

Environmental Assessment Registration

Buchans Wind Power Generation

**Prepared for
Government of Newfoundland and Labrador
Department of Environment and Conservation**

Environmental Assessment Division

St. John's, NL



Submitted by

Horizon Legacy Energy Corp.

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1. Name of Undertaking

Buchans Wind Power Generation

2. Proponent

2.1 Name of Corporate Body

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3. The Undertaking

Generation of 25 megawatts of electrical power from wind at Buchans.

3.1 The nature of the undertaking

This project will generate electrical power using atmospheric wind as the energy source.

This proposed project involves the installation, operation and maintenance of 13 to 20 horizontal axis, 3 blade, wind turbines and associated infrastructure to generate 25 megawatts of electrical power. The wind turbines may range in size from 1.3 to 2.0 megawatts depending on the final model selection. The electrical power generated by these wind turbines will be supplied to Newfoundland and Labrador Hydro (NL Hydro) at the Buchans terminal sub station.

The associated wind turbine infrastructure will primarily be comprised of access roads, concrete foundations, transformers and overhead electrical power transmission lines.

The installation will be completed using standard construction methodology for access roads, foundations and civil work. Heavy lifting cranes will be used to place the equipment and standard techniques will be used for installing power poles and electrical cable.

All of the equipment and materials to be installed on the site will be transported to the site by highway truck over provincial road system and site access roads.

Ongoing operations after construction will be monitored by NL Hydro system control center and Horizon Legacy Energy Corp control center and on site visits as required.

There will be no office, service or maintenance facilities permanently installed on the site. Maintenance will be conducted on site as well as in off site repair facilities as required.

3.2 Purpose/ Rationale/ Need for the undertaking

This project is being evaluated and prepared in response to a Request for Proposal issued by NL Hydro in December of 2005 for the supply of 25 mw of wind generated electrical power. The proposals are due for submission by August 31, 2006.

The wind resource for the area can be reviewed in detail on the Canadian Wind Atlas web site at <http://www.windatlas.ca/en/index.php>

4. Description of the undertaking

4.1 Geographic Location

The geographic coordinates for the general center of the site are:

	Latitude	Longitude
1000 meter UTM Zone 21	5409000 meters north	519000 meters east
NAD 27	48° 50.2'	56° 45.5'

4.1.1 Proposed Site

The site is located on the north side of highway route 370 approximately 9 kilometers east of the town of Buchans, generally in a location known locally as Mary March Hill. NL Hydro have a communications tower installed on a hilltop at that location. The project location is generally at the crest of three hills that are open and wind swept. Portions of the site are visible from the highway as well as from the community of Buchans.

