Melancthon Grey Wind Project
Environmental Screening Report

File No. 162603849
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Prepared for:

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NOTICE

Stantec Consulting Ltd. ("Stantec") has prepared this Environmental Screening Report ("ESR") for Phase I of the Melancthon Grey Wind Project with all reasonable skill, care, and diligence for the sole use of Canadian Hydro Developers, Inc. ("Canadian Hydro"). Information provided herein may not be reproduced, or otherwise used by any third party, without the expressed written consent of Canadian Hydro.

Stantec has prepared this ESR, using a multidisciplinary team of specialists, based upon the project specific terms of reference approved by Natural Resources Canada as outlined in their Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act* (2003), as well as following the Ontario Ministry of the Environment's *Environmental Screening Process* (2001) for a Category B project. In fulfilling the terms of reference, Stantec applied the industry best practices principles as outlined by the International Association for Impact Assessment (www.iaia.org).

FORWARD

This Environmental Screening Report ("ESR"), for the Melancthon Grey Wind Project (the "Project"), has been prepared and is consistent with the Ministry of the Environment's ("MOE") Guide to Environmental Assessment Requirements for Electricity Projects (March 2001) as mandated under Ontario Regulation 116/01, the *Electricity Projects Regulation*. Furthermore, this ESR is consistent with the provisions of the *Canadian Environmental Assessment Act* ("CEAA") and the requirements identified in the Natural Resources Canada ("NRCan") document Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act* and the Scope of Assessment provided by NRCan (**Appendix A2**).

In completing the ESR for the Project, the authors have responded to the provisions of two similar, yet distinct environmental screening requirements stipulated by the governing provincial and federal authorities. As the ESR follows an integrated report format, the following concordance table provides a checklist to the reader for comparing the contents of the ESR to the information requirements of NRCan and the MOE.

Table F-1: Concordance Analysis of Key ESR Requirements

Requirement	NRCan	MOE	Section Where Addressed in ESR
Notice of Commencement	✓	✓	Section 5.3.2
Scope of Assessment	✓		Chapter 3 & Appendix A2
Proponent Information	✓	✓	Section 1.2
Purpose of Project		✓	Sections 1.1 & 1.9
Project Location	✓	✓	Section 1.4
Project Description	✓	✓	Chapter 2
Project Expansion Plans	✓	✓	Sections 1.5 & 2.2.7
Power Line and Substation Alternatives			Section 2.3 & Appendix B
Advantages and Disadvantages of the Project		✓	Section 1.9
Agencies (and Permits) Involved in Project	✓	✓	Section 1.8 & Chapter 4
Stakeholder Consultation and Information Disclosure	✓	✓	Chapter 5
Baseline Environmental* Characteristics	✓	✓	Section 2.1 & Appendix C
Screening Criteria Checklist / Anticipated Environmental Effects		✓	Chapter 6 & Appendix I
Protection and Mitigation Measures	✓	✓	Chapter 7
Net Effects**	✓	✓	Chapter 7
Significance of Net Effects	✓	✓	Chapter 7
Accidents and Malfunctions	✓		Section 7.17
Effects of the Environment	✓		Section 7.18
Summary of Potential Effects and Mitigation Measures	✓	✓	Section 7.19
Cumulative Environmental Effects	✓	✓	Section 7.20

Table F-1: Concordance Analysis of Key ESR Requirements

Requirement	NRCan	MOE	Section Where Addressed in ESR
Monitoring and Follow-Up	✓	✓	Chapter 8
Conclusions	✓	✓	Chapter 9
Technical Reports	✓	✓	See Appendices
Signatures of ESR Authors	✓		Chapter 10
Notice of Completion		✓	Section 5.5 & Appendix H4
Statement of Completion		✓	Filed with MOE following successful completion of 30-Calendar Day Stakeholder Review
Screening Determination	✓		NRCan to Provide

Notes:
* the term “environment” is defined herein to include natural, physical, biological, agricultural, socio-economic, and historical and archaeological components.
** the term “net effects” has been used herein and is interchangeable / equivalent to NRCan’s term “residual effects”

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GLOSSARY

AADT	Average Annual Daily Traffic
BSC	Bird Studies Canada
Canadian Hydro	Canadian Hydro Developers, Inc.
CEA	Cumulative Environmental Change Assessment
CEAA	*Canadian Environmental Assessment Act*
CEA Agency	Canadian Environmental Assessment Agency
Chinodin	Chinodin Wind Power
CH_4	Methane
CIA	Customer Impact Assessment
CLI	Canada Land Inventory
CO	Carbon Monoxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee of the Status of Species at Risk in Ontario
CPL	Canadian Projects Limited
CSA	Canadian Standards Association
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans Canada
EA	Environmental Assessment
EA Guide	Guide to Environmental Assessment Requirements for Electricity Projects, March 2001
EAA	*Environmental Assessment Act*
EC	Environment Canada
ECP	Environmental Choice Program
EPA	*Environmental Protection Act*
EPC	Engineering, Procurement, Construction
EMF	Electric and Magnetic Fields
ESA	Electrical Standards Authority
ESP	Environmental Screening Process
ESR	Environmental Screening Report
FA	Federal Authority
GE	General Electric, Wind Energy Division
GRCA	Grand River Conservation Authority
GSCA	Grey Sauble Conservation Authority
HC	Health Canada
Hydro One	Hydro One Networks Inc.
Hz	Hertz
IAIA	International Association for Impact Assessment
IBA	Important Bird Area

IESO	Independent Electricity System Operator
ISO	International Standards Association
kV	Kilo Volt
LLA	Land Lease Agreement
mG	Milli Gauss
MOE	Ministry of the Environment
MTO	Ministry of Transportation Ontario
MVCA	Maitland Valley Conservation Authority
MW	Mega Watt
NIEHS	National Institute of Environmental Health Sciences
NHIC	Natural Heritage Information Centre
NO_X	Oxides of nitrogen
NPSW	Non Provincially Significant Wetland
NRCan	Natural Resources Canada
NVCA	Nottawasaga Valley Conservation Authority
OEFC	Ontario Electricity Financial Corporation
OMNR	Ontario Ministry of Natural Resources
O_3	Ozone
PPA	Power Purchase Agreement
Project	Melancthon Grey Wind Project, Phase I
PSW	Provincially Significant Wetland
RA	Responsible Authority
Regulation 116/01	Ontario Regulation 116/01, The Electricity Projects Regulation
RFP	Request for Proposals
ROW	Right-of-Way
SIA	System Impact Assessment
SLC	Stakeholder Liaison Committee
SO_2	Sulphur Dioxide
t	Tesla
TC	Transport Canada
U.K.	United Kingdom
U.S.	United States of America
VEC	Valued Ecosystem Component
VOC	Volatile Organic Compounds
VTE	Vulnerable, Threatened, or Endangered
WPPI	Wind Power Production Incentive Program
WPPI Guide	Wind Power Production Incentive – Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act* (2003)

1 PROJECT SUMMARY

This section provides a summary of the Melancthon Grey Wind Project (the "Project") as suggested in Natural Resources Canada's ("NRCan") document, entitled: *Wind Power Production Incentive – Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act, 2003* ("WPPI Guide"). Detailed information about the Project, its potential environmental[1] effects, protective and mitigative measures, significance of net effects, and follow-up programs is provided in the following sections of this Environmental Screening Report ("ESR").

1.1 PROVINCIAL GOVERNMENT PPA

The Government of Ontario has made a commitment to the generation of electricity from renewable sources an important part of Ontario's energy future. Specifically, the Government of Ontario has set targets of having 1,350 megawatts ("MW") of renewable electricity in service by 2007 and 2,700 MW in service by 2010, and has actively taken steps to reach these targets.

The first step towards reaching these targets occurred on 24 November 2004, when Canadian Hydro Developers, Inc. ("Canadian Hydro") was awarded a Power Purchase Agreement ("PPA") from the Ontario Electricity Financial Corporation ("OEFC") (**Appendix A1**). Canadian Hydro was awarded 67.5 MW of electricity generation for Phase I of the Melancthon Grey Wind Project[2].

1.2 PROJECT PROPONENT

Canadian Hydro is one of Canada's premier independent developers of EcoLogo® certified low-impact renewable energy. Publicly listed since 1990, the company owns and operates seventeen renewable power facilities (net installed capacity of 111 MW). Wind generated electricity accounts for four sites, biomass for one site, and hydroelectric power for twelve sites.

Canadian Hydro's renewable power allows future generations to have reliable, efficient, and affordable energy supplies, which is consistent with the Ontario Government's objective to provide for the protection, conservation, and wise management of Ontario's environment. Below is the key corporate information for Canadian Hydro; additional information on the company and its projects is available at: www.canhydro.com.

Personnel

- John Keating: Chief Executive Officer
- Ross Keating: President and Chief Operating Officer
- Kelly Matheson: Manager, Environmental Affairs
- Gavin Lowe: Manager, Wind Energy Division
- Geoff Carnegie: Manager, Ontario Projects.

[1] The term "environment" is defined herein to include natural, physical, biological, agricultural, socio-economic, and historical and archaeological components.

[2] Under the terms and conditions of the executed PPA, Canadian Hydro has applied to the OEFC to provide an additional 10% of electricity. Using the General Electric 1.5 MW machine, this would bring the total capacity of the Melancthon Grey Wind Project to 75 MW using 50 turbines (the "Project"). Canadian Hydro is awaiting the determination of the OEFC on this matter. Thus, to maintain conservancy in the Environmental Screening Process, this ESR has been prepared on the basis of 50 turbines (i.e., 75 MW).

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1.3 TITLE OF PROJECT

Chinodin Wind Power ("Chinodin") originally conceived the proposed project in 2000 and subsequently named it the *Ontario Highlands Wind Project*. At that time, and continuing during the first quarter of 2004, Chinodin actively undertook:

- wind energy monitoring studies;
- acquisition of Land Lease Agreements ("LLA") with area landowners;
- a preliminary System Impact Assessment ("SIA") with the Independent Electricity System Operator ("IESO")[3] to determine the existing transmission lines' (i.e., B4V and B5V) capacity to handle increased electricity volumes known as "loads";
- a preliminary Customer Impact Assessment ("CIA") with Hydro One Networks Inc. ("Hydro One") to ensure that any new electrical infrastructure associated with the Project would not adversely affect Hydro One's existing services to its customers; and
- registration in the WPPI program queue for the federal funding administered by NRCan.

With this material in hand, Chinodin sold their project to Canadian Hydro in early 2004. Upon acquisition, Canadian Hydro officially titled the project the *Melancthon Grey Wind Project*. It is by this title, Melancthon Grey Wind Project, that the Project is now known locally, provincially, and federally.

1.4 PROJECT LOCATION

Phase I (i.e., 75 MW) of the Project is situated within Melancthon Township, Dufferin County, Province of Ontario. A more complete description of the Project follows in **section 2**. The wind turbine component of the Project is scattered over an area of approximately 3,511 hectares, generally centred on Dufferin County Road 17. The study area for the power line, required to tie the electricity generated by the wind turbines into the provincial grid, encompasses parts of Melancthon and Amaranth Townships, Dufferin County and an area of approximately 10,498 hectares (**Figure 1.1**). The general latitude and longitude coordinates (NAD 83) for the Project study area, including both wind turbine and power line components, are:

Northern Point

latitude: N 44° 7' 8.9"
longitude: W 80° 17' 0.6"

Northeastern Point

latitude: N 44° 5' 51.2"
longitude: W 80° 14' 34.8"

Southeastern Point

latitude: N 43° 56' 2.2"
longitude: W 80° 13' 14.7"

Southwestern Point

latitude: N 43° 54' 58.6"
longitude: W 80° 20' 11"

Western Point

latitude: N 44° 3' 4.1"
longitude: W 80° 20' 12.6"

[3] The IESO was formally known as the IMO (Independent Electricity Market Operator).

Figure 1.1 Project Location and Study Area

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1.5 ESTIMATED CAPACITY OF WIND FARM

Canadian Hydro believes that the Townships of Melancthon and Grey Highlands have proven potential for electricity generated by the wind. However, given the large land area involved within the Townships, and the provincial government's first Request for Proposals ("RFP") for 300 MW of renewable power, Canadian Hydro decided to undertake the Project in up to four phases as discussed below.

1.5.1 Total Project: 240 MW of Renewable Energy

In order for a wind farm to effectively generate electricity, it is critical that the turbines are located in windy locations. The strong winds that blow across the Townships of Melancthon and Grey Highlands provide excellent potential for wind power generation and make this area particularly suitable for the installation of a 240 MW wind farm. Assuming a turbine rating of 1.5 MW each, a total of 160 turbines could be installed. The four phases of the Project could eventually cover the land area generally defined by the Melancthon – Mulmur Town Line, Amaranth Side Road 30 to the south, the westerly Township boundaries of Melancthon and Grey Highlands, and Highway 4 to the north (**Figure1.2**).

However, at this time, the Project is focused on the construction and operation of 75 MW (50, 1.5 MW turbines – see **section 1.5.2**) dispersed over an area of approximately 3,511 hectares, in the south-western quadrant of Melancthon Township (**Figure 1.1**).

As Ontario's electricity market evolves, it is possible that the Project could be expanded to include an additional 165 MW of renewable energy in the Township of Melancthon and/or the Township of Grey Highlands. To a large extent, the future steps and schedule of the Government of Ontario in meeting its 2007 and 2010 renewable energy targets will drive the final configuration and output of the Project. Depending upon the Government of Ontario's future requirements, the Project could be: i) expanded in one large, two medium, or three smaller phases to a total capacity of 240 MW; and/or ii) contained entirely within Melancthon Township or dispersed between the Townships of Melancthon Grey Highlands.

1.5.2 Phase I: 75 MW of Renewable Energy

Fifty, 1.5 MW General Electric model sle wind turbines will generate an estimated 180,000 MWh per year of renewable energy. General Electric's Wind Energy Division ("GE") will supply the wind turbines to Canadian Hydro; the total anticipated capital cost for 75 MW is $130 million. Construction of the Project is scheduled to commence in April 2005, with a targeted in-service date of December 2005, but no later than 31 March 2006 to meet the WPPI funding requirements.

1.6 CONSTRUCTION SCHEDULE

The construction schedule and key milestones in the development of the Project include:

- initiate preliminary engineering – April 2004
- post Notice of Commencement and begin Environmental Screening Process ("ESP") – May 2004
- submit ESP Statement of Completion – March 2005
- complete provincial and federal environmental assessment processes – March 2005
- obtain Official Plan and Zoning By-Law Amendments – April 2005
- obtain other project approvals – March and April 2005
- initiate construction – April 2005

- complete construction activities – December 2005
- start of commercial operations – December 2005.

1.7 NRCAN'S INVOLVEMENT IN THE PROJECT

Based upon the proposed 75 MW, and the Renewable Energy bid to the Ontario Ministry of Energy, the total requested incentive funding over the ten year period (2006 – 2016) is estimated to be CDN$17,721,300. Since Canadian Hydro has applied for WPPI funding, NRCan has been identified as the Responsible Authority ("RA") under the *Canadian Environmental Assessment Act* ("CEAA"). The NRCan contact person for the Project has been:

Jean-Philippe Croteau and Curtis Lockett
Environmental Managers
Natural Resources Canada
580 Booth Street
Ottawa, Ontario
K1A 0E4

1.8 FEDERAL AND PROVINCIAL AGENCIES INVOLVED IN THE ENVIRONMENTAL SCREENING

The Project is subject to both provincial and federal environmental assessment requirements. Consequently, multiple agencies were contacted as part of the Project works; key agencies are listed below:

Federal

- NRCan
- Canadian Environmental Assessment Agency ("CEA Agency")
- Environment Canada ("EC") / Canadian Wildlife Service ("CWS")
- Health Canada ("HC")
- Department of Fisheries and Oceans ("DFO")
- Transport Canada ("TC")

Provincial

- Ministry of the Environment ("MOE") – West Central Area
- Ministry of Natural Resources ("OMNR") – Midhurst District
- Ministry of Agriculture and Food ("OMAF") – Agricultural Land-Use Unit
- Ministry of Transportation Ontario ("MTO") – Planning & Design Section
- Ministry of Municipal Affairs ("MMA") – Municipal Services Office
- Ministry of Culture – Southwest Region

Conservation Authorities

- Grand River Conservation Authority ("GRCA")
- Maitland Valley Conservation Authority ("MVCA")
- Nottawasaga Valley Conservation Authority ("NVCA")
- Saugeen Valley Conservation Authority ("SVCA").

Figure 1.2 Possible Four Phased Project

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1.9 PROJECT NEED, DISADVANTAGES, AND ADVANTAGES

1.9.1 Project Need

The need for new, renewable electricity generation capacity within the Province of Ontario is fully documented in the IESO's document entitled: *10-Year Outlook: An Assessment of the Adequacy of Generation and Transmission Facilities to Meet Future Electricity Needs in Ontario, From January 2005 to December 2014* (http://www.theimo.com/imoweb/monthsYears/monthsAhead.asp). This report (March 2004) outlines the significant challenges over the next ten years, concluding, "new transmission, supply, and demand side initiatives are urgently needed to address this gap [i.e., severe electricity shortfall] and secure Ontario's energy future".

In response to the predicted electricity shortfalls, and after reviewing various power generation alternatives, the Government of Ontario, through the Ministry of Energy on 24 June 2004, released a Renewable Energy Request for Proposals ("Renewables RFP"). The Renewables RFP contained provisions for the supply of approximately 300 MW of capacity from new, renewable generating facilities as soon as practicable, but no later than 31 December 2007. In addition, the Ontario Government released an RFP on 25 June 2004 for 2,500 MW of clean generation (including demand side management) and requested electricity generation proposals of at least 5 MW through a process other than burning coal or oil as a primary fuel.

In addition to these alternatives to electricity generation, Canadian Hydro considered alternatives methods of carrying out the Project in terms of design and rationale for selecting the preferred design. Consideration of alternative Project methods is discussed in **Appendix B**. Alternative alignments for the 34.5 kV main power line and sites for the 230 kV substation are discussed in **section 2.3**.

Phase I of the Project will provide up to 75 MW of renewable electricity as part of the 300 MW Renewables RFP process and is considered a new renewable generating facility. On an annual basis, this amount of energy is sufficient to satisfy the electricity needs of approximately 25,000 average Ontario homes; helping the Government of Ontario to address the predicted electricity shortfalls.

1.9.2 Project Disadvantages

As required under the Environmental Screening Process, the ESR must review the overall environmental advantages and disadvantages of the Project. **Sections 1.9.3** and **1.9.4** deal with the advantages of the Project and benefits of wind energy that offset any potentially adverse environmental effects, while the disadvantages are highlighted in this section.

Just about every human activity has the ability to positively or negatively affect the environment; the same is true for electricity generation. Since the mid-twentieth century electricity has been an essential part of human life; electricity powers our appliances, office equipment, heats our homes, and assists in refining the fuels that power vehicles and machinery. Indeed, the use of electricity is something that many take for granted.

While it is true that in comparison to other forms of electricity generation, electricity generated from wind power is relatively benign, there are some real and perceived disadvantages, which include:

- a small amount of agricultural land is taken out of production over the Project's lifecycle
- there is potential to kill a limited number of birds (<2 birds/turbine/year)
- new sources of sound have been added to the environment

- there is potential for public safety issues related to ice throw and catastrophic failure (i.e., collapse) of the structures
- the viewscape will be changed for the Project's lifecycle (some argue that this is a positive change)
- it has been claimed, but not demonstrated, that property values will be adversely affected within the viewshed
- electric and magnetic fields from the Project are perceived by some people to have adverse health effects.

Additional information on the real and perceived disadvantages of the Project is provided in **section 7**. As appropriate, **section 7** also outlines the protective and mitigative measures recommended to avoid, minimize, and/or offset any potentially adverse environmental effects.

1.9.3 Project Advantages

The advantages/benefits of the Project include:

- *construction phase will have significant economic benefits:* the construction of 50 wind turbines will create a peak labour force of about 70 to 80 full and part-time employment positions with average labour force of roughly 30 to 40 persons. The construction phase will generate expenditures of about $17 – 18 million, including locally purchased goods and services.
- *operation phase will provide annual economic benefits:* wind farm operations will require roughly six full time operation and maintenance staff and about six secondary jobs (e.g., snow removal and road work). It is anticipated that operations and maintenance costs for the Project will be approximately $2 million annually.
- *property tax revenues will increase:* development of Phase I is expected to increase property tax revenues collected in Melancthon Township by approximately $600,000 annually – an increase of roughly 20% ($3 million tax base) to 30% ($2 million tax base) over current property tax revenues – with limited demand for municipal services.
- *secondary incomes will be created:* for those landowners with an executed LLA and assist in off-setting existing financial burdens, particularly for the subsistence farming community in the area.
- *increased investment into renewable energy:* contributing to the growth and establishment of Ontario's growing wind power industry.
- *no material affect to property values:* based upon the available literature there is no evidence supporting the claim that views of the wind farm will decrease property values.
- *no emissions of green house gases:* every kilowatt hour of clean, emission-free wind energy produced is a kilowatt hour that does not require the burning of fossil fuel.

1.9.4 Benefits of Wind Energy

The numerous benefits of generating electricity from wind energy are well documented. For example, in comparison to other forms of electricity generation, wind energy is:

- "clean" and thus does not produce any air pollution
- renewable, highly reliable, and efficient

- evolving as an economical source of new large-scale electricity generation
- associated with few environmental effects
- assisting in reducing our contributions to global climate change
- part of an overall solution to Ontario's forecasted electricity needs.

1.10 KEY CONCLUSIONS OF ESR

This ESR has been completed to assist Canadian Hydro in fulfilling the various regulatory requirements as mandated by provincial and federal government agencies for the development of the Melancthon Grey Wind Project. Specifically, this ESR is consistent with the provisions of Ontario Regulation 116/01 for a Category B Project and with the applicable NRCan and CEAA requirements. An interdisciplinary team of impact assessment specialists, using best practice principles (e.g., quantitative and qualitative analytical techniques), completed this ESR.

Field and analytical studies have been carried out during the ESR to fulfill data gaps and assist in the determination of potential effects associated with construction, operation, and decommissioning of the Project. As a result, various protection and mitigation measures have been identified to manage potentially adverse environmental effects. A project follow-up and monitoring program was also developed.

A comprehensive stakeholder consultation and information disclosure program identified key issues of interest to the local community and various government agencies. Based upon detailed analyses of the interests identified through the program, coupled with those recognized by the project team through the MOE's Environmental Screening Criteria Checklist (**Appendix I**), NRCan's scope of work (**Appendix A2**), and section 16 of the CEAA, the Project is not likely to cause important environmental effects, taking into account the implementation of appropriate protection and mitigation measures.

Further, potentially significant adverse environmental effects have been avoided through careful site selection, following good environmental assessment and planning principles, and adherence to regulatory requirements. The Project is located in a rural, agricultural area where it will not interfere with the existing natural features and has been sited in such a way as to minimize effects to agricultural operations. All potentially net adverse effects that could not be avoided by siting or through regulation can be effectively mitigated using proven, industry accepted methods and technologies. No significant net adverse environmental effects are expected.

As demonstrated above, the overall conclusion of the ESR is that the Project can be constructed, operated, and decommissioned in such a manner as to minimize potentially adverse effects on the environment, whilst enhancing the positive effects both locally and provincially. In particular, migratory bird deaths due to collision with the turbines are anticipated to be negligible given the absence of known migratory flight paths in the study area. Effects to breeding bird habitat have been minimized through siting initiatives and the mitigation measures proposed in **section 7**.**10**. Environmental noise levels at surrounding receptors are predicted to be within the applicable MOE noise criteria (**section 7.8**). Finally, published documentation has shown that there will be no negative effect on property values within the viewshed of the turbines (**section 7.5**).

Significant net positive environmental effects are expected to result from development of the Project. Of note, the Project benefits include the provision of up to 75 MW of clean renewable electricity, increased investment into renewable energy, increase municipal tax revenue with limited demand for municipal services, and no emission of green house gases. Economic benefits during the construction phase include increased local hiring and procurement of local goods and services. The operation phase should

provide annual economic benefits including potential employment opportunities for roughly six full time operation and maintenance staff and about six secondary jobs (e.g., snow removal and road work).

1.11 AUTHOR AND TEAM OF THE ESR

As per good environmental assessment practices, this ESR has been prepared by an independent, multidisciplinary team of professionals led by Stantec Consulting Ltd. ("Stantec"). Stantec has extensive experience preparing environmental reports for power projects in Ontario and worldwide. **Table 1.1** shows the key ESR consultancy team, followed by general contact information for Stantec who was the primary author of the ESR.

Table 1.1 ESR Consultancies and Primary Roles

Consultancy	Primary Role
Stantec	ESR author and environmental resources specialists
Aercoustics Engineering Ltd.	Environmental noise specialists
AMEC	Electrical interconnect specialists
Archaeologists Inc.	Cultural and historic resource specialists
Bousfields Inc.	Municipal planning specialists
Chinodin Wind Power	Industry, business and wind development specialists
Hélimax Énergie Inc.	Wind power production and environmental noise specialists

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2 PROJECT DESCRIPTION

2.1 ENVIRONMENTAL SETTING

The study area (**Figure 1.1**) is located within the Dundalk Upland Climatic Region which experiences colder than average temperatures, a reduced growing season, and receives fewer heat units than the South Slopes Climatic Region to the south (Brown et al., 1974). Additionally, due to the elevation of the uplands, the Dundalk Upland Climatic Region has cooler temperatures, reduced heat units, and a shorter growing season than areas further north adjacent to Georgian Bay (e.g., Collingwood and Owen Sound). Cooler climates and a reduced growing season results in limitations to the types of crops that can be produced within the area.

The Dundalk Till Plain physiographic region encompasses the study area (Chapman and Putnam, 1984). This area consists of a gently undulating till plain containing swamps or bogs and poorly drained depressions, including the Luther Marsh in the Townships of East and West Luther. The headwaters of the Saugeen, Maitland, Grand, and Boyne Rivers are within the Dundalk Till plain. The physiography of the area is variable in terrain and parent materials due to formative glacial processes (e.g., deposition from glacial meltwaters) and variability of topography associated with the drumlinized till plain physiography occupying the majority of the study area. Underlying bedrock in the area is Silurian dolomite of the Guelph formation (Chapman and Putnam, 1984).

Distribution of the individual soil types within the study area is quite variable (Soils of Dufferin County, 1964). All of the soils identified within the study area are widely disbursed with no significant areas of consistent soil type. The soils within the study area exhibit variable soil drainage characteristics consistent with the physiography of the area. Soil parent materials are dominantly glacial till. Soils developed from lacustrine and outwash parent materials are not extensive and generally occur as inclusions within the surrounding till materials.

Review of aerial photography for the study area indicates that the agricultural land-use pattern closely follows the soils distribution identified in the County-level mapping (Soils of Dufferin County, 1964). Forest cover in the study area are generally located within regions identified as “muck” in the county soils mapping, while actively farmed and recently idle areas are located on higher capability mineral soils.

Melancthon Township demonstrates good agricultural potential as more than 80% of the land base is Canada Land Inventory (“CLI”) Class 1, 2, or 3 soils. Melancthon also contains the greatest area of farmland in Dufferin County. Most of Melancthon Township’s farmland is cropped, although the Township contains a diversity of farm types; beef farms and field crop farms are the most dominant.

The study area is located within the Great Lakes Forest Region’s Huron-Ontario Section (Rowe, 1972). Natural upland forest cover is generally dominated by sugar maple, American beech, basswood, white ash, white oak, bur oak, eastern hemlock, yellow birch, and eastern white pine. Forests of silver maple, white elm, red elm, black ash, and eastern white cedar generally develop in lowland areas. Because of the elevation of this region, and a climate harsher than in the surrounding regions, there are northern forests affinities in certain types of communities; particularly those located in cooler-than-normal microclimatic locations (e.g., lowlands). These are demonstrated by the presence of white and black spruce, tamarack, and balsam fir.

The northern half of the Dundalk Till Plain forms the Headwaters Ecoregion of the Grand River Watershed. Despite the CLI classification, generally poor drainage and climate limit agricultural productivity in this Ecoregion and most of the original forest cover was cleared during the last century for agriculture and urbanization. However, the Ecoregion still retains an above average forest cover of 21% and 4% wetland cover in comparison to other areas in southern Ontario.

In terms of employment, manufacturing is the largest industry in Melancthon Township, employing about 21.9% of the workforce. Jobs in agriculture employ about 10% of the Township's workforce. Family incomes in Melancthon and Dufferin County are less than the provincial average, although they are more evenly distributed.

The number of farms in Melancthon Township is slowly declining, however, the remaining farms are getting larger. Most of the farms in Melancthon Township are operated as sole proprietor operations, and implement crop rotation and permanent grass cover as their primary soil conservation practices. On average, capital investment per farm in the Township is just over $791,000 (Census of Canada, 2001).

Agriculture appears to be an economically-viable industry in Melancthon Township, although net revenues are lower than the provincial average. Melancthon Township is one of the stronger agricultural townships in Dufferin County, with farm gate sales ($23.5 million), sales per farm ($142,760), and sales per acre ($498) (Census of Canada, 2001), which are the highest of any township in Dufferin County. On average, net revenue per farm in Melancthon Township was just over $9,400 as of the most recent census (Statistics Canada, 2001). Although this amount is lower than the provincial average, it is higher than the average net revenue at the County level and in some adjacent townships where negative net revenue was recorded over the same time period.

The Stage I Archaeological Assessment completed for the Project has shown the study area to have potential for the presence of archaeological sites. The limited influx of early European settlers to the study area by 1880 may have been the result of the area's short growing season and poor drainage. These factors would have theoretically inhibited substantial sedentary settlements as characterized during the Precontact Woodland periods. The study area does, however, contain areas that could support complex crops and these areas have potential for Indigenous Woodlands peoples who were involved in agricultural production.

Poor soil and drainage would not have affected the activities of Indigenous hunter-gatherers. During the last twelve thousand years this area of the province was likely inhabited by bands of hunter-gatherers who lived off the resources of the landscape. They may have left behind small traces of their activities such as campsites, quarry sites, and seasonal hunting sites with caches of artefacts. Rivers, streams, even small swampy areas attracted game resources and consequently it attracted early inhabitants who harvested these resources. The presence of the Grand River, within close proximity to the study area, and its tributaries that run though the study area, would have facilitated hunters to harvest the resources that lived in or were drawn to the water.

The presence of the protection area Niagara Escarpment, located approximately 6 kilometres form the study area, would have also drawn Indigenous peoples from all over Ontario to procure stone. The raw material present in the escarpment has been found in tool manufacturing on archaeological sites all over Ontario. The stone tools made from these "chert" sources gathered from the escarpment have been dated to as early as 9,500 B.C.

Detailed information regarding environmental features and baseline conditions within the study area, examined as part of the ESR, is presented in the technical appendices contained in **Appendix C**. **Figures 2.1** and **2.2** show the key environmental features identified within the study area.

Figure 2.1 Environmental Features (Part I)

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Figure 2.2 Environmental Features (Part II)

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2.2 LIFECYCLE OVERVIEW

2.2.1 How Wind Energy Is Produced

Wind turbines capture the kinetic energy in surface winds and convert it into electrical energy in the form of electricity. To do this, in addition to the tower, they use three basic parts: blades, a shaft, and a generator. As wind moves over the turbine's blades it causes "lift"; the same effect used by airplane wings. Lift makes the blades rotate and the moving blades turn a shaft. The turning shaft creates a magnetic field in the generator, which in turn produces electricity. A typical turbine structure is shown in **Figure 2.3**. .

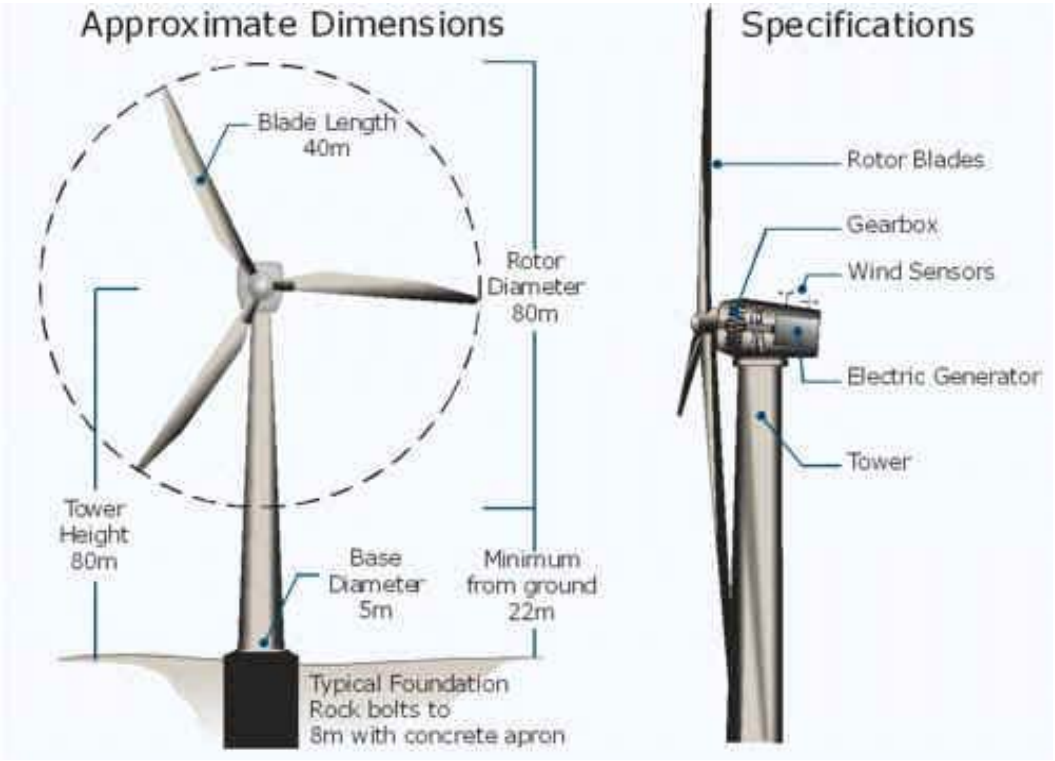

Figure 2.3 Typical Turbine Structure

2.2.2 Key Project Components

The basic components of the Project include 50 wind turbines with a corresponding total installed capacity of 75 MW, 50 step-up transformers (i.e., converting 575 V to 34.5 kV) positioned immediately adjacent to each turbine, a 34.5 kV underground and aboveground electrical line gathering system, roughly 16 km of 34.5 kV of overhead power line, a substation (i.e., converting 34.5 kV to 230 kV), and a maintenance shop/control building **(Figure 2.4 and Figure 2.6)**.

