas outside the dashes (>130m) are below 45dbs.
- 4) The nearest inhabitants are 350 metres away.