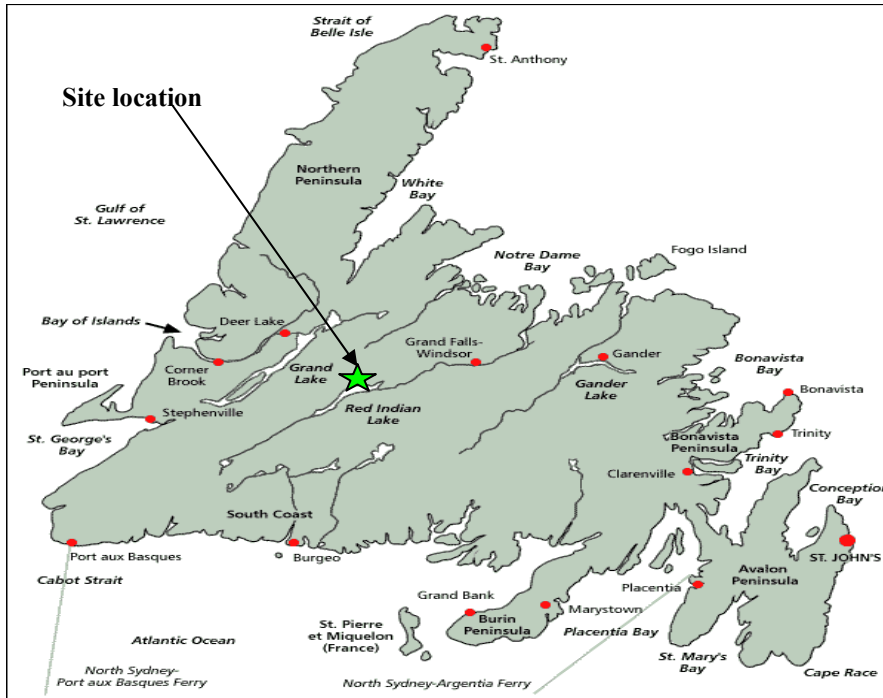
Photos of Project Site, 2005/06



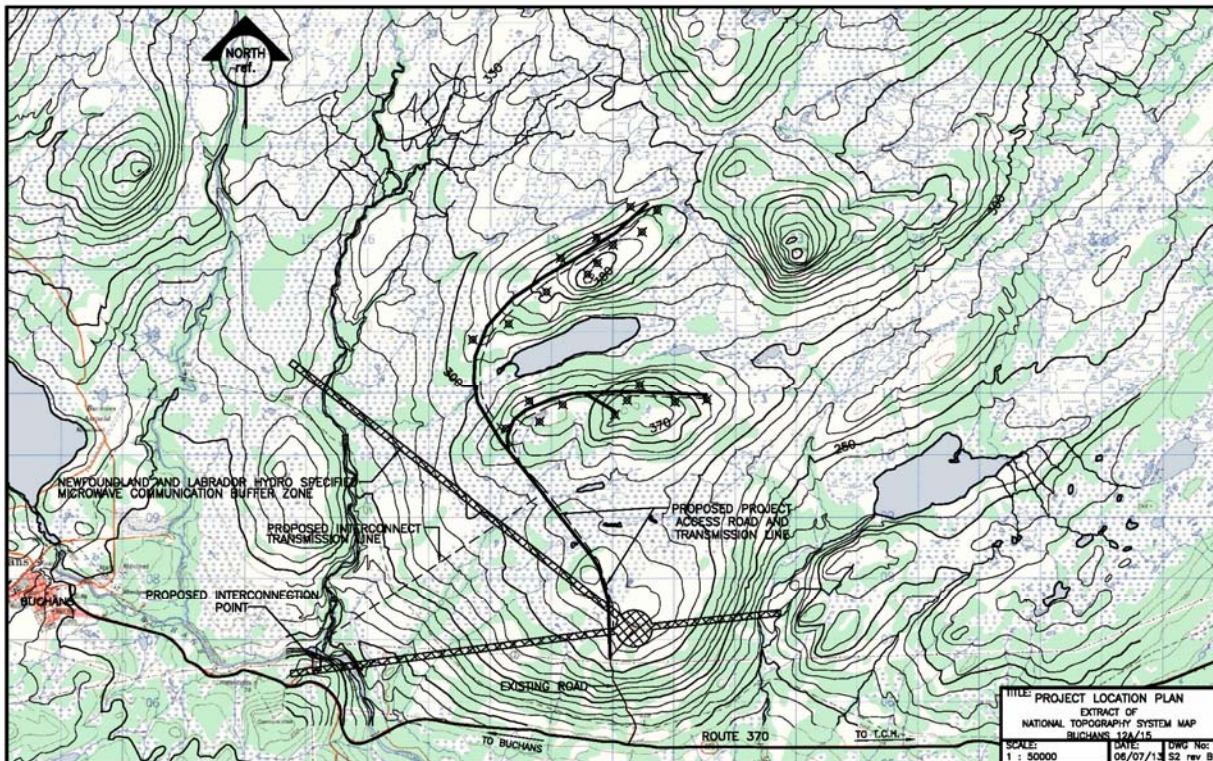
4.1.2 Mapping

The site is shown on the two maps below. Map 1 is a general geographic location map showing the site location on the island of Newfoundland. Map 2 is an extracted portion of a 1:50000 scale National Topographical System topographical map (Buchans 12 A/15, edition 3) and shows the proposed turbine, road and interconnection route layout. The specific locations of the turbines may vary from that indicated when the detailed site design is finalized.

Map 1
Geographic location



Map 2
Proposed location of turbines access roads and interconnections.
Extracted portion of 1:50 000 scale topographical map (Buchans 12 A/15)



4.2 Physical Features

The main physical features of the site will be the wind turbine superstructure comprised of the tubular shaped steel wall support tower, nacelles housing the mechanical and electrical equipment at the top of the tower and the 3 rotor blades.

The other features of the project that would be considered as main physical features are access road, concrete foundations, transformers and overhead electrical wiring for transmission of the electrical power to the NL Hydro sub station at Buchans Brook.

Each of these main physical features is discussed in the relevant sections of 4.2.1 below.

4.2.1 Major Physical Features of the Undertaking

4.2.1.1 Wind Turbines

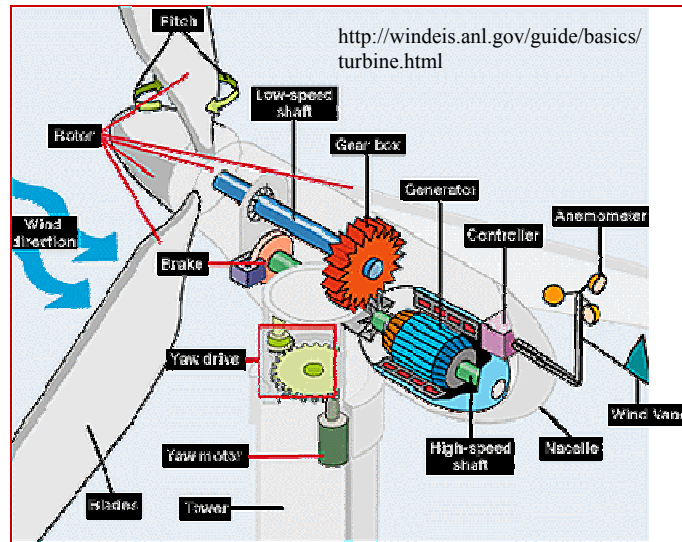
The electrical power output of the site will be approximately 25 megawatts. The turbine manufacturer and detailed size of the turbines has not been finalized however it is anticipated that the project will install from 13 to 20 turbines, depending on the size of the turbines selected. The installed turbines will all be of the same design and manufacturer and will be horizontal axis, 3 bladed, upwind design. The turbines under active consideration range in size from 1.3 to 2.0 megawatts per turbine.

The wind turbines will have 3 blades attached to a central hub located approximately 60 meters above grade mounted in the nacelle at the top of the support tower. Depending on the selected turbine, the blades will sweep a circle between 60 and 80 meters in diameter and will operate facing into the wind when viewed from the nacelle. The overall height of the turbines from grade to top of a vertical blade will be approximately 90 to 100 meters depending on the selected turbine.

The blade assembly or rotor is mounted on a central hub that is installed in the nacelle at the top of the support tower. The blade construction is a fiberglass shell over a central support member. The nacelle and blades orientation is actively controlled by computer systems to optimize the energy production. The nacelle also houses the mechanical and electrical equipment that generates the electrical energy using the rotation motion of the blade assembly. The equipment is generally comprised of a transfer system (gears or direct drive) from the blade hub and electrical generator and cooling equipment. The generated electrical energy is transmitted to transformers at the base of the support tower for supply to the site transmission lines.