2.2.2.1 Wind Turbines

The wind turbines consist of the supporting tower, tower foundation, rotor blades, and gearbox/electrical generator housing (the "nacelle"). The GE 1.5 MW sle model turbines procured for the Project are horizontal-axis turbines with three bladed upwind rotors, a rotor diameter of 77 metres, and a hub height (i.e., centre height) of 80 metres. **Table 2.1** presents the general specifications of the wind turbine as provided by GE. The components of the GE 1.5 MW sle model turbines will be manufactured in the following locations:

- towers: Cap de la Madeleine, Quebec, Canada
- nacelles and hubs: Pensacola, Florida, USA
- blades: Grand Forks, North Dakota, USA
- controllers: Tehachapi, California, USA.

Table 2.1 Turbine Description – GE Wind Energy 1.5sle

Operating Data	Specification
General	
• Rated capacity (kW)	1,500
• Cut-in wind speed (m/s)	3.5
• Cut-out wind speed (m/s)	25
• Rated wind speed (m/s)	12
Rotor	
• Blade type	Composite
• Number of rotor blades	3
• Rotor diameter (m)	77
• Swept area (m^2)	4,657
• Rotor speed (rpm)	10.1 – 20.4 (variable)
Tower	
• Hub height (m)	80
Power Control	Active blade pitch control
Power Train	Indirect through gearbox
• Gearbox	Three step planetary spur gear system

Each tower will be 80 metres in height to the nacelle, while the length of each rotor blade will be 37 metres (total blade diameter of 77 metres including the rotor). The nacelle includes the gearbox and electric generator, as well as blade and turbine control equipment, wind speed and direction sensing equipment, and cooling equipment. Based upon the local wind regime, and technical specifications of the GE 1.5 MW sle model turbines, the blades are expected to rotate at an average speed of 10 to 20 revolutions per minute.

The tower will require the construction of a poured in place concrete foundation. Specifications of the GE turbines can be found in **Appendix D**. The permanent/operational land base required for each turbine, excluding the access road, is approximately 0.4 acres (i.e., 0.25 acre excavation, 0.15 acre maintenance clearing). **Figure 2.5** provides a general overview of the temporary/construction land base requirements.

Figure 2.4 Project Layout

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Figure 2.5 Typical Wind Turbine Layout Construction Plan

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Figure 2.6 Alternative Power Line Routes

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2.2.2.2 Ancillary Facilities

Each wind turbine will require several ancillary facilities including: access road, above/below ground electrical gathering system, and a pad mounted step-up transformer. Access roads will be required to access each turbine site from existing public roads during both the construction and operation phases of the Project. Construction access roads will be approximately seven to 14 meters wide, while operation and maintenance roads will be roughly four to six meters wide.

Along the construction access roads, and at the landowner's preference, topsoil will be stripped, temporarily stored, and used to rehabilitate lands affected by construction. A gravel base, up to one metre deep, will be installed to facilitate the movement of heavy construction equipment (**Appendix E**). The location of the access roads has been determined based upon turbine locations, accessibility of equipment to adjacent sites, and consultations with the affected landowner, with a view to minimizing effects on agricultural operations.

A step-up transformer will be required for each turbine, located at the base of the turbine, to transform the electricity created in the nacelle to a standard operating power line voltage (i.e., 575 V to 34.5 kV). The step-up transformer structure will be approximately two metres by two metres in size. From each step-up transformer, 34.5 kV underground and/or aboveground gathering lines will transmit the electricity to the main 34.5 kV line enroute to a 34.5/230 kV substation located in Amaranth Township.

The main 34.5 kV line will consist of three-circuits of overhead power lines that will carry the electricity towards the interconnection point with the existing Hydro One Networks Inc. ("Hydro One") grid. At the grid interconnection point, a 34.5/230 kV substation will be required. The short transmission line will connect the Project to Hydro One's existing 230 kV transmission lines (i.e., B4V and/or B5V) that run between the Bruce Nuclear Generating Station and the Orangeville Transformer Station.

2.2.3 Overview of Key Project Activities

A description of the key construction, operation, and decommissioning phases of the Project are provided in **Table 2.2.**

Table 2.2 Description of Key Project Activities

Construction	*Turbine Sites* • construction of access roads • delineation of temporary work areas • completion of necessary site grading • installation of tower foundations • tower/turbine erection • installation of transformer and required wiring • remediation of temporary work areas • site landscaping (final grading, topsoil replacement, etc.). *Collector Lines* • installation of underground and aboveground collector lines parallel to access roads and property lines. *Main Power Line and Substation* • installation of wooden power line poles within existing municipal road right-of-ways • stringing and installation of the power line • construction of the required substation • connection of power line to the provincial grid	• Off-site land-use requirements may include temporary work areas and construction within existing municipal road right-of-ways

Table 2.2 Description of Key Project Activities		
Operation	*Turbine Sites* • Periodic pick up truck access for maintenance • remote condition monitoring • meter calibrations • grounds keeping *Collector Lines* • intermittent maintenance typically carried out from LLA area and/or municipal easement agreements • power line and substation upkeep • visual survey of condition of poles and lines annually • tree trimming as required and approved by the Townships/Hydro One • inspection, testing, and maintenance of electrical equipment and services at substation	• no off-site land-uses are anticipated during the operation of the Project
Decommissioning	*Turbine Sites* • removal of tower and turbine infrastructure • removal of transformer • turbine site grading (dependent upon new proposed use) *Collector Lines* • collector line excavation and removal *Power Line and Substation* • removal of power line wires • removal of wooden poles • removal of substation • site grading (dependent upon new proposed use)	• expected life of the turbines is 40 years, after which decommissioning or re-powering of the turbines will be considered.

2.2.4 Construction Phase

A construction and Environmental Management Plan will be designed by Canadian Hydro to minimize potential for adverse environmental effects, while enhancing the Project's benefits. As part of the construction program, good site practices and procedures will be implemented to further reduce the environmental effects identified in this ESR. These practices may include specifications regarding disposal of excavated material, sediment control, dust control, soil compaction control, and local hiring. In addition, Canadian Hydro staff and contractors will be made aware of the environmental commitments contained in this ESR to ensure the commitments are implemented.

Site construction activities leading up to Project operation are anticipated to take approximately eight to twelve months, beginning in April 2005. Approximately 75 percent of the peak labour force may be supplied through local and neighbouring communities. Consequently, no special housing, healthcare, or food facilities will be required as part of the Project's activities.

Construction activities will result in an increase in traffic on local and regional roads leading to the turbine sites. Contractors and employees working at the sites will also contribute to increased traffic along local roads. Any adverse effects to local roads and traffic conditions are expected to be short-lived (i.e., less than one year) and do not require any special mitigative measures outside those discussed in **section 7**.

2.2.4.1 Resource/Material Requirements

The production processes used at the Project include the generation of electricity as harnessed from the renewable wind resource present in the area. The Project's raw materials will consist of standard building materials for construction including concrete, wood, aggregate, wiring and cables, and metal. To the extent possible, these materials will be procured locally where they are available in sufficient quality and quantity and at competitive prices.

Beyond the materials required for construction of the Project structures, resource requirements for ongoing operation of the Project include the existing, renewable wind resource and the land-base required for the turbine locations, road maintenance, turbine maintenance, and electrical line and substation maintenance.

Excavation and fill requirements for the Project will include subsurface excavations for turbine foundations, crane pads, access roads, step-up transformers and substation, as well as excavation for the installation of below ground gathering lines, and installation of wooden power line poles.

Fill will be required for the installation of access roads to the turbine sites, construction of crane pads, as well as for turbine foundation installation and site grading. The amount of fill material added or removed during construction of the Project will be determined following additional geotechnical investigations and site-specific design/layout works. Limited additional fill or excavation works are anticipated during the operation of the Project.

Hazardous materials to be used during the course of the Project are limited to common fuels and lubricants that will be on-site for use in equipment during the construction phase, as well as the use of lubricants and fluids for the operation and maintenance of the turbines, transformers, substation, and maintenance vehicles. There are no other known hazardous by-products of the wind energy generation process itself.

2.2.4.2 Surveying and Siting

To date, environmental surveying activities (e.g., vegetation and avian surveys) have been conducted on foot, at a site/area-specific level. Prior to construction, a registered Ontario Land Surveyor will survey all access road, gathering and power line, and turbine locations as appropriate. Any temporary work locations will also be surveyed to ensure construction vehicles and personnel stay within the demarcated areas.

Preliminary geotechnical works have been undertaken using an all-terrain drilling rig. However, additional studies will be undertaken in February 2005, to confirm site-specific conditions at each of the proposed turbine locations. This information will be used to determine the suitability of each site for turbine construction as well as for designing an appropriate style of foundation for each turbine.

A Stage II Archaeological Assessment will be conducted in the spring of 2005 on lands directly affected by construction and/or operation activities. Consistent with provincial requirements, this will include select pit and shovel testing along access roads and at the turbine sites. The results of this survey will be presented to the Ontario Ministry of Culture for review and comment. Pending the result of the Stage II Assessment (i.e., any resources identified), a licensed archaeologist may be present on-site to monitor construction activities in high potential archaeological resource areas.

The location of artificial tile drainage and associated drains has been determined in conjunction with each landowner. During the construction phase, drainage tile will be severed, capped, and/or new header tiles installed as appropriate. Where necessary, this work will be surveyed and undertaken by a licensed drainage contractor.

The general siting process of selecting the Project area within Melancthon Township was conducted by Chinodin. This work was undertaken using 50 metre guyed instrument towers equipped with approved anemometers, wind direction indicators, and temperature gauges. Data from the equipment was recorded in a battery powered data logger at the base of each tower for a combined period of approximately 24 months. No communications or power lines were required to facilitate data collection. Road access to the measuring towers was via existing farm roads.

Canadian Hydro, along with their team of environmental specialists and landowners with LLAs, conducted the detailed siting process of positioning the individual turbines and ancillary facilities. From a technical perspective, the detailed siting process has involved, among other items, completion of detailed environmental studies (e.g., avian and terrestrial), environmental noise modelling, wind energy and wake loss modelling, visual simulation studies, and electrical interconnection models.

2.2.4.3 Access Road Construction

Wherever possible, Canadian Hydro will use existing roadways, farm lanes, and accesses to reach the construction site for the turbines. This will also include upgrades (e.g., road widening and strengthening) to existing municipal roads. However, where access is not available, or not of a standard to support construction and transportation vehicles, new access roads will have to be constructed. Where possible, access has been planned in parallel with property boundaries to reduce the interaction with the drainage tiles and farm operations.

At the preference of the landowner the topsoil will be stripped and either stockpiled or removed. The subsoil will then be removed, and will be used to in-fill any hollows on-site, or removed to other locations. The depth of the roadbed will be approximately 0.50 – 1.0 m. The base will consist of roughly 0.40 m of coarse gravel or stone, topped with 0.10 m of crushed gravel. The road will be 12 to 14 m wide, but potentially wider where turning of large construction vehicles (e.g., transport trucks delivery blades, towers, and nacelles) is required. Based upon the preliminary geotechnical studies, the excavation for the roadbed is expected to be above the water table at all times of the year. Load bearing targets for the largest equipment will be in the range of 100 to 150kPa.

The road construction for each turbine will take about five to six days depending upon location and will utilize one to two backhoes, several dump trucks and compaction equipment.

Dependant on landowner preferences and upon completion of turbine erection and commissioning, the construction access roads will either be left as is or reduced in width to about 5 m.

2.2.4.4 Foundation Construction

Generally, the foundations for the turbines will be a raft style, made of poured in place reinforced concrete. As noted above, selection of the final foundation design will be determined based upon the site-specific geotechnical assessment to be carried out in the first quarter of 2005. The foundation is expected to be octagonal in shape with a diameter of approximately 15 to 17 m. The foundation is anticipated to be about 1.0 to 1.5 m thick.

The turbine tower base is approximately 4.3m in diameter and is anchored to the concrete foundation using 138 large diameter anchor bolts. The excavation of the foundation will be by an excavator and truck. Subsoil will be moved and used to in-fill any hollows on-site and/or removed from the site. The foundation itself is then back filled and compacted with select fill and subsoil. Disturbed areas adjacent to the turbine work area will be re-seeded with the existing crop as appropriate.

Ready mix trucks will be used to transport the concrete to the site. Approximately 45 truck trips will be required per foundation. The excavation will take approximately two to three days. Construction of each foundation (formwork, rebar placement and concrete pour will be completed within a week. The foundation then needs to cure for 14 to 21 days prior to erection of the turbine.

2.2.4.5 Turbine Assembly

The turbine consists of an 80 m steel tower, three 37 m blades, the nacelle, rotor hub, and transformer. The tower will be delivered to the site in three sections and is assembled using a heavy-lift crawler crane (e.g., CC2600 or CC2800). The nacelle arrives on-site assembled and is lifted into place by the heavy-lift crane. The rotor hub consists of the nose cone and the three blades, and is hoisted into place by two cranes: a large crawler crane does the heavy lifting, while a smaller crane stabilizes the component as it is being lifted.

The blades will be delivered on an oversize vehicle roughly 45 m long, the nacelle on an oversized vehicle approximately 35 m long, and the towers on an oversized vehicle of sufficient to carry the respective sections. Delivery of these main turbine components will involve up to seven oversized vehicles per site: one to move the nacelle, two or three to move the blades (depending upon whether or not two blades can be shipped per truck), and three to transport the tower sections.

Two crawler cranes will be employed to facilitate the expeditious Project schedule and achieve the WPPI in-service date requirements. These cranes, due to their size and weight, will arrive in multiple pieces. For example, each crane will be shipped in individual pieces, requiring 20 to 35 individual transports, and then assembled on-site.

The assembly of the turbine takes 3 to 5 days depending on wind conditions since the cranes cannot operate in high winds. In addition to the cranes, there will be an assortment of flatbed trucks and specialty trucks to deliver both the smaller cranes and the remaining turbine components (e.g., cabling and fencing).

2.2.4.6 Electrical Line Construction

Below and above ground 34.5 kV gathering lines will connect the individual step-up transformers to the main 34.5 kV power line, which in turn will transmit the electricity to the 34.5/230 kV substation in Amaranth Township. Where the gathering lines are proposed below ground, the lines will be excavated to a depth of approximately 1.5 m and a width of approximately 1 m using an excavator to create the trench. The cable is then dropped into the trench from a spool pulled by a truck. The material removed from the trench will be used as backfill in the trench.

Above ground gathering lines will be strung on wooden poles and constructed in a similar manner as the main power line discussed below. To the greatest extent possible, collector cables will be positioned alongside access roads, thus minimizing the potential for interference with agricultural drainage tiles and tillage patterns. Where drains are encountered and severed they will be repaired temporarily until such time as the trench is backfilled and permanent repairs can be affected.

Approximately 16 km of above ground power line will carry the electricity generated by the Project to the Hydro One interconnection location. This power line will be strung on wooden poles along the proposed route shown in **Figure 2.6**. The power line will be strung within existing road rights-of-way (“ROW”) with work conducted from the existing road area.

Equipment used may include a tandem truck pole carrier equipped with an integral crane, a truck or track mounted pole auger, and a backhoe or track mounted excavator. The poles will be delivered to predetermined locations. Post insulators will be installed and piles will be set into holes augured to a depth of approximately two to three metres. The poles will then be plumbed, backfilled, and stabilized with guys as appropriate. The power lines are then strung using reel trailers and tensioning machines.

2.2.4.7 Step-Up Transformer Construction

The step-up transformers used to transform the energy generated by the turbines into the electricity to be delivered to the grid will be a three-phase, pad mount transformer. The step-up transformer is mounted on a concrete pad adjacent to the turbine tower. Approximate dimensions of the transformer are 1.5 m tall, 2 m long, and 2 m wide. Cables will run under and/or above ground from the step-up transformer to the main 34.5 kV power line. Construction activities are as described above for the other Project components.

2.2.4.8 Substation Construction

The 34.5/230kV substation will be located approximately 16 km south of the turbine area. The substation yard will be excavated to allow construction of concrete foundations and installation of substation gravel. An electrical grounding grid will be installed throughout the yard in the gravel fill to which the substation equipment will be grounded. Transformers and other substation structures will be installed on the foundations and electrically connected to the incoming 34.5 kV overhead power line and the outgoing 230 kV transmission line. A 1.8 m high chain link fence will enclose the substation yard and be equipped with a vehicle gate to allow for maintenance access.

2.2.4.9 Maintenance Shop / Control Building

A maintenance shop/control building will be constructed for the Project to provide: i) space for storage of spare parts; ii) room for maintenance of vehicles and small project components; and iii) accommodate the needs for staff for monitoring and control of the wind farm. Equipment and working space for Project control functions will be contained in a separate room, complete with washroom facilities, in the building. The maintenance and storage areas will occupy a common area and, as appropriate, potentially hazardous materials will be located in areas with secondary containment.

An overhead crane may be installed in the maintenance shop to assist in maintenance work and handling of heavy components. Building construction and finishes will be chosen to be compatible with the rural setting of the Project and other buildings in the area. This structure will be located within the wind farm area.

To support these facilities a water well, with drinking water treatment system if required, and septic system will be installed. These systems will be designed to normal rural farm specifications for the area as defined by the MOE and/or Township. The septic system will consist of a septic tank, distribution box (or drop box), and absorption field installed in gravel bedding. If a high water table renders a septic system unsuitable, a holding tank will be utilized and pumped out as required by a contracted service.

Drinking water will be provided by either a treatment system for the well water or bottled water (e.g., five gallon bottles with refrigerated cooler). If the well water is suitable a simple filter system with carbon (e.g., for the removal of organic compounds) and fiber (e.g., for the removal of suspended sediment/turbidity) filters combined with an ultraviolet system for sterilization will be utilized.

2.2.4.10 Component Transportation

GE will be responsible for the transportation of all wind turbine components to the Project sites, which includes securing the necessary transportation and safety permits. Once transported to the Project sites, Canadian Hydro will assume responsibility for unloading, which may include obtaining the relevant transportation and safety permits from the municipal authority.

Within the turbine siting area several intersections will require road widening to accommodate the turning radius of the trucks carrying the tower, nacelle, and blades. GE will be responsible for acquiring these permits and where appropriate Canadian Hydro will pay for any temporary or permanent road widening activities within Melancthon Township.

The track-propelled construction cranes, used to erect the tower and blades, weigh approximately 450 tonnes, are about 11 metres wide, and roughly 14 metres long (not accounting for the boom and counter weights). Given the crane size (**Appendix E**), but depending upon the availability and use of crane moving vehicles, key roads within the siting area may have to be widened and structurally enhanced since most, if not all, of the Township roads have not been designed for this type of conveyance. Canadian Hydro would pay for any structural enhancements to roads within Melancthon Township. Once the full road requirements have been finalized, detailed plans will be developed with the Township, County, and Province as appropriate.

2.2.5 Operation and Maintenance Phase

The wind turbines will be operated in a manner consistent with nationally recognized standards for operation of wind turbine facilities in Canada. For the first two years of the Project's life, GE will hire and train technicians to carry out the various operation and maintenance activities associated with the turbines and ancillary facilities. It is envisioned that in year three of the Project's life, these technicians could become Canadian Hydro employees, carrying on with their operation and maintenance duties. Should there be any change over in staff, Canadian Hydro, as one of Canada's first commercial scale wind farm operators, has extensive experience in successfully operating wind turbines.

Normal maintenance on the individual wind turbines occurs twice per year. It involves complete checks of structural soundness, changing of hydraulic and lubricating fluids, etc. Two person teams, for safety reasons, conduct the required maintenance. The expected maintenance time involved is approximately five days per turbine. Extraordinary maintenance occurs infrequently and typically involves the replacement of a major component, such as a gearbox, transformer, or blade. In the event of a major malfunction, a crane may be required to lift the affected component. The first year is expected to have more maintenance time, as the systems are fine-tuned.

The communication system between the turbines and control building will be constructed with a redundant fibre optic line. The control system will also be designed such that no single failure of the Project's major components will diminish the ability of the non-affected components to function, nor prevent the control room operator from monitoring and controlling the turbines.

Devices defined as critical, such as the rotor, generator, gearbox, and cooling system, will be equipped with double redundant protection systems to ensure safe and proper shutdown of the equipment. Controls will be implemented for fail safe action in the event of electrical or instrument losses.

All critical alarms will be hardwired into a remote I/O rack and a serial link established to transmit these alarms to the control building. To add redundancy to the system, these alarms will be duplicated in the digital control system, and may include the following:

- cooling system off-line

- gearbox temperature high
- generator temperature high
- rotors out of alignment
- electrical interconnection severed
- high winds creating shutdown conditions.

2.2.6 Decommissioning Phase

The design life of the Project is estimated to be 40 years, however, it is not uncommon for well-maintained projects to have a longer useful life than the design life. If during its useful life, the Project is no longer required to meet the Province's renewable energy needs, it could be dismantled and transported to another location.

Although no definitive decommissioning plan has been finalized at this stage in the planning process, it is foreseeable that at the end of the Project's useful life, the structures can be dismantled. The steel towers, maintenance shop / control building could be kept to support another wind power generation project, converted to an alternate use, sold to a third party, or dismantled. Dismantling activities for the Project could involve the following works:

- removal of mechanical and electrical equipment
- removal of ancillary facilities
- removal of concrete foundation to a depth that does not interfere with agricultural operations
- demolish remaining site structures
- fill and grade the turbine site with suitable engineered fill
- replace topsoil and cultivate and/or seed as required.

As documented throughout this ESR, the Project has been designed to minimize the risk of contamination during its operational lifespan. Containment and storage areas will limit contamination; any remedial clean-up during the decommissioning or asset transfer will therefore also be limited. Provided the Project is operated and maintained in-line with industry best practices there should be no significant environmental liabilities associated with clean-up or remediation. Regardless of the ultimate outcome, all decommissioning activities will be performed in compliance with the applicable regulations in force at that time.

2.2.7 Future Phases of Project

As noted in **section 1.5.1**, the Project may evolve to include a total generating capacity of 240 MW. Depending upon the Government of Ontario's future renewable energy requirements, the Project could be expanded in one large, two medium, or three smaller phases to the total capacity. Assuming a turbine rating of 1.5 MW each, a total of 160 turbines could be installed.

2.3 POWER LINE ROUTING

Based upon the MOE's categorization of electricity projects as provided in their Guide to Environmental Assessment Requirements for Electricity Projects, 2001 ("EA Guide"), wind turbines greater than or equal to 2 MW are classified as Category B projects and thus subject to approval under the ESP of the *Environmental Assessment Act* ("EAA"). This categorization, coupled with the results of the screening

criteria checklist (**Appendix I**), has led the wind turbines to be assessed as an ESR under Ontario Regulation 116/01.

The power line associated with this Category B project is less than 115 kV and is thus exempt from the ESP as well as from the requirements of the MOE's Class EA for Minor Transmission Facilities. The Amaranth substation at 34.5 kV to 230 kV, however, is considered a Category B project under the ESP. Regardless of the various categorizations of the electrical components, Canadian Hydro sought to utilize a route that was both technically preferable and environmentally sound. As a result, a traditional route selection approach was employed to identify a preferred route for the power line. The methodology took into consideration the end points, environmental constraints and opportunities, and technical considerations. Canadian Hydro also conducted a review of alternative sites for the Amaranth substation.

The environmental effects and mitigation measures for the power lines, substation, and other electrical facilities are addressed in **section 7**. As such, the following subsections discuss the route selection methodology and identification of the preferred power line route and substation location.

2.3.1 Lifecycle Overview

2.3.1.1 Construction

Multiple 34.5 kV lines will connect each turbine to a main 34.5 kV power line that will in turn carry the electricity generated by the turbines to the interconnection point with the existing 230 kV Hydro One maintained grid. The main 34.5 kV power line will consist of three, double circuits fastened on wooden poles and extending for a distance of approximately 16 km to the interconnect. The power line would be strung within existing road ROWs in both Melancthon and Amaranth Townships; construction of the power line and substation is discussed above in **sections 2.2.4.6** and **2.2.4.8**, respectively.

At the interconnection point a 34.5/230 kV substation will be required and a short (i.e., <40 metres) 230 kV power line will connect the substation to the existing 230 kV power line (i.e., B4V) that runs between the Bruce Nuclear Generating Station and the Orangeville Transformer Station. The interconnection falls within the Bruce Special Protection System ("BSPS"), requiring upgraded communication systems at the substation.

2.3.1.2 Operation and Maintenance

Maintenance of the power lines will be required to ensure acceptable performance of the lines over time and to repair damage due to accidents and unusual climatic conditions. This may involve periodic patrols and/or inspections. Specific maintenance programs will be developed and will be carried out on a regular basis and/or by or in conjunction with Hydro One. Major and localized maintenance will be carried out as required. Planned repairs may take approximately one day to complete and may require a maintenance truck. Major repairs and maintenance, such as replacement of wires or poles or of a nature to require long range planning, will to the extent possible be scheduled in advance to minimize inconvenience to local property owners. As required, emergency repairs will be carried out as quickly as possible to minimize the danger to the public and to ensure that the power line is back in operation as quickly as possible.

Regular ROW management will be conducted to ensure the optimum operation of the power line. This typically involves keeping the lines and conductors clear of vegetation to a specified distance. This could include cutting and/or pruning as permitted under Ontario law. Other regular maintenance includes ensuring that the power lines are kept in a visually acceptable and safe condition and that the stability of the poles is maintained in those areas that may be prone to erosion or settling.

2.3.1.3 Decommissioning

In general, the physical works involved in dismantling the electrical infrastructure follow the procedures and practices for their construction. The degree to which the affected lands are restored may ultimately depend upon their intended use. For example, where the intent is to turn the land back to agricultural use, the structures will be taken down and the footings cut off at a depth to permit ploughing.

During the decommissioning phase Canadian Hydro will adhere to all applicable guidelines, which may include, among others, the MOE's Guidelines for the Decommissioning and Cleanup of Sites in Ontario or equivalent that is in effect at the time of decommissioning. Additional information on decommissioning is provided in **section 2.2.6**.

2.3.2 Study Area

The study area for the power line is located in Melancthon and Amaranth Townships, Dufferin County and encompasses an area of approximately 10,498 hectares. The northern limit of the study area is Highway 89, the western limit the Amaranth/West Luther Town Line, the eastern limit Amaranth Township 6th Line and the southern limit an east-west line approximately half way between Amaranth Township Side Roads 10 and 15 (**Figure 2.6**). A review of published documents and an NHIC database enquiry (2004) indicated the presence of four wetlands within the study area. These included the Bowling Green Swamp Provincially Significant Wetland ("PSW"), the Campania Fen non-Provincially Significant Wetland, Maple Grove Bog non-Provincially Significant Wetland, and Willow Brook non- Provincially Significant Wetland. Vulnerable, threatened, or endangered ("VTE") faunal species identified to have historically been in the area include the short eared owl (*Asio flammeus*), the yellow breasted chat (*Icteria virens*), and Henslow's sparrow (*Ammodramus henslowii*). The last sighting of these birds was 1987, 1983, and 1988, respectively.

2.3.3 Alternative Substation Sites and Selection of Preferred Site

2.3.3.1 Siting Criteria

The siting criteria used for identifying a suitable location for the 230 kV Amaranth substation included:

- previously cleared land adjacent to the Hydro One ROW for the B4V and B5V lines
- Hydro One transmission tower(s) on-site
- scalable area sizing requirements to accommodate all Project phases
- avoidance of environmental features
- ease of access from existing public roads.

2.3.3.2 Alternative Sites

Building upon these siting criteria, three alternative sites were identified for the Amaranth 230 kV substation:

- Site 1 – east side of the Amaranth – East Luther Town Line road approximately 600 m north of the Amaranth 15th Side Road – located in a fallow field adjacent to the 230 kV line, a tower structure nearby, and an adjacent rural residence.

- Site 2 – west side of the Amaranth 10th Line approximately 300 m south of the Amaranth 15th Side Road – located in an agricultural field adjacent to the 230 kV line south of a farm residence and actively used barn with a tower structure nearby.
- Site 3 – east side of the Amaranth 10th Line approximately 400 m south of the Amaranth 15th Side Road – located in an agricultural field adjacent to the 230 kV line with a tower structure nearby.

2.3.3.3 Preferred Site

Based upon field reconnaissance, published environmental information, and professional opinion, the preferred site the Amaranth 230 kV substation is Site 3. This alternative site has the following key advantages over the other two alternatives:

- is removed from adjacent farm and/or rural residences
- thus exhibits a low potential for adverse effects associated with environmental noise and visual / landscape alterations
- has the most available land area to accommodate the present and any future phases of the Project.

2.3.4 Power Line Routing Objectives, Constraints, and Opportunities

2.3.4.1 Routing Objectives

The process of developing alternative routes commenced with the identification of routing objectives. Routing objectives are the general principles that are used to generate a set of reasonable and/or feasible alternative routes. The following objectives were used to assist in the generation of alternative routes within the study area given the end points (Melancthon Township Lot 6, Concession VII SW and Amaranth Township Lot 15, Concession IX):

- existing ROWs should be utilized or paralleled to minimize the amount of disturbance to the social fabric
- routes should avoid sensitive environmental features to the extent possible – where they cannot be avoided routes should be located to minimize adverse effects
- routes should minimize adverse effects of construction and operation on existing infrastructure
- routes should follow a reasonably direct path between the end points, minimizing route length and the associated potential for adverse environmental effects
- consideration of relevant planning policies, guidelines, and regulations.

2.3.4.2 Constraints and Opportunities

Environmental constraints are considered to be any feature that would be adversely affected by power line construction or operation, and/or a feature that possesses unique attributes. Opportunities are considered to be any existing feature, such as a linear corridor or physical boundary, which provides a suitable location for the alignment of the power line.

The environmental inventory of the study area identified many of the features considered either as routing constraints or opportunities. The environmental inventory was undertaken using desktop appraisals of available documentation as well as a windshield survey of a number of roadways in Amaranth Township.

The identification of sensitive environmental features (i.e., constraints) was based upon the following criteria:

- site specific mitigation measures would be required to minimize potential effects
- the feature had been selected or designated for protection
- the feature had been recognized through local, regional, provincial, or federal policy, plan or statute, or is otherwise valued as an economic resource.

Considering the criteria listed above, examples of significant environmental features within the study area include:

- productive agricultural lands
- Bowling Green Swamp Provincially Significant Wetland
- rural residential homes.

The identification of environmental features that provided opportunities to avoid or minimize the environmental effects to sensitive features where based upon the following criteria:

- linear features that could be paralleled
- land ownership / management (public versus private).

Based upon these criteria, the following environmental features were identified as potential opportunities:

- existing roads or other linear corridors
- lands owned / managed by the Township of Amaranth.

Paralleling existing linear features presents opportunities to reduce the area of land potentially affected by construction and operation of the proposed power line. This principle opportunity significantly guided the generation of alternative routes.

2.3.5 Generate Route Alternatives

A review of existing linear features in the study area resulted in the identification of six alternative routes for the proposed 34.5 kV power line. Each route is established within an existing ROW owned/managed by the Township of Amaranth. The location and extent of the environmental features and their proximity to the alternative routes are shown on **Figure 2.6**.

Each of the alternative routes are reasonable from an environmental perspective since the power line can be located entirely within the previously disturbed road allowance. Within this study area, road allowances do not contain certain environmental features such as agricultural land and residences.

2.3.6 Alternative Route Comparison

The alternative routes were subject to a comparative evaluation as discussed below. This process consisted of comparatively evaluating the effects of each route upon identified environmental features. The primary goal of the comparative evaluation was to determine which alternative route has the least environmental effect coupled with ease of construction and operation. The potential effects of the alternate routes are based upon biophysical, agricultural, socio-economic, and construction considerations.

2.3.6.1 Biophysical Considerations

The Town Line and 10th Line alternate routes have limited potential to affect biophysical features and these route alternatives significantly reduce potential effects to wetlands. However, the Town, 6th, and 10th Lines traverse the edges of wetland features including the Willow Brook swamp, Maple Grove swamp, and Campania Fen within the existing previously disturbed road allowance. Additionally, the Town Line route parallels the Baxendale Tract, a GRCA managed forest and hiking area, and a Ducks Unlimited wetland enhancement project.

The route following the 9th Line would follow an unopened and uncleared road allowance between Side Roads 15 and 20, which traverses the Bowling Green Swamp PSW. This route has a significantly greater potential affect to this feature in comparison to the other alternative routes. On this basis the 9th Line route was discarded from further consideration.

2.3.6.2 Agricultural Considerations

Agricultural considerations evaluated in the comparison of the alternative routes included agricultural land and infrastructure such as tile drainage. All of the alternative routes avoid potential effects to agricultural lands and infrastructure due to their locations within existing road ROWs. No additional consideration was given to agricultural features as part of the route selection process.

2.3.6.3 Socio-Economic Considerations

All routes pass by several rural and farm residences. Of the remaining alternative routes, the 6th Line would be the longest followed in decreasing order by the 7th, 8th, 10th, and Town Line. A private airfield is located on the west side of the 7th Line north of Side Road 20.