A generalized typical schematic layout is provided below

Fig 1: Generalized Turbine



A tapered tubular shaped steel tower supports the nacelle. The base of the tower will be approximately 4 meters diameter and the top approximately 2.3 meters diameter. The overall height of the tower from top of foundation to nacelle mounting will be approximately 58 meters.

Fig 2 Typical Tower Installation



<http://www.windpower.org/en/tour/wtrb/tower.htm>

4.2.1.2 Access Roads

The project access roads will be gravel surfaced and constructed in accordance with the provincial regulations, specifications and guidelines for installation of resource access roads. Generally the roads will be 5 meters in width and constructed to allow the safe transport of the materials and equipment to the individual turbine sites.

The road layout is shown on Map 2 in section 4.1.2 above. It will include upgrading a 1.5-kilometer section of existing access road north from highway route 370. NL Hydro maintains this road as access to the microwave communications tower on the top of Mary March Hill. The new project access road, as show in Map 2, is approximately 8 km in length. At each turbine location the travel area will be enlarged to accommodate a turbine site entry and foundation construction, heavy lifting equipment and assembly and lay down areas for the tower sections, blade assemblies and nacelles.

The access roads will remain installed for the life of the project to provide service access to the turbine sites. The roads will be cleared during the winter as required to provide emergency or heavy equipment access. The road surfaces will be maintained using standard road grading techniques.

Fig 3: Typical Road and Foundation Construction



4.2.1.3 Concrete Foundations

The foundations for the turbines are planned as formed and poured in place reinforced concrete gravity based structures. The foundations will require placement of approximately 250 cubic meters of reinforced concrete per turbine. A foundation will be approximately 4 meters deep x 9 meters diameter. This configuration may vary when the specific sites for the turbines have been selected. The top of the foundation pad will be slightly above the surrounding grade to facilitate sloping of the top of the foundation pad and positive drainage away from the tower base.

4.2.1.4 Overhead electrical transmission lines

The electrical energy generated by each turbine will be transmitted via wiring in the nacelle and support tower to a unit transformer located adjacent to the base of each turbine tower. These transformers will increase the generation voltage (400 to 600 volts) depending on the selected turbine) to the transmission and interconnection voltage.

The site will utilize overhead power transmission lines to interconnect the turbines as well as deliver the electrical energy to the Newfoundland and Labrador Hydro terminal sub station at Buchans. The lines will be supported by either wooden power line poles as presently used by both Newfoundland Power and NL Hydro or steel lattice towers.

4.2.2 Areas to be affected

The areas to be affected include the locations for the project access road, each turbine site access road, each turbine site construction area and foundation, as well as, project transmission lines as shown on Map 2 section 4.1.2 above. Additionally areas will be utilized for rotor assembly at each turbine site.

The total road length is approximately 13.9 km. The planned surface width is 5 meters with side slope and drainage ditching increasing the total disturbed width to approximately 10 meters. Thus, the project access road total disturbed area will be approximately 139,000 square meters (sqm).

Each turbine installation location will require a site entry road of approximately 20 meters long x 10 meters wide, a turbine site construction area (approximately 750 sqm), a foundation area (approximately 64 sqm), and a level rotor assemble area (approximately 5050 sqm).

The turbine sites entry roads, construction areas and foundations for the total project will occupy approximately 13,000 to 20,000 sqm depending on the number of turbines installed. This area will be functional for the life of the project.

The rotor assembly area (5700 sqm/turbine site) will be required only for the assembly of the rotor unit just prior to lifting it into position. This total area for the project of approximately 66,000 to 100,000 sqm would be restored to a level vegetated area after the turbine has been installed.

The transmission lines will follow the access roads on the site. The interconnect line from the project access road to the Buchans substation will be approximately 4.8 km in length. The right of way for these lines is generally 5.5 meters wide thus disturbed area for the transmission line is estimated as 24,000 sqm. This will be in service for the life of the project. The standing trees and tall shrubs will be cleared from the right of way to prevent interference with line operation and maintenance. The low shrubs and ground cover plants will be maintained in place.

The total area that will be utilized for the life of the project for the project access road, turbine site entry roads, turbine construction area and foundations, and transmission lines is estimated as 176,000 to 183,000 sq meters depending on the number of turbines installed. The additional total area that will be required for the rotor assembly, only during the installation, will be 66,000 to 100,000 sqm.

There are two small ponds, three small streams, bogs and drainage ways on the site. The site roads will cross the small streams and drainage ways. Waterways will be considered as fish bearing until determined otherwise by appropriate regulatory authority. Appropriate designs will be submitted for approvals as required. The interconnect transmission line will cross Buchans Brook in the vicinity of the location where Newfoundland and Labrador transmission lines now cross the river. Appropriate designs will be submitted for approval at that river crossing.

4.2.3 Review of Physical and Biological Environments of the Site

The physical and biological environment of the site and surroundings was reviewed by Jacques Whitford Limited (JWL) under contract to *fga* Consulting Engineers Limited. The work at JWL was managed by Mr. Bruce Bennett. The text presented to *fga* Consulting Engineers Limited by JWL for this work is copied below.

 Start JWL report

PHYSICAL FEATURES

The Project Site is located at the transition from the Central Newfoundland Forest Ecoregion to the Long Range Barrens Ecoregion. The Buchans Plateau/Topsails subregion of the Long Range Barrens takes in most of the site. This subregion is a windswept, highland area containing widespread barrens. Elevations in the Subregion range from 200 m to more than 650 m (PAA 2000a). Within the Project area, elevations range from approximately 250 m to a peak of 465 m (Topographic Map 12A/15).

The Buchans Plateau/Topsails Subregion habitats include dense thickets of wind-stunted black spruce, known locally as tuckamore; mainly in sheltered valleys and hillsides. On the Topsails, in the northern part of the Subregion, string fens and slope bogs alternating with rock-filled pools cover large areas. This Subregion contains some of the most extensive string fens on the island of Newfoundland (PAA 2000a).

Vegetation

Vegetation in the Project Area is dominated by arctic-alpine plants. Trees such as black spruce, eastern larch and balsam fir all occur as tuckamore in sheltered valleys and slopes. The exposed hilltops are characterized by low ground cover such as diaspensia, alpine azalea, and pink crowberry, especially in areas of erosion (PAA 2000a). Some of the common vegetation species and their typical habitats are outlined in Table 1.

Table 1 Plant Species Typical of the Project Area and Their Typical Habitat

Common Name	Scientific name	Typical Habitat
Black Spruce (Tuckamore)	<i>Picea mariana</i>	Valleys and slopes, not on hilltops
Balsam Fir – less common	<i>Abies balsamea</i>	Only found in deep, sheltered valleys
Larch	<i>Larix laricina</i>	Only found in deep, sheltered valleys
Sweet Gale	<i>Myrica gale</i>	In most wet areas along brooks
Sheep Laurel	<i>Kalmia angustifolia</i>	Barrens
Rhodora	<i>Rhododendron canadense</i>	Barrens
Pink Crowberry	<i>Empetrum eamesii</i>	Dry, exposed sites (i.e., hill summits and rocky ledges)
Diapensia	<i>Diapensia laponica</i>	Exposed highlands
Alpine Azalea	<i>Loiseleuria procumbens</i>	Exposed highlands

Streams, Ponds and Wetlands

Buchans Brook drains the west side of the site and an unnamed brook drains the east; both of these flow into Red Indian Lake to the southeast. Red Indian Lake is accessible to Atlantic salmon (*Salmo salar*) and has populations of ouananiche (land-locked salmon), brook trout (*Salvelinus fontinalis*), Arctic charr (*S. alpinus*) and threespine stickleback (*Gasterosteus aculeatus*). American eel (*Anguilla rostrata*) also migrate into and are widely distributed within the Exploits River system.

Buchans Brook is partially obstructed by seasonal low flows and migration from Red Indian Lake is likely limited (Porter et al 1974). The streams that drain the proposed site are small and many areas have steep gradients and no headwater ponds, which may render them seasonally ephemeral. The only ponds on the site are quite small.

There are large areas of wetland shown on the topographic map. These are predominantly ribbed fens.

Geology

The bedrock of the region surrounding the town of Buchans is underlain by the Ordovician Buchans Group, which consists largely of a bimodal suite of basalt and rhyolite (Klassen 1998).

The bedrock of the Topsails Plateau, which encompasses part of the proposed site, consists of granite (NRCAN n.d.).

The northern portion of the Buchans Plateau/Topsails Subregion, where the proposed site is located, consists of ash and lava deposits, which are approximately 420 million years old (PAA 2000a).

Sediments in the Plateau area are granite-rich and zinc-poor (NRCAN n.d.).

Climate

The Buchans Plateau/Topsails subregions experiences cool summers and cold winters. Snow cover is permanent during the winter and persists until June in some years. The growing season is quite short. The annual precipitation is 1,300 to 1,500 mm per year, and annual snowfall is 3 to 4 m. Average daily temperatures in February are -5°C to -8°C and are 13°C to 15°C in July. Winds are usually strong and are predominantly from the west and southwest (PAA 2000a).

Resource and Land Use

A review of the provincial Land Use Atlas (WEB-Based and pers. comm.) indicates that there are designated land use areas that are near, but do not overlap, the proposed site. These include:

- the site is located just north of Route 370, which is a protected road (Newfoundland and Labrador Department of Municipal Affairs);
- the site is located approximately 9 km east of the Town of Buchans;
- Town of Buchans protected water supply is approximately 4 km west of the site;
- Reidlots (Kruger-Abitibi) are south of the site, primarily between Route 370 and Red Indian Lake;
- hydroelectric development area (Hinds Lake) approximately 10 km to the northwest of the site;
- licensed outfitting operations are located at Hinds Lake (16 km to the northwest of the site), Eclipse Pond (15.5 km roughly north of the site) and near Buchan's Junction (19 km east of the site); and
- just north of the site, sensitive wildlife and waterfowl areas extend over large areas of the Buchans plateau and the Gaff Topsails.

WILDLIFE

The range of the Buchans caribou (*Rangifer tarandus*) herd includes most of the proposed site and Gaff Topsails caribou herd is ranges to the east of the site. Both of these herds roam the upland barrens that extend throughout the local subregions.

The barrens area is also home to Arctic hare (*Lepus arcticus*) and visited by other transient wildlife.

The lower level forest and shrub habitats are home to moose (*Alces alces*), lynx (*Lynx canadensis*), snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*) and little brown bat (*Myotis lucifungus*). Black bear (*Ursus americanus*), red fox (*Vulpes delextris*), mink (*Mustela vison*), masked shrew (*Sorex cinerius*), meadow vole (*Microtus pennsylvanicus*), deer mouse (*Peromyscus maniculatus*) and short-tailed weasel (*Mustela erminea*) range throughout a variety of habitats in this subregion (PAA 2000a; 2000b). Beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*) and otter (*Lutra canadensis*) are found near the ponds, lakes and streams. Coyote (*Canis latrans*), which have expanded their range from west to east across the island in the past few decades, have often been sighted in the region.

There are Buchans and Gaff Topsail Moose, Caribou and Black Bear Management Areas, which regulate the licensing and open seasons for big game hunting. These areas overlap, or are proximal to the proposed site.