From a socio-economic perspective aligning the proposed power line within the road allowance with the shortest distance is generally preferable as shorter routes have lower potential to create adverse environmental effects. On this basis/preference, coupled with the location of the private airstrip, known biophysical features, and density of rural residences, the 6th and 7th Lines were discarded from further consideration.

2.3.6.4 Construction Considerations

Construction considerations were evaluated to identify which alternative route could accommodate construction activity, while minimizing disturbance to environmental features. Each of the remaining routes (i.e., 8th, 10th, and Town Lines) can be constructed entirely within the existing, previously disturbed road allowance and do not require a new easement. Potential effects associated with the alternative routes are primarily limited to the work areas. Use of the road allowance for a working area presents opportunities to further reduce potential effects upon biophysical, agricultural, and socio-economic features.

However, given the preference for shorter routes and the costs associated with construction, additional poles and wires to accommodate longer routes, the 8th Line was discarded from further consideration due to the increased length to the interconnection point in comparison to the 10th and Town Lines.

2.3.7 Selection of Preferred Route

Based upon the comparative evaluation carried out above, the alternative routes in the ROWs of the 10th and Town Lines were determined as equally preferable from an environmental perspective. In both cases, either side of the roads are environmentally acceptable. However, at the 34.5 kV voltage, and considering cost factors (i.e., shorter route typically means less capital cost), constructability (i.e., ease of construction), and engineering / design requirements (e.g., the ability for joint-use poles with Hydro One), the 10th Line was identified as the preferred route for Phase I of the Project.

3 SCOPE OF THE ASSESSMENT

3.1 FEDERAL PROJECT CATEGORIZATION

The CEAA follows a four-step review process for environmental studies conducted under its jurisdiction:

Step 1: Does CEAA Apply?

An environmental assessment is required if a federal authority exercises or performs one or more of the following powers, duties, or functions in relation to a project:

1. proposes the Project
2. grants money or any other form of financial assistance to the project
3. grants an interest in the land to enable a project to be carried out
4. exercises a regulatory duty, in relation to a project, that is included in the Law List prescribed in the Regulations.

Since an application has been made to NRCan for WPPI funding, the proposed Project is subject to the conditions and requirements of CEAA. Once the applicability of the CEAA has been determined, the next step is to identify the type of study required.

Step 2: Identification of Study Type

There are two general types of studies identified under CEAA: *Self-Directed* and *Public Review*. Specifically, "screening" and "comprehensive" studies fall under the self-direct study while "mediation" and "panel review" are included under the public review study. Screening studies are typically undertaken for small-scale projects with minor, predictable, and mitigable environmental effects, whereas comprehensive studies deal with projects that have the potential to result in significant environmental effects. Approximately 95% of the environmental studies conducted under CEAA are screenings.

Section 18 (1) of CEAA states that where a project is not described in the Exclusion List Regulation or the Comprehensive Study List Regulation, the Responsible Authority ("RA") shall ensure that a screening of the project is conducted. The proposed Project is not described in either the Exclusion List or Comprehensive Study List Regulations. Thus, the Project has been assessed as screening study and this ESR prepared.

A screening study is a self-directed assessment in which the RA, in conjunction with other Federal Authorities ("FA"), determines the scope of the study (**Appendix A2**), manages the environmental assessment process, and ensures the proponent prepares an appropriate screening study. For the proposed Project, NRCan is the RA and thus responsibility falls to this agency to ensure that the screening report is carried out in compliance with the CEAA.

Step 3: RA Determination

It is also the responsibility of the RA to determine the course of action to be taken by the proponent following the evaluation of the screening report. This decision may consist of three options, to:

- proceed with the project as proposed
- not proceed with the project
- conduct a further assessment

Generally, the proponent is not required to undertake additional studies if the RA's decision is to proceed. However, where the RA decides that further assessment is required the proponent must comply with the requests or abandon the project.

Step 4: Review and Determination

If further assessment is required, the project will be subject to either a Panel Review or Mediation. Under a panel review, the Minister of Environment appoints the panel and establishes its terms of reference after consulting with the RA. Mediation is a voluntary process of negotiation in which an independent and impartial mediator helps the interested parties resolve their issues.

When the report of the panel or mediator is completed the RA decides on what action to take: to proceed or not to proceed with the project.

3.2 PROVINCIAL PROJECT CATEGORIZATION

Ontario Regulation 116/01 ("Regulation 116/01) sets out the ESP as a proponent driven, self-assessment process. The proponent is responsible for determining if the project falls within the ESP and when to formally commence the process. The proponent is also responsible for determining the time required to adequately conduct the ESP and when to publicly release project documentation and/or solicit comments from stakeholders.

Under Ontario Regulation 116/01 ("Regulation 116/01"), new electricity projects are classified into one of three categories:

- Category A: projects that are expected to have minimal environmental effects and do not require approval under the EAA;
- Category B: projects that have environmental effects that can likely be mitigated, but require approval under the ESP of the EAA; and
- Category C: projects that have known significant environmental effects and require the preparation of an "individual environmental assessment" under the EAA.

There are two possible stages of environmental study required under the ESP, depending upon the potential adverse environmental effects of a project and/or stakeholder issues: "screening" and "environmental review". All projects subject to the ESP are required to go through the screening stage, which requires proponents to apply a series of screening criteria to identify the potential adverse environmental effects of the project. The more detailed stage, an environmental review, is required if potential concerns raised during the screening stage dictate a need for additional, detailed studies.

Based upon the MOE's categorization of electricity projects, wind turbines greater than or equal to 2 MW are classified as Category B Projects and thus subject to approval under the ESP of the EAA. This categorization, coupled with the results of the screening criteria checklist (**section 6 and Appendix I**) has led the Project to be assessed as an environmental screening under Regulation 116/01.

3.3 STUDY OBJECTIVES

Working within the federal, provincial, and municipal approvals processes, and consistent with NRCan's scope of study and the MOE's environmental screening criteria checklist, the main objectives of this ESR are threefold:

1. to identify, define, and assess the potential effects of the Project on the environment
2. to ensure environmental considerations are explicitly addressed and incorporated into the planning, design, and decision-making processes

3. considering objectives one and two, to design a project follow-up and monitoring program that contains plans to prevent, mitigate, and compensate for the potentially adverse environmental effects of the Project.

3.4 METHODOLOGY OF ENVIRONMENTAL SCREENING

Environmental Assessment is commonly defined as the process of identifying, predicting, evaluating, and mitigating the environmental effects of a proposed project prior to making irreversible project decisions and commitments (IAIA, 1999). In carrying out this ESR, the assessment relied upon a number of common data collection techniques (e.g., primary and secondary data) and predictive tools (e.g., dispersion modelling), all of which considered the following factors:

- ***Purposive:*** activities should lead to informed decision-making.
- ***Rigorous:*** assessment should apply *best practicable science*, employing techniques appropriate to address the issues under investigation.
- ***Focused:*** concentrating on key issues and significant environmental effects.
- ***Practical:*** process should result in information and outputs that assist with decision-making in a manner that minimizes time and finance requirements for the proponent.
- ***Transparent:*** the process should be easily understood and replicable by project stakeholders.

A key component of the ESR methodology is the identification and description of the pre-project environmental conditions (i.e., baseline conditions). During the preparation of this ESR, the following primary and secondary data collection activities were undertaken to determine key baseline conditions in and around the proposed Project. Each methodology was based upon the best practicable science and tools available at the time of survey as shown in **Table 3.1**.

Table 3.1 Key Data Collection Tasks

Feature/Data	Method	Timing	Report Section
breeding birds	implement an area specific sampling program on lands with a LLA and other key lands within study area and obtain data from published sources where available	Spring 2004	Section 7.9 and 7.10 Appendix C.5
migratory birds	implement an area specific sampling program on lands with a LLA and other key lands within study area and obtain data from published sources where available	Spring 2004 Autumn 2004	Section 7.10 Appendix C.5
raptors	implement a sampling program within the study area and obtain data from published sources where available	Winter 2004 Winter 2005	Section 7.10 Appendix C.5
critical avian species	implement an area specific sampling program on lands with a LLA and other key lands within study area and obtain data from published sources where available	Spring 2004 Autumn 2004 Winter 2004	Section 7.9 and 7.10 Appendix C.5
terrestrial flora	implement field surveys on lands with a LLA using transects and obtain data from published sources where available	Spring 2004 Summer 2004 Autumn 2004	Section 7.9 Appendix C7

Table 3.1 Key Data Collection Tasks

Feature/Data	Method	Timing	Report Section
terrestrial fauna	visual observation during all field surveys and obtain from published sources where available	Spring 2004 Summer 2004 Autumn 2004	Section 7.9
critical terrestrial species	implement field survey using transects and listening techniques and obtain data from published sources where available	Spring 2004 Summer 2004 Autumn 2004	Section 7.9
amphibians	implement field survey using spot locations and listening techniques and obtain data from published sources where available	Spring 2004	Section 7.9 Appendix C2
critical amphibian species	implement field survey using spot locations and listening techniques and obtain data from published sources where available	Spring 2004	Section 7.9 Appendix C2
fish and fish habitat	implement field survey using spot locations and obtain data from published sources where available	Autumn 2004 Winter 2004	Section 7.3
critical fish species	Obtain data from published sources where available	Spring 2004	Section 7.3
surficial water characterization	Obtain data from published sources where available	Summer 2004	Section 7.3
groundwater characterization	Obtain data from published sources where available	Summer 2004	Section 7.4
land-use	aerial photo and topographic map review and field observation	Spring 2004 Summer 2004 Winter 2004	Section 7.5 Appendix C1, C6
agricultural characterization	field survey and obtain data from published sources where available	Summer 2004	Section 7.11 Appendix C1
socio-economic data of Melancthon Township	obtain from published sources where available	Autumn 2004	Section 7.5, 7.11 Appendix C1, C6
historical and archaeological resources	implement Stage I archaeological impact assessment and review published sources	Summer 2004	Section 7.15 Appendix C3
historical and archaeological resources	implement Stage II archaeological impact assessment and review published sources	Spring 2005	
environmental noise	implement a receptor specific ambient monitoring program at five select locations	Summer 2004	Section 7.8 Appendix C4
environmental noise	undertake ISO 9613 compliant modelling and complete Environmental Noise Impact Assessment	Winter 2005	
meteorological data	implement area-specific monitoring program and obtain from published sources	2002 – 2004	Section 2.1

3.5 STUDY AREA

The study area for this ESR was determined through professional judgment and experience with the well-known and geographically predictable environmental effects of wind energy generation facilities. The study area incorporates approximately 3,511 hectares within Melancthon Township and 10,498 hectares within Amaranth Township.

The southern boundary of the wind turbine study area is Highway 89 between the Town of Shelburne to the east and the hamlet of Jessopville to the west. The eastern boundary of the study area is Highway 10 running from Shelburne to Dundalk. The northern and western boundaries of the study area are bounded by 280 Sideroad and 8th Line SW respectively (**Figure 1.1**).

The study boundary for the power line study area is bounded by Highway 89 to the north, the Amaranth and East Luther Town Line to the west, Amaranth 6th Line to the east, and a line running approximately half way between Amaranth 10th and 15th Side Roads to the south (**Figure 1.1**).

3.6 UNCERTAINTY AND DATA GAPS

Identifying uncertainty and data gaps is important when evaluating the occurrence and significance of potentially adverse environmental effects and their probabilities. In terms of incomplete and unreliable knowledge during the ESR it was determined that existing information about the study area was insufficient for the purposes of the ESR. Thus, background data collection studies were completed to provide a description of (see also **Appendix C**):

- meteorological conditions
- environmental noise conditions
- breeding and migratory birds
- raptors
- amphibians
- terrestrial flora and fauna
- historical and archaeological resources.

The field-based information, collected on the basis of best practicable science and industry accepted methodologies, is considered reliable and suitable for use within the ESR. The completion of these background field studies has minimized both uncertainty and data gaps related to the proposed Project and the assessment of its potentially adverse environmental effects.

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4 PERMITS AND APPROVALS

The following subsections outline the key permits and approvals required from all three levels of government. **Appendix G** provides background on the requirements for these permits and approvals through legislation covered under the applicable acts, regulations, and planning documents.

4.1 FEDERAL

In applying for financial incentives provided under the WPPI program a proponent who is proposing the construction of an inland wind farm triggers the need for a federal environmental assessment under the CEAA. As noted above, NRCan is the RA for projects applying for WPPI funding, but will be assisted by other FAs in determining the scope of assessment for the study (**Appendix A2**). It is the intent of this ESR to be compliant with the CEAA requirements. Several permits and authorizations may also apply depending upon the final configuration of the Project (**Table 4.1**).

Table 4.1 Key Federal Permits and Authorizations

Permit / Authorization	Administering Agency	Rationale
CEAA Authorization	NRCan	WPPI funding program
Navigational Clearance	Canadian Coast Guard/Transport Canada	Crossing a navigable watercourse
Fisheries Act Authorization	DFO / GRCA	Harmful alteration, disruption, or destruction of fish and/or fish habitat
Aeronautical Obstruction Clearance	Transport Canada – Aerodrome Safety Branch	Height hazards / lighting requirements

4.2 PROVINCIAL

At the provincial level there are multiple permits and approvals that will be required to facilitate the development of the Project (**Table 4.2**). These requirements range from EA to design, to interconnecting with the provincial electricity grid. Their ultimate applicability will be determined based upon the Project's detailed design.

Table 4.2 Key Provincial Permits and Authorizations

Permit / Authorization	Administering Agency	Rationale
Environmental Screening Process – Ontario Regulation 116/01 / EAA	MOE	Electricity project approval
Certificate of Approval, Sewage Works – EPA	MOE	Construction and operation of on-site sewage disposal systems
Certificate of Approval, Air – EPA	MOE	Environmental noise emissions
Fill, Construction, and Alteration of Waterways	Conservation Authority	Work within floodplains
Archaeological Clearance –	Ministry of Culture	Archaeological and historical

Table 4.2 Key Provincial Permits and Authorizations

Permit / Authorization	Administering Agency	Rationale
Heritage Act		resources
Provincial Policy Statement ("PPS") – *Planning Act*	MMA	Regard for spirit of PPS and ultimate Official Plan approval
Change of Access and Heavy/Oversize Load Transportation Permit	MTO	Compliance with provincial highway traffic and road safety regulations
Generator's License	OEB	Generation of electrical power for sale to grid
Transmitter License	OEB	Transmission of electrical power to interconnect with provincial grid
Customer Impact Assessment	Hydro One	Integration of project with Hydro One and effects to customers
System Impact Assessment	IESO	Integration of project with Hydro One's transmission and distribution system
Approval of Connection	IESO	Electrical interconnect with IESO grid regulated network

4.3 MUNICIPAL

Several municipal permits and approvals will also be required from the Township of Melancthon, Township of Amaranth, and/or the County of Dufferin (**Table 4.3**).

Table 4.3 Key Municipal Permits and Authorizations

Permit / Authorization	Administering Agency	Rationale
Official Plan Amendment	Township of Melancthon	Land-use compatibility
Rezoning Amendment	Township of Melancthon / Amaranth	Land-use facilitation
Site Plan Approval	Township of Melancthon	Compliance with by-laws
Building Permit	Township of Melancthon / Amaranth	Compliance with building codes
Change of Access and Heavy Load Transportation Permit	County of Dufferin	Compliance with county road specifications
Notice of intent to cut trees	County of Dufferin	Compliance with tree cutting by-law

5 STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

Stakeholder[4] consultation and information disclosure activities are typically undertaken to provide Project stakeholders with an opportunity to participate in the planning and development of a proposed project. Such participation can lead to improved decision-making by the proponent, while fostering good-neighbour relationships with project stakeholders.

For this Project, a three phased approach was adopted: *phase I* to introduce the Project concept to area residents, government agencies, and other stakeholders and solicit their input; *phase II* to present the preliminary layout and visual interpretation of the Project to stakeholders and solicit their input; and *phase III* to present the ESR and receive any additional feedback from stakeholders.

5.1 DEFINING THE TERMS

5.1.1 Stakeholder Consultation

Stakeholder consultation is a tool for initiating and managing communications among the project proponent, stakeholders, and other affected persons/groups. It provides an avenue for the reviewing agencies and the project proponent to improve their decision-making capabilities, while fostering an environment of understanding by actively involving organizations, groups, and individuals directly affected by or involved in the Project.

5.1.2 Information Disclosure

Effective consultation is driven in part by adequate and appropriate disclosure of information to stakeholders in a timely fashion. Disclosure of information is critical if stakeholders are to have meaningful input and participation in the decision-making process. Exchange of information also allows stakeholders to better understand the trade-offs between the Project's advantages and disadvantages.

5.2 METHODOLOGY

When developing a methodology for stakeholder consultation and information disclosure it is important to understand the extent to which stakeholders may be interested in the Project based upon their perceptions and concerns. Another objective is to develop a representative understanding of the stakeholders' views about the area in which they live, community characteristics, and environmental resources that are important to them.

Since many of the issues addressed within the ESR are of public relevance, or are matters that would benefit from public review and comment, a framework that facilitates stakeholder participation is important. Such a framework must also contain mechanisms to monitor consultation and disclosure activities on a continuous basis during construction and as required during operational activities.

Building upon the phased approach to consultation and disclosure, as well as the methodological considerations above, the following subsections outline the various methods and techniques used to facilitate meaningful consultation and disclosure with the Project stakeholders.

[4] Stakeholders are defined as: i) parties with an interest in the Melancthon Grey Wind Project (e.g., neighbouring residents, ratepayer associations, and community and non-governmental organizations); and ii) municipal, provincial, and federal agencies, or self-autonomous governments with a legislative mandate for any aspect of the Project's planning, construction, operation, and/or decommissioning.

5.3 CONSULTATION AND DISCLOSURE ACTIVITIES

Consultation and disclosure have been key components of the project planning and development activities. These activities were accomplished through direct mailings, newspaper ads, newsletters, Public Open Houses, and a stakeholder liaison committee ("SLC"). Additional communications about the Project were conveyed through direct stakeholder contacts, as well as a toll-free telephone line, a project website, project specific e-mail, and written correspondence. A summary of stakeholder consultation and information disclosure activities and copies of newsletters and newspaper notices is provided in **Appendix H**.

Another component of stakeholder consultation was the initial work undertaken by Chinodin in the community prior to the involvement of Canadian Hydro. For three years Chinodin, as part of landowner, government, and community relations building, prepared and gave presentations on a consistent basis covering the following topics:

- energy alternatives
- energy alternatives in Ontario
- wind energy and characteristics
- the energy outlook in Ontario
- local / municipal situation and economic alternatives, mainly focussed on wind
- progress updates on the Project
- landowner comments and opportunities

The presentations evolved as knowledge and definition of the business opportunity advanced, as comments were received from the stakeholders, and as the wind business evolved in Canada and around the world. This approach allowed for the refinement of the business model, the improvement of relations with stakeholders, and allowed discussions to be maintained on a rational and cooperative level.

5.3.1 Communication Tools

A number of methods were used to facilitate on-going stakeholder dialogue including:

- A toll-free telephone line (866.873.2465), e-mail address (comments@mgwindpower.info), and fax (519.836.2493) were established for the Project. A Project website (www.mgwindpower.info) was also implemented to provide stakeholders with current on-line updates of Project activities and past and upcoming community events and stakeholder consultation activities. These communication points were provided on all stakeholder contact information (e.g., newsletters and newspaper advertisements).
- At key points in the environmental planning process newsletters were released in an ongoing effort to disclose information. The newsletters also contained a form that stakeholders could fill out and fax or mail back to the Project team to register for direct mail outs and/or raise questions about the Project. Newsletters were direct mailed to over 420 addresses and provided to 6,200 additional stakeholders through Canada Post's Unaddressed Admail™ program (**Appendix H1)**.
- A SLC was also established by Canadian Hydro to serve as a communication forum between the Project and the community for the planning phase of the Project. The SLC was made up of 12 local residents and chaired by two members from Stantec. Additional information on the SLC is provided in **section 5.3.5**.

As of January 31, 2005, 47 stakeholders had called the toll-free number, 20 had used the e-mail address, and 16 had used the fax service. The majority of queries related to: how one could register for a wind turbine; obtaining additional information about the Project and its development plan; and energy efficiency and fuel use. All names, phone numbers, addresses, and comments received were entered into a project database for tracking, responding to questions and for future mailings[5].

5.3.2 Public Notices

The *Notice of Commencement of an Environmental Screening and Public Open House* was distributed to stakeholders through written correspondence to agencies, neighbours, the general public, and other interested stakeholders. Notification was provided directly to stakeholders, via the first Project newsletter, by a combination of direct mail outs (e.g., to agencies, directly affected landowners, and interest groups) and mass mailings (e.g., selected mailing addresses) through Canada Post's Unaddressed Admail™ program ("Admail"). The agency stakeholder mailing list and Admail coverage are provided **Appendix H2**

The *Notice of Commencement of an Environmental Screening and Public Open House* was also published in five local newspapers, covering a large geographic area: The Dundalk Herald, The Flesherton Advance, The Shelburne Free Press and Economist, The Orangeville Citizen, and the Orangeville Banner. The Dundalk Herald and Flesherton Advance are joint publications with separate runs in the towns of Dundalk and Flesherton. The same applies to the Shelburne Free Press and Economist and the Orangeville Citizen. This Notice was also posted on the Project's website and contained within the Project newsletter.

The *Notice of Second Public Open House* was distributed directly to stakeholders, via the second Project newsletter, using direct mailouts to stakeholders who registered their attendance at the first public open house and other stakeholders anticipated to have an interest in the Project, and by Admail. **Appendix H3** provides the agency stakeholder mailing list and Admail coverage. This Notice was also published in the same local and regional papers and on the Project's website.

The *Notice of Commencement of an Environmental Assessment* was posted on January 28, 2005 on the Canadian Environmental Assessment Registry website notifying the public of the intent of NRCan to conduct a screening commencing on October 29, 2004 (**Appendix H5)**.

The *Notice of Completion* of the ESR and commencement of the 30-calendar day stakeholder review period for the ESR were published in the same local and regional newspapers, mailed directly to all stakeholders on our mailing list, and mass mailed using Admail (**Appendix H4**). This Notice was also published on the Project's website. Additional information on the *Notice of Completion* is provided in **section 5.5**.

5.3.3 Stakeholder Engagement

Using the various communication tools identified above, stakeholders were engaged to participate in the development of the planning process and ESR through the following means:

- letters of invitation to participate in the Project (**Appendices H2** and **H3**)
- public notices that contained the name of the proponent, a brief description of the project, maps showing the key project location, statements that the Project was subject to Regulation 116/01 and the CEAA, and contact names, addresses, e-mail, fax, and telephone numbers

[5] Consistent with the requirements of the *Freedom of Information and Protection of Privacy Act,* personnel information has been removed from the public record as provided in the technical Appendices.

- public open houses and comment cards
- SLC meetings
- newsletters and comment forms
- notice of 30-calendar day stakeholder review period for the ESR.

Additional opportunities for stakeholders to become engaged in the Project were provided through the Project's toll-free telephone line, facsimile, e-mail, and website. As noted above, total of 84 stakeholders (i.e., members of the public) responded through these communication tools.

Multiple interest groups were known to be active within the local area and were contacted to become engaged in the planning process for the Project's ESR. Key interest groups contacted included:

- Power Up Renewable Energy ("PURE")
- Shelburne Economic Development Committee
- Southgate Public Liaison Committee
- Melancthon Citizens Coalition
- Mono-Mulmur Citizens Coalition
- Grey County Corn Producers
- The Ontario Federation of Agriculture (Grey County)
- The Grey-Bruce Christian Farmers Association
- Agricultural Societies (District 10)
- Grey County Dairy Producers
- Grey County Agricultural Services
- The Grey-Bruce Sheep Farm Business Management Association
- Hills of the Headwaters Tourism Association
- Grey County Farm Safety Association
- Grey County Soil & Crop Improvement Association
- The Grey Association for Better Planning
- Grey-Bruce County Pork Producers
- Grey-Bruce Maple Syrup Association
- Grey County Beef Improvement Club
- Grey-Bruce Beekeepers Association
- Grey-Bruce Livestock Cooperative
- Markdale Agricultural Society
- Women's Federated Institute (Grey County)
- Coalition On The Niagara Escarpment
- Grey County Junior Farmers.

Numerous government agencies were contacted to participate in the planning and development of the ESR. Specifically, the following departments and agencies were contacted:

- Canadian Environmental Assessment Agency
- County of Dufferin
- County of Grey
- DFO
- EC
- GRCA
- GSCA
- Indian and Northern Affairs Canada
- OMAF
- Ministry of Tourism and Recreation
- Ministry of Culture
- Ministry of Citizenship and Immigration
- Ministry of Energy
- MOE
- MMA
- OMNR
- MP for Dufferin-Caledon
- MPP for Dufferin, Peel, Wellington and Grey

- MPP Bruce, Grey, Owen Sound
- Natural Resources Canada
- Niagara Escarpment Commission
- NVCA
- MTO
- OEB
- Ontario Native Affairs Secretariat
- SVCA
- Technical Standards and Safety Authority
- Town of Grey Highlands
- Town of Mono
- Town of Orangeville
- Town of Shelburne
- Township of Amaranth
- Township of Clearview
- Township of Melancthon
- Township of Southgate
- Transport Canada
- Upper Grand District School Board.

Details of the communications with these departments and agencies are included in **Appendix H5**. To date, nine agencies have provided comments on the Project including:

- Indian and Northern Affairs Canada (14 May 2004)
- SVCA (01 June 2004)
- EC (17 June 2004)
- GRCA (28 July 2004)
- MTO (14 September 2004)
- GSCA (21 September 2004)
- NVCA (22 September 2004)
- OMFA (28 September 2004)
- MOE (29 October 2004).

Canadian Hydro and its representatives have undertaken numerous meetings as part of the stakeholder consultation and information disclosure process. Key meetings completed to the end of 2004 include:

- meeting with Melancthon Township Council: 19 June 2003
- Shelburne Economic Development Council: 26 June 2003
- Shelburne Economic Development Council: 18 December 2003
- meeting with Melancthon Township Council: 08 January 2004
- meeting with Melancthon Reeve: 14 April 2004
- meeting with Melancthon Township Council: 12 May 2004
- first Public Open House: 07 June 2004
- planning session Melancthon Township Council: 09 June 2004
- planning session Melancthon Township Council: 14 July 2004
- stakeholder liaison committee meeting: 15 September 2004
- Phase I landowner meeting: 20 October 2004

- Phase II, III, and IV landowner meeting: 21 October 2004
- second Public Open House: 21 October 2004
- meeting with Amaranth Township Council: 17 November 2004
- stakeholder liaison committee meeting: 01 December 2004
- Phase I landowner meetings: 06, 07, and 08 December 2004
- meeting with Melancthon Township Council: 16 December 2004.

Each meeting helped to: expand Canadian Hydro's understanding of stakeholders' opinions about the Project; actively and continuously engage stakeholders in the Project; refine the Project design; and provide the various regulatory agencies with the information required to keep the Project moving forward through the various planning and environmental screening processes.

5.3.4 Public Open Houses

First Public Open House

The first Public Open House was held on 07 June 2004, between 4:30 and 8:00 pm at Centre Dufferin District High School in Shelburne, Ontario. The purpose of this Public Open House was to provide stakeholders with an opportunity to:

- learn about Canadian Hydro and meet their representatives
- gather information about the proposed Project
- become familiar with the MOE's ESP
- be informed of the way forward, including ongoing opportunities for stakeholder input to the ESP.

Representatives of Stantec, Canadian Hydro, and Chinodin were present throughout the Public Open House to provide information, answer questions, and receive comments. Comment cards were available on entrance to the open house (**Appendix H6**). One hundred and thirty nine persons registered their attendance at the Public Open House, and nine of these persons completed a comment card. The results of the comment cards are summarized in **section 5.4**.

Second Public Open House

The second Public Open House was held on 21 October 2004 between 6:00 and 8:30 pm at Centre Dufferin District High School in Shelburne, Ontario. The purpose of the second Public Open House was to provide stakeholders with an opportunity to:

- review the progress of the environmental studies
- voice opinions about the Project and the environmental screening process
- review the preliminary siting of the wind turbines
- be informed through a presentation and one on one conversations about the Project, the way forward, including ongoing opportunities for public input to the environmental planning process.

Representatives of Stantec, Canadian Hydro, and Chinodin were present at the Public Open House to provide information, answer questions, and receive comments. Comment cards were available on entrance to the open house (**Appendix H6**). Eighty-one people registered their attendance at the second

Public Open House, and 15 of these persons completed a comment card. A summary of the comments received is included in **section 5.4**.

5.3.5 Stakeholder Liaison Committee

The SLC was comprised of a cross-section of community representatives, including neighbours, interested members of the public, business people, and representatives of stakeholder organizations. The SLC's objective was to:

- provide guidance on stakeholder consultation efforts necessary to ensure optimum community participation in the ESP
- act as a liaison and facilitator of communication between interested stakeholder organizations, including local government bodies and Canadian Hydro
- provide input on specific environmental screening design and implementation issues including a review of the MOE's Environmental Screening Checklist
- encourage discussion and evaluation of scientific, planning and environmental issues among diverse groups of stakeholders.

The SLC met on September 15 2004, at the Shelburne Public Library to review the Project activities, provide comments on how to improve the Project, and to review, comment, and have input to the MOE's screening criteria checklist as applicable to the Project. Ten of the twelve SLC members attended and the meeting minutes were posted on the Project website (**Appendix H7**).

A subsequent SLC meeting was held on 01 December 2004, at the Shelburne Public Library to inform the members of the key findings of each main section of the draft ESR, provide thoughts and comments on how to improve the Project and/or the ESP prior to filing the ESR for the 30-calendar day review period, and to answer any remaining questions about the Project. Due to winter weather conditions six of the twelve SLC members attended. The meeting minutes were posted on the Project website (**Appendix H8**).

All SLC meetings were open to observation by the public, with date, time, and place of each meeting posted on the Project website. It is important to note that membership on the SLC did not constitute support for the Project. SLC members were acknowledged to be representing their personal interests, with no expectation that their views or comments represented those of the organizations with which they may be affiliated.

5.4 CONSULTATION AND DISCLOSURE RESULTS

The issues raised by stakeholders during the consultation and disclosure process for the Project are summarized in **Table 5.1** below.

Table 5.1 Key Stakeholder Issues and Project Responses

Stakeholder Issue	Project Response
How do I sign up for a turbine?	Locational information was collected and forwarded to Canadian Hydro's lands representative for consideration / future reference. Typically, Canadian Hydro is looking for contiguous blocks of land with ≥100 acres.
What is the operating history of the wind turbines selected?	GE and/or its acquired companies have been producing wind turbines since 1980. With each new generation of

Table 5.1 Key Stakeholder Issues and Project Responses

Stakeholder Issue	Project Response
	turbine, the technology has evolved to make the turbines more efficient, quieter, and structurally enhanced. The GE 1.5 MW sle units are the newest generation turbine with this power output. They have evolved from the GE 1.5 MW sl units that have been successfully in production since 1980. In Canada, GE is committed to the wind business and has already supplied turbines to Alberta and is contracted to do so in Quebec.
How noisy are the wind turbines?	The Project must comply with the environmental noise requirements of the MOE as outlined in their document entitled: *Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators (06 July 2004)*. To demonstrate compliance, Canadian Hydro undertook detailed noise modelling and prepared and submitted an Environmental Noise Impact Assessment report to the MOE for review and approval. This report has been approved by the MOE as discussed in **section 7.8**.
Concerned about laneways running through the middle of the property.	To the extent practicable, every attempt has been made in the planning stage and through discussions with landowners to ensure that access roads are located in such a way as to minimize effects to the activities occurring on that parcel of land. Examples include is placing the access roads in parallel with property lines and/or drainage features.
Will the electric and magnetic fields affect my health?	With the exception of the interconnection substation to interface with Hydro One's 230 kV power line, the Project will operate at voltages between 575 V and 34.5 kV. At these low voltages no adverse effects to human health are anticipated (**section 7.14**).
Project development may adversely affect my property value.	Property evaluation studies carried out in the U.S., Australia, and Europe where wind turbines are more common generally indicate that the installation of such facilities has no material effect to property values (**section 7.5**).
How will the turbines look?	Standing 80 metres tall at the nacelle, the turbines are not small machines. To assist stakeholders in visualizing what the turbines will look like, Canadian Hydro prepared a series of visual simulations (**section 7.16**).
How much revenue will the Project generate for the Township?	Based upon the installation of 50 turbines, and the taxation rate set out by the Ministry of Finance, the Project is expected to contribute approximately $ 600,000 annually to Melancthon Township with limited demand for municipal services.
Good luck with your Project – renewable power projects like wind are needed.	We concur and many thanks.

As shown in **Table 5.1**, there was considerable interest in the Project and its effect on the community and environmental fabric. On the whole, stakeholder response was positive towards the Project, the way Canadian Hydro conducted the ESR process, and the level of consultation and information disclosure that Canadian Hydro provided. In addition, many stakeholders saw the opportunity for Melancthon Township to be at the forefront of renewable power in Ontario as a considerable positive.

5.5 STAKEHOLDER REVIEW OF ESR

In compliance with Ontario Regulation 116/01 the ESR must be made available for a minimum 30-calendar day stakeholder review period. This ESR is being made available for review and comment from 15 February 2005 through to 17 March 2005. Hard copies of the ESR can be found during this review period at the following public locations:

Township of Melancthon Office	Shelburne Public Library
RR6	201 Owen Sound Street
Shelburne ON	Shelburne ON

The ESR and supporting materials may also be viewed at the Project's website: www.mgwindpower.info. Newspaper ads have also been published in the local and regional papers, and distributed to stakeholders via direct mail outs and Admail (**Appendix H4**) to provide *Notice of Completion of an Environmental Screening Report* and to invite comment on the report.

Canadian Hydro must receive comments regarding the Project and/or the ESR **no later than 4:30 p.m. on 17 March 2005**. All comments and correspondence should be sent to:

Geoff Carnegie
Canadian Hydro Developers, Inc.
c/o Stantec Consulting Ltd.
361 Southgate Drive
Guelph ON N1G 3M5
Fax: 519.836.2493 Tel: 866.873.2465 E-mail: comments@mgwindpower.info

As per the process outlined in the EA guide, stakeholders must first attempt to resolve any outstanding issues with Canadian Hydro during the 30-calendar day period. In the event that issues cannot be resolved with Canadian Hydro during the review period the concerned party may make a written request, to the Director of the MOE's Environmental Assessment and Approvals Branch at the address noted below, to *elevate* the Project to an *Individual Environmental Assessment*. A copy of the *elevation request* must also be sent to Canadian Hydro at the address noted above.

Director of Environmental Assessment and Approvals Branch
Ministry of the Environment
2 St. Clair Avenue West, Floor12A
Toronto ON M4V 1L5

Elevation requests must be made in accordance with the provisions set out in the MOE's EA Guide and be received by the MOE and Canadian Hydro **no later than 4:30 p.m. on 17 March 2005**. A copy of the MOE's EA Guide is available on their website (www.ene.gov.on.ca/envision/gp/4021e.pdf).

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6 ENVIRONMENTAL FEATURES SCREENING

The effects of constructing, operating, and maintaining a wind farm are well understood and can be typically mitigated through well known and accepted techniques and practices. For example, siting the Project outside of known migratory bird pathways, outside of forested and wetland areas, and away from residential (noise) receptors reduces the potential for adverse environmental effects. Further, the use of the wind as the primary fuel source negates concerns related to air quality effects and contributions of green house gases.

A screening of environmental features was undertaken consistent with Regulation 116/01, in order to focus the ESR on issues and effects relevant to the Project using the MOE Screening Criteria Checklist. The MOE's screening criteria, as presented in Appendix C of the EA Guide, are intended to be applied to a Project without considering the remedying effects of protection and mitigation measures (**Appendix I**).

A "No" listing in the table indicates environmental features that are not affected by construction, operation, and maintenance, while a "Yes" listing acknowledges the potential for negative effects prior to the application of mitigation measures. Environmental features identified with a "No" listing have subsequently been screened out from further analysis and discussion, while those identified with a "Yes" listing are discussed in detail in **section 7**. Based upon the above screening of environmental features, the following Project specific issues have been identified that require further analysis and discussion:

- surface water quality
- groundwater quality
- sedimentation and soil erosion
- residential, commercial, or institutional land-use
- air quality
- environmental noise
- wildlife and VTE species
- migratory birds
- agriculture resources and practices
- fish and fish habitat
- neighbourhood and community characteristics
- traffic patterns and flow
- public health and safety
- historical and archaeological resources
- aesthetics / viewscape
- waste material disposal
- remediation of contaminated sites.

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7 PROJECT SPECIFIC MITIGATION

The EA Guide, and similarly the WPPI Guide, requires that for each project-specific issue identified through the environmental features screening checklist (**Appendix I**), the following analysis be completed:

1. *Existing Environment* – describes the potentially affected environmental feature;
2. *Potential Effects* – identifies potential effects, both positive and negative, to environmental features that may occur as a result of the Project;
3. *Mitigative Measures* – recommends specific protective and/or mitigative measures that will be implemented to minimize any potential negative effects of the Project upon environmental features;
4. *Net Effects* – describes the effects remaining after mitigation measures have been applied; and
5. *Significance of Net Effects* – determines the significance of net effects. The criteria for assessing the level of significance of net effects after mitigation measures have been applied are shown in **Table 7.1**. This table has been replicated from the federal WPPI Guide, although it generally encompasses the provincial MOE's criteria for determining significance as well. These criteria include: value of the resource affected; magnitude of the effect; geographic extent of the effect; duration and frequency of the effect; irreversibility of the effect; and ecological/social context.

Table 7.1 Level of Significance After Mitigation Measures

Level	Definition
High	Potential effect could threaten sustainability of the resource and should be considered a management concern. Research, monitoring, and/or recovery initiatives should be considered.
Medium	Potential effect could result in a decline in resource to lower-than-baseline, but stable levels in the study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring, and/or recovery initiatives may be required.
Low	Potential effect may result in a slight decline in resource in study area during the life of the project. Research, monitoring, and/or recovery initiatives may be required.
Minimal	Potential effect may result in a slight decline in resource in study area during construction phase, but the resource should return to baseline levels.

The expected net effects and their significance to environmental features are based upon the assumption that all mitigative activities are fully implemented during relevant stages of project construction, operation, and maintenance. Issues raised by stakeholders during the consultation program have also been included below when they differ from those issues identified in the environmental features screening process.

7.1 METHODOLOGY FOR MITIGATION

The need, assessment, and selection of mitigation measures discussed in the following subsections have been predicated on the hierarchical principles of:

- avoidance – the elimination of adverse environmental effects by siting and design considerations (**section 2**)
- minimization – reduction or control of adverse environmental effects through Project modifications or implementation of protection and mitigation measures (**sections 2**, **7**, and **8**)
- compensation – enhancement or rehabilitation of affected areas (**sections 7** and **8**)

The application of these principles has greatly reduced the potential for adverse environmental effects from the Project as demonstrated in the following subsections.

7.2 RESPONSIBILITIES

Canadian Hydro is the sole owner of the Project. To assist with the specialized construction activities, Canadian Hydro retained Canadian Projects Limited ("CPL"), a qualified engineering and environmental consultancy. CPL is responsible for overseeing and carrying out the engineering, procurement, and construction ("EPC") aspects of the Project as well as ensuring environmental compliance during those activities. CPL is referred to as the Construction Contractor throughout this ESR.

GE will provide the operations staff for the first two years of Project operation. After this period, Canadian Hydro will either renew GE's operating contract or assume all operating and maintenance activities and responsibilities. Regardless, both Canadian Hydro and GE have proven industry experience in operating wind farms in Canadian climates.

7.3 SURFACE WATER QUALITY, SOIL EROSION, AND FISHERIES HABITAT

This section refers to items 1.1, 1.3, 1.4, and 4.5 of the MOE's environmental screening checklist: will the project –

- *have negative effects on surface water quality, quantities, or flow?*
- *cause significant sedimentation, soil erosion, or shoreline or riverbank erosion on or off-site?*
- *cause potential negative effects on surface or ground water from accidental spills or releases to the environment?*
- *have negative effects on fish or their habitat, spawning, movement, or environmental conditions (e.g., water temperature, turbidity)?*

7.3.1 Existing Environment

A number of watercourses traverse the study area including a combination of agricultural drains and warm water and cold-water tributaries and streams in the Grand River and Nottawasaga River watersheds. Cold-water tributaries flowing east to the Boyne River are found in the eastern portion of the study area located in the Nottawasaga River Valley watershed. Warm water tributaries of the Grand River flow west-southwest (**Figure 2.1**).

Information provided by the GRCA on those watercourses within the study area (i.e., McCue and Coutts Drains) indicates that the watercourses are classified as Type C drains. According to the *Class Authorization System for Agricultural Drains in the Southern Ontario Region* (DFO, 1999) the McCue and Coutts Type C drains are permanent warm water watercourses that contain baitfish species. No specific fish species data was available. Authorized activities for these drains include:

- brushing of side slopes
- bottom cleanout
- debris cleanout
- full cleanout.

These activities may be carried out with certain restrictions and with the authorization of the local conservation authority.

The NVCA (2005) provided information for watercourses in their drainage area jurisdiction that may be affected by construction activities. One watercourse, called the Curphy Drain, is a Class 'D' cold water drain. A fish survey completed in 2000 identified the Central Mud Minnow (*Umbra limi*), Johnny Darter (*Etheostoma nigr*um), Iowa Darter (*Etheostoma exile*), Brook Stickleback (*Culaea inconstans*), Fathead Minnow (*Pimephales promelas*), other cyprinids, and Brook Trout (*Salvelinus fontinalis*) at the edge of the study area, at the intersection of Highway 10 and 5th line.

Type D drains are permanent cold/cool/unknown water watercourses that could contain trout or salmon. Type D drains are sensitive to maintenance activities and projects associated with these drains are evaluated on a project-by-project basis to determine if the effects can be mitigated. In some cases a project specific authorization may be required under the *Fisheries Act*.

7.3.2 Potential Effects

7.3.2.1 Construction

Based upon the turbine locations and the alignment of the power line, collector lines, and access roads, three small agricultural drainage ditches (i.e., Type C drains) will be crossed by overhead collector lines and one access road in the turbine siting area, while six drains along the 10th Line in Amaranth Township will be crossed with the overhead power line (**Figure 2.6**). Construction of the overhead lines will not require in-stream works.

Other potential effects to watercourses from Project construction activities include possible erosion of stockpiled topsoil into the flood plain areas, which could result in a short-term and spatially limited increase in water turbidity and degradation of the water quality and fish habitat.

7.3.2.2 Operation

No effects to agricultural drains, watercourses, fish and fish habitat are anticipated as a result of the operation of the Project.

7.3.3 Mitigation Measures

7.3.3.1 Construction

Where there is potential to affect agricultural drains during Project construction, the following protection and mitigation measures are recommended:

- In the vicinity of all drains, clearing of woody vegetation should be kept to the minimum necessary to accommodate construction, to prevent sediment runoff to drains. Vegetation should be retained in place as long as possible prior to construction and roots of any trees should not be grubbed. Silt fencing, geotextile, and/or other appropriate erosion and sediment transport control techniques should be installed prior to, and remain in place immediately following clearing.
- Prior to construction, top-of-bank sediment barriers should be installed at drain areas that abut the construction work areas.
- Where soil is stockpiled adjacent to drains, silt fencing should be erected at the down slope side of the soil stockpile to prevent the movement of soil into the drains.
- Where construction parallels drains, silt fencing should be erected and maintained along the potentially affected length.
- Refuelling and storage of fuel, lubricants, and other potential contaminants should occur in protected locations well removed from all drains. In the event of an accidental spill, the MOE's Spills Action Centre should be contacted and emergency spill procedures initiated immediately.
- Other contingency materials (e.g., silt fencing, straw bales, absorbents, silt curtains, etc.) should be available for immediate use in the event of a major storm or spill.
- In the event that a drainage ditch crossing is required the GRCA will be consulted to determine the appropriate permitting and mitigation requirements.

7.3.3.2 Operation

Materials used in the operation and maintenance of the Project will be stored in appropriate containers within a secure storage area at the turbine and/or maintenance shop/control building. Since effects to agricultural drains and fish and fish habitat are anticipated to be limited to construction activities, no protection or mitigation plans have been developed for the operation phase of the Project.

7.3.4 Net Effects

7.3.4.1 Construction

With the implementation of the above protection measures, no net effects are anticipated to the agricultural drains. However, in the event that in stream work is required and/or conditions arise, and topsoil is positioned within the flood plain, any associated effects to the drains would be both spatially and temporally limited. Outside of the various protection and mitigation measures noted in **section 7.3.3.1**, no other protection or mitigation measures are proposed.

7.3.4.2 Operation

No net effects to drains, fish and fish habitat are anticipated as a result of the operation of the Project.

7.3.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have minimal short- or long-term effect on agricultural drains, fish and fish habitat either during construction or operation of the Project. The level of impact after protection and mitigation measures have been employed is rated as minimal (i.e., the resource should return to baseline levels). As such, no significant negative net effects are anticipated to surface water quality, quantities, flow, and/or fishery resources.

7.4 GROUNDWATER QUALITY

This section refers to items 1.2 of the MOE's environmental screening checklist: will the project have negative effects on groundwater quality, quantity, or movement?

7.4.1 Existing Environment

A study completed for the AEMOT (Artemesia, Euphrasia, Melancthon, Osprey, and the Town of The Blue Mountains) Groundwater Management Steering Committee (Greenland International Consulting Inc., 2001) states that groundwater is the main source of water for the approximately 14,000 inhabitants of these Townships. More than 80% of wells within the AEMOT study area obtain water from the bedrock. The main bedrock aquifer in the study area is the fractured limestone of the Guelph-Amabel aquifer.

It is estimated that $3.3X10^8m^3$ of rainwater infiltrates into the AEMOT study area annually and that 95% of this annual infiltration discharges to streams and rivers. The remaining 5% leaves the area as contribution to the regional groundwater flow. The main area where groundwater leaves the study area is in the Grand River watershed in the south-western part of Melancthon Township (Greenland International Consulting Inc. 2001).

A review of water well records for the study area found 44 wells (MOE, 2004, 2005). Mean depth to water is approximately 26 m with all but two wells finding water-bearing formations in bedrock.

7.4.2 Potential Effects

7.4.2.1 Construction

Similar to other regions in southern Ontario, aquifers within the study area are susceptible to land-use change effects given the type and variable thickness of the overburden and/or the shallow depth to groundwater. It is possible that some dewatering activities may be required when installing the tower foundations, however, it is unlikely that the foundation excavation will expose the main bedrock aquifer. A water well and small septic system will also be installed as part of the maintenance shop / control building.

7.4.2.2 Operation

Water taking for the water well will be approximately 500 l/day, while the septic system will be rated to handle 500 l/day. No other groundwater taking activities are planned during this phase of the Project.

7.4.3 Mitigation Measures

7.4.3.1 Construction

Although it is possible that near surface groundwater may be encountered in the course of excavation for some turbine foundations, it is unlikely that withdrawal quantities will exceed the threshold for the MOE's requirement for Temporary Permit To Take Water (i.e., >50,000 l/day) and will not negatively affect groundwater quality, quantity, or movement. In the event that turbines are located within 100 m of private

residential wells the Construction Contractor may, at the landowner's request, undertake to monitor the quality and quantity of these wells over the course of construction for the individual turbines to ensure there is no interruption in use of or impact on the water quality of these wells.

Construction of the well and septic system will conform with the latest MOE and Township guidelines, local building code requirements, and industry best practices, as appropriate.

7.4.3.2 Operation

The water well and septic system installed at the maintenance shop/control building will be maintained as per the applicable regulations and industry best practices.

7.4.4 Net Effects

7.4.4.1 Construction

Some temporary disturbance may be possible during the excavation of the turbine foundations to isolated near surface groundwater contained in overburden aquifers. However, with the implementation of good construction practices, it is anticipated any potential effects will be short term in nature and have little to no effect on adjacent private water wells.

7.4.4.2 Operation

The operation of the water well and septic system will have little effect on groundwater supply or quality due to the limited number of staff and use of the maintenance shop/control building where the water well and septic system are to be installed.

7.4.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have no long-term effect on the groundwater resource of the study area either during construction or operation of the facilities. The level of impact after protection and mitigation measures have been employed is rated as minimal (i.e., the resource should return to baseline levels). As such, no significant negative net effects are anticipated to groundwater quality, quantity, or movement.

7.5 RESIDENTIAL, COMMERCIAL, AND INSTITUTIONAL LAND-USE

This section refers to items 2.1 of the MOE's environmental screening checklist: will the project have negative effects on residential, commercial, or institutional land-uses within 500 metres of the site?

7.5.1 Existing Environment

Land-use within the study area is dominated by agricultural related activities and more than 80% of Melancthon Township's land base is CLI Class 1, 2, or 3 soils. Crop production, coupled with animal husbandry, are the main sources of agricultural production; with lands rented for potato production often drawing a premium in Melancthon. However, employment within the agriculture sector is limited to approximately 10% of Melancthon's workforce. There are no other sizable commercial or industrial land-uses within the study area.

The study area has a number of non-farm rural residences. Within the study area there is a small cluster of homes on County Road 17 near the intersection with Highway 10, with numerous agricultural/rural lots appearing to have severed parcels (e.g., along the 2ND Line). There are a number of scattered farm and non-farm rural residences throughout the study area and within 500 metres of the Project.

Commerical and institutional services provided within the local/regional area include lodging and dining, construction/building, gravel, concrete, and haulage, banking and legal, medical, education, and other services common to rural municipalities across southern Ontario. The agricultural and socio-economic profiles of the study area and Melancthon Township are provided in **Appendix C1** and **C6**, respectively.

7.5.2 Potential Effects

7.5.2.1 Construction

While the increased number of personnel present in the area during construction will demand some services from the local municipalities (e.g., lodging, food, and banking), the demand is expected to be nominal and short-term since the majority of construction workers (e.g., 75%) are expected to be from the local/regional area. This will also generate local benefit to business and services from Project spending.

During construction, there will also be a temporary increase in environmental noise and dust levels around the work and haul areas. These potential effects are common to any industrial or large-scale construction project.

7.5.2.2 Operation

Lands for the Project will be required for the lease period (i.e., 20 years with renewal options). During the lease period these lands will be removed from their present land-use and preclude the opportunity for the utilization of these lands for other land-uses during the occupation period.

Additionally, once the Project is in operation, there will be some low level use of municipal services and facilities including local roads and emergency services. Stakeholders have also identified a concern over residential property values in the areas adjacent to the Project.

7.5.3 Mitigation Measures

7.5.3.1 Construction

Given the existing commercial and institutional services within the local and regional area, coupled with the use of area labour and services, specific protection or mitigation measures have not been defined. However, to the extent possible, Canadian Hydro and/or the Construction Contractor will purchase local goods and services where available in sufficient quantity and quality and at competitive prices. The Construction Contractor and/or Canadian Hydro will address any concerns expressed during construction of the Project by stakeholders in an expeditious and courteous manner.

All construction vehicles will be equipped with mufflers and silencers as per the MOE requirements and dust will be controlled by suppressants where necessary. Additional information on noise, dust control and road traffic during the construction period is provided in **sections 7.7**, **7.8**, and **7.13**.

7.5.3.2 Operation

Those individuals who have areas where turbines permanently take agricultural land out of production will be financially compensated through the individual LLAs. The potential income from turbines has been designed to exceed any agricultural income lost due to a decrease in productive lands. Upon the end of the Project's useful life, the Project will be decommissioned (**section 2.2.6**) and the land returned to its original use.

During the operation phase of the Project road usage will be similar to any other business and no additional road modifications are anticipated to facilitate the Project's operational activities. Barring a catastrophic event or accident, the Project should have limited, to no, demand for local emergency services. Additional information on accidents and malfunctions is provided in **section 7.17**.

Within the wind energy industry, as with any infrastructure industry (e.g., pipelines, electrical lines, and power stations), there is continuing dialogue over the affect that industrial scale wind turbines may or may not have on property values within the viewshed. To assist in addressing this question a literature review was undertaken. No Ontario or Canadian studies were identified as part of the literature review to substantiate a claim one way or the other; however, such studies have been completed in Australia, Denmark, U.K., and U.S.A. These experiences provide a useful context for exploring this issue and the key results are highlighted below.

Australia

An informal study (i.e., with no controls or departure investigations) on behalf of Pacific Hydro (2001) examined the effects in the community of Esperance where there are two wind farms in operation, one of which is Australia's earliest, the other which is located less than 200 metres from the Salmon Beach residential area (a premier housing location in Western Australia). Of the 15 properties investigated, only one decreased in value due to the property being subdivided and sold as two lots (i.e., one half of the property was sold for slightly less than the amount that the whole property was valued at).

Denmark

A report by the Institute of Local Government Studies (1996) found that the economic expenses in connection with noise and visual effects from wind turbines are minimal. The study identified some effect on house prices within proximity to a wind farm, however, it emphasises that not all the results from the survey were significant according to their significance criterion. Specifically, the observations recorded could not be statistically linked to wind farm development and could be due to coincidental factors.

It is also noteworthy that the study does not clearly indicate the age of the installed turbines, and since this study is relatively old in terms of the evolution of the wind industry and its technology the results may not reflect current trends. Denmark has been one of the pioneering countries of wind energy, it is plausible that these installations date from a time when wind turbines were not only significantly noisier than modern machines, but were also placed with very little planning control.

United Kingdom

In the United Kingdom the Royal Institution of Chartered Surveyors (UK) found no studies to suggest an effect on property values either way (2002). This pattern has been repeated at the 70-plus operating wind farms in England, Wales, and Scotland where evidence available demonstrates that wind farms have no material effect on housing prices.

United States

The Renewable Energy Policy Project (2003) carried out one of the most recent studies on the correlation between wind farms and property values. The study looked at price changes for ten projects, with a minimum of 10 MW generating capacity, in three ways: how property values changed in the viewshed (i.e., an area within five miles from the turbines) and in a comparable community over the entire period of the study; how property values changed in the viewshed before, and after, the projects came on-line; and how property values change in the viewshed and comparable community only after the project came on-line.

In all, the ten projects yielded a total of 30 individual analyses. In 26 of the cases, property values in the affected viewshed actually performed better than the alternative. Moreover, values increased faster in the viewshed after the projects came on-line than they did before. Finally, after projects came on-line, values increased faster in the viewshed than they did in the comparable community.

A separate study, prepared for a wind farm in Kittitas County, Washington (2002), included both a nationwide phone study of tax assessors who had recently experienced the installation of wind turbines in their areas as well as a review of statistical studies that quantified the effect of wind turbines on property values. The report concluded that they found no evidence supporting the claim that views of wind farms decrease property values.

7.5.4 Net Effects

7.5.4.1 Construction

During the course of construction there will be short-term disruption to traffic patterns along local roads and the potential for short-term inconvenience (e.g., noise and dust) to residential, commercial, and institutional receptors in the affected areas. Lands hosting the Project will also be removed from their present use for the life of the Project.

7.5.4.2 Operation

Some site-specific adjustments may be required to farming practices based upon the location of access roads, the power collection lines, and turbines. A small increase in local road usage will also occur due to use for turbine maintenance activities.

Based upon a review of the property value literature, comprised of studies in North America, Europe, and Australia, there appears to be no demonstrable, material (i.e., detrimental) effect on property values within a viewshed of a wind farm. Perhaps the U.S. studies most closely resemble what can be expected in Ontario with regard to property values and wind farms; supporting the notion that property values will at least be maintained at present values.

7.5.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have no long-term effect on residential, commercial, or institutional land-uses of the study area either during construction or operation of the facilities. On agricultural lands, property owners provided input on access road locations that would minimize inefficiencies in agricultural operations. It is expected that farmers will quickly adapt to changes in agricultural practices where required and that inconvenience to these operations will be balanced through the benefits of their individual LLAs. Further, based upon the available information, no material effect to property values within the viewshed are anticipated as a result of the Project.

The level of impact after protection and mitigation measures have been employed is rated as minimal (i.e., the resource should return to baseline levels) and there will be the positive economic effects associated with procuring local labour, services, and materials (**section 1.9**). As such, no significant negative net effects are anticipated to residential, commercial, or institutional land-uses within 500 metres of the site area.

7.6 DISPOSAL OF WASTE MATERIALS

This section refers to items 2.5 and 9.1 of the MOE's environmental screening checklist:

- *will the project result in the creation of waste materials requiring disposal?*
- *have potential negative effects related to the remediation of contaminated land?*

7.6.1 Existing Environment

Active waste disposal sites in Melancthon Township are located in Lot 5, Concession I and Lot 12, Concession IV (MOE, 1991). Each site is approved to receive domestic and commercial waste. In addition the waste disposal site in Concession I, it is permitted to receive other waste, while the waste disposal site in Concession IV is permitted for non-hazardous solid industrial waste. The Township is responsible for managing these waste disposal sites and operating a limited drop off only recycling program (e.g., paper, cardboard, and metal). All of the turbines will be located on land currently used for agricultural production and thus the potential of encountering contaminated material is minimal.

7.6.2 Potential Effects

7.6.2.1 Construction

Wastes such as excavated soils, equipment packaging and wrappings, and scraps, will require reuse, recycling, and/or disposal at an appropriate off-site facility. Excess, excavated soils may be reused elsewhere on a property with landowner permission. Improper disposal of waste material generated during construction may result in contamination to soil, groundwater, and/or surface water resources on and off the Project sites. Waste generated during construction may also become a nuisance to nearby residences if not appropriately contained and is allowed to be blown or carried off the construction sites.

Sanitary waste generated by the construction crew will be collected via portable toilets and wash stations supplied by a licensed third party. Disposal of these wastes will be the responsibility of the contracted third party and they will ensure disposal in accordance with municipal and/or provincial standards.

7.6.2.2 Operation

The Project will generate waste lubricating and hydraulic oils associated with turbine maintenance and operation. Waste paper, cardboard, printing cartridges, etc. will also be generated in the maintenance shop /control building. Fluids, containers, cleaning materials, etc., unless appropriately disposed of, may result in contamination to soil, groundwater, and/or surface water resources both on and off the Project sites.

The septic system installed at the maintenance shop / control building will either be an anaerobic digester system or aerobic biological oxidation unit consistent with municipal and/or provincial requirements. However, should the system fail to function properly, there is potential to contaminate soil and groundwater resources.

7.6.3 Mitigation Measures

7.6.3.1 Construction

During construction the Construction Contractor should implement a site-specific waste collection and disposal management plan, which may include good site practices such as:

- systematic collection of waste with any associated on-site storage in weather-protected areas

- labelling and proper storage of liquid wastes (e.g., used oil, drained hydraulic fluid, and used solvents) in a secure area that will ensure containment of the material in the event of a spill – any spill that does occur, which could potentially cause an adverse environmental effect, should be reported to the MOE's Spills Action Centre
- prohibition of dumping or burying wastes within the Project sites
- should contaminated soil be encountered during the course of excavations the contaminated material will be disposed of in accordance with the current appropriate provincial legislation, specifically Ontario Regulation 153/04
- disposal of non-hazardous waste at a registered waste disposal site(s)
- implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials.

7.6.3.2 Operation

Canadian Hydro and/or GE should implement a waste collection and disposal system, as well as implementing good site practices, such as:

- systematic collection of waste with any associated on-site storage in weather-protected areas
- labelling and proper storage of liquid wastes (e.g., used oil, drained hydraulic fluid, and spent solvents) in a secure area that will ensure containment of the material in the event of a spill. All spills that could potentially have an adverse environmental effect should be reported to the MOE's Spills Action Centre
- disposal of non-hazardous waste at a registered waste disposal site(s)
- implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials.

The Project is a facility that utilizes a clean, renewable fuel resource so there are no issues related to operation induced emissions control and disposal.

7.6.4 Net Effects

7.6.4.1 Construction

During construction the temporary on-site storage of waste should not create any adverse effect provided the mitigation measures are implemented. However, like all wastes, it is possible that the disposal of such wastes will have a minor incremental effect on soil, groundwater, and surface water at the waste disposal site pending municipal on-site containment practices and quality of the landfill protection mechanisms (e.g., use of geotextiles to contain leachate).

7.6.4.2 Operation

During operations the temporary on-site storage of waste should not create any adverse effect provided the mitigation measures are implemented. However, like all wastes, it is possible that the disposal of such wastes will have a minor incremental effect on soil, groundwater, and surface water at the waste disposal site pending municipal on-site containment practices and quality of the landfill protection mechanisms (e.g., use of geotextiles to contain leachate).

7.6.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have limited effect on waste disposal sites during construction or operation of the facilities. Given the waste management plan for the construction phase and the limited amount of waste produced during operation, but that waste will be disposed at the local waste disposal site (e.g., occupation of wastes), the level of impact after protection and mitigation measures have been employed is rated as low (i.e., slight decline in resource over life of project). However, no significant negative net effects are anticipated to waste disposal sites.

7.7 AIR QUALITY

This section refers to items 3.1, 3.2, and 3.3 of the MOE's environmental screening checklist: will the project –

- *have negative effects on air quality due to emissions of NO_X, SO_2, TSP, or other pollutants?*
- *cause negative effects from the emissions of greenhouse gases (CO_2 and methane)?*
- *cause negative effects from the emission of dust or odour?*

7.7.1 Existing Environment

The MOE collects continuous ambient air quality data at more than 40 monitoring sites across the province to determine the state of air quality. Many of the monitoring stations record concentration levels of pollutants such as sulphur dioxide ("SO_2"), total reduced sulphur, nitrogen dioxide, carbon monoxide ("CO"), ozone ("O_3"), and volatile organic compounds ("VOCs"). The closest monitoring sites to the study area are Tiverton to the west, Barrie to the northeast, and Newmarket to the southeast.

Based upon the MOE's Air Quality Index Summary (2003) at these monitoring locations, air quality within the local airshed is expected to be of good to very good more than 90% of the time. This may in part be due to the limited extent of urbanization, seasonality of agricultural activities, and climatic patterns of the area. It appears that the primary pollutants contributing to a decrease in air quality in 2003 were O_3 and particulate matter.

7.7.2 Potential Effects

7.7.2.1 Construction

During construction minor, localized air emissions will occur from operating heavy equipment and temporary operation of generator sets. Additionally, construction related traffic and various construction activities (e.g., excavation, grading, and exposed areas) have the potential to create short-term nuisance dust effects in the immediate vicinity of the Project.

7.7.2.2 Operation

Aside from the operation of maintenance vehicles, and the heating of the maintenance shop/control building, no other potential effects to air quality have been identified with the operation of the Project. The potential effects of these activities are similar to that of most homes or businesses in Ontario for which standard combustion practices and emission controls are built-in design features.

7.7.3 Mitigation Measures

7.7.3.1 Construction

To protect adjacent receptors from potential offsite dust concerns the Construction Contractor will implement good site practices during construction including: maintaining equipment in good running condition and in compliance with regulatory requirements; protecting stockpiles of friable material with a barrier or windscreen and in the event of dry conditions and excessive dust watering of source areas and covering loads of friable materials during transport.

In terms of emissions from combustion engines, all construction equipment will meet the emissions requirements of the MOE and/or MTO. This will assist in minimizing the Project's short-term contributions of greenhouse gases, odour, and other airborne pollutants.

7.7.3.2 Operation

As noted above in **section 7.7.2.2**, aside from standard design controls, no special protective or mitigative measures have been identified for the operations phase of the Project.

7.7.4 Net Effects

7.7.4.1 Construction

The application of the recommended protection and mitigation measures during construction should limit fugitive dust and odour emissions to the work areas and limit combustion emissions. Any net effects are expected to be short-term in duration and highly localized.

7.7.4.2 Operation

Provided maintenance vehicles are maintained in good condition, and the heating system functions within their design parameters, net effects will be limited to emissions that are localized and limited to periods of operation only.

Since the generation of electricity from wind does not produce atmospheric pollutants and human health irritants such as NO_X, SO_2, O_3, and methane, the Project will not contribute to global climate change. Furthermore, every kilowatt hour of emission-free wind energy produced represents a kilowatt hour that does not require the burning of fossil fuel. Thus, at a broad level, the Project will contribute to improving Ontario's air quality, which in turn reduces human health risks associated with air quality.

7.7.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have no long-term effect on the air quality of the local airshed either during construction or operation of the facilities. The level of impact after protection and mitigation measures have been employed is rated as minimal (i.e., the resource should return to baseline levels). This, coupled with provincial improvements to air quality and human health, demonstrates no significant negative net effects are anticipated to air quality.

7.8 ENVIRONMENTAL NOISE

This section refers to item 3.4 of the MOE's environmental screening checklist: will the project cause negative effects from the emission of noise?

7.8.1 Existing Environment

The MOE designates “Points of Reception” into three classes: Class 1, 2, or 3. Class 1 refers to an acoustical environment typical of a major population centre where the background noise is dominated by the urban hum. These areas are highly urbanized and have moderate to high noise levels throughout the day and night. Class 2 areas have an acoustic environment that has low ambient sound levels between 19:00 hours and 07:00 hours; where the evening and night time levels are defined by natural sounds, infrequent human activity, and there are no clearly audible sounds from stationary sources (e.g., industrial and commercial facilities). Finally, Class 3 areas are those that are rural and/or small communities with a population of less than 1,000 with an acoustic environment that is dominated by natural sounds and has little or no road traffic.

Within the study area, the main sources of ambient sound that currently exist include:

- vehicular traffic noise from provincial Highways 10 and 89
- vehicular traffic noise from County Road 17
- vehicular traffic on the local concession and side roads (some of which are gravel roads)
- sounds due to agricultural activities
- occasional sounds due to anthropogenic domestic activities
- natural sounds.

A baseline, ambient noise assessment for the study area was completed and submitted as part of the Environmental Noise Impact Assessment to the MOE for review, comment, and approval (**Appendix C4**). The ambient noise study concluded that all Points of Reception within the study area have a Class 3 acoustic environment with the exception of those receptors within 120 m of Highway 89, 200 m of Highway 10, and 40 m from County Road 17, which are assessed as Class 2 due to traffic noise. Twenty-two of the 88 Points of Reception fall within the Class 2 boundaries, while the remaining 66 Points of Reception are within the Class 3 area.

7.8.2 Potential Effects

7.8.2.1 Construction

During construction noise will be generated by the operation of heavy equipment at each of the work areas and associated vehicular traffic on-site. The audible noise at receptors beyond the construction areas is expected to be a minor, short-term disruption consistent with noise generated by any industrial construction project.

7.8.2.2 Operation

During operation there is potential for limited off-site environmental noise effects from mechanical and aerodynamic noise emitted from the wind turbines.

7.8.3 Mitigation Measures

7.8.3.1 Construction

It is generally accepted that construction activities will result in short term environmental noise effects. To minimize inconvenience brought on by excessive noise during the construction phase of the Project, all engines associated with construction equipment will be equipped with mufflers and/or silencers in

accordance with MTO guidelines and regulations. Noise levels arising from equipment will also be compliant with sound levels established by the MOE.

To the greatest extent possible, construction activities that could create excessive noise will be restricted to daylight hours and adhere to any local noise by-laws. If construction activities that cause excessive noise must be carried out outside of these time frames, adjacent residents and the Township will be notified in advance. In addition, sources of continuous noise, such as portable generator sets, will be shielded or located so as to minimize disturbance to off-site receptors.