BIRDS

Birds in the region are broadly distributed in the barrens and forest habitats (PAA 2000a). The barrens are home to game birds such as rock ptarmigan (*Lagopus mutus*) and willow ptarmigan (*Lagopus lagopus*), with the later also being present in the forest and shrub habitats. Savannah sparrow (*Passerculus sandwichensis*), horned lark (*Eremophila alpestris*), and American pipit (*Anthus rubescens*) all are fairly common in the open highlands. Common redpoll (*Carduelis flammea*) inhabit tuckamore areas and blackpoll warbler (*Dendroica striata*) and northern waterthrush (*Seiurus noveboracensis*) are found in the forest habitat. Wetland habitat species include swamp sparrow (*Melospiza georgiana*), Lincoln's sparrow (*M. lincolni*) and common yellow-throat (*Geothlypis trichas*).

References:

Klassen, R.A. 1998. Geological factors affecting the distribution of trace metals in glacial sediments of central Newfoundland. *Environmental Geology* 33(2/3): 154-169.

NRCAN (Natural Resources Canada). No date. Glaciation, Bedrock Composition and Trace Metals in the Environment. Available at: <http://gsc.nrcan.gc.ca/geochem/envir/pdf/index7.pdf>

PAA (Protected Areas Association of Newfoundland and Labrador). 2000a. Long Range Barrens Ecoregion – Buchans Plateau/Topsails Subregion 8b. Ecoregions Brochures prepared by Government of Newfoundland and Labrador, Department of Environment and Conservation.

PAA (Protected Areas Association of Newfoundland and Labrador). 2000b. Central Newfoundland Forest Red Indian Lake Subregion 2b. Ecoregions Brochures prepared by Government of Newfoundland and Labrador, Department of Environment and Conservation.

Porter, T.R., L.G. Riche and G.R. Traverse. 1974. Catalogue of Rivers in Insular Newfoundland: Volume D. Environment Canada. Fisheries and Marine Service. Data Record Series No. NEW/D-74-9. Resource Development Branch. Newfoundland Region.

End JWL report

This review indicated that the site ecosystem does harbour a diversity of terrestrial and aquatic plant and animal species. The project activities may impact each of these in similar but differing ways. There may be impacts from the planning and construction phase as well as the operational phase of the project.

The site construction is not anticipated to impact the water quality of either of the two brooks or other drainage ways from the general project area as outlined above as silt and sediment control of run off will be an integral part of site design.

A meeting with the town council and this review has guided the site selection toward the southern portion of the general site area under consideration. The present location for the project, as shown in Map 2 , section 4.1.2, was supported by the Buchans Town Council after a presentation to, and meeting with them in May of 2006

The ecosystems of the specific site and general area will be more thoroughly documented through site visits by environmental consultants when the site details are being finalized. That documentation will be used to modify the site design and specific turbine locations as required mitigating or eliminating environmental impacts from either the development/construction phase or the operational phase of the project. The review and documentation will be used as input to development of the site environmental protection plan (EPP). Run off and silt control will form an integral part of the EPP and project design and operation. As part of the EPP it is proposed to design and establish ongoing monitoring programs to review the interactions of the project with the bird and animal populations in the site area.

4.3 Construction

This project has two major construction phases. Phase one is the civil work comprising the installation of the access roads and foundations. Phase two is the delivery and installation of the turbine equipment and electrical system. Phase one will generally be completed prior to the commencement of phase two however there will be overlap of these project phases.

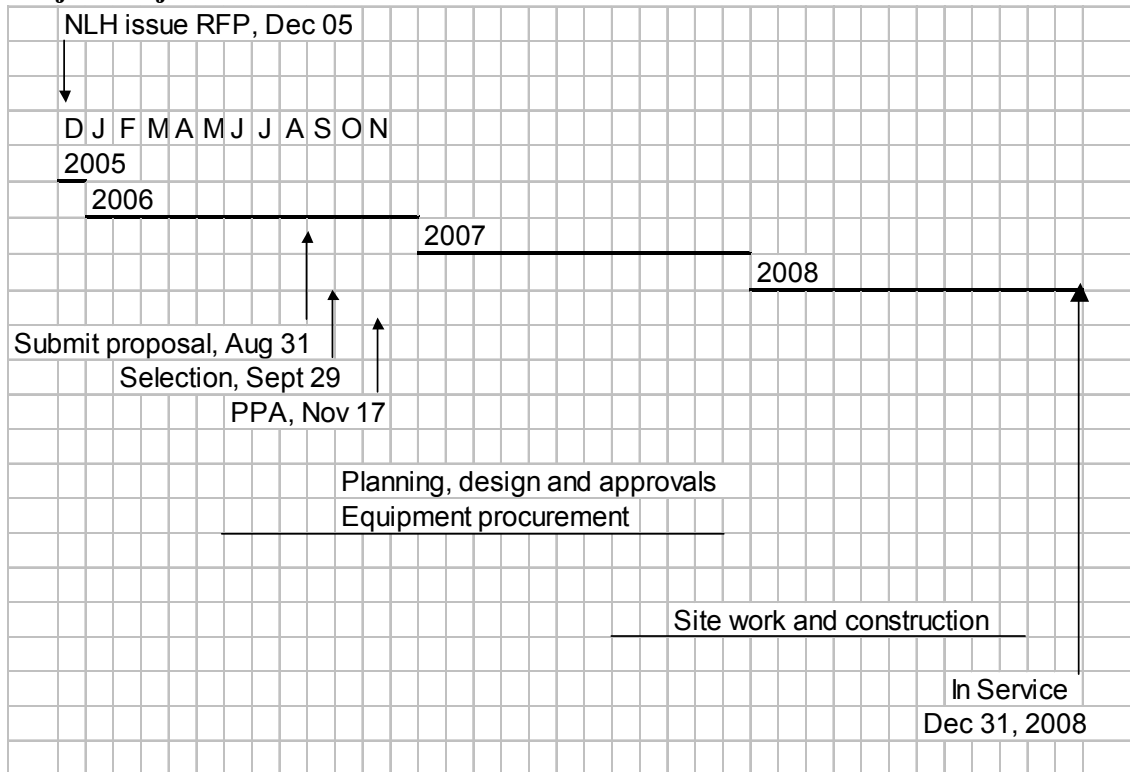
4.3.1 Schedule

The primary milestones for the project have been established by NL Hydro in the Request for Proposal, RFP 31315OQ. These are:

- Proposal Submission by August 31, 2006
- Selection by September 29, 2006
- Power purchase agreement completed by November 17, 2006
- Mandatory project in service date of December 31, 2008

These milestones are shown in bar chart format below.

Project major milestones



Site construction is planned to commence late summer/ early fall of 2007 with commissioning by November 2008. The construction may be halted during winter months of 2007/8. The significant construction activity is planned to be completed within approximately 6 months duration.

4.3.2 Construction Period Potential Pollutants

The project construction will entail civil earth works and installation of mechanical and electrical equipment. The civil earth works comprise upgrading and installation of roadbeds and excavation for the installation of the reinforced concrete foundations and installation of power line poles. The mechanical installation includes assembly and crane lifting of heavy equipment to heights of 60 to 65 meters.

This work will require approximately 50 men on site with tooling and various mobile equipment, excavators and cranes as well as temporary office, first aid, sanitary and lunch room support facilities.

The environmental aspects of the construction activities will be managed through a site environmental protection plan. The plan will be developed in conjunction with the development of the detailed site design. The plan will utilize standard industry approaches that have proven to successfully eliminate similar potential environmental impairments in other construction situations. The implementation and day-to-day operation of the site environmental protection plan will be a primary responsibility of the site construction superintendent. The plan will address the normal planned day to day operations as well as potential abnormal or emergency situations.

4.3.2.1 Emissions

The major source of emissions from the construction will be vehicle exhaust as well as the potential for soil dust from the excavations and road surfaces. Other minor sources would be from metal working during the installation and evaporation of various installation and maintenance fluids. The operation of the sanitary and lunchroom facilities may have minor emissions related to them. There will be no burning of brush or any other materials permitted on site. Noise levels will increase from the ambient background noise during the construction period.

4.3.2.2 Effluents

Run off from precipitation events will be the primary source of effluent from the site. The design of the access roads and the foundation installations will accommodate the historical precipitation levels in the area and potential generation of silt. Slit and sediment containment systems will be an integral part of the runoff control. The construction operation will have wash down requirements especially for equipment handling concrete. Temporary wash down areas including effluent retention and or collection/reuse/disposal will be installed as required. Site housekeeping will be significant feature of the site environmental protection plan to eliminate the impact of installation materials on the surrounding soil and water and to promote site safety.

There will also be effluents from the operation of the sanitary and lunchroom support facilities. These will be either treated through an approved on site septic system or collected in storage tanks for periodic pumping and disposal at an approved sanitary waste disposal location.

4.3.2.3 Solid waste

The solid waste generated during construction will be metallic items, inorganic material such as stone and concrete, wood, plastics, paper and food related waste. These will be collected in centralized on site locations for reuse as required during construction as well as eventual disposal through recyclers or at approved waste disposal sites.

4.3.2.4 Potential causes of resource conflicts

There are potential sources of various resource conflicts during the construction phase. These are listed below. However, in general there does not appear to be any significant or irresolvable issues related to resource conflicts.

The potential sources of resource conflict during construction are listed and discussed below:

- *Highway transportation issues*
- *Use of NL HYDRO maintained access road*
- *Noise*
- *Recreational use of area*
- *Mining claims*

Highway transportation issues

A resource conflict that could develop would be related to transportation issues. The project involves transport of large loads over provincial highways. Portions of these may require closure or slowed speeds during the transport of the equipment. Such conflicts or interruptions will be addressed through the various permitting procedures.

Use of NL Hydro maintained access road

The 1.5 km portion of the existing access road to the NL Hydro Mary March Communication tower will be upgraded. This road must remain open for access to the tower thus the approvals for and implementation of the upgrading will be coordinated with NL Hydro.

NL Hydro has designated microwave communication corridors to, from and around the microwave tower on Mary March Hill. The planned installations are outside of these corridors however the project access road does cross one of these corridors. The installation of the site access road and the transport of equipment and materials across this corridor will not pose a problem as the equipment and transported loads will be significantly lower than the microwave receivers and transmitters. However all activity on or around this corridor will be coordinated with NL Hydro.

Noise

The construction phase will generate noise from the operation of earth moving equipment, lifting cranes, concrete haulage trucks and pick up etc. The site is remote from the community of Buchans and the shores of Red Indian Lake. The noise levels at these locations related to the site will be imperceptible.

Recreational use of area

Access to the site area during construction will be limited to authorized personnel for safety reasons. Thus there may be impact on the persons who normally use the area for recreational activity. The town council indicated that the number of persons who use that area for recreation on a regular or occasional basis is very limited if any.

Mining claims

The Buchans area has been well explored by many prospectors. The area under consideration for the installation of the turbines has not been considered suitable for staking of mining claims. It is anticipated that no valuable mineralization will be located during the geotechnical work for the foundations or the excavation for the road and foundations.

4.4 Operation

The project involves the operation of megawatt capacity wind turbines to produce 25 megawatts of electrical energy. The project will be designed for a nominal life of 20 years however it is expected that the project would have a life of at least 30 years before major maintenance would be required. The operation of the project may extend beyond that period depending on economic performance.