7.8.3.2 Operation

During operation the Project will be a source of noise emissions. The potential for the emissions to result in nuisance noise was determined by comparing the noise levels contributed by the Project at Points of Reception within 1,000 m of one or more turbines for wind speeds of 6, 7, 8, 9, 10, and 11 m/s as per the MOE's *Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators*, *2004* ("MOE Interpretation").

Propagation of environmental noise emissions from the Project to Points of Reception was modelled using ISO 9613 noise propagation algorithms. This ISO model can account for distance, ground, and atmospheric attenuation, meteorological effects, source directivity, and acoustical screening, among other factors. Using these algorithms an *Environmental Noise Impact Assessment* was prepared and submitted to the MOE for review, comment, and approval prior to initiating the 30-calendar day stakeholder review period (**Appendix C4**).

When modelled according to the ISO 9613 standard, the conditions specified in the MOE Interpretation, and noise levels guaranteed by GE, the environmental noise produced by the turbines was found to be within the acceptable limits at all critical Points of Reception within 1,000 m of one or more turbines for wind speeds of 6, 7, 8, 9, 10, and 11 m/s. The MOE's letter of approval dated February 1, 2005, confirming these findings, is also provided in **Appendix C4**.

It is important to note that attenuation due to sound propagation through foliage was not considered in the Environmental Noise Impact Assessment. Consequently, it is probable that for select cases where there are trees or shrubs in the propagation path between a turbine and a Point of Reception, such that the line of sight is blocked by the foliage, there will be resulting attenuation that has not been accounted for in the modelling. Thus, the values calculated for sound attenuation are likely to be conservative in areas where there is foliage present in the line of sight between any turbine and a Point of Reception.

7.8.4 Net Effects

7.8.4.1 Construction

Application of the recommended mitigation measures during construction should limit noise emissions to the general vicinity of the work areas. Any net effects are expected to be limited to short-term, intermittent noise increases during daylight hours at the work areas and/or along the haul routes.

7.8.4.2 Operation

Mechanical and aerodynamic noise will be emitted from the wind turbines, but environmental modelling approved by the MOE has predicted sound levels to be within the applicable MOE noise guidelines for Class 2 and 3 areas.

7.8.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have limited effect on the environmental noise conditions of the study area during construction or operation of the facilities. The level of impact after protection and mitigation measures have been employed is rated as low (i.e., slight decline in resource over life of project) since a new source of environmental noise has been added in the study area. However, on the basis of the MOE approved model results, no significant negative net effects are anticipated to environmental noise conditions.

7.9 VTE SPECIES, WILDLIFE, AND HABITAT

This section refers to items 4.1, 4.4, and 5.6 of the MOE's environmental screening checklist: will the project –

- *cause negative effects on VTE species of flora or fauna or their habitat?*
- *have negative effects on wildlife habitat, populations, corridors, or movement?*
- *have negative effects on game and fishery resources, including negative effects caused by creating access to previously inaccessible areas?*

7.9.1 Existing Environment

A review of background information, as well as detailed field inventories conducted in the spring, summer, autumn, and winter, was conducted to determine the potential presence and actual occurrences of species at risk (**Appendix C2, C5 and C7**). The OMNR's Natural Heritage Information Centre ("NHIC") database was accessed to identify any records of significant species on or in the vicinity of the study area. This search, along with subsequent correspondence with OMNR, indicated sightings of the provincially and nationally endangered Henslow's Sparrow (*Ammodramus henslowii*) occurred south of the study area in 1983, 1984, and 1988.

This species prefers moist, fallow grassy areas, however, the OMNR indicated that these records are now considered historical. Some marginally suitable habitat for Henslow's Sparrow was surveyed within the study area north of Regional Road 17 and west of the 2nd Line. Henslow's Sparrow was not detected during the evening taped-call playback surveys or during intensive daytime breeding bird surveys. There were no other VTE records within one kilometre of the study area.

Field reconnaissance identified the presence of the Black Tern (*Chlidonias niger*), noted during spring migration. This species is ranked S3, rare to uncommon in Ontario, and is designated Vulnerable by the Committee on the Status of Species at Risk in Ontario ("COSSARO"). Because the species is sedentary during the breeding season, and does not breed on or in the vicinity of the study area, no special measures are necessary to protect it.

A total of 75 breeding bird species were recorded on or adjacent to the study area. All of the species identified are ranked COSSARO S5 (i.e., very common and demonstrably secure in Ontario), or S4 (i.e., common and apparently secure), except for the Rock Pigeon (*Columba livia*), European Starling (*Starnus vulgaris*), House Finch (*Carpodacus mexicanus*), and House Sparrow (*Passer domesticus*), which are ranked COSSARO SE (i.e., exotic and not a native component of Ontario's fauna).

Forest birds such as flycatchers, woodpeckers, thrushes, and warblers were generally confined to larger wooded patches, often at the periphery of the study area, although the small patches scattered throughout the study area occasionally supported the more common Red-eyed Vireo (*Vireo Olivaceus*) and other area-insensitive species. It is possible that the small wooded feature in Lot 8, Concession VI contains a Red-tailed Hawk (*Buteo jamaicensis*) nest, based on the behaviour of the pair observed here in 2004.

The study area supports a diverse community of grassland birds, with the highest density of most species found in hay fields. The farming practice of hay field cutting (underway during site visits in June) before the end of the breeding cycle for many grassland species makes it unlikely that many of the more sensitive species depending on hay fields, such as Northern Harrier (*Circus cyaneus*) and Bobolink (*Dolichonyx oryzivorus*), are currently successful in breeding within the study area.

Field reconnaissance also identified one regionally significant, and several locally significant, breeding bird species. The Common Raven (*Corvus corax*) is significant in Site Region 6 (the southern Ontario ecological zone lying south of the Canadian Shield). This designation is based upon the distribution of the species in the first Ontario Breeding Bird Atlas (1981-1985). The Atlas is currently being updated and data collected in 2001-2003 indicate the Common Raven has increased significantly in Site Region 6 (Ontario Breeding Bird Atlas, 2004) and should probably no longer be considered significant.

Within the study area most of wetland areas have been classified by the OMNR as non-provincially significant wetlands ("NPSW"). These include the Canadian Pacific Swamp located in the northern portion of the study area, the Willow Brook Swamp located along the southeast limit of the study area, Maplegrove Northwest in the central portion of the study area, Jessopville North found at the west end of the study area, and Campania Fen along the power line route in Amaranth Township. Only two PSWs, Melancthon Complex #1 and Bowling Green Swamp, are located within the study area. The largest complexes of wetland vegetation occur within Concessions I, II, IV, and V for the Melancthon Complex #1. Detail on these wetland areas is provided in **Appendix C7**.

Although larger patches of upland forest are uncommon within the study area, several exist and appear to be good quality stands displaying original community characteristics despite being managed for local timber. The largest complex is located along the western boundary of Concession III. The study area also contains several plantation forests, mostly coniferous, with white spruce (*Picea glauca*), white pine (*Pinus strobus*), and scotch pine (*Pinus sylvestris*). The plantation forests occur on a variety of sites and moisture conditions, with the largest patch existing in Concession IV on moist to wet soils.

The study area does not contain nationally or provincially rare or endangered plant species and relatively few, locally rare species that are otherwise common within Ontario. Locally rare plant species in Dufferin County, that were found during the course of the field reconnaissance, were golden groundsel (*Senecio aureus*), American prickly-ash (*Zanthoxylum americanum*), black willow (*Salix nigra*), bog willow (*Salix pedicellaris*), small's spike-rush (*Eleocharis smallii*), and hard-stemmed bulrush (*Scirpus acutus*). These locally rare species are largely confined to wetland locations where turbine and ancillary facility development are not proposed. All of the vegetation community types, found within the study area, are common in Ontario.

Amphibian surveys recorded both early (i.e., wood frogs and spring peepers) and late (i.e., green frogs) breeding amphibians. None of the five amphibian species recorded as breeding within the study area are nationally, provincially, or locally rare. Further, none of the amphibian habitat identified and surveyed would qualify as significant wildlife habitat and thus poses no constraints for Project development. Additional information on the amphibian survey is provided in **Appendix C2**.

Correspondence from the OMNR did not identify any other notable wildlife features or areas of provincially significant earth or life science Areas of Natural and Scientific Interest. In addition, no deer wintering yards or known wildlife corridors have been identified in the study area.

No bats were detected during the field reconnaissance. Additionally, no roosting areas or individuals were noted during the forty-one person-days of daytime bird survey efforts in fields, hedgerows, forests, and wetlands during May, June, August, September, and October 2004. Details on the reconnaissance methodologies and results of the breeding bird and bat surveys are provided in **Appendix C5**.

7.9.2 Potential Effects

7.9.2.1 Construction

Aside from the avian and terrestrial flora species noted above, field reconnaissance, the NHIC, database, and the OMNR have not identified any other significant species within the study area. However, alteration or removal of vegetation could have the potential to affect both flora and fauna by reducing available habitat, especially for species with low mobility.

With regard to turbine collision mortalities, there may be greater risk to bird species with aerial courtship displays such as Horned Lark (*Eremophilia alpestris*) and Bobolink, both of which were abundant in open areas within the study area. Wilson's Snipe (*Gallinago delicata*) and American Woodcock (*Scolopax minor*), observed within the study area, also have aerial courtship displays. Some literature has noted a reduction in nesting grassland bird density within a few hundred metres of wind turbines, but some grassland birds including Horned Larks, continued to forage underneath turbines. Destruction, fragmentation, and disturbance of habitat as a result of wind energy projects are larger threats to breeding grassland birds than direct mortality through collision.

As shown in **Figure B4**, access roads and power lines have generally been oriented parallel to lot lines; typically lot lines contain trees and other vegetation that make up a hedgerow that various wildlife species (e.g., deer) may use to move between core areas (e.g., woodlots). Bisecting a notably vegetated lot line has the potential to affect wildlife movement.

Sensory disturbance of game resources may occur during all phases of the Project as a result of increased on-site human activities (e.g., site preparation, turbine assembly, maintenance activities). However, a certain level of sensory disturbance to game and wildlife resources in the study area has already resulted from ongoing agricultural and domestic activities.

7.9.2.2 Operation

Since the Project has largely been sited outside of vegetated areas and parallel to lot lines, any potential effect to VTE species, wildlife, and their habitats will be temporary; for a period of time until the Project becomes part of the environmental "background". The study area supports a diverse community of grassland birds, including two area-sensitive open country species. Several breeding birds with aerial courtship displays occur within the study area and may be more susceptible to collision with turbines in comparison to birds that do not exhibit aerial courtship displays. However, for most breeding species, habitat loss or disruption during construction was flagged as a larger concern than disturbance or direct mortality as a result of Project operation.

The study area does not appear to support resident or migratory bats in any significant numbers and habitat for roosting and foraging bats is limited in the agricultural landscape. No hibernation habitat for the majority of bat species found in southern Ontario is present in the study area, although it is common for the little brown (*Myotis lucifugus*) and big brown bats (*Eptesicus fuscus*) to hibernate in farmhouses, barns, or sheds.

7.9.3 Mitigation Measures

7.9.3.1 Construction

Efforts have been made to ensure that the Project is sited on previously cleared lands and not in natural areas including PSWs, NPSWs, and woodlots. However, limited clearing of trees will be required to facilitate the installation of ancillary facilities such as the access roads and collector lines (e.g., through hedgerows). As appropriate, a Notice of Intent to Cut will be filed with the Dufferin County Forester or covered under Site Plan Control with the Township.

From the floristic and vegetation point of view, the study area contains few constraints for wind power development since the preferred locations for turbines are: exposed, previously cleared areas; typically upland vegetation units; and the properties are almost invariably in agricultural and/or rural use. However, prior to construction, the limits of vegetation clearing should be staked in the field. The Construction Contractor should ensure that no construction disturbance occurs beyond the staked limits and that edges of woodlots and other sensitive areas adjacent to the work areas are not disturbed.

To the extent practical tree and/or brush clearing where required will be completed prior to the breeding season for migratory birds (April 15 to July 15). Should clearing be required during the breeding bird season, prior to construction, surveys will be undertaken to identify the presence of nesting birds or breeding habitat. In the event that breeding birds are identified, appropriate species-specific setbacks will be created with exclusion zones flagged from the work area(s).

7.9.3.2 Operation

Siting the Project outside of vegetated areas has largely precluded disturbance to local flora, fauna, habitat, and corridors. There will be some temporary disturbance to wildlife in the commissioning period during which wildlife will adjust to the presence of the Project, but it is expected that this effect will be short term.

7.9.4 Net Effects

7.9.4.1 Construction

Though the effects are anticipated to be minimal, there is some potential for disturbance of natural features, habitats, and species during construction of the Project as a result of the limited removal of vegetation and increased human activity. However, these effects are expected to be short-term in duration and spatially limited to the work areas and immediately adjacent areas.

Studies related to the sensory effects of constructing and operating wind farms on big game resources, carried out in the Western U.S., have shown that there is no significant effect (Strickland and Erickson, 2003). These studies indicate that species are either unaffected by this type of development, given their small footprint and preservation of the existing land-use, or that they can readily adapt to the presence of the wind farm. Outside of the various protection and mitigation measures noted in **section 7.9.3.1**, no other protection or mitigation are proposed.

7.9.4.2 Operation

Once the Project is operating, activity around the facilities will decrease, thus allowing local flora and fauna and wildlife movement patterns to re-establish. Disturbance to local flora, though permanent, will be spatially restricted to the operating areas.

7.9.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have limited effect on the VTE species, wildlife, and their habitats during construction or operation of the facilities. Given that the Project is generally sited in areas already cleared for agricultural use and away from any sensitive environmental areas such as wetlands and woodlots, (although there will be some areas of permanent vegetation removal), the level of impact, after mitigation measures are implemented, is rated as low (i.e., slight decline in resource over life of project).

Considering the temporary nature of construction effects, the limited extent of permanent works, and the periodic nature of maintenance activities, it is likely that resident wildlife will adapt to the Project once the wildlife realize there is no threat. Consequently, no significant negative net effects are anticipated to VTE species, wildlife, and their habitats.

7.10 MIGRATORY BIRDS

This section refers to item 4.6 of the MOE's environmental screening checklist: will the project have negative effects on migratory birds, including effects on their habitat or staging areas?

7.10.1 Existing Environment

The main flight corridors for migratory birds are across Manitoulin Island and the Bruce Peninsula, and along the eastern shore of Georgian Bay through Parry Sound and Muskoka Districts. Major concentration areas include the tip of the Bruce, Point Pelee, Rondeau, Long Point, and Hamilton Harbour. There is also a flyway along the eastern shore of Lake Huron and Lake St. Clair. However, birds are also known to move along general "fronts", such that a high proportion of Ontario's migrating birds may be encountered anywhere within the province. The Project is not on a major migratory bird flyway.

No landforms that concentrate birds, or that could potentially elevate turbines, such as ridges, escarpments, peninsulas or spits, were present on or in the vicinity of the study area. Additionally, no particular foraging or stopover locations for waterfowl or shorebirds were noted during the field reconnaissance. Significant migrant waterfowl concentrations are known in the Luther Marsh Important Bird Area ("IBA"), more than 12 km to the southwest of the study area.

A total of 51 species of migrating birds were observed within the study area. All were ranked COSSARO S5 (very common and demonstrably secure in Ontario) or S4 (common and apparently secure). Five migrant raptors were observed in the study area: Sharp-shinned Hawk (*Acipter striatus*), Red-tailed Hawk, Broad-winged Hawk (*Buteo platypterus*), Merlin (*Falco columbarius*), and Turkey Vulture (which is actually not a raptor, but is included here due to its similarity to the soaring raptors). None of the migrating bird or raptor species identified are provincially or nationally threatened, rare, or endangered.

Neotropical migrants[6] observed within the study area include vireos, wrens, veery (*Catharus fuscescens*), and warblers. However, field reconnaissance indicates that neotropical migrants are present only in very small numbers, indicating that there is no significant stopover or "fallout" habitat or features for neotropical migrants.

During stakeholder consultation activities, members of the public made comments regarding a potential swan [presumably Tundra Swan (*Cygnus columbianus*)] flyway in Melancthon Township. Long Point is a major spring and fall staging area in Ontario, and marked bird studies using standard neck collars and radio transmitter tracking in 2001-2003 indicated that individuals in the autumn tend to migrate on the west

[6] The term "Neotropical migrants" refers to those species that breed in the Nearctic biogeographic realm, but that winter in the Neotropical realm (Hagan and Johnston, 1992). The Neotropics include Central America and tropical parts of South America.

side of Lake Huron, and move east to Long Point and then the Atlantic coast, rather than south through Dufferin and Grey Counties (Atlantic Flyway Eastern Tundra Swan Project, 2004). The eastern population of this species typically migrates south through the latitude of southern Ontario in late October through early December.

During the spring migration through southern Ontario Tundra Swans stage inland, usually on agricultural land, most often in cornfields, but appear to prefer marsh habitat during the fall (Petrie et al., 2001). Very little marsh habitat, most of it in very small patches, is present in the study area. Therefore, although some Tundra Swans may pass over the study area during their migration seasons, the study area is not in the path of a major known Tundra Swan flyway and does not contain suitable staging or stopover habitat.

No staging areas for shorebirds, waterfowl or landbirds were noted. Details on the reconnaissance methodologies and results of the spring, autumn, and winter migration are provided in **Appendix C5**.

7.10.2 Potential Effects

7.10.2.1 Construction

Installation of wind turbines in existing agricultural fields will have a very small effect on habitat, as it will not require the removal of significant amounts of vegetation. The destruction and fragmentation of natural habitats, especially wetlands and woodlands, through construction of turbines and ancillary facilities in or across any remaining natural habitats could have the potential to affect birds by reducing available habitat.

7.10.2.2 Operation

The main, direct effect of Project operation on birds is mortality due to collision with turbines. Background information reviewed and field reconnaissance have demonstrated that the study area is not in the path of a major migratory flyway, that it does not contain any topographical or other physical features that would concentrate birds or significantly elevate turbines, that it does not provide habitat for breeding species at risk, and that it supports generally lower-quality agricultural habitat. As a result, these factors indicate that the potential for direct avian mortality at the Project is limited.

Some portions of high-quality PSWs and NPSWs exist within the study area and the area does include some small and medium sized wooded areas, providing islands of habitat for forest and wetland birds and potentially for bats. Thus, there is potential for direct effects to birds and bats using and moving among these patches, as well as to birds migrating through the study area

7.10.3 Mitigation Measures

7.10.3.1 Construction

The indirect effects arising from the removal, fragmentation, or disturbance of habitat during the Project's construction phase has a larger potential to negatively affect birds or bats than the direct mortality from turbine collisions. However, since bird habitat requirements during migration are much less specific than during the breeding season, limited habitat removal and disturbance is expected to have an insignificant effect on migratory birds. The removal and fragmentation of natural habitats, especially wetlands and woodlands, has been minimized by avoiding construction of the Project in or across any noticeably sized natural habitats.

7.10.3.2 Operation

The study area does not support significant numbers of migratory birds or bats and no other species at risk were detected. The study area, although not entirely devoid of natural habitat, has been largely altered for agricultural purposes and provides mostly lower quality bird habitat. Through the design (e.g., turbine shape and lighting) and siting process (e.g., outside of flyways), it is possible to mitigate many of the potential direct and indirect effects of the Project.

Installation of wind turbines in existing agricultural fields will have a very small effect on habitat, as it will not require the removal of significant amounts of vegetation. Current farming practices (e.g., cropping and haying) will continue under the turbines. However, the operation of the turbines may result in disturbance to breeding habitat or migrating individuals. These include some migrating waterfowl, which will dramatically increase their flight altitude to increase the space between themselves and the turbines, and some grassland breeding species, which nest in lower densities in the vicinity of turbines.

7.10.4 Net Effects

7.10.4.1 Construction

Construction of the turbines in areas close to or within natural habitat has the potential to create some disturbance to natural habitat for migratory birds. However careful siting of these features has minimized both the spatial and temporal disturbance. Additionally, habitat requirements for birds during migration are much less stringent than for breeding species and limited habitat disruption will have a negligible effect on migrating birds.

7.10.4.2 Operation

The main, direct effect of the proposed undertaking on birds is mortality due to collision with turbines during operation. Background information reviewed and field studies have demonstrated that the study area is not in the path of a major migratory flyway, that it does not contain any topographical or other physical features that would concentrate birds or significantly elevate turbines, that it does not provide habitat for breeding species at risk, and that it supports generally lower-quality agricultural habitat. These factors lead to the conclusion that the potential for direct avian mortality at the Project is very limited.

The study area meets the general and specific siting guidelines for onshore facilities suggested by Bird Studies Canada, 2003 (“BSC”). BSC (2003) notes that “the greatest adverse effect that wind energy facilities have on birds is disturbance to breeding and wintering birds (except in areas where poor habitat quality exists, such as agricultural and industrial areas)” and that “in areas where sufficient information…indicates or predicts a low risk to birds (generally urbanized areas and intensive agricultural sites where there are no other features present that would increase collision risk or disturbance), the project can proceed with little or no pre-construction monitoring”. Bird mortality at another site in southern Ontario, also outside of major flyways, has been demonstrated to be less than two birds per turbine per year. This number is negligible compared to the number of individuals that pass through southern Ontario and, if realized at this Project, would not have an appreciable effect on local or regional populations.

7.10.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have limited effect on birds and bats during construction or operation of the facilities. Given that the Project is generally sited in areas already cleared for agricultural use, the study area does not support significant numbers of bats or migratory birds, and is not on major migratory flyway, but that some avian mortality will occur as a result of turbine operation, the level of impact after protection and mitigation measures have been employed is rated as low (i.e., slight decline in resource over life of project). No significant negative net effects are anticipated to migratory birds, their habitat or staging areas.

7.11 AGRICULTURAL AND RURAL RESOURCES

This section refers to items 5.2 and 5.3 of the MOE's environmental screening checklist: will the project –

- *have negative effects on the use of CLI Class 1 – 3 lands, specialty crops, or locally significant agricultural lands?*
- *have negative effects on existing agricultural production*

7.11.1 Existing Environment

As noted in **section 7.5**, most of the lands within the study area are identified as CLI Class 1 through 3 (i.e., prime agricultural land). The soils associated with these prime agricultural lands are typically mapped as CLI class 1, indicating no limitations to agriculture. However, other soils in the study area are hindered by agricultural limitations associated with wetness ("w") and undesirable topography ("t"). Partially as a result of these soil types and their associated limitations, the productivity of many fields within the study area has been enhanced with the installation of artificial tile drainage.

Within the study area the distribution of the individual soil types is quite variable. All of the soils identified are widely disbursed with no significant areas of consistent soil type and they exhibit variable soil drainage characteristics due to the physiography of the area. Soil parent materials are dominantly glacial till. Soils developed from lacustrine and outwash parent materials are not extensive, and generally occur as inclusions within the surrounding till materials.

A mix of crop types are grown in the study area and during field reconnaissance were observed to include winter wheat, canola, forage, pasture, corn, soybeans, and potatoes. Areas of idle and scrub lands were also identified. Like most areas of southern Ontario, the crops identified within the study area were variable in their distribution. Land rented for potato production typically draws the highest rental fee and thus this land is arguably the most significant agricultural land within the Township. The agricultural study report is provided in **Appendix C1**.

7.11.2 Potential Effects

7.11.2.1 Construction

Review of the published soil information indicates the presence of high capability agricultural lands within the study area and therefore, there is the potential to affect these lands due to Project construction. Construction activities may also create a temporary inconvenience to site-specific cropping patterns.

During Project construction, additional land in excess of the final Project footprint will be temporarily required to accommodate the construction and assembly of the individual turbines and ancillary facilities. These areas could be subject to compaction and potential soil mixing in the event of wet weather.

Within the study area, forage and field croplands are often surrounded by livestock fencing, indicating their potential use as pasturelands at some point in the agricultural crop rotation. Access to turbine locations may require these fences to be temporarily cut and relocated.

There are several municipal drains serving the agricultural lands within the study area and numerous fields with artificial tile drainage installed. Construction of the Project could result in adverse effects to local surface drainage as a result of damage to drainage tile.

7.11.2.2 Operation

Operational effects of the Project on the agricultural lands and infrastructure are limited to removal of agricultural land from production over the Project's life and the possibility that some readjustment of agricultural operations (e.g., field farming patterns) may be required to accommodate the facilities.

7.11.3 Mitigation Measures

7.11.3.1 Construction

To the greatest extent possible, efforts have been made to site the turbines, access roads, and any other ancillary facilities in such a way as to minimize disturbance to existing agricultural lands, operations, and infrastructure. This has involved actions taken to:

- avoid or minimize field fragmentation and diagonal access road crossings
- minimize disruptions to agricultural drains and tile drainage
- minimize ploughing, cultivation, and harvesting pattern disruptions
- place access roads and ancillary facilities adjacent to lot lines and use existing roads where they exist
- place turbines near lot lines, in headlands, and/or in areas that are not in main agricultural production

The exact area required for construction of the Project, including any temporary workspaces, will be determined in conjunction with the affected landowner prior to the commencement of construction activities. On active agricultural lands, these areas will be delineated prior to construction and at the request of the landowner; the area will be stripped of topsoil that will be stockpiled at the edge of the construction area.

Construction activity should be restricted to the delineated construction areas and any travel of construction equipment beyond the delineated areas should be restricted. Travel to and from the construction areas should be via the access roads only. Following the completion of construction the temporary workspaces should be graded and de-compacted (if required), the topsoil replaced, and the area left as close to pre-construction condition as possible.

In areas where agricultural land may be utilized for livestock, it will be necessary to erect appropriate fencing around the workspaces or to install gates to accommodate access roads through pasturelands. This requirement will be determined in conjunction with the landowner prior to the commencement of construction.

Lands with agricultural drainage systems, and where the drainage will be affected, will include appropriate re-alignment of existing tile drainage system. A qualified agricultural tile drainage contractor will carry out any re-alignment works as well as repair tiles and/or drains that may experience construction related damage.

Finally, some disturbance to the movement of agricultural machinery on rural roads may be experienced, particularly during harvest and planting times, due to construction related traffic (e.g., transport trucks hauling turbine blades, the towers, and nacelles). To the extent possible, the Construction Contractor and GE will use predetermined routes to minimize road conflicts with agricultural equipment.

7.11.3.2 Operation

Where new fences have been installed, ownership will be turned over to the landowner. As appropriate, gates will have shared access between the Project and landowner and maintenance vehicles will limit their movement to the access roads and turn around areas.

7.11.4 Net Effects

7.11.4.1 Construction

Temporary and spatially limited disturbance to agricultural lands, operations, and infrastructure are expected in the construction workspace areas. However, temporary construction areas will be rehabilitated following construction and put back into agricultural use.

7.11.4.2 Operation

Where the turbines, access roads, and other ancillary facilities are situated, these lands will be taken out of agricultural production for the operational life of the Project. There may also be some requirement by the landowner to make some adjustment in cropping patterns and/or machinery practices (e.g., lifting implements over access roads).

7.11.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have limited effect on agricultural lands, operations, and infrastructure during construction or operation of the facilities. Given that the Project is generally aligned with lot configurations and current farming practices, but that some land will be permanently taken out of agricultural use of the Project's lifecycle, the level of impact after protection and mitigation measures have been employed is rated as low (i.e., slight decline in resource over life of project). However, no significant negative net effects are anticipated to prime agricultural lands, operations, and infrastructure.

7.12 NEIGHBOURHOOD AND COMMUNITY CHARACTERISTICS

This section refers to item 6.1 of the MOE's environmental screening checklist: will the project have negative effects on neighbourhood or community character?

7.12.1 Existing Environment

The area in which the Project is situated is almost exclusively agricultural/rural in nature. As discussed in **section 7.11,** the predominant use of the lands within the study area is for agricultural production, and specifically, for row crop and hay production. Several areas of woodland were also identified (**section 7.9**). Less predominant agricultural systems identified within the study area include idle agricultural land and pasture. The nearest community that offers commercial and social services is Shelburne located approximately two kilometres east of the study area.

7.12.2 Potential Effects

7.12.2.1 Construction

Location of the Project is in an exclusively rural setting and away from urban areas. Residents may experience a temporary disruption in the enjoyment and use of their property during Project construction due to the short-term effects associated with noise, dust, or additional traffic volumes. Although these effects are common with any large-scale industrial construction project, they do have the potential to affect the character of the neighbourhood during this phase of the Project.

7.12.2.2 Operation

As noted in **section 7.16**, whether stakeholders view the turbines as a wonderful addition to the neighbourhood or if they view them as an industrial distraction, there is no clear answer since beauty is in the eye of the beholder. However, the presence of the wind turbines will undoubtedly alter the current agricultural and rural character of the area.

7.12.3 Mitigation Measures

7.12.3.1 Construction

As appropriate, dust from the work areas will be controlled through suppressants (e.g. water, calcium chloride) as described in **section 7.7.** Environmental noise will be reduced through the standard operating practices discussed in **section 7.8**. A traffic plan will be developed and implemented by the Construction Contractor as per the specifications set out in **section 7.13**.

Canadian Hydro and/or the Construction Contractor will have a designated representative to maintain good community relations throughout construction. The Project representative will address concerns expressed by stakeholders during construction in an expeditious and courteous manner. Prior to construction, all potentially affected residents in the neighbourhood should be provided with a contact telephone number for the community liaison representative and the general construction schedule.

7.12.3.2 Operation

While the turbines will be visible for some distance, selecting an appropriate paint colour can assist in softening the look of the Project. To this extent, Canadian Hydro has selected a light grey colouring that will not stand in sharp contrast against the skyline. Aviation safety lighting for the turbines will be determined in conjunction with the Aerodrome Safety Branch of Transport Canada, however, it is not expected that all turbines will require lighting.

Canadian Hydro will continue to have a presence in the neighbourhood and community through education on the advantages of renewable power. To date, Canadian Hydro has been active in donating both hard and soft resources to the Centre Dufferin District High School's joint renewable energy project with the PURE Co-Operative. The project, known as "Reduce the Juice", involves the installation and operation of a wind and PV system coupled with a smart meter to power a portion of the High School's electricity needs.

Given the novelty of large-scale wind facilities in Ontario it is also likely that there will be a significant influx of visitors to the area to view the turbines. This should have positive spin offs on local retail services including restaurants, accommodations, and service stations, among others.

7.12.4 Net Effects

7.12.4.1 Construction

During construction there will be some temporary effect to the neighbourhood character due to the increased activity on the roads and in nearby towns such as Shelburne and Dundalk. Construction activity at the work areas may temporarily result in nuisance noise and dust and some sporadic inconvenience to local/adjacent residents.

7.12.4.2 Operation

Though it is possible that some short-term dissatisfaction may arise from a limited number of local residents, this will be balanced by the anticipated spin-offs to local tourism, Canadian Hydro's continuing involvement in the community, and the positive feedback generated from the utilization of renewable power.

7.12.5 Significance of Net Effects

Installing the various Project components is anticipated to have limited effect on neighbourhood character during construction or operation of the facilities. Given that the Project effect on the rural community will be temporary and will be minimized through the implementation of good site practices and transport planning, and community involvement, but that the wind turbines will permanently alter the neighbourhood character, the level of impact after protection and mitigation measures have been employed is rated as low (i.e., slight decline in resource over life of project).

The community is likely to experience a net benefit due to the increased use of local goods and services and increased employment opportunities for the local workforce both during construction and operation of the wind turbines, plus additional spin-offs from tourism, and new municipal tax revenues paid by Canadian Hydro with limited demand for services. Thus, no significant negative net effects are anticipated to the neighbourhood's character.

7.13 CONSTRUCTION RELATED TRAFFIC

This section refers to item 6.7 of the MOE's environmental screening checklist: will the project have negative effects related to traffic?

7.13.1 Existing Environment

Provincial Highways 10 and 89 occur within the study area, while County Road 17 bisects the turbine siting area. The provincial highways are the most heavily traveled followed by County Road 17. The remaining road networks consist of township concession and side roads that run either east to west or north to south. Traffic on these roads is largely rural, agricultural traffic and/or low-level residential traffic. The road network in Amaranth Township consists of largely unpaved township roads with the exception of 20th Sideroad, which is paved. As in Melancthon, traffic on these roads is largely rural agricultural traffic and/or low-level rural residential traffic.

The Ontario MTO Average Annual Daily Traffic ("AADT") volume data for 2002 for Highways 10 and 89 is provided below in **Table 7.2**. AADT is defined as the average twenty-four hour, two-way traffic for the period January 1st to August 21st, excluding weekends.

Table 7.2 MTO AADT for Provincial Highways 10 and 89

	Highway 10 (Edge of Town to Barrie-Mount Forest OPP District Boundary, 15.4km)	Highway 89 (Edge of Town to County Road 25 Intersection, 11.8km)
AADT	6,400	3,600

Source MTO 2002, Provincial Highways Traffic Volumes, 1988-2002.

Traffic data provided by Dufferin County (Roads Dept. Pers. Comm. 2004) for County Road 17 at two locations for a one-day period in 2004 is provided in **Table 7.3** below.

Table 7.3 Traffic Data For Dufferin County Road 17

	First Sign North of Intersection of County Road 17 and Highway 89 (Collected August 12, 2004)	First Sign South of Intersection of County Road 17 and Highway 10 (Collected July 29, 2004)
24 Hour Daily Traffic Volume	522	757
Peak Traffic Times	9:00am to 10:00am 4:00pm to 5:00pm	11:00am to 12:00am 4:00pm to 5:00pm

7.13.2 Potential Effects

7.13.2.1 Construction

It is expected that during the construction phase (e.g., April to December) truck trips will be required to deliver the Project components, equipment, and supplies and remove excess materials and waste. However, truck trips will be noticeably reduced after October 2005 since all the access roads and foundations will be installed and the turbine components will be on-site. The increase in traffic, including excess load traffic, may result in disturbance to traffic patterns, create potential traffic safety hazards, and produce abnormal wear and tear on the roads.

7.13.2.2 Operation

During operation of the Project up to six full-time and six part-time staff will be involved with the Project. The addition of this traffic to local and regional roads is not expected to create any unique or noticeable effects related to traffic.

7.13.3 Mitigation Measures

7.13.3.1 Construction

There will be instances during construction where excess loads (e.g., turbine and transformer components) will require special traffic planning. In addition, widening turning radiuses and road widths, opening unopened municipal road rights-of-way, and the creation of new ingress/egress nodes from the work areas will be required. As appropriate, permits will be obtained from provincial and municipal

agencies to implement these activities. For example, the following permits may be required to facilitate construction activities:

- Excess Load – MTO
- Special Vehicle Configuration – MTO
- Temporary Construction Access – MTO, County, and/or Township
- Commercial Permanent Access – MTO
- Alteration to Existing Access Permit – MTO, County, and/or Township.

If required, as determined during the detailed design phase, Canadian Hydro and/or the Construction Contractor will implement a road safety program to deal with specific traffic planning issues. The program may consider the use of signage, road closures, speed restrictions, truck lighting, load restrictions, and equipment inspections. Construction traffic will avoid residential streets.

7.13.3.2 Operation

Once in operation, additional traffic planning is not anticipated as Project related traffic would be restricted to maintenance transportation and limited to a defined workforce.

7.13.4 Net Effects

7.13.4.1 Construction

Although road safety is not expected to be an issue during the construction phase, the potential for accidents along the haul routes and on-site cannot be totally avoided.

7.13.4.2 Operation

No net effects from traffic are anticipated during the operation of the Project.

7.13.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have limited effect on traffic during construction or operation of the facilities, yet the potential for road traffic accidents exists on every road in Ontario. In light of this fact, but considering the mitigation measures identified, the level of impact after protection and mitigation measures have been employed is rated as minimal (i.e., the resource should return to baseline levels). No significant negative net effects are anticipated to result from traffic.

7.14 PUBLIC HEALTH AND SAFETY

This section refers to item 6.8 of the MOE's environmental screening checklist: will the project cause public concerns related to public health and safety?

7.14.1 Existing Environment

At present there are no industrial scale wind turbine facilities operating in the study area or within the Township of Melancthon. This will be the first project of its kind in Melancthon Township and Dufferin County. While wind energy facilities do not contribute green house gases or other atmospheric pollutants (**section 7.7**), they do have unique structural components that may be perceived to present health and safety concerns (e.g., rotating blades throwing ice).

7.14.2 Potential Effects

7.14.2.1 Construction

Potential effects to public health and safety are largely in the form of increased construction related traffic and unauthorised access of the public to the work sites.

7.14.2.2 Operation

The Project will not contribute green house gases or other atmospheric pollutants to the environment and thus no air-related public health concerns associated with the operation of the Project have been identified. However, during the stakeholder consultation program health and safety comments were made with regard to the potential effects of electric and magnetic fields ("EMF"), ice fall and throw, and catastrophic failure of the turbines (i.e., collapse).

Electric and Magnetic Fields

Since the mid-twentieth century, electricity has been an essential part of human life; electricity powers appliances, office equipment, heats our homes, and assists in refining the fuels that power vehicles and machinery. Indeed, the use of electricity is something that many take for granted. However, some have wondered whether the EMF produced through the generation, transmission, and use of electric power [i.e., power-frequency EMF, 50 or 60 hertz "(Hz")] might adversely affect human health.

To date, the largest evaluation of EMF[7] and human health has been carried out in the U.S. and is known as the Electric and Magnetic Fields Research and Public Information Dissemination ("EMF RAPID") Program. Led by the National Institute of Environmental Health Sciences ("NIEHS") of the National Institutes of Health and the Department of Energy, the EMF RAPID Program was a six-year project designed to provide scientific evidence to determine whether exposure to EMF involved a potential risk to human health.

The study concluded that the overall scientific evidence for human health risk from EMF exposure is weak. No consistent pattern of biological effects from exposure to EMF had emerged from laboratory studies with animals or with cells. However, epidemiological studies (i.e., studies of disease incidence in human populations) had shown a fairly consistent pattern that associated potential EMF exposure with a small increased risk of leukemia in children and chronic lymphocytic leukemia in adults.

Several other assessments that have been completed support an association between childhood leukemia and exposure to power-frequency EMF. However, these studies do not support a link between EMF exposures and adult leukemias. For both childhood and adult leukemia, interpretation of the epidemiological findings has been difficult due to the absence of supporting laboratory evidence or any scientific explanation linking EMF exposures with leukemia.

Ice Fall and Throw

Accumulation of ice on the turbine blades is possible during the winter months with extreme weather events where the turbines may be subject to coating from freezing rain or interception of low clouds containing super cooled rain. The two hazards associated with ice accumulation on wind turbines include: the danger of falling ice that may accumulate on the turbine itself as a result of freeze-thaw of snow and ice; and the throwing of ice from the moving turbine blades.

[7] EMF are invisible lines of force that surround any electrical device. Power lines, electrical wiring, and electrical equipment all produce EMF.

Falling ice from an immobile turbine does not differ from other tall structures like telecommunication towers, power lines, and antenna masts. The ground area potential affected by falling ice depends to a large extent on the blade position and the prevailing wind speed. Conservative modelling documented by the Finnish Meteorological Institute (2000) indicates that when a blade has an azimuth of 90°, wind speed is 10 m/s, and the ice weights 15.3 kg, the fall distance is about 40 metres. In comparison, when a blade has an azimuth of 0°, wind speed is 20 m/s, and ice weights 1.5 kg, the fall distance is reduced to about 30 metres.

With regard to the turbines throwing ice, the throwing distance varies depending upon the rotor azimuth, rotor speed, radius, and wind speed. Also, the geometry of the ice fragments and its mass will affect the flight trajectory. To better understand the factors influencing ice throw, the Finnish Meteorological Institute (2000) undertook a project known as *Wind Energy production COld climate* ("WECO") coupled with a review of wind tunnel tests studying the aerodynamics of iced airfoils. These studies are generally regarded as conservative within the industry.

The Finnish and wind tunnel studies suggest ice throw from smaller turbine blades (e.g., 15 to 20 metres), which have a higher rpm and more blade energy than the GE turbines proposed for the Project, have an average range of 25 to 100 metres depending upon the ice fragment's mass. Throwing distances for turbines with a blade length of 30 to 33 metres are recorded at <75 metres depending upon the fragment's mass.

Based upon this trend in the available data, it is expected that ice throw from a 37 to 40 metre blade, similar to those used in this Project, would be less than the 33 meter blade. This is primarily due to the fact that larger blades tend to turn more slowly in comparison to smaller blades, creating less energy to throw the ice.

In terms of icefall and throw it is important to note that the reality of icing is likely limited to a few days per year. That is to say, icing of the turbine blades is not an every day occurrence.

Catastrophic Failure

Although highly improbable, any tall structure exhibits the possibility of collapse. Although very unlikely, there is also the possibility of blade detachment from the turbine structure under extreme conditions. Should either of these events occur, and given the weight of the wind turbine components, there is potential that the collapse zone and/or landing area would be damaged from the impact.

7.14.3 Mitigation Measures

7.14.3.1 Construction

Implementing good transportation planning and safety measures during construction will minimize the potential for traffic related safety concerns. Safety concerns related to construction traffic are addressed in **section 7.13**.

Public safety has been and will continue to be incorporated into the Project design. Land access to the construction site will be controlled through signage and restricted to authorized personnel only. The Construction Contractor will also employ good site safety practices during the construction phase.

7.14.3.2 Operation

Canadian Hydro will ensure that the wind turbines are maintained and operated in accordance with all applicable codes and regulations. Maintenance personnel will continuously undertake additional safety measures, such as automated and manual surveillance and adherence to Canadian Hydro's health and safety policies.

Many of the perceived safety concerns related to Project operation could be mitigated through the built-in safety measures and standard procedures for wind turbine operation and maintenance and control systems (**section 2.2.5**). Critical alarms on-site are directly linked to emergency personnel, to expedite response to potential events at the facility. Potential effects due to operation malfunctions are mitigated through this control and alarm system. The mitigation measures for EMF, ice fall and throw, and catastrophic failure are discussed below. Information on other types of accidents and malfunctions is provided in **section 7.17**.

Electric and Magnetic Fields

Electrical transmission lines (i.e., > 50 kV) bring electricity from a generating station to an electrical substation. Electrical distribution lines (i.e., < 50 kV) bring electricity from a substation to a home or business. Transmission and distribution lines can be either overhead or underground. Overhead lines produce both electric field and magnetic fields; underground lines do not produce electric fields above ground, but may produce magnetic fields above ground.

The strength of electric fields is measured in units of volts per metre ("V/m"), while magnetic fields are measured in units of gauss ("G") or tesla ("T"). EMF levels decrease with increasing distance from the source. For a power line, EMF levels are highest near the centre of the right-of-way and decrease as one moves away from the transmission corridor.

Typical voltages for power distribution lines in Ontario are less than 44 kV. Electric field levels directly beneath overhead distribution lines may vary from a few volts per metre to 100 or 200 V/m. Magnetic fields directly beneath overhead distribution lines typically range from 10 to 20 milligauss ("mG") for main distribution lines and less than 10 mG for laterals (for example lines leading into homes). Such levels are also typical directly above underground distribution lines (NIEHS, 2002).

Peak EMF levels can vary considerably depending upon the amount of current carried by the distribution line. EMF RAPID measured peak magnetic field levels as high as 70 mG directly below overhead distribution lines and as high as 40 mG above underground lines.

With respect to substations the strongest EMF around the outside of a substation generally comes from the power lines entering and leaving the substation. The strength of the EMF from equipment within the substation, such as transformers, reactors, and capacitor banks, decreases rapidly with increasing distance. Beyond the substation fence, the EMF produced by the substation equipment is typically indistinguishable from background levels.

Health Canada's website (http://www.hc-sc.gc.ca/english/iyh/environment/magnetic.html) notes that research has shown that EMF from electrical devices and power lines can induce weak electric currents to flow through the human body. However, these currents are much smaller than those produced naturally by your brain, nerves, and heart, and are not associated with any known health risks (Health Canada, 2004).

Health Canada goes on to note that there have been many studies about the effects of exposure to EMF at extremely low frequencies (i.e., ≤300 Hz). Their scientists are aware that some studies have suggested a possible link between exposure to extremely low frequency fields and certain types of childhood cancer. However, when all of the studies are evaluated, the evidence appears to be very weak (Health Canada, 2004).

After a recent evaluation of the scientific data, the World Health Organization International Agency for Research on Cancer classified extremely low frequency magnetic fields as "possibly carcinogenic" to humans based upon studies of childhood cancer. However, the evidence is not strong enough to conclude that EMF definitely causes cancer in children. It is Health Canada's opinion that more studies are needed to draw firm conclusions (2004).

As a partial result of these findings, at this point in time neither Ontario nor Canada has established standards limiting occupational or residential exposure to 60-Hz EMF. Consequently, there are no particular levels of EMF exposure that trigger a regulatory response. However, in the U.S. at least six states have set standards or guidelines for power line electric fields; two of these have also established standards or guidelines for magnetic fields (**Table 7.4**).

It is important to note that these standards and guidelines have been established based upon EMF levels that have historically been present at ground level in the ROWs of power lines. None of these guidelines have been prepared based upon the conclusion that a particular level(s) of EMF poses a risk to human health and none have been developed using careful scientific methodologies.

Table 7.4 U.S. Power line Standards and Guidelines for EMF*

State	Electric Field		Magnetic Field	
	On ROW	Edge of ROW	On ROW	Edge of ROW
Florida	8 kV/m[a]	2 kV/m	--	150 mG (max load)[a]
	10 kV/m[b]	--	--	200 mG (max load)[b]
	--	--	--	250 mG (max load)[c]
Minnesota	8 kV/m	--	--	--
Montana	7 kV/m[d]	1 kV/m[e]	--	--
New Jersey	--	3 kV/m	--	--
New York	11.8 kV/m	1.6 kV/m	--	200 mG (max load)
	11.0 kV/m[f]	--	--	--
	7.0 kV/m[d]	--	--	--
Oregon	9 kV/m	--	--	--

Notes:
[a] for 69 – 230 kV lines
[b] for 500 kV Lines
[c] for 500 kV lines on specified existing ROWs
[d] maximum for highway crossings
[e] may be waived by the landowner
[f] maximum for private road crossings
* Source: EMF Research and Public Information Dissemination Program (2002).

As described in **section 2.2**, the Project will operate several power lines in order to export the electricity generated by the wind turbines to the provincial grid. While the Project's main power line will function as a transmission line, it will actually operate at a distribution voltage level (i.e., 34.5 kV). The gathering lines will also operate at this voltage.

Given the highest magnetic field levels recorded by EMF RAPID were 70 mG, with an overhead line yielding an average magnetic field level of up to 20 mG, the understanding that the Project will operate within this range, and based upon the U.S. standards and guidelines (i.e., most stringent standard of 200 mG), no adverse effects on human health would be expected from operation of the Project. For continued reference, the Earth's magnetic field is about 500 mG. Consequently, no additional protection and/or mitigation measures have been identified.

Ice Fall and Throw

Unlike telecommunication towers, the wind turbines purchased for this Project will have a solid conical tower. This design reduces the potential for ice build up on the tower itself since there is no lattice or crevices for ice to accumulate. No other specific protection or mitigation measures are available to address ice fall.

In terms of ice throw, when the rotor becomes unbalanced due to a change in blade weighting (e.g., caused by ice build up), the turbine brake is automatically applied to stop the blades from turning (i.e., it shuts itself off). The blades will not restart their movement until the imbalance is removed (e.g., the majority of ice is removed). This design feature greatly reduces the potential ice throw from the turbines on the few days per year when icing is possible.

Canadian Hydro, with nine years of wind operating experience in Alberta, a province that experiences a wide range of climatic conditions during the winter months, has never encountered an issue with ice fall or throw.

Catastrophic Failure

The structural integrity of the GE turbines is designed to withstand wind speeds of about 200 km/hr, equivalent to a Level 2 tornado. However, during high wind events (i.e., >25 m/s or about 90 km/hr) the turbines will cease operations. Turbine braking is accomplished by full blade feathering. Each blade is equipped with a hydraulic cylinder enabling the blade to rotate 95 degrees to easily pass the wind without causing lift. In addition, the nacelle has a yaw system that allows the entire blade assembly to be turned so as to not catch the wind. A secondary fail-safe mechanical brake system is mounted on the high-speed shaft connecting the gearbox to the generator.

The blades of the turbine weigh over six tonnes. Thus, in an extreme weather and unlikely malfunction event where the blades would detach from the rotor, they would drop to the ground rather than be flung a large distance. The same can be said about the entire rotor assembly, which including blades and nose cone weighs 35 tonnes.

7.14.4 Net Effects

7.14.4.1 Construction

With proper protection and mitigation measures, and adherence to Canadian Hydro's safety policies and procedures, there is minimal increased or new risk to public health and safety from construction of the Project.

7.14.4.2 Operation

With the implementation of appropriate operations protocols there is minimal increased or new risk to public health and safety from the operation of the Project. Though the possibility of injury from ice falling or thrown from the turbine tower or blades or from the collapse of the entire structure exists, the possibility of this happening with the built in safety features to the structures as well as on-going maintenance of the equipment is highly unlikely.

7.14.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have limited effect on public health and safety during construction or operation of the facilities. Given the short-term nature of construction activities, and limited operational risks associated with the Project, the level of impact after protection and mitigation measures have been employed is rated as minimal (i.e., the resource should return to baseline levels). No significant negative net effects are anticipated to public health and safety.

7.15 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

This section refers to item 7.1 of the MOE's environmental screening checklist: will the project have negative effects on heritage buildings, structures, or sites, archaeological resources, or cultural heritage landscapes?

7.15.1 Existing Environment

A Stage I Archaeological Assessment was completed for the study area. The assessment consisted of background research to identify known sites or areas of potential archaeological sites within the study area. A variety of sources were consulted in the course of this work and included a thorough review of published and unpublished reports on past archaeological surveys and excavations, a review of the history of land-use in the area, and an examination of archaeological site inventories and archival materials.

The limited settlement of the study area by early European settlers may have been the result of the areas short growing season and extensive areas of poor drainage. These factors would also have theoretically discouraged sedentary settlements during the precontact Woodland period, though portions of the study area could support crops thus providing for the potential Indigenous Woodlands people who were involved in agricultural production. The poor soil drainage and short growing season would, however, not have impacted the activities of Indigenous hunter-gatherers.

The Stage I Archaeological Assessment found no known/registered archaeological sites within the study area, though it should be noted that the area may not have been intensely investigated for archaeological resources in the past. Consequently, the absence of registered archaeological sites may not accurately reflect the archaeological potential of the study area. Research conducted in conjunction with the Stage I Archaeological Assessment has indicated the possibility for the recovery of pre-contact and European archaeological material to be of moderate to high potential (**Appendix C3**).

7.15.2 Potential Effects

7.15.2.1 Construction

Given the potential for the discovery of as-yet unrecovered artefacts, there is some potential for these resources to be lost or damaged over the course of Project construction activities. As with most areas in southern Ontario, there is also a limited potential to discover burial areas.

7.15.2.2 Operation

Once the turbines, access roads, power lines, and ancillary facilities are installed, no additional effects on historical and/or archaeological resources are expected.

7.15.3 Mitigation Measures

7.15.3.1 Construction

As per the Ministry of Culture guidelines (1993), a Stage II Assessment will be conducted on those areas that have potential for archaeological or heritage finds based upon a visual evaluation in the field by a licensed archaeologist. If any significant historical or archaeological resources are found, the resource(s) will be avoided or Stage III Assessment will be initiated to document and/or remove the resource(s). During the assessment process, protective and mitigative measures, including avoidance and/or systematic excavation strategies, will have to be designed to the satisfaction of the Ministry of Culture.

Should deeply buried archaeological resources be found during construction, the Ministry of Culture should be notified immediately. If deemed necessary by the Ministry of Culture, a licensed archaeologist may be required to develop site-specific mitigative measures and oversee site salvage operations.

As is possible on virtually any land in southern Ontario, unmarked Aboriginal or Euro-Canadian burials could be present within the work areas. In the event that human remains are encountered before or during construction, all work should stop immediately, the Ministry of Culture contacted, and the Registrar or the Deputy Registrar of the Cemeteries Regulation Unit of the Ontario Ministry of Consumer and Commercial Relations notified, as well as the appropriate police and/or local medical officer of health.

7.15.3.2 Operation

No protection or mitigation measures are required for the operation phase of the Project due to the previous identification of any historical and/or archaeological resource during the course of construction.

7.15.4 Net Effects

7.15.4.1 Construction

By following the procedures recommended above no net effects to historical and/or archaeological resources are anticipated.

7.15.4.2 Operation

Operation of the Project is not anticipated to have any net effect on historical and/or archaeological resources.

7.15.5 Significance of Net Effects

The effect of installing the various Project components is anticipated to have limited effect on historical and archaeological resources during construction or operation of the facilities. Given the limited use of this area by First Nations and early European settlers, the level of impact after protection and mitigation measures have been employed is rated as minimal (i.e., the resource should return to baseline levels). No significant negative net effects are anticipated to historical and/or archaeological resources.

7.16 VIEWSCAPE

This section refers to item 7.2 of the MOE's environmental screening checklist: will the project have negative effects on scenic or aesthetically pleasing landscapes or views?

7.16.1 Existing Environment

It is generally understood that the physiography and land-use of an area largely contributes to the visual characteristics of the given landscape. Within the south-western portion of Melancthon Township, the visual characteristics are composed of a generally flat to gently undulating landscape made up of a large plateau of surficial soils dominantly derived from glacial till overlaying Silurian dolomite bedrock of the Guelph formation.

European settlement occurred in the early 19TH Century, however, many settlers were discouraged given the short growing season and extensive areas of poor drainage. Today, assisted with modern technologies, agriculture is the dominant land-use in the Township. The study area is primarily used for growing winter wheat, canola, forage, pasture, corn, soybeans, and potatoes.

Located within the Great Lakes Forest Region's Huron-Ontario Section the natural upland forest cover is dominated by sugar maple, American beech, basswood, white ash, white oak, bur oak, eastern hemlock, yellow birch, and eastern white pine. Forests of silver maple, white elm, red elm, black ash, and eastern white cedar generally develop in lowland areas. Because of the elevation of this region, and a climate harsher than in the surrounding regions, there are northern forests affinities in certain types of communities.

7.16.2 Potential Effects

7.16.2.1 Construction

During the construction phase large transport vehicles and construction cranes will be on-site and in the area to erect the turbines and ancillary facilities. The scale of the equipment required to construct the Project will be larger than what most persons are familiar with; even in contrast to most agricultural equipment. Consequently, construction machinery has the potential to temporarily affect the local viewscape.

7.16.2.2 Operation

The key potential effect during the operation phase of the Project is visibility and its association with a change in the present viewscape. The diameter of the tower base is approximately seven meters, nacelle height is 80 metres, and the blades are 37 metres long. Thus, these tall structures will be visible for some distance in the surrounding environs. However, visibility of the turbines will vary from receptor to receptor based upon the following factors:

- *surficial patterns*: landform – largely determined by physiography and tree cover
- *topography*: slope – the greater the slope the more easily turbines can be seen from greater distances
- *observer position*: viewing – distance from the turbines reduces scale
- *turbine marking*: lighting – primarily affecting night time visibility.

7.16.3 Mitigation Measures

7.16.3.1 Construction

Construction activities will be confined to the workspace areas, which will assist in limiting the potential disruptions to the viewscape. Further, it is expected to take about three days to erect each turbine, which

will also assist in dispersing the visual changes over the course of the construction period (i.e., they will not be heavily concentrated in one area). Dust, which can also produce short-term visibility effects, will be controlled as noted in **section 7.7**.

7.16.3.2 Operation

The visual characteristics of the Project and the surrounding agricultural and wooded landscape are considered to exhibit minimal to moderate scenic attributes with respect to landscape distinction. That is, the landform of the study area tends to exhibit indistinct surface patterns due to uniformity in land-use and vegetation.

The turbines are designed to rotate into the prevailing wind direction at any given time. Accordingly, the turbines will be oriented between WSW and WNW more than 50% of the time. Thus, the turbines will be most visible (i.e., full fontal view) to receptors in this zone. To soften the look of the turbines, the towers will be painted light grey and made out of rolled steel (i.e., they are not steel lattice towers). The nacelle and blades will also be light grey in colouring. Light grey colouring was selected since it is generally understood that this colouring blends with the environment in comparison to other colours such as white.

Given the general uniformity in surficial landform patterns, limited topographic relief (i.e., slope), multiple viewing locations from residences and transportation routes, and moderate scenic attributes throughout the study area, representative visual simulations of what the proposed Project would look like were prepared. The simulations were prepared from six viewing locations throughout the study area (**Figures 7.1** through **7.3**). As shown in the Figures, the visibility factors noted above confine the visibility of the turbines.

Transport Canada's Aerodrome Safety Branch is in the process of reviewing and updating the requirements with respect to the provision of navigation warning lights to ensure the aeronautical safety of wind farms. The Canadian Wind Energy Association has been working with Transport Canada to refine the existing lighting standards to better reflect the uniqueness of wind turbines. For example, in Canada some wind farms have every turbine lighted, while others have no lights.

With respect to the Project, it is proposed that not every turbine be lighted for navigational purposes. While maintaining pilot safety, this approach would reduce observed lighting effects in the local area and make the Project less attractive to avian species. Further, if Transport Canada permits a choice between red or white, solid or flashing lights, the Project proposes to use white flashing lights with minimal intensity and flashes per minute. The final navigational requirements will be determined with Transport Canada's Aerodrome Safety Branch prior to the start of Project commissioning.

As noted in **section 7.5**, stakeholders raised concerns about property values within the viewscape of the Project. Studies carried out in Australia, Europe, and the U.S. all indicated no material effect to property values in the viewscape of a wind farm. No additional protection or mitigation measures are proposed.

7.16.4 Net Effects

7.16.4.1 Construction

With the implementation of the identified protection and mitigation measures, and considering the dispersed nature of the construction activities, no net adverse effects have been identified.

7.16.4.2 Operation

The installation and operation of the wind turbines will permanently alter the existing viewscape, however, existing landform, and appropriate tower colouring and lighting will combine to reduce the extent of this effect. While it is true that beauty is in the eye of the beholder when it comes to the aesthetics of wind turbines, the fact that local and provincial support for the Project has been overwhelming cannot be overlooked.

7.16.5 Significance of Net Effects

The effect of installing the various Project components will have an effect on the local viewscape during construction or operation of the facilities. Given the various mitigative measures, coupled with the existing landform, the level of impact after protection and mitigation measures have been employed is rated as low (i.e., slight decline in resource over life of project) due to the change in viewscape (without suggesting negative or positive attributes). However, no significant negative net effects are anticipated to the viewscape.

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Figure 7.1 Simulated Views 1 and 2

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Figure 7.2 Simulated Views 3 and 4

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Figure 7.3 Simulated Views 5 and 6

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7.17 ACCIDENTS AND MALFUNCTIONS

This section refers to items 9.2 of the MOE's environmental screening checklist:

- *will the project cause any other negative environmental effects not covered by the criteria outlined above?*

The primary protective measure for accidents and equipment malfunctions is the safe design, construction, operation and maintenance, and decommissioning of the turbines and ancillary facilities. Accidents and malfunctions can also be minimized through proper training and education of employees. Canadian Hydro should ensure that landowners with a LLA and emergency responders within the study area are aware of the location of the turbines and the procedures to be followed in the event of an emergency. Response to malfunctions or accidents, which may occur as a result of the operation of the turbines, are addressed in Canadian Hydro's Emergency Response Plan (**section 8**).

7.17.1 Potential Effects

Seismicity

Ontario is situated generally within a seismically stable area. National Research Council of Canada velocity seismic zoning mapping for large structures, that is structures greater than 10-storeys (National Building Code of Canada, 1995), indicates that the study area is located in an area rated 0. As such, there is limited potential for seismic activity.

According to section 4.1.9.C of the Ontario Building Code (OBC, 1997), the Foundation Factor for use in calculating live loads due to earthquakes is 1.3 for the tower sites. Table 2.5.1.A of the Ontario Building Code indicates that the Zonal Velocity Ratio is .05 for the area of the Project. Based upon the available information it has been determined that there is very little danger to the integrity of the turbines from seismic activity.

Third Party Damage

The wind turbines are typically located away from roads (e.g., 40-plus metres) and are largely in agricultural areas. Nevertheless, the possibility exists for accidental collision from farm equipment and maintenance vehicles. Although possible, it is highly unlikely that farm equipment would significantly damage the towers given their structural integrity (e.g., the rolled steel in the towers is over an inch thick, supporting foundations, and surrounding gravel pad).

Aeronautical Obstruction

The turbines could potentially pose a risk to low flying aircraft. Consequently, the turbines will adhere to marking and lighting requirements of the Aerodrome Safety Branch of Transport Canada. Although marking and lighting have yet to be finalized with Transport Canada, the regulations generally require tower painting if no daytime lighting is installed and night time lighting (red or white in colour).

7.17.2 Mitigation Measures

Based upon the history of the wind industry, accidents and malfunctions are extremely rare with commercial wind turbines. During construction and decommissioning, major components of the turbines are required to undergo an "engineered lift". This means the lifting of each component is designed in advance by an Ontario certified engineer, and only carried out in moderate wind conditions. Construction of the turbines is completed to stringent national and international codes.

The turbines are subject to Canadian Standards Association ("CSA") inspection and approval, as well as Electrical Safety Authority ("ESA") approval. As such, drawings and wiring are physically inspected for safety. In addition, the turbine is installed and maintained by factory-trained personnel. Factory-trained personnel will carry out service and maintenance and these employees are trained in safety procedures.

Ascent of the turbine for service purposes is accomplished using a permanent fixed ladder inside the tower that ascends in stages; a harness system is used as a secondary measure to ensure safety. Two persons are always used to perform turbine service.

As described above, the turbines also utilize sophisticated failsafe devices capable of shutting down the turbine blades in the event of excessive wind conditions, imbalance (i.e., due to ice loading), or malfunction of other turbine components. The location of the turbines, away from residences and in open agricultural fields, minimizes the possibility of an accident or malfunction having any interaction with adjacent residents or structures that are not owned or leased by Canadian Hydro.

The turbines are also equipped with sophisticated lightning protection, including a large copper ground wire in each blade and grounding of the tower. The placement of low concrete or steel barriers/posts along the perimeter of the gravelled area around the turbine would also prevent agricultural equipment from inadvertently striking the turbine structure and pad mounted transformers.

It should be pointed out that turbine marking and lighting are secondary safety measures for aircraft. The turbines, 117 metres tall (about 384 feet) when one blade is upright, are below the minimum flight floor of 500 feet above ground level. It is illegal for aircraft to fly below 500 feet unless they have been granted a special clearance for a low level flight. Low-level aircraft such as ultra-lights and crop dusters are to be familiar with the area they are flying over and are prohibited from night time flights. NAVCanada will update all aeronautical charts, with the turbine locations, within 12 months of Project approval.

7.17.3 Net Effects

With the application of the recommended mitigation measures, any accidents or malfunctions are expected to be limited to levels well below those that could cause significant negative net effects.

7.17.4 Significance of Net Effects

Given the rural nature of the study area, current transportation, storage, and operational practices followed by Canadian Hydro, and the limited magnitude of effects caused by accidents and malfunctions, but that accidents and malfunctions are possible, the level of impact after protection and mitigation measures have been employed is rated as low (i.e., slight decline in resource over life of project). However, no significant negative net effects are anticipated from accidents and malfunctions.

7.18 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

This section refers to items 9.2 of the MOE's environmental screening checklist:

- *will the project cause any other negative environmental effects not covered by the criteria outlined above?*

Specifically, this section assesses the potential of climatic fluctuations in the study area as well as the potential effects that extreme weather and natural events may have on the Project.

7.18.1 Climatic Fluctuations

7.18.1.1 Provincially

The climate of the area is predominately controlled by west to east trending weather patterns, alternating from warm humid air from the Gulf of Mexico to cold dry air from the Arctic. These patterns shift south in the winter and north in the summer. Global computer climate modelling indicates an increase in the variability of the weather patterns with increases in more extreme events (i.e., more frequent low and high temperature events). Overall an increase in average annual temperatures is projected with an increase in precipitation amounts (Climate Change Science Program et al, 2004). The increase in extreme conditions is likely to be accompanied by increases in wind speeds. As noted previously, the turbines have a cut out speed (i.e., shut off) of 25 m/s.

7.18.1.2 Regionally

With regard to regional climates, researchers from the University of Calgary working with researchers at Princeton, modelled the potential effects of a hypothetical large-scale wind farm in the Great Plains region of the U.S. Midwest (i.e., Oklahoma). The study attempted to simulate the possible effects of 10,000 wind turbines with 50 metre blades in a 96-by-96 kilometre grid. The model predicted that 10,000 turbines could increase temperatures upward by 2 °C for several hours in the early morning (Globe and Mail, 2004). However, the study authors are quick to point out that the research is ringed with uncertainties.

In our opinion, the scale of this hypothetical project is unrealistic since there:

- is no contiguous land base in Ontario that could support 10,000 turbines
- the geography of Ontario is such that the specified grid spacing of turbines is virtually impossible
- 50 metre blades are still relatively uncommon
- if the turbines were only rated to 1 MW the 10,000 turbines would produce far more electricity than what is currently envisioned by the provincial government

Without debating the numerous assumptions that were built into the model, including the unrealistic scale of the project, it is sufficient to say that no climatic fluctuations are expected as a result of Phase I or future phases of the Project either as a stand alone project or in combination with other projects proposed in the surrounding environs.

7.18.2 Extreme Events

Extreme events include rain, hail, ice storms, fire, tornadoes, earthquakes, and lightening strikes. The following events have been considered and are included within the various Project design components:

- rain – surficial drainage patterns will remain intact and continue to convey rain water
- hail – the turbine blades, nacelle, and tower are constructed of materials to be able to withstand damage from the impact of hail
- ice storms / freezing rain – as noted in **section 7.14**, the turbines are designed to automatically shut down when there is any significant ice load on the blades
- tornadoes – as noted in **section 7.14**, the blades will stop moving at wind speeds greater than 25 m/s, even though they are designed to withstand the forces of a Level 2 tornado (i.e., 200 km/hr), and the foundation design will resist similar forces

- earthquakes – as noted in **section 7.17**, structures will be designed to meet the earthquake loads for the Shelburne area as per the Ontario Building Code
- lightning – the turbines and substation will be equipped with lightning protection systems designed to accept the electrical charge and transfer it to the ground; the systems may be equipped with lightning strike sensor to determine the number of strikes and whether it is necessary to send out an inspector prior to the turbine being placed back in service.

7.19 SUMMARY OF POTENTIAL EFFECTS AND MITIGATION MEASURES

Table 7.5 provides a summary of the potential effects, mitigation measures, net effects, and the significance of those net effects for the project specific issues identified in **sections 7.3** through **7.18**.