4.4.1 Description of the Operation

The visual operation of the wind turbines will display slowly turning 60 to 80 meter diameter three bladed rotor assemblies mounted atop slender 60 meter high towers. The rotors turn at a relatively slow speed of about 16 rpm.

The blades will rotate at relatively constant velocity in wind speed from about 4 meters per second (m/s) to 25 m/s. Above this speed an automatic breaking system is employed to stop the turbine rotation to eliminate possible damage to the units.

The rotary motion of the blades is transferred through mechanical linkage to the generator in the nacelle. The generator produces the electrical energy for transfer to the grid through transformers and the interconnection overhead electrical lines.

Each of these units (mechanical linkage, generator and transformer) has requirements for liquid or air-cooling. The liquid cooling would be closed circuit and may, depending on design, use either water or oil as cooling liquids.

The entire operation and individual turbines will be monitored and controlled remotely by the NL Hydro system center in St. John's, as well as the Horizon Legacy Energy Corp. office. Personnel will visit the site on an as required basis to provide service or affect repairs. NL Hydro will control the units to balance the supply of electrical energy to the island power grid and may start and stop one or more turbines as required. Horizon Legacy Energy Corp. will monitor the units to ensure optimum performance is being achieved and to determine service and maintenance requirements.

4.4.2 Operational period potential pollutants

The potential pollutants that would be present during the operational phase of the project are related to the mechanical operation and maintenance of the turbines and generators, transformers and power lines, transportation to and from the site and maintenance of roads and turbine locations.

There will be no office, lunchroom or sanitary facilities maintained on site. These will be provided as portable units as required.

4.4.2.1 Emissions

The major source of emissions from the operational phase will be vehicle exhaust as well as the potential for soil dust from the road surfaces. Other minor sources would be from metal working during maintenance as well as evaporation of various maintenance fluids. There will be no burning of brush or any other materials permitted on site. Noise levels will increase from the ambient background noise.

4.4.2.2 Effluent

The effluent from the site will be ambient precipitation runoff from the turbine surfaces and road surface drainage. There will be no operations on site that will generate an ongoing directed effluent.

Spills of motor vehicle fluids or operational or maintenance liquids represent a source of potential liquid pollutants on the site. These would not normally be released as an effluent from the site. A loss of containment incident involving either of these fluids will require immediate clean up actions.

Liquid waste will be generated during on site service and maintenance. These liquids will typically be wash down fluids and used oils. These would not normally be released as an effluent from the site. They will be collected and disposed of through approved industrial waste handlers for oil-contaminated liquids. Rare emergency situations may result in effluent such as fire fighting water. This would be dealt with in a case-by-case basis.

4.4.2.3 Solid waste

The solid waste generated during operation will primarily be metallic items, electrical components, wood, plastics, paper and miscellaneous domestic related waste. These will be collected and removed during the personnel visits to the site for inspection and service. These materials will be disposed of through recyclers or at approved waste disposal sites.

4.4.2.4 Potential causes of resource conflicts

There are a number of potential sources of resource conflict as listed and discussed below.

- *Visual*
- *Noise*
- *Recreational use of countryside*
- *Interactions with birds/wildlife.*
- *Road use by NL Hydro*
- *Increased tourism*
- *Air traffic*

In general there does not appear to be any significant irresolvable issues related to resource conflicts during operation.

Visual

There are mixed opinions regarding the visual impact of large geometric structures on the landscape. This site is approximately 9 km east of Buchans and only a portion of the installed turbines will be visible from the town. Those that can be seen from the community will appear as small units. Some of the turbines will be seen from vantage points on route 370. As there are many and mixed opinions regarding the visual aspects of these types of structures on the landscape, consideration may be given to use of color to reduce the visual impact of the turbines.

Each of the turbines will be equipped with collision avoidance lighting for air traffic, thus there will also be visual indication of each turbine location at night by red lights mounted on the top of the nacelles. This type of lighting is generally considered as unobtrusive and often becomes nighttime directional locator landmarks by persons using the countryside.

Noise

The turbines will produce noise due to the turning of the blades in the wind, as well as, the operation of the various equipment in the nacelle. This noise level will be perceptible when on site and generally a person can carry on a conversation without raising ones voice when standing close to the operational turbine. Given that the turbines will be located approximately 5 km from the highway and 9 km from the community the noise generated will be imperceptible at those distance.

Recreational use of countryside

The project access road will make access to the countryside in that general area somewhat easier than it is at present. The big game hunters that are well north of the site may view the road as an encroachment into their unopened hunting areas. Discussions during the town council meeting in May indicated that the location of the development as shown in section 4.1.2 Map 2 would not present a problem to the big game outfitters that have lodges north of the project site.

Interactions with birds/wildlife

The interaction of birds with wind turbine has been the subject of extensive research and many site-specific studies. In general it has been found that mortality of birds due to impacts with wind turbines is lower than many other man made structures, such as lighted office towers and smoke stacks. Like wise the impacts on mammals around operational turbines has been studied and found to be low. The results of bird impact monitoring studied and mammal impact studies would likely be the same for a wind turbine installed in Newfoundland as it was for the studies conducted elsewhere.

As this may be the first operational multi mega watt scale wind power generation project in Newfoundland the proponent considers it appropriate to design and conduct a wildlife interaction monitoring study. Such a study would be designed in conjunction with recognized wildlife persons to ascertain site-specific impacts on mammal and bird behavior around the turbines.

Road use by NL Hydro

The project access road will encompass a portion of Mary March Hill microwave communications tower access road maintained by NL Hydro. The frequency and type of use of this section of the project access road will be low frequency and generally pick up truck or similar small service type vehicle. There will unlikely be any conflicts arising over this type of use. Use of the road for heavy equipment for project major maintenance would be in coordination with NL Hydro.