Table 7.5 Summary of Project Activities, Mitigation Measures, and Significance of Net Effects

Project Activity	Affected Environmental Feature(s)	Potential Effect(s)	Mitigation Measures	Net Effect(s)	Significance of Net Effects
Construction Activities					
• turbine construction • construction of turbines in close proximity to drains	• drains crossed or immediately adjacent to turbine construction sites	• erosion of drainage banks • short-term increases in turbidity from soil erosion • short-term degradation of fisheries habitat	• consult the GRCA to determine permitting and mitigation requirements • in the event that construction will occur proximal to watercourses, prior to, and for the duration of construction, erosion control fencing fronted with a row of straw bales should be securely installed on both banks of the watercourse parallel to the water's edge • refuelling of construction equipment should occur a minimum of 100 m from surface water receptor or body of water • as appropriate, report spills to Ministry of Environment Spills Action Centre	The effect will be spatially limited and of a temporary duration with the implementation of the protection and mitigation measures specified.	Minimal
• turbine construction • foundation construction	• groundwater	• encounter water-bearing formations during foundation construction • encounter non-documented shallow dug wells • temporary interruption of supply of well water	• before construction commences, existing wells located 100 m away from the construction site should be identified by field reconnaissance and/or landowner interviews • supply water where water levels have dropped due to any dewatering activities • compensation where monitoring identifies short-term or long-term impaired water supply • refuelling and other potentially contaminating activities should not occur near wells • as appropriate spills should be reported immediately to the MOE Spills Action Centre • repair of any damaged wells	Following the implementation of good construction practices, it is anticipated that this effect will be short term in nature and to have little to no effect on adjacent private water wells.	Minimal

Table 7.5 Summary of Project Activities, Mitigation Measures, and Significance of Net Effects

Project Activity	Affected Environmental Feature(s)	Potential Effect(s)	Mitigation Measures	Net Effect(s)	Significance of Net Effects
• general activities associated with Project construction	• residential, commercial, and institutional land-use	• temporary/limited increased pressure on local services • temporary disturbance and inconvenience to local rural inhabitants	• project representatives will be available to respond to community concerns • all efforts will be made to minimize inconvenience to local inhabitants • where practical and cost effective local goods and services will be purchased locally	There will be short-term disruption to traffic patterns along local roads and the potential for short-term inconvenience to residential, commercial, and insitutional receptors in the affected areas. Lands hosting the Project will also be removed from their present use for the life of the Project.	Minimal
• general activities associated with Project construction	• air quality	• temporary increase in nuisance dust and construction vehicle emissions	• nuisance dust should be controlled as needed by treating topsoil piles, construction sites, and access roads • as appropriate, road surfaces at construction access points should be cleaned of debris • all combustion engine equipment will be appropriately maintained to meet emission standards of the MOE and/or MTO	Application of mitigation measures should limit dust and odour emissions to the work areas and limit combustion emissions. Any net effects are expected to be short-term and localized.	Minimal
• general activities associated with Project construction	• environmental noise	• short-term construction-related noise at offsite receptors	• maintain construction vehicles in good working order with functioning standard engine muffling devices • to the extent possible, restrict work activity to daylight hours and with regard for any local regulations and by laws	Short-term, intermittent noise increases at the work areas and/or along the haul routes.	Low
• general activities associated with Project construction	• VTE species, wildlife, and habitat	• limited removal of habitat • temporary disruption to movement of wildlife	• where practical, avoid clearing during breeding season for migratory birds (April 15 to July 15) • restrict vehicle movements to construction area and access roads and avoid harassment of animals • minimize natural vegetation removal to the extent practical through strategic siting of turbines away from natural areas	Some potential for disturbance of natural features, habitats, and species as a result of the limited removal of vegetation and increased human activity. Effects are expected to be short-term in duration and spatially limited to the work areas and immediately adjacent areas.	Low

Table 7.5 Summary of Project Activities, Mitigation Measures, and Significance of Net Effects

Project Activity	Affected Environmental Feature(s)	Potential Effect(s)	Mitigation Measures	Net Effect(s)	Significance of Net Effects
• general activities associated with Project construction	• migratory birds	• limited removal of habitat	• where practical, avoid clearing during breeding season for migratory birds (April 15 to July 15) • minimize natural vegetation removal to the extent practical through strategic siting of turbines away from natural areas	Construction of the turbines in areas close to or within natural habitat has the potential to create some disturbance to natural habitat for migratory birds. However careful siting of these features has minimized both the spatial and temporal disturbance.	Low
• general activities associated with Project construction	• agriculture and rural resources	• disruption of artificial drainage systems • potential productivity reduction in areas best suited for growing common crops (i.e., CLI Class 1, 2, and 3 lands) • disruption to pastured livestock • disturbance to normal agricultural cultivation activities	• topsoil stripping • minimize diagonal severance through routing of access roads along headlands and field edges and placement of turbines near lot lines and in headlands • identify type and location of drainage system • retain licensed tile contractor to repair drainage system if required • ensure livestock not effected by turbine construction through erecting of temporary or permanent fencing as required • return extra land taken for construction as close to preconstruction condition as is practical	Limited disturbance to agricultural lands, operations, and infrastructure are expected in the construction workspace areas. Portions of these areas will be rehabilitated following construction and put back into agricultural use.	Low
• general activities associated with Project construction	• neighbourhood and community characteristics	• temporary disruption in the enjoyment of the rural character of the area	• a project representative will be available to respond to individual concerns • construction related activities will be conducted to minimize disturbance to the local rural inhabitants as much as is practical	Temporary effect to the neighbourhood character due to the increased activity on roads and in nearby towns. Activity at the work areas may temporarily result in nuisance noise and dust and some sporadic inconvenience to local residents.	Low

Table 7.5 Summary of Project Activities, Mitigation Measures, and Significance of Net Effects

Project Activity	Affected Environmental Feature(s)	Potential Effect(s)	Mitigation Measures	Net Effect(s)	Significance of Net Effects
• general activities associated with Project construction	• construction related traffic	• temporary increase in traffic volume • intermittent temporary disruption of local traffic patterns • intermittent / temporary inconvenience to local traffic	• development of a traffic management plan • ensure all contractor employees adhere to local speed limits, traffic signage, and utilize safe defensive driving practices	Road safety is not expected to be an issue during the construction phase, however, the potential for accidents along the haul routes and on-site cannot be totally avoided.	Minimal
• general activities associated with Project construction	• public health and safety	• increased hazard to local inhabitants due to increased construction vehicle activity • hazard to locals who make unauthorized access to work sites	• ensuring all contractor employees adhere to local speed limits, traffic signage, and utilize safe defensive driving practices • controlled access to work site	With the application of protection and mitigation measures there is little risk to public health and safety.	Minimal
• general activities associated with Project construction	• historical and archaeological resources	• damage or destruction of buried artefacts	• completion of a Stage II Archaeological Assessment at turbine construction sites and along access roads prior to commencement of construction • notification to contractors on stop work protocol should artefacts be encountered during construction	By following the procedures recommended above no net effects to historical and/or archaeological resources are anticipated.	Minimal
• general activities associated with Project construction	• viewscape	• construction machinery will temporarily alter the viewscape	• minimise time and location of equipment on worksite to the shortest extent practical	With the implementation of the identified protection and mitigation measures, and considering the dispersed nature of the construction activities, no net adverse effects have been identified.	Low

Table 7.5 Summary of Project Activities, Mitigation Measures, and Significance of Net Effects

Project Activity	Affected Environmental Feature(s)	Potential Effect(s)	Mitigation Measures	Net Effect(s)	Significance of Net Effects
• general activities associated with Project construction	• disposal of wastes	• nuisance refuse being spread to adjacent properties • potential for surface and/or groundwater contamination	• systematic collection of waste • removal of all wastes to an approved disposal facility • appropriate handling and disposal of all waste classes according to current provincial standards and guidelines • disposal of contaminated material if encountered to current regulatory standards	Temporary on-site storage of waste should not present any adverse effect. It is possible that the disposal of wastes will have a minor incremental effect on soil, groundwater, and surface water at the waste disposal site.	Low
Operation Activities					
• operation of water well and septic system at maintenance shop / control building	• groundwater	• interruption of supply of well water to offsite wells • contamination of wells by septic system	• both the water well and septic system will be maintained to the applicable standards and regulations	The operation of the water well and septic system will have little effect on groundwater supply or quality due to the low/occasional use of the facility.	Minimal
• general activities associated with Project operation	• residential, commercial, and institutional land-use	• loss of use of land taken for the Project • perceived effects to property values adjacent to Project	• compensation provided to those landowners who have lost land use for the Project via the LLA • research into the correlation between wind farms and property values indicates no material effect	With regard to land-use the operation of the Project is not anticipated to greatly affect the character of the area. With regard to property values and wind farms property values are expected to be maintained at least at present values.	Minimal
• turbine operation	• environmental noise	• limited off-site environmental noise effects from mechanical and aerodynamic noise emitted from the operating wind turbines	• environmental noise will be within acceptable MOE limits at all critical Points of Reception within 1,000 m of one or more turbines for wind speeds of 6, 7, 8, 9, 10, and 11 m/s.	Based upon the modelling completed, and the MOE's approval of the modelling, the Project will be in compliance with applicable environmental noise guidelines.	Low
• Project operation	• VTE species, wildlife, and habitat	• disturbance to wildlife	• disturbance to wildlife limited to area immediately adjacent to turbines will minimized to the extent practical	Disturbance to local flora, though permanent, will be spatially restricted to the operating areas	Low
• turbine operation	• migratory birds	• mortality due to collision of birds and bats with turbines	• siting of turbines away from know migration routes • siting of turbines in non-natural areas	The study area meets the general and specific siting guidelines for onshore facilities suggested by BSC (2003).	Low

Table 7.5 Summary of Project Activities, Mitigation Measures, and Significance of Net Effects

Project Activity	Affected Environmental Feature(s)	Potential Effect(s)	Mitigation Measures	Net Effect(s)	Significance of Net Effects
• Project operation	• neighbourhood and community characteristics	• changes in the present local character	• Canadian Hydro will continue to work with the community to make the incorporation of the Project into the rural landscape positive	Some short-term dissatisfaction may arise from some, but this will be balanced by the anticipated spin offs to local tourism, Canadian Hydro's continuing involvement in the community, and the positive feedback generated from the utilization of renewable power.	Low
• Project operation	• public health and safety	• threats from EMF, ice fall and throw, and catastrophic failure	• all equipment will be maintained to current mandated industry standards • braking system on turbines to stop blades from rotating when they are out of alignment • Turbines will be equipped with lightning protection • Turbines will be fitted with appropriate navigational lighting and identified of aircraft navigational maps	Though the possibility of injury from ice falling or thrown from the blades or from the collapse of the entire structure remotely exists; the possibility of this happening with the built in safety features to the structure as well as on-going maintenance of the equipment is unlikely.	Minimal
• turbine operation	• viewscape	• change in present viewscape	• low visibility paint on the turbines and lighting will be utilized to attenuate visual effects	The wind turbines will permanently alter the existing viewscape, however, existing landform, tower colouring, and lighting combine to reduce the extent of this effect.	Low
• Project operation	• disposal of wastes	• nuisance refuse being spread to adjacent properties • potential for surficial and /or groundwater contamination	• systematic collection of waste • removal of all wastes to an approved disposal facility • appropriate handling, storage, and disposal of all waste classes according to current provincial standards and guidelines	Temporary on-site storage of waste should not present any adverse effect. It is possible that the disposal of such wastes will have a minor incremental effect on soil, groundwater, and surface water at the waste disposal site itself.	Low

Table 7.5 Summary of Project Activities, Mitigation Measures, and Significance of Net Effects

Project Activity	Affected Environmental Feature(s)	Potential Effect(s)	Mitigation Measures	Net Effect(s)	Significance of Net Effects
• Project operation	• accidents and malfunctions	• seismicity • third party damage • aeronautical obstruction	• turbines will be built to Ontario Building Code requirements earthquakes in the Shelburne area • urbines will be maintained to current regulatory standards • turbines equipped with sensors that will shut down the turbines in the event of excessive ice loading • turbines will be equipped with lighting to current federal regulatory aeronautical obstruction standards • the area immediately around the turbine will be sufficiently protected to prevent third party interference from the surface	With the application of the recommended mitigation measures, any accidents or malfunctions are expected to be limited to levels well below those that could cause significant negative net effects.	Low
• Project operation	• climatic fluctuations • extreme events	• Potential impact on current regional climate patterns • Potential damage from extreme events including rain, hail, ice storms, fire, tornadoes, earthquakes, and lightening strikes	• surficial drainage patterns will continue to convey rain water • turbine blades, nacelle, and tower are constructed of materials able to withstand damage from the impact of hail • turbines are designed to automatically shut down when there is ice load on the blades • turbine blades will stop moving at wind speeds greater than 25 m/s, and the foundation design will resist similar forces • structures will be designed to meet the earthquake loads for the Shelburne area as per the Ontario Building Code • the turbines and substation will be equipped with lightening protection systems	Given that the turbines are built to withstand a majority of typical weather occurrences and are equipped with failsafe devices in the event; the potential impacts of the climate on the Project are expected to be limited to levels well below those that could cause significant negative net effects	Minimal

Table 7.5 Summary of Project Activities, Mitigation Measures, and Significance of Net Effects

Project Activity	Affected Environmental Feature(s)	Potential Effect(s)	Mitigation Measures	Net Effect(s)	Significance of Net Effects
Decommissioning Activities					
• structure removal	• soils, terrain, vegetation	• reduced productivity of land	• compensation over life of project through LLA • removal of foundations to depths where they will not interfere with agricultural activities. • rehabilitation of soil	With the removal of the foundation and soil rehabilitation the site can generally be returned to productive agricultural use if desired.	Minimal

7.20 CUMULATIVE EFFECTS

This cumulative environmental effects assessment ("CEA") describes the potential cumulative effects of the proposed Project in combination with the existing environment and the effects of other *certain* and *reasonably foreseeable* actions and projects. **Sections 7** and **8** build upon the hierarchical best practice principles of avoidance, minimization, and compensation to limit Project-specific effects. As such, the potentially adverse effects on environmental systems from the Project have been minimized prior to applying CEA.

The objective of this CEA is to identify and assess cumulative effects that are considered significant at the regional level. To accomplish this, the CEA must not only consider the net effects of the Project, but also how these effects will interact with the net effects of other unrelated actions and projects. **Section 7.20** has been prepared with regard for CEA Agency's Operational Policy Statement OPS-EPO/3-1999: *Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act* as well as their *Practitioners Guide: Cumulative Effects Assessment, 1999* (CEA Guide).

7.20.1 Methodology

7.20.1.1 Terminology

Throughout the literature there is often differing and overlapping opinions on how to define cumulative effects. However, the CEA Guide defines cumulative effects as changes to the environment that are cause by an action [of the Project] in combination with other past, present, and future human actions. For example, several developments may have insignificant effects individually, but together they may have a significant, additive effect on a given environmental system. CEA is a study of these effects.

Unrelated actions or projects that are considered *certain* are defined as an action/project that will proceed or that there is a high probability the action/project will proceed (e.g., the project has a building permit). *Reasonably foreseeable* actions/projects are defined as an action/project that may proceed, but there is some uncertainty about this conclusion (the project is subject to a regulatory review).

Valued ecosystem components ("VECs") are defined as the components of the natural and social environment that are considered valuable by the participants in the stakeholder engagement process. Values may be attributed for economic, social, environmental, aesthetic, or ethical reasons.

Finally, the impact zone is defined as a geographic area, extending from an action or project (i.e. potential impact zone or area), in which an effect is measurable. This term is most often used when establishing a spatial study area for the CEA.

7.20.1.2 How Cumulative Change Occurs

Cumulative environmental change can occur in various ways, including the following pathways:

- *physical-chemical transport:* a physical or chemical constituent is transported away from the project under review, where it then interacts with another project (e.g., air emissions, sedimentation, waster water effluent)
- *nibbling loss:* the gradual disturbance and loss of land and habitat (e.g., clearing of land for a new sub-division and new roads into a forested area)
- *spatial and temporal crowding:* occurs when too much development occurs within too small an area and in too brief a period of time

- *growth-inducing potential:* each new project can induce further actions or projects to occur; sometimes referred to as "spin-off" effects (e.g., increased vehicle access into a previously roadless hinterland area resulting in increased hunting pressure).

7.20.1.3 Study Design

CEA is a process to describe the multiple pathways that project effects may interact to produce change within environmental systems. This process of change, accumulating additively (i.e., cumulatively) or interactively (i.e., synergistically), occurs over both temporal and spatial boundaries and can be the aggregate result of past, present, and future project activities.

This CEA has been undertaken in five key steps, consistent with CEA Agency's Operational Policy Statement and the CEA Guide:

1. *scoping:* identification of regional concerns, VECs, spatial and temporal boundaries, other unrelated projects, and potential effects of the unrelated projects
2. *effects analysis:* focusing on key concerns identified in the scoping step
3. *mitigation selection:* for the various effects identified
4. *significance of net effects:* determination of remaining net effects and their significance within a regional context
5. *follow-up:* identification of any monitoring activities.

Determining the significance of cumulative environmental effects, following the application of protection and mitigation measures, is a key step in the assessment process and assists in identifying appropriate follow-up activities. The definitions of "significance" are provided in **Table 7.1**.

7.20.2 Scoping

The objective of scoping the CEA is to identify the key issues and environmental systems that are to be considered within the effects analysis phase. Scoping was initially undertaken to focus the ESR on Project-specific effects without the application of protection and mitigation measures (**Appendix I**). An assessment of the Project-specific effects was subsequently carried out to determine the significance of any Project net effects (**section 7**). On this basis the following effects and their significance were identified in relation to the Project:

Minimal

- surface water, soil erosion, and fisheries
- groundwater quality
- residential, commercial, or institutional land-use
- air quality
- construction traffic
- public health and safety
- historical and archaeological resources

Low

- environmental noise
- VTE species, wildlife, and habitat
- migratory birds
- agricultural and rural resources
- neighbourhood and community characteristics
- viewscape and aesthetics
- waste material disposal and remediation of contaminated land
- accidents and malfunctions

Building upon the predicted Project-specific effects, the next step in CEA is to identify regional issues of concern to identify where overlap may occur.

7.20.2.1 Identification of Regional Activities/Issues

To assist in identifying regional issues of concern, comments were solicited from local and regional non-governmental organizations and agencies, as well as local individuals and groups. Issues were only considered if the unrelated projects were certain or in the foreseeable future and if their assessment would influence the CEA. The key regional issues identified included:

- geographic concentration/clustering of proposed wind farm developments and their associated effects
- intensification of area agricultural markets (i.e., high yielding land rentals associated with cash crops such as potatoes) and associated economic effects
- implementation of the provincial green belt plan and the associated potential demands for/on new housing and municipal services
- new municipal tax revenues.

Considering the regional issues of concern that have been identified, coupled with the Project-specific effects, there is demonstrable overlap and similarity of issues among the potential effects. These potentially overlapping effects are examined in detail below.

7.20.2.2 Identification of Regional VECs

The VECs addressed in the CEA have also been identified based on stakeholder concerns, prioritizing various components through professional judgement and industry experience, and from comments solicited during the consultation process (e.g., open houses, website/e-mail, and SLC). The key issues, VECs, and indicators are outlined in **Table 7.6**.

Given the complexities and practical difficulty of scoping transboundary effects (i.e., bird migrations), and the predicted limited effect on the resource, these issues are not included within the regional discussion below. The Project, and/or its interactions with other unrelated projects, is not expected to contribute to global scale effects (e.g., ozone depletion and global warning) and thus this issue is not included within the scope of the CEA.

Table 7.6 Issues, VECs, and Indicators

Environmental Feature	Regional Issue	Regional VECs	Example Indicators
avian resources	avian mortality, habitat fragmentation, decrease in resource	birds, bats, and raptors	resident bird and bat species
aquatic resources	disruption or alteration to fish/fish habitat	aquatic flora and fauna	resident fish species
wildlife resources	sensory alienation, habitat fragmentation	wild game resources	resident non-avian wildlife species
environmental noise	changes to rural noise patterns	residential receptors	humans
viewscapes	alteration to views and/or landscapes	area aesthetics	humans

Table 7.6 Issues, VECs, and Indicators

Environmental Feature	Regional Issue	Regional VECs	Example Indicators
land-use / landform	introduction of new land-use, permanent change in land-use	land-use fabric	agricultural lands, estate residential
employment	new type of employment, job creation	labour pool/employment rate	humans
agricultural land (rentals & crops)	loss of land base for agricultural use	agricultural land and infrastructure	agricultural land productivity
housing (lot severances)	increased pressure for lot severances	agricultural land and infrastructure	severances for estate residential
municipal services	demand for services such as water and waste water, emergency services	municipal infrastructures	water supply treatment facilities ambulance/hospitals
municipal tax	access to new revenues from taxation	municipal budget	budget allocations/ expenditures

7.20.2.3 Identification of Spatial and Temporal Boundaries

During the scoping process, selection of definitive spatial and temporal boundaries for the CEA is required since cumulative environmental change often extends beyond the geographical site boundaries of the Project. The spatial and temporal boundaries selected for the CEA are discussed below.

Spatial Boundaries

To make conservative assumptions about the magnitude and probability of possible effects, the spatial boundaries were established with an additional ten kilometres around the turbine siting area (**Figure 7.4**). The power line corridor was not considered in this assessment since all construction and operation activities are planned within an existing road ROW and the scale of those activities are common to all road ROWs in Ontario.

These spatial boundaries are beyond the zone of influence of turbine and ancillary facilities construction (e.g., dust and noise) and operation activities (e.g., vegetation control), and consequently the identified effects will have diminished to background levels. The spatial boundaries are also considered conservative in terms of managing both effects and risks.

Temporal Boundaries

The temporal boundaries for this CEA reflect the nature and timing of Project activities and the availability of information surrounding the certain and foreseeable future projects. The construction and operation phases of the Project have three key milestone activities: i) ESR and technical design – 2004/2005; ii) construction – 2005/2006; and iii) operation 2006 – 2046[8]. Based upon these milestone activities, three time periods were selected for evaluation in the CEA: 2004, 2006, and 2012.

Existing conditions were considered as those that existed and were identified during the ESR studies (i.e., 2004). In some cases published information was not current to 2004 and thus the assessment relied on a combination of best available information and field reconnaissance. The year 2006, covering post construction clean-up activities, was selected to represent the construction and reclamation period, while

[8] A forty-year life span for the Project has been assumed for the purpose of the CEA. The actual operating life of the turbines and ancillary facilities may actually exceed this timeframe with diligent maintenance.

the year 2012 was selected to represent the operation and maintenance period. Forecasting beyond 2012 increases the uncertainty in effects predictions, largely due to the likelihood of foreseeable future development and unknown projects proceeding.

Although rare in occurrence, it is plausible that accidents or malfunctions may arise due to an unforeseen chain of events during the Project's operational life. Because of the rarity and magnitude of such events, they have been assessed separately (**sections 7.17** and **7.18**) as they are extreme in nature when compared to normal construction and operation activities.

Decommissioning is another event that is beyond the temporal boundaries of this CEA since there is no certainty that this Project will ever be decommissioned. A general discussion on decommissioning is provided in **sections 2.2.6** and **8.3.3**.

7.20.2.4 Identification of Unrelated Projects that May Affect VECs

Other unrelated actions or projects that have been identified through consultations with stakeholders include:

- Canadian Hydro's proposed project in the Township of Melancthon (i.e., next phases) – 165 MW (110, 1.5 MW turbines)
- Superior Wind Energy's project in the Township of Grey Highlands / Town of Blue Mountain – 120 MW[9] (67, 1.8 MW turbines)
- Invenergy Wind Canada's proposed project in the Township of Southgate – 200 MW[10] (133, 1.5 MW turbines)
- Helix-Synergy's proposed project in the Township of Southgate/West Grey – 150 MW[11] (100, 1.5 MW turbines)
- Residential Plan of Subdivision expansion in Riverview, Township of Melancthon (Lot 21, Concession 7 SWTSR).

Although it is unlikely that all the unrelated projects will proceed simultaneously with Project construction, the conservative assumption has been made that they will. This assumption is considered conservative since the effects of the unrelated projects will be assessed simultaneously during their maximum intensity[12]. For example, road traffic associated with moving the various turbine components to the other project sites could interact. It is important to note that not all the proposed wind projects are within the spatial study area, but have been included in the analysis of effects to provide another layer of conservancy in the CEA.

7.20.2.5 Potential Effects of Unrelated Projects

The key potential effects associated with the other unrelated projects, which have the potential to affect the VECs, include:

- avian mortality and habitat fragmentation

[9] Information adopted from Superior Wind Energy Inc.'s website: www.superiorwindenergy.com/5_blue_highlands_wind_farm.asp.
[10] Information adopted from the Independent Electricity Services Operator's website for Connection Assessments (www.ieso.ca/imoweb/connAssess/caa_StatusSummary.asp) and assumed turbine capacity of 1.5 MW.
[11] No pubic information was available at the time of writing, but Helix-Synergy Inc. has established an office in Dundalk, Ontario. 150 MW, achieved with 1.5 MW turbines, represents a best guess of this unrelated project.
[12] Considering the spatial distribution of the other unrelated projects, the staging or phasing of such projects should, in most cases, allow environmental systems time to recover prior to a subsequent disturbance and thus presents a less conservative evaluation framework.

- disruption to wildlife and habitat fragmentation
- disruption and/or alteration to fish and fish habitat
- increase in environmental noise
- change in land-use
- increased construction related traffic
- alteration of existing viewscapes
- new employment opportunities
- demand on municipal services
- contribution of new municipal revenue via taxes.

7.20.3 Identification of Cumulative Effects

7.20.3.1 Year 2004: Baseline Conditions

Information pertaining to the detailed baseline conditions for the ESR study area is provided in **section 2.1** and **Appendix C**. The following is a brief overview of the baseline conditions with the CEA study area.

The CEA study area is comprised of two major physiographic regions that include the Dundalk Till Plain and the Horseshoe Moraines. The study area is underlain by sedimentary bedrock of the Silurian Bass, Guelph, and Amabel-Lockport formations (Chapman and Putnam, 1984). Due in part to the study area's elevation above sea level, and its location in southern Ontario, the area experiences colder than normal temperatures when compared to the surrounding climatic regions.

The Great Lakes Forest Region's Huron-Ontario Section Forest Region (Rowe, 1972) characterizes most of the study area's vegetation, while aquatic flora is consistent with warm, cool, and cold watercourses. Agriculture is the dominant land-use within the CEA study area, supporting field crops such as corn, soybeans, winter wheat, and potatoes. Artificial tile drainage has been installed throughout the study area to assist with increased crop production.

Landscape patterns throughout the CEA study area have been modified through resource development (e.g., aggregate operations), human settlement, agricultural and rural practices, and the infrastructure necessary to support these activities. Each of these activities contributes resources (e.g., employment) into the study area's economy, helping to sustain a reasonable standard of living.

The ESR and technical design phase of the Project will not produce any effects that have the potential to interact with the baseline conditions and/or the other identified unrelated projects. No cumulative effects are anticipated as a result of these activities.

Figure 7.4 CEA Spatial Study Area

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7.20.3.2 Year 2006: Construction

Construction activities associated with the development of the Project between 2005 and 2006 are discussed in **section 2.2.4** and shown in **Table 2.2**. During the 2005 – 2006 time period, although highly unlikely, the CEA has assumed that all the other unrelated projects discussed in **section 7.20.2.4** will proceed with their own construction related activities.

All of the unrelated projects will require some form of environmental assessment prior to being approved for development. During this process it is expected that each development will be required to meet applicable municipal, provincial, and federal standards and regulations as well as employing industry and environmental best practices. This will eliminate and/or minimize the potentially adverse net effects associated with the unrelated projects and in turn limit the type and intensity of their effects to interact with the Project.

On the basis of the above expectation, regional VECs that have been identified as potentially affected by the net construction effects of the Project in combination with the net construction effects of one or more of the other unrelated projects include:

- birds, bats, and raptors – potential loss of habitat, disruption during breeding season
- aquatic flora and fauna – potential alteration or disruption of fish habitat
- wild game resources – increased noise (sensory effect), fragmentation of habitat
- residential receptors – noise and dust
- agricultural land and infrastructure – temporary and permanent loss of agricultural land
- labour pool / employment rate – local hiring
- municipal infrastructures – demand for availability of emergency services.

The significance of these potential cumulative effects is discussed in **section 7.20.5**

7.20.3.3 Year 2012: Operation and Maintenance

The operational and maintenance activities associated with the Project are discussed in **section 2.2.5** and shown in **Table 2.2**. Similar activities are expected for the other wind farm developments, with only basic maintenance (e.g., road upkeep and snow removal) required for the proposed residential plan of subdivision. On this basis, the regional VECs that have been identified as potentially affected by the net operating and maintenance effects of the Project in combination with the net operating and maintenance effects of one or more of the other unrelated projects include:

- birds, bats, and raptors – potential loss of habitat, disruption during breeding season
- aquatic flora and fauna – potential alteration or disruption of fish habitat
- wild game resources – increased noise (sensory effect), fragmentation of habitat
- residential receptors – noise and dust
- area aesthetics – geographic concentration of wind farms
- land-use fabric – change to installation of wind turbines and ancillary facilities
- labour pool / employment rate – local hiring
- agricultural land and infrastructure – temporary or permanent loss of agricultural land

- municipal infrastructures – demand for availability of emergency services
- municipal budget – increase of payments to municipalities through the mill rate established for wind turbines.

The significance of these potential cumulative effects is discussed in **section 7.20.5**

7.20.4 Identification of Mitigation Measures

Mitigating local effects at the source is the best way to reduce the potential for cumulative environmental change. Consistent with the principal of avoidance, implementation of standard construction and operation protection and mitigation measures, and following good industry practices, it is expected that all unrelated projects will be:

- located outside of major migratory bird routes
- separated from residential and institutional receptors such that environmental noise guidelines are maintained
- separated from PSWs, hazard lands, and other sensitive environmental areas
- planned to minimize the amount of land removed from agricultural production
- marked and lighted with regard for both aviation safety and avian fauna attraction
- sited, operated, and maintained with regard for municipal, provincial, and federal policies and standards.

These project-specific activities will greatly limit the potential for adverse effects to interact between or among the various projects, and thus the need for mitigation measures. However, at the regional level, there is still the potential for cumulative environmental effects that will be both temporary (e.g., construction noise) and permanent (e.g., viewscape changes).

The majority of biological and physical change is anticipated to occur through nibbling loss over a very dispersed spatial area and is best mitigated at the project site(s). There is also the potential for positive alteration to socio-economic features through growth-inducing changes associated with new forms of employment, increased municipal budgets via new taxation, and new tourist attractions.

Any changes related to the physical-chemical transport of constituents should be spatially confined with limited potential to adversely interact with other projects and are best mitigated at the project site(s).

On a regional level, the production of electricity from wind energy does not contribute pollutants such as NO_X, SO_2, CH_4, and low level O_3 to the environment; wind power generation does not affect the Earth's protective ozone layer. Consequently, every kilowatt-hour of emission-free wind energy produced potentially represents a kilowatt-hour that does not require the burning of fossil fuel or nuclear operation. This means, the cumulative effects of the Project and other unrelated wind projects could achieve an air quality "offset", contributing to the improvement of Ontario and downwind jurisdictions' air quality.

Considering the vast wind resources available in the Townships of Amaranth, Grey Highlands, Melancthon, Mulmur, Southgate, and the Town of Grey Highlands, among others, should the Ontario Wind Energy Association or the provincial government decide to form a wind power coordinating committee, to monitor the status of wind farm development in this region of Ontario, coordinate planning policies, and/or report on monitoring results (e.g., avian mortalities) to improve future development practices, Canadian Hydro would consider participation in such an initiative.

7.20.5 Evaluation of Significance

A cumulative effect on a VEC may be considered significant even though each individual project-specific effect on the VEC are noted as insignificant. Project specific assessments, which focus on the incremental contribution of the project being assessed, can assist in making significance determinations, but serve only as a starting point. This CEA takes other factors into account, including:

- size of study area
- effectiveness of mitigation
- incremental contribution of net effects from each project under review
- magnitude of change relative to baseline conditions.

Considering these factors, and using the significance criteria set out in **Table 7.1**, a comparative evaluation of project-specific effects and their ability to interact in space and time was carried out (**Table 7.7**). The results of this evaluation suggest that at a regional level, the significance of cumulative environmental change is generally considered minimal to low.

Minimal and low significance cumulative effects are not discussed further since the resource is expected to return to baseline levels or experience only a slight decline over the life of the project. However, there were several VECs affected that were given a rating of medium or high; the cumulative effects on these VECs are discussed below.

7.20.5.1 Medium Significance

Medium significance definition: *the potential effect could result in a decline in the resource to lower-than-baseline, but stage levels in the study area after project closure and into the foreseeable future.*

The regional VECs identified with medium cumulative environmental change significance include:

- birds, bats, and raptors
- area aesthetics
- labour pool / employment rate
- municipal budget

Birds, Bats, & Raptors (negative effect)

While there is no doubt that the operation of wind turbines has the potential to cause avian mortality, the levels of mortality can be reduced following the principle of avoidance (e.g., don't position a project in a known major migratory flight path) and implementing good planning practices (e.g., lighting and marking selection). Good planning and siting practices can also limit the amount of vegetation clearing required for each project and thus minimize the effects of habitat fragmentation.

While the avian mortality at each wind farm is expected to be low (e.g., <2 birds/turbine/year based on data from other wind developments), the combined interactions of all projects have the potential to produce a decline in resource to lower-than-baseline, since there is presently no industrial scale wind farm in the study area. However, given the low mortality rates (especially in comparison to avian fauna killed by cats, vehicles, and buildings – see **Appendix C5**), populations are anticipated to remain in stable condition.

Area Aesthetics (positive/negative effect)

Like any human made structure, and natural landscapes, beauty is in the eye of the beholder. Installation of the projects will permanently change the aesthetics/viewscapes of the study area; stakeholders will view the change as positive, neutral, or negative. While no actions are required to address stakeholders who view the change as positive, actions can be implemented to minimize the aesthetics of the projects. With regard to the wind farms, these actions include tower colouring and lighting, among others (**section 7.16**).

Labour Pool / Employment Rate (positive effect)

Development of the wind industry within the province, specifically within the region under study, is leading to new training and jobs that would otherwise not exist. Although employment at each wind farm will be modest (e.g., 4 – 10 personnel), cumulatively they will produce a noticeable change to better-than-baseline conditions. The spin-off effects from employment are well documented and need not be discussed here except to say that employment means income, which should generate additional disposable income.