Increased tourism

Many persons view the production of electrical energy by wind turbines as a very positive approach to environmental sustainability. Other jurisdictions have noted that the installation of wind turbines has resulted in an increase in casual visits to view the turbine structures. Thus the installation of the wind turbine may result in increased tourism by resident Newfoundlanders as well as visitors to the province. This may have a positive impact on the business activity in the town of Buchans.

Air traffic

There is a small, closed, airfield on the southeast shore of Buchans lake adjacent to the community of Buchans. Small aircraft uses the airfield from time to time. The runway orientation is approximately parallel to the location of the project turbine such that the take off and landing approaches to the airstrip are not in line with the turbines. The turbine locations will be marked as requirements by Nav Canada and will be posted in the Notices to Airmen .

4.5 Occupations

The occupations listed in the National Occupational Classification 2001 that will be directly involved to a greater or lesser degree are as follows:

Group	1	2	7
Skill level 0	011 Administrative Services Managers 012 Managers in Financial and Business Services 013 Managers in Communication (Except Broadcasting)	021 Managers in Engineering Architecture Science and Information Systems	071 Managers in Construction and Transportation 072 Facility Operation and Maintenance Managers
A	111 Auditors, Accountants and Investment Professionals 112 Human Resources and Business Service Professionals	213 Civil, Mechanical, Electrical and Chemical Engineers 217 Computer and Information Systems Professionals	
B	121 Clerical Supervisors 122 Administrative and Regulatory Occupations 124 Secretaries, Recorders and Transcriptionists	221 Technical Occupations in Physical Sciences 223 Technical Occupations in Civil, Mechanical, and Industrial Engineering 224 Technical Occupations in Electronics and Electrical Engineering 225 Technical Occupations in Architecture, Drafting, Surveying and Mapping 226 Other Technical Inspectors and Regulatory Officers 227 Transportation Officers and Controllers 228 Technical Occupations in Computer and Information Systems	721 Contractors and Supervisors, Trades and Related Workers 722 Supervisors, Railway and Motor Transportation Occupations 723 Machinists and Related Occupations 724 Electrical Trades and Telecommunication Occupations 725 Plumbers, Pipefitters and Gas Fitters 726 Metal Forming, Shaping and Erecting Trades 727 Carpenters and Cabinetmakers 728 Masonry and Plastering Trades 729 Other Construction Trades 731 Machinery and Transportation Equipment Mechanics (Except Motor Vehicle) 732 Automotive Service Technicians 733 Other Mechanics 737 Crane Operators, Drillers and Blasters 738 Printing Press Operators, Commercial

			Divers and Other Trades and Related Occupations, n.e.c.
C	141 Clerical Occupations, General Office Skills 142 Office Equipment Operators 143 Finance and Insurance Clerks 145 Library, Correspondence and Related Information Clerks 146 Mail and Message Distribution Occupations 147 Recording, Scheduling and Distribution Occupations		741 Motor Vehicle and Transit Drivers 742 Heavy Equipment Operators 743 Other Transport Equipment Operators and Related Workers 744 Other Installers, Repairers and Services
D			761 Trades Helpers and Labourers 762 Public Works and Other Labourers, n.e.c.

The precise number of persons that will be employed by the project has not been determined. The estimate at this time is that there will be approximately 50 trades persons and associated designers and other professional and support staff employed. Installation and commissioning will require approximately 6 months. The operational phase of the project will have 1 full time employee. Maintenance will be through contract services and is estimate to require the equivalent of three full time employees. These services will be contracted, as the maintenance aspects of the turbines will require a diversity of skills.

4.6 Project-Related Documents

There are numerous documents concerning virtually all aspects of wind power electrical energy generation available through the web.

One of the more significant document specifically related to this project is the “Request For Proposals for a Wind Generation Project , RFP 31315 OQ” issued by NL Hydro in December 2005. This document sets out the requirements for the proposal and the terms under which a contract would be issued for the purchase of the electrical energy generated by the project.

This document is available on request from NL Hydro. The questions and answers that have been generated by RFP respondents and NL Hydro is available at the NL Hydro web site under the “vendors/ wind generation” tab at

<http://www.nlh.nl.ca/hydroweb/hydroweb.nsf/default?openform>

5. Approval of the Undertaking

One of the primary approvals required for the project to proceed is the acceptance of the Horizon Legacy Energy Corp. proposal by NL HYDRO and award of the Power Purchase Agreement.

Other permit and approvals required are

Permit	Authority
Environmental Approvals	Dept of Environment & Conservation
Crown Land Application and Approvals	Dept of Environment & Conservation
Resource Road Construction Permits	Department of Agriculture
Water Crossing Permits	Department of Government Services
Large Load Highway Permits	Department of Transportation and Works
Air Navigation Obstruction Clearance	Transport & Nav Canada
Electrical Design Approvals and Installation and Operational Approvals	Department of Government Services and NL Hydro

The Government of Newfoundland and Labrador, Table of Public Statutes available on the web at

http://www.hoa.gov.nl.ca/hoa/sr/table_of_Public_Statutes/tableofpublicstatutes.htm

lists 568 Acts with accompanying regulations. The project will address applicable regulatory requirements.

6. Schedule

The primary milestones for the project have been established by Newfoundland and Labrador Hydro in the Request for Proposal, RFP 313150Q. The schedule is shown in bar chart format in section 4.3.2 above. Construction is planned to commence late summer early fall 2007 and sufficient resources will be applied to meet the NL Hydro established mandatory in service date for the project of December 31, 2008.

7. Funding

The project capital cost is being established however it is estimated to exceed \$15 million. Horizon Legacy Energy Corp will fund the project through private funding sources.