Municipal Budget (positive effect)

As noted in the ESR, the development of new infrastructure such as wind farms (and subdivisions) will create an additional tax stream and hence revenue for the local municipality. Both wind farms and the residential lots associated with subdivisions will be taxed at higher mill rates than agricultural or rural lands. While there are many options for the municipalities to allocate this new revenue, it is hoped that they will use the new revenue to maintain and improve existing services and/or create new services or facilities.

7.20.5.2 High Significance

High significance definition: *potential effect could threaten sustainability of the resource and should be considered a management concern.*

The only regional VECs identified with high cumulative environmental change significance, was agricultural land and infrastructure. This was identified as a potentially negative effect, since it is foreseeable that the provincial greenbelt plan will push new residential developments and rural residences in greater numbers into the study area. New industrial and manufacturing plants may also be developed on lands outside of the greenbelt.

In Melancthon Township for example, which is similar to other rural municipalities, it is understood that severances are typically limited to one per lot. However, increased housing and/or industrial demands as a result of the greenbelt, coupled with an aging population that is in the process of retiring from agribusinesses, could mean more applications for severances and subdivisions will occur over the temporal study boundaries.

Should this occur, there would be a permanent change to the agricultural fabric within the spatial study boundaries. In addition, from the wind industry perspective, if new houses/subdivisions were situated on severed lots that are too close to the turbines, environmental noise complaints could arise against the projects, potentially causing difficulties with stakeholder relationships. Corrective actions could be required by the project(s) and/or new subdivision/severance approvals.

It should be recognized that land-use change is a continual process – just as the lands of the spatial study area were converted from forested lands to agricultural lands. However, municipalities and the provincial government will still be active in reviewing new development proposals, implementing planning controls

(e.g., setbacks), and following good planning practices to minimize the potential for future land-use conflicts at both the site-specific and regional levels.

7.20.6 Follow-Up

The purpose of follow-up is to verify the accuracy of the environmental assessment and determine the effectiveness of mitigation measures. Under CEA it is typically the RA that defines and implements the monitoring program, while it is the proponent's responsibility to monitor their own project's contribution to cumulative environmental change. This approach is generally undertaken since it is unreasonable to expect one proponent to monitor the effects caused by another proponent.

To this end, and consistent with environmental assessment best practices, Canadian Hydro has designed and will implement the monitoring program discussed in **section 8**. Many of the example indicators in **Table 7.6** are the same or similar to those indicators that will be used by Canadian Hydro during the construction and operation phases of the Project. As required by NRCan, Canadian Hydro will make any non-confidential results of its monitoring program available to stakeholders upon request.

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Table 7.7 Determining Significance of Cumulative Environmental Change

Regional Issue	Regional VECs	Project Effects	Unrelated Projects Effects					Potential Regional Interaction	Project Phase	Significance of Net Effects (+/-)
			Canadian Hydro	Superior Wind	Invenergy	Helix-Synergy	Plan of Sub-division			
avian mortality, habitat fragmentation, decrease in resource	birds, bats, and raptors	✓	✓	✓	✓	✓	✓	• habitat loss and collision with the turbines have the potential to affect avian resources • avian mortality at each wind farm will be low (e.g., <2 birds/turbine/year), but cumulatively may produce a decline in resource to lower-than-baseline, but stable conditions	• construction • operations	Medium (-)
disruption or alteration to fish / fish habitat	aquatic flora and fauna	✓	✓	✓	✓	✓	✓	• disruption or alteration of habitat have the potential to affect aquatic resources • DFO has implemented a “no-net-loss” policy to ensure habitat levels/areas remain as per baseline • slight decline in resource is possible depending upon designs and construction practices	• construction	Low (-)
sensory alienation, habitat fragmentation	wild game resources	✓	✓	✓	✓	✓	✓	• no demonstrable long-term effect to big game • habitat fragmentations could affect local populations and movements • significant clearing and habitat fragmentation are not issues typically associated with wind farm development • potential for resource to experience a slight decline during construction, but return to baseline during operations	• construction • operation	Minimal (-)
changes to rural noise patterns	residential receptors	✓	✓	✓	✓	✓		• predominately a construction related effect • projects will operate within provincial noise guideline requirements	• construction • operation	Low (-)
alteration to views and/or landscapes	area aesthetics	✓	✓	✓	✓	✓	✓	• multiple turbines scattered over a large geographic have the potential to affect area landforms • permanent changes to viewscapes	• operation	Medium (+/-)
introduction of new land-use, permanent change in land-use	land-use fabric	✓	✓	✓	✓	✓	✓	• small footprint of industrial turbines and ancillary facilities limit land requirements, but have the potential to permanently	• operation	Low (+/-)

Table 7.7 Determining Significance of Cumulative Environmental Change

Regional Issue	Regional VECs	Project Effects	Unrelated Projects Effects					Potential Regional Interaction	Project Phase	Significance of Net Effects (+/-)
			Canadian Hydro	Superior Wind	Invenergy	Helix-Synergy	Plan of Sub-division			
								change the existing agricultural/rural fabric		
new type of employment, job creation	labour pool / employment rate	✓	✓	✓	✓	✓		• employment at each wind farm will be modest (e.g., 4 – 10 personnel), but cumulatively will produce a noticeable change to better -than-baseline conditions	• construction • operation	Medium (+)
loss of land base for agricultural use	agricultural land and infrastructure	✓	✓	✓	✓	✓	✓	• small footprint of industrial turbines and ancillary facilities limit land requirements and potential affects to agricultural infrastructure • due to permanent loss of land for agriculture there will be a slight decline in the resource	• construction • operation	Low (-)
increased pressure for lot severances	agricultural land and infrastructure						✓	• the provincial greenbelt plan may force new residential developments and rural residences in greater numbers into the study area • if situated on severed lots that are too close to the turbines, environmental noise complaints could arise • municipal controls and good planning practices will be required	• operation	High (-)
demand for services such as water and waste water, emergency services	municipal infrastructures	✓		✓	✓	✓	✓	• wind farm demand should typically be limited to emergency services, which may only be required periodically • subdivision may have permanent demands for water related infrastructure • given the dispersed geographic area, and multiple Townships involved, no long term interactions are anticipated	• construction • operation	Minimal (-)
access to new revenues from taxation	municipal budget	✓	✓	✓	✓	✓	✓	• taxes associated with wind farm development and new subdivisions can noticeably affect a Township's annual revenue generated by taxes	• operation	Medium (+)

8 PROJECT FOLLOW-UP MEASURES AND MONITORING

This section details the overall package of follow-up measures and monitoring that the Construction Contractor and/or Canadian Hydro will carry out in relation to the Project. The package has been designed to ensure the continued compliance of the Project with the environmental requirements set out in this document and applicable legislation.

8.1 MONITORING PLAN STRUCTURE

8.1.1 Methodology

Fundamental to quantification of the significance of net effects, and the success of protection and mitigation measures, is the need for monitoring. The monitoring plan for the Project has been designed to:

- monitor the effectiveness of the proposed protection and mitigation measures
- verify compliance of the Project with applicable municipal, provincial, and federal standards and guidelines
- optimize environmental management with the goal of continual improvement.

Environmental monitoring, which started with the collection of primary background data as part of this ESR study, will continue with appropriate follow-up activities during the construction and operation phases of the Project. Monitoring will provide data on key environmental, health, and safety aspects and on the effectiveness of management measures implemented as part of this Project. The monitoring procedures noted herein, directly link to the potential effects and protection and mitigation measures discussed in **section 7**.

8.1.2 Goals and Objectives

Following are the goals of the monitoring plan:

- minimizing conflicts with communities within the Project's area of influence
- minimizing conflicts in the communities affected by the execution of the works according to legal terms and to the proponent's policies.
- minimizing accidents and malfunctions
- avoid levies or sanctions from the corresponding authorities for negligent environmental performance.

The monitoring plan is designed to achieve the following objectives:

- reduce the environmental effects associated with construction works on agricultural lands
- reduce the environmental effects on natural habitats, flora, and fauna
- establish measures that increase occupational safety to safeguard the physical and psychological integrity of people linked to these activities
- minimize complaints from the community in terms of effects identified during the development of infrastructure and/or refurbishment activities
- comply with all environmental quality standards set by law.

8.1.3 Guiding Principles

The following principles were used to guide the preparation of the monitoring plan:

- focus upon environmental, health, and safety risk prevention
- conformance with relevant standards, codes, and practices were considered in the application of safe technologies
- all activities will be performed in a safe and effective manner by trained personnel
- all equipment will be maintained in good operating condition for protection of property, conservation of the environment, and protection of worker health and safety
- all necessary precautions to control, remove, or otherwise correct any health and safety hazards will be implemented
- construction and operation of the Project will meet relevant municipal, provincial, and federal standards that collectively ensure sufficient technical levels of safety.

The monitoring plan is composed of three components: environmental management systems; programs, plans, and procedures; and monitoring requirements. Each component is discussed below.

8.2 ENVIRONMENTAL MANAGEMENT SYSTEMS

As part of the environmental monitoring objectives outlined above, several programs, plans, and procedures will be developed by Canadian Hydro and/or the Construction Contractor and are outlined below (**section 8.3**). They will guide all stages of construction, operation, and decommissioning so that the environmental performance of the Project is optimized. However, for the programs, plans, and procedures to be effective, appropriate management structures and contract documents must be firmly established.

8.2.1 Management Structures

Canadian Hydro, GE, the Construction Contractor, and subcontractors will take steps to ensure that they have appropriately skilled personnel to carry out the environmental responsibilities as defined in the ESR. All organizations associated with Project development activities will develop responsive reporting systems that clearly assign responsibility and accountability for development actions. As appropriate, Canadian Hydro will review these reporting documents.

8.2.2 Contract Documents

Canadian Hydro is committed to constructing, operating and decommissioning the Project in an environmentally responsible manner and in compliance with all applicable environmental laws, regulations, and guidelines. All of Canadian Hydro's contractors and subcontractors will be accountable for actions that have an adverse effect on the environment. As such, any contract documents executed by Canadian Hydro will incorporate appropriate provisions from the ESR.

Additionally, all contractors, subcontractors, and other associates of the Project will follow the guiding principles of the monitoring program. These organizations will also comply with all relevant municipal, provincial, and federal legislation.

Canadian Hydro should adopt an environmental policy that states the principles and intentions of the enterprise in relation to its overall environmental performance. Such principles and intentions will be communicated to each employee as well as the nature of their individual environmental responsibilities. Where appropriate, staff training will be undertaken to ensure continued environmental performance.

8.2.3 Change Management

During the implementation of the Project, change may be required to address unforeseen or unexpected conditions or situations. Canadian Hydro, GE and the Construction Contractor will be responsible for ensuring environmental and safety issues are addressed. Canadian Hydro will effect any significant changes to Project programs, procedures, and plans throughout the life of the Project.

8.2.4 EcoLogo® Certification

At present, all of Canadian Hydro's facilities are EcoLogo® Certified. The Environmental Choice (EcoLogo®) Program ("ECP") is Environment Canada's ecolabelling program. To obtain the EcoLogo®, a product or service must be made or offered in a way that: improves energy efficiency; reduces hazardous by-products; uses recycled materials; is re-usable; or provides some other environmental benefit. In addition, certified products or services should meet or exceed any applicable industry specific safety and performance standards. A company may have its product or service certified in one of the following ways:

- the product or service meets or exceeds the ECP criteria; or
- If no criteria exist for the product or service type, a panel of experts convened by the ECP (Panel Review Process) determines that a specific product or service has significantly less adverse environmental effects than competing products or services.

It is Canadian Hydro's intention to have the Project registered under the EcoLogo® Certification program.

8.3 PROGRAMS, PLANS, AND PROCEDURES

Canadian Hydro, GE and/or the Construction Contractor will implement the programs, plans, and procedures discussed below.

8.3.1 Construction Program

The Construction Contractor, with oversight from Canadian Hydro, should prepare a Project Construction and Environmental Management Plan ("CEMP") prior to the initiation of any substantive on-site works. This CEMP should be the controlling plan for all construction activities specifying the "way of working" for each key project component. The CEMP should be comprised of a series of plans and procedures covering all critical construction and environmental management tasks.

At a minimum, the Project CEMP should develop procedures and plans, based upon regulatory requirements and accepted good site practices, for the following activities:

- *traffic management plan:* the Construction Contractor and/or GE should develop and implement this plan, which should contain the following strategies: movement of materials and personnel to, from, and within the workspace areas, management of connection points between site access roads and public roads; transport of abnormal loads; control of any upgrading/modification roadworks; dust and vehicle emission controls
- *waste management plan:* developed by the Construction Contractor, with input from Canadian Hydro, should specify provisions for the reuse, recycling, and/or disposal of solid waste, hazardous waste, and sanitary waste.

- *health and safety plan:* the GE and/or Construction Contractor's plan should consider both public and occupational health and safety issues. This may include protecting the public from equipment and construction areas by posting warning signs, use of personal protective equipment, accident reporting, equipment operation, and confined space entry.
- *emergency response plan:* the Construction Contractor should include a plan for the proper handling of material spills and the associated procedures to be undertaken during a spill event. The plan will also specify containment and clean-up materials and their storage locations. As appropriate, the plan may cover response actions to high winds, fire preparedness, evacuation procedures, and medical emergencies.
- *training plan:* as appropriate, this should involve the training/informing of construction personnel on the unique features of the above plans prior to construction.

8.3.2 Operation and Maintenance Program

During pre-operational mobilization, GE should, in conjunction with Canadian Hydro, develop an operation and maintenance program. The program should be based upon existing procedures that have been developed for wind turbine facilities owned and operated by Canadian Hydro and GE. The program should also be designed to ensure compliance with any applicable municipal, provincial, and/or federal requirements.

The program should cover predictive/preventive maintenance, routine maintenance, annual overhauling, inspection of equipment and components, the procurement of spare parts, and maintenance of optimum inventory levels in order to reduce inventory carrying costs and working capital costs. It should also include a schedule for regular inspections of the turbines and ancillary facilities.

The regular maintenance that will occur through the operation and maintenance program will optimize the operating condition of equipment. Where necessary, Canadian Hydro and/or GE will incorporate the corresponding elements of the monitoring program as documented in the following subsections.

8.3.2.1 Environmental Procedures

Canadian Hydro and/or GE will be responsible for implementing all approved environmental procedures during the operation phase of the Project. Individual personnel responsibilities will be assigned as necessary to support the full and effective implementation of the environmental procedures. At a minimum, the environmental procedures should address the following issues to prevent environmental contamination and injury to personnel:

- *environmental calendar:* to establish the specific dates and times for environmental inspections of turbine facilities, monitoring events, and emergency notifications.
- *spills and releases:* to identify the specific procedures for the prevention, response, and notification of spills. In addition it should establish the general procedures for spill clean-up, personnel training, and material handling and storage to prevent spills.
- *hazardous waste management:* to outline the procedures for the proper identification of hazardous waste and its proper storage, handling, transport, and disposal. In addition, the procedures should outline specific requirements for personnel training, emergency response, product review and approval, and record keeping.
- *solid waste management:* to establish alternative procedures for the management and disposal of used lubricants, used drums, and general office waste.

These procedures will ensure internal and external risks are fully evaluated and the information communicated to personnel in advance of any accident or malfunction.

8.3.2.2 Occupational Health and Safety Procedures

Canadian Hydro and/or GE should undertake the following measures to ensure employee health and safety is maintained throughout their employment term:

- sanitary facilities should be well equipped (e.g., protective creams and soaps)
- ventilation systems will be used to control work area temperatures and humidity and where work is required in hot and/or humid places employees will be encouraged to take breaks away from these areas.

Canadian Hydro and/or GE should also implement the following safety procedures and protocols in an effort to ensure employee safety is addressed throughout operation and maintenance activities:

- personal protective equipment (PPE), including non-slip footwear, eye protection, clothing, and hardhats, will be worn by operations and maintenance personnel when on duty
- elevated platforms, walkways, and ladders will be equipped with handrails, toeboards, and non-slip surfaces
- electrical equipment will be insulated and grounded in compliance with the appropriate electrical code.

Incidents in the work place have the potential to cause personal injury and property damage. As such, Canadian Hydro and/or GE should maintain a master Incident Report that documents illnesses and accidents. The Incident Report should document all activities resulting in incapacity to work for at least one full workday beyond the day on which the illness or accident occurred. Records should also be maintained noting the total number of days of absence from work as a direct result of the illness or accident.

8.3.2.3 Training Program

As appropriate Canadian Hydro and/or GE should develop an operations training program to ensure personnel receive appropriate training in relation to operation and maintenance programs, environmental, health, and safety procedures, and emergency response plan. Training may cover the following issues:

Facility Safety

- accident reporting
- chemical and hazardous materials handling
- fall and arrest protection
- eye, ears, head, hands, feet, and body protective equipment
- first aid training and equipment
- equipment operation and hazards
- fire prevention and response
- lockout and tag out procedures
- scaffolds and ladders

Emergency Preparedness

- fire preparedness and response
- natural disasters (i.e., extreme weather events)
- hazardous materials and spill response
- medical emergencies
- rescue procedures.

Training should begin as the initial staff complement is hired during the pre-operational mobilization period. There should also be on-going training for personnel as well as specific training sessions for new hires. Graduated testing and certification by supervisors and the operation mangers will ensure that all trainees perform at an acceptable level prior to being assigned a full position.

8.3.2.4 Emergency Response Plan

As noted in **section 8.3.2** during pre-operational mobilization Canadian Hydro and/or GE should finalize an emergency response plan for the operational activities. This plan should be based upon the existing plans developed by Canadian Hydro and GE for its other wind power facilities, the final design of the Project, and the management actions noted above.

8.3.2.5 Information Disclosure

Canadian Hydro should continue its contact with stakeholders during the initial period of operation and for as long as this remains an effective two-way channel for communication. To this end, as appropriate, Canadian Hydro should maintain the project website to convey information about the Project, Canadian Hydro's involvement in the community, and to provide notice of unique maintenance events.

8.3.3 Decommissioning Program

No definitive decommissioning plan has been finalized at this stage in the planning process (i.e., before the approvals have been granted). The design life of the wind turbines is estimated to be approximately 40 years, but it is possible that the turbines could continue to operate at the same location after the design life. Alternatively, newer turbine components could replace old and/or worn ones enabling Canadian Hydro to continue to provide electricity to the provincial grid.

Should decommissioning become necessary, Canadian Hydro would follow the standard industry accepted practices in effect at that time. Such practices presently include the removal of facilities, recycling of suitable materials (e.g., metal and parts), reuse of components and equipment in other facilities, conversion of buildings to other uses, and/or rehabilitation of the site areas. Additional information on Project decommissioning is provided in **section 2.2.6**.

8.3.4 Measurement of Performance

Once performance standards have been established and personnel have been trained (and are functional in procedural operations), the next step is to monitor the performance of individuals relative to the performance standards and programs.

Specific internal audits (e.g., management team and/or process team), and external audits against the plans, safety and environmental procedures, and other policies and procedures are all part of establishing performance standards necessary to minimize risks on a continuing basis.

As appropriate, a formal audit program for the Project, with regard to loss control programs (i.e., health, safety, environment, and security), should be performed annually.

8.4 MONITORING REQUIREMENTS

8.4.1 Construction Phase

The Construction Contractor will be the primary organization responsible for the implementation of the construction monitoring measures. Implementation of the measures should be undertaken consistent with Canadian Hydro's standard environmental and engineering practices and in compliance with applicable municipal, provincial, and federal standards and guidelines. The following subsections outline the key monitoring activities to be implemented; other standard industry monitoring practices are discussed in **section 7**.

8.4.1.1 Terrestrial Habitats

Construction activities that have the potential to affect terrestrial flora and fauna include equipment operation, vegetation clearing and disturbance, accidental spills and/or leaks, and waste disposal. Stringent monitoring of these activities is necessary to ensure terrestrial flora and fauna are protected.

Records of vehicle maintenance should be retained and be available for periodic review by the Construction Contractor. All vehicles involved in construction must be maintained in good operating condition and gas powered vehicles be fitted with catalytic converters as required; all vehicles identified through the monitoring program that fail to meet the minimum emission standards should be repaired immediately or removed from the construction area.

Vegetation clearing activities should be under constant observation and monitoring. Monitoring of vegetation clearing will ensure that vegetation is cleared only from designated areas. Areas outside the designated construction sites shall not be disturbed.

Monitoring will be required following the unlikely event of contamination from an accidental spill or leak. Contaminated soils will be removed and replaced as appropriate. Monitoring should also be undertaken at the point of release and at all areas thereby affected.

As appropriate, records of waste generation and disposal should be maintained. Waste disposal monitoring should include a periodic review of all waste records, visual inspection of waste storage areas for effectiveness, and inspection of waste receiving facilities. The purpose of the inspection is to ensure that wastes are properly recycled and/or disposed of, consistent with provincial standards and good industry practices. Where a third party's activities are identified as non-compliant or insufficient, the Construction Contractor will seek out an alternative recycling or disposal solution.

8.4.1.2 Aquatic Habitats

Construction activities that have the potential to affect aquatic habitats and watercourses include equipment operation, vegetation clearing and disturbance and accidental spills and/or leaks associated with the construction of watercourse crossings to access the construction sites. Stringent monitoring of these activities is necessary to ensure aquatic flora and fauna are protected.

A Construction Contractor representative should be on-site during installation of watercourse crossings to ensure compliance with specifications and site plans. In particular, the Construction Contractor should ensure that pre-construction preparation is completed prior to commencement of in-stream work and that bank, bed and floodplain conditions are restored to pre-construction conditions should the crossings be removed after use.

Where watercourses have year round flow, the Construction Contractor should ensure that detailed pre-construction profiles of the slopes, banks and bed are determined prior to construction. Watercourse flow rates should be measured to determine appropriate culvert sizing. The Construction Contractor should monitor weather forecasts prior to the installation of the crossings, particularly before crossings of larger watercourses with year-round flow.

In conjunction with the general pre- and post-construction monitoring activities, the Construction Contractor may conduct random water quality monitoring of standard parameters that could be affected by construction activities (e.g. for turbidity and total suspended solids) in the watercourse crossings.

Environmental inspection following spring run-off the year after construction should be considered to review the effectiveness of the bank and slope re-vegetation program, to check bank and slope stability, and to ensure surface drainage has been maintained. Appropriate remedial measures should be completed as necessary, and additional follow-up monitoring conducted as appropriate.

8.4.1.3 Agricultural Soils

Work on agricultural lands will be required for construction of the turbines, temporary and permanent access roads, and for installation of power lines. In areas where activity on agricultural land will be for the duration of the construction only, the Construction Contractor should monitor topsoil stripping to ensure that the correct depth of topsoil is removed and stockpiled in a manner that avoids mixing with subsoil material.

To determine the success of soil mitigative measures, soil characteristics should be monitored during and following construction. As appropriate, relative soil compaction measurements, on and off site, should be undertaken on agricultural lands after topsoil replacement to identify any areas that might require additional chisel ploughing and/or subsoiling during final clean-up operations.

Potential soil problem areas, including subsidence over power line trenches, soil erosion, and stoniness, should be recorded by the Construction Contractor at the end of the construction period and after one winter. A list of outstanding areas that may require additional clean-up and/or additional monitoring should also be compiled.

If soil mixing is known to have occurred during construction, soil characteristics, including depth to carbonates and percent organic matter, should be randomly analyzed on the temporary disturbance area and in an adjacent non impacted area after final clean-up to identify the relative degree of topsoil/subsoil mixing so appropriate mitigation can be developed.

As appropriate, the effects of construction on agricultural soils should be assessed through a post-construction monitoring program. After construction, an inspection should be made by the Construction Contractor to compile a list for year-after clean-up activities.

8.4.1.4 Artificial Tile Drainage

Since artificial tile drains will be severed and there is additional potential for damage during construction, their operation should be monitored during the construction phase, immediately after final clean up, and after the spring thaw the following year. Landowners should be consulted and given the opportunity to inspect and approve artificial drainage repairs before backfilling. As part of the on-going monitoring activities, a visual inspection of fields adjacent to the construction footprint should be undertaken to identify the presence of standing water that may be an indication that artificial drainage has been improperly repaired, has been crushed, or is blocked.

Should a persistent drainage problem be identified on, or adjacent to, the construction footprint and the problem is determined to be a result of construction activity, a qualified drainage specialist should be retained to identify drainage solutions. To ensure the success of measures recommended by the drainage specialist, all persistent drainage problem sites should be monitored quarterly for a minimum of one year after repair.

8.4.1.5 Public Roads

Municipal, county, and provincial roads will be restored to their pre-construction conditions to the satisfaction of local authorities. Roads should be monitored following a heavy rain event, and a year after construction following spring runoff, to ensure no erosion, bank slumpage, road subsidence or major rutting has occurred. Roadside ditches and drains should be revegetated if required and monitored to ensure that they are functioning properly.

8.4.1.6 Air Quality & Environmental Noise

Air quality and environmental noise effects due to construction typically relate to the generation of noise and emissions from construction equipment; specifically construction vehicles, generators and power tools. The Construction Contractor will ensure that all equipment and vehicles brought onto the work sites are in proper working order with functioning mufflers and emission control systems.

High winds during a dry summer may erode and disperse loose soil material, including topsoil, away from the construction area. Wind erosion results in permanent loss of topsoil and creates excessive dust, which is a nuisance to residential and agricultural properties located in close proximity to the construction sites. Erosion associated with high winds, resulting soil loss and nuisance dust can be reduced or eliminated by stabilizing topsoil storage piles with straw mulch or other appropriate means. Applying a low energy water spray or dust suppressors to the construction sites and any gravel access roads used for equipment transfer can also temporarily control nuisance dust.

8.4.1.7 Stakeholder Relations

Canadian Hydro will continue its pre construction contact with project stakeholders during construction and through the initial period of operation as long as this seems an effective two-way channel for communication. Prior to the commencement of construction activities Project stakeholders will be provided with contact name(s) and number(s) that they can use to contact the Construction Contractor and/or a Canadian Hydro representative to express concerns or to ask questions. All efforts will be made to respond to those inquiries as soon as is reasonably possible.

8.4.1.8 Local Expenditures

Where practical the Construction Contractor will encourage the hiring of local manpower and subcontractors to conduct non-specialized aspects of the Project construction. This may include tree and brush clearing, topsoil removal and site grading, construction of access roads and construction and servicing of maintenance buildings and other structures. Where practical the Construction Contractor will also encourage the use and procurement of local goods and services where they are available in sufficient quality and quantity and at competitive prices. A record of the value of these goods and services procured in the community should be recorded and retained by the Construction Contractor.

8.4.2 Operation Phase

Building upon the environmental management measures recommended to minimize potentially adverse effects, while enhancing the positive effects associated with the operation of the Project (**section 7**), the following operations monitoring program has been developed. The monitoring program is designed to allow Canadian Hydro to monitor and assess the effectiveness of the proposed management measures and to verify compliance of the Project with applicable municipal, provincial, and federal legislation and guidelines.

Canadian Hydro, with support from GE, will be the primary organization responsible for the implementation of the operational monitoring measures. Implementation of the measures will be undertaken consistent with Canadian Hydro's standard environmental and engineering practices.

8.4.2.1 Avian Fauna

Though the likelihood of any significant avian mortality from turbine operation is not anticipated, Canadian Hydro should monitor the presence of bird carcasses at the base of the turbines for a period of one year after the turbines become operational. This will entail periodic checks at the base of the turbines in the morning to look for birds that may have died as a result of collision with the turbines. Canadian Hydro will maintain records of bird mortality to compare with records maintained by other wind farm facilities. As appropriate, Canadian Hydro may opt to extend this program.

8.4.2.2 Environmental Noise

The EPA requires that noise emissions for any new project must not have adverse effects on the natural environment. The C of A (Air) process is the mechanism through which the controls are administered under the EPA.

A typical condition of a C of A (Air) is for the project proponent to complete an acoustic audit of the project, once it is operational, to ensure that the noise emissions meet the requirements of the MOE noise guidelines, in this case those guidelines specified in the *Interpretation For Applying MOE NPC Technical Publications to Wind Turbine Generators*. These are the same guidelines that have been used to assess the potential environmental noise effect during the design phase (**Appendix C4**), and for the assessment report supporting the C of A (Air) application. The C of A (Air) is contingent upon meeting the applicable noise guidelines, as demonstrated by the acoustic audit results.

8.4.2.3 Stakeholder Relations

Canadian Hydro will continue its contact with Project stakeholders during operation of the Project for as long as this seems an effective two-way channel for communication. As a long-term presence in the community Canadian Hydro will continue to develop contacts and other local relationships and channels of communication, which could benefit the local area.

Ongoing stakeholder communication will allow Canadian Hydro to receive and respond to community issues on an ongoing basis. The goal of the program is to further Canadian Hydro's "smart business – good neighbour" strategy to be good corporate citizens, protect the environment, and enhance the quality of life in the communities in which they operate.

8.4.2.4 Local Expenditures

Following on from the practices utilized during the construction phase Canadian Hydro should continue to encourage the use and procurement of local goods and services where they are available in sufficient quantities and at competitive pricing and quality. A record of the value of the goods and services procured in the community should be recorded and retained by Canadian Hydro and/or GE.

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9 SUMMARY AND CONCLUSIONS

1. This Melancthon Grey Wind Project Environmental Screening Report is consistent with the MOE requirements of Ontario Regulation 116/01 as documented in the EA Guide. Furthermore, this ESR is consistent with the CEAA requirements as identified in section 16 of the Act, as well as NRCan's scope of work and WPPI Guide requirements.
2. A comprehensive Stakeholder Consultation and Information Disclosure Program identified the key issues of interest to the local community. This ESR documents Canadian Hydro's commitment to the best practices it intends to employ and defines the means by which the Project addresses the stakeholder interests expressed.
3. Based upon a detailed and thorough analyses of the interests identified through the Stakeholder Consultation and Information Disclosure Program, and those identified by the Project team through the MOE's Environmental Screening Process, the CEAA requirements, and NRCan's scope of work and WPPI Guide, the following features were identified as potentially affected by the Project prior to the implementation of protection and mitigation measures:

- surface water quality
- fish and fish habitat
- groundwater quality
- sedimentation and soil erosion
- agriculture resources and practices
- wildlife, VTE species, and habitats
- migratory birds
- neighbourhood and community characteristics
- traffic patterns and flow
- residential, institutional, or commercial land-use
- air quality
- environmental noise
- public health and safety
- historical and archaeological resources
- aesthetics / viewscape
- remediation of contaminated sites
- waste material disposal
- accidents and malfunctions
- effects of the environment on the Project.

Once protective and mitigative measures are applied, the Project is expected to have few net negative effects on the environment. The potential for cumulative environmental effects is also generally considered minimal to low.

1. Significant adverse net environmental effects have been avoided through careful site selection. The Project is located in a rural, agricultural area and thus has a minimal effect on the natural features, while minimizing effects on agriculture lands and operations.
2. All potentially adverse net effects that could not be avoided by siting can be effectively mitigated using well-known and proven methods and technologies. For example:
   - avian mortality due to collision with the turbines is anticipated to be negligible given the absence of known migratory flight paths in the study area. Effects to breeding bird habitat have been minimized through the mitigation measures proposed in **section 7.10**.
   - environmental noise levels at surrounding receptors are predicted to be within the applicable environmental noise criteria (**section 7.8**).
   - research and published documentation has shown that there will be no negative effect on property values of lands within the viewshed of the turbines (**section 7.5**).

1. Significant net positive effects are expected to result from development of the Project. In particular, the Project benefits include:

Environment

- the Project will provide up to 75 MW of clean renewable electricity
- no emissions of green house gases and every kilowatt hour of clean, emission-free wind energy produced is a kilowatt hour that does not require the burning of non-renewable fuel sources.

Economic

- construction activities will create approximately 30 to 40 jobs with a peak labour force of 70 to 80 personnel
- operation activities will create up to six full time jobs and up to six part-time positions
- increased investment into renewable energy, contributing to the growth and establishment of Ontario's growing wind power industry.

Community

- municipal taxes paid by Canadian Hydro should increase the local property tax base by 20 to 30%
- Canadian Hydro has made both hard and soft contributions to the Centre Dufferin District High School's renewable energy project known as Reduce the Juice.

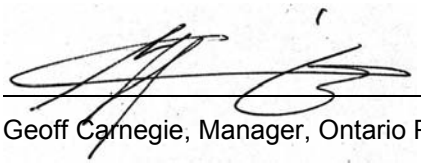
In conclusion, the Project is not likely to cause important environmental effects, taking into account the implementation of appropriate mitigation measures. Further, the Project will positively contribute economic resources to the community, while not contributing green house gases.

10 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

Stantec Consulting Ltd. prepared this Environmental Screening Report for Canadian Hydro Developers, Inc. for Phase I of the Melancthon Grey Wind Project. Canadian Hydro is committed to implementing all the appropriate protection and mitigation measures as they apply to the various Project site areas.

CANADIAN HYDRO DEVELOPERS, INC.

11 February 2005

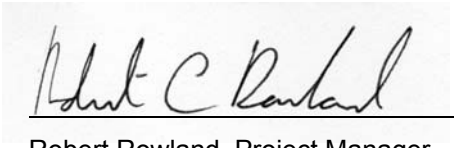


Geoff Carnegie, Manager, Ontario Projects

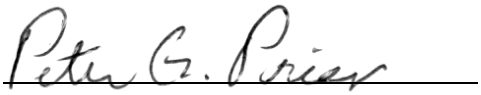
Kelly Matheson, Manager, Environmental Affairs

STANTEC CONSULTING LTD

11 February 2005



Robert Rowland, Project Manager



Peter Prier, Project Director

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Appendices:

See ESR page on website