FINAL
ENVIRONMENTAL SCREENING REPORT / ENVIRONMENTAL IMPACT STATEMENT ADELAIDE WIND FARM

Submission to:

Ministry of the Environment – Southwestern Region
Ministry of the Environment – Environmental Assessment and Appeals Branch
Ministry of Natural Resources – Aylmer District
Environment Canada – Environmental Protection Operations Division
Township of Adelaide Metcalfe

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ENVIRONMENTAL SCREENING REPORT /
ENVIRONMENTAL IMPACT STATEMENT
ADELAIDE WIND FARM

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1.0 INTRODUCTION

Air Energy TCI Inc (AET), the North American subsidiary of TCI Renewables Ltd., a company registered in England, proposes to develop (construct, operate, and eventually decommission) the Adelaide Wind Farm (the "Project"), a wind power generating facility (wind farm) with a capacity of up to 72 megawatts (MW). Wind developments greater than 2 MW are classified as Category B projects under the Electricity Project Regulation (Ontario Regulation 116/01). As a result, the proposed project is subject to Ontario's *Environmental Assessment Act*, requiring the completion of an Environmental Screening Report (ESR). AET has also registered the Adelaide Wind Farm Project under the federal ecoENERGY for Renewable Power Program on March 11, 2008 (Registration Number 5911-A17-1). Once a Contribution Agreement has been signed with Natural Resources Canada (NRCan), the Project will have officially received federal funding, and the Project will trigger the need for an Environmental Impact Statement (EIS) under the *Canadian Environmental Assessment Act* (CEAA) (NRCan, 2008). Although the CEAA was not officially triggered prior to the completion of this report, it is foreseeable that this trigger may occur in the future (see Section 3.1) and AET has made the decision to also prepare this document to meet the requirements of CEAA.

This report has been prepared to meet both the provincial and federal environmental assessment processes, and follows the Wind Power Production Incentive (WPPI) EIS Guidelines for Screenings on Inland Wind Farms under the *Canadian Environmental Assessment Act* and the Electricity Project Regulation (Ontario Regulation 116/01) as outlined in the Guide to Environmental Assessment Requirements for Electricity Projects (MOE, 2001). Although the ecoENERGY for Renewable Power program (described further in Section 3.1.1) has replaced WPPI, NRCan still uses the WPPI guidelines when evaluating an EIS for wind projects.

The objective of the combined ESR/EIS is to provide the Ministry of the Environment (MOE), NRCan, other federal departments, other provincial regulatory agencies, potentially affected Aboriginal groups and the public with details of the proposed Project. The following report describes:

- The Adelaide Wind Farm Project (herein referred to as the Project);
- Outlines the potential environmental and social effects of the Project; and
- Details mitigation measures proposed by AET that will be used to reduce and, where possible, eliminate potential effects.

2.0 PROJECT SUMMARY

2.1 Project Proponent

The Project is being proposed directly by Air Energy TCI Inc (AET), the licensed business name of the Project proponent in Canada. AET was established in 2006 as a subsidiary company of TCI Renewables Inc (TCI), and was set up specifically to develop and promote North American projects. AET is a registered Canadian company (Registration Number: 4296508) with the North American head office located in Montreal, QC. AET is commonly known and trades as TCI Renewables in the North American marketplace. TCI, the parent company of AET, was created in 1996 specifically to integrate technology with the built environment. From its origins in mobile telecommunications network deployment, the company has developed expertise spanning several industries including the rapidly expanding renewable energy sector. Collectively, TCI and AET are active in both the European and North American marketplace. More information on TCI and AET and a copy of the final ESR/EIS document is available at http://www.tcir.net.

The AET contact for the Project is:

Mark Gallagher, Development Manager
Air Energy TCI Inc
381 Rue Notre-Dame (Ouest), Montréal, QC H2Y 1V2
Toll Free Phone: 1-888-842-1923
Fax: (514) 842-7904
Email: mark.gallagher@tcir.net

2.2 Title of Project

The name of the Project is the Adelaide Wind Farm. Throughout this ESR/EIS, this undertaking will be referred to as “the Project”.

2.3 Project Location

The Project area spans approximately 8,299 ha, and is located in the Township of Adelaide Metcalfe, Middlesex County, Ontario. The Project location is shown on Figure 2.3-1 and coordinates for the approximate extent of the Site Study Area are provided in Table 2.3-1. The Project will reside entirely within portions of privately owned land parcels, and AET has secured licence and option agreements on approximately 2720 ha within the Project area (Table 2.3-2).

Table 2.3-1: Geographic Coordinates for the Site Study Area (SSA) (UTM Zone 17 NAD 83).

Site Location	Easting	Northing
Northwest corner	435675	4767509
Northeast corner	447395.6	4767509
Southwest corner	435675	4756097
Southeast Corner	447395.6	4756097

2.4 Estimated Capacity of Wind Power Project

The Project consists of 40 x 1.8 MW wind turbines with a total rated capacity of 72 MW. The turbines will each have a nameplate capacity of 1.8 MW. This represents the maximum generating capacity in Megawatts (MW) of each wind turbine. However, it is recognized that wind levels are not constant, and therefore a "capacity factor" is calculated to forecast how much energy will actually be produced by the combined installed capacity of all of the wind turbines. Based on experience in Ontario, in the period between March 2006 and December 2008, the average capacity for wind power Projects located in the province was 27% (IESO, 2008). Wind measurements on site have indicated an estimated capacity factor of 32%, which equates to 201 Gigawatt hours (GWh) of electricity, or enough to supply over 18,000 average homes (Ontario Ministry of Energy and Infrastructure, 2008).

2.5 Overall Project Schedule

The overall Project schedule may be influenced by the final supporting legislation associated with the *Green Energy & Green Economy Act*, 2009, which was introduced in February 2009 and received royal assent and became law on May 14, 2009.

Major target milestones in the Project schedule are provided in Table 2.5-1. Pre-construction includes activities such as design, engineering, geotechnical assessment and site surveys of the final turbine locations, and procurement of turbine, substation equipment and balance of plant. The construction schedule was designed to account for minor delays that could result from an extended regulatory process, delayed equipment arrival and adverse weather conditions. If regulatory approval is substantially delayed, there could be significant impacts on Project funding and ultimately the final delivery of the Project.

Table 2.5-1: Major Project Milestones

Phase	Timeline
Pre-Construction	June 2007 to April 2010[1]
Construction	April 2010 to December 2010
Project Commissioning	December 2010
Operations	2010 to 2040
Decommissioning	2040

[1] Outset end date allowing for full 8 month review period by Natural Resources Canada; this date may be made sooner if ecoENERGY or other federal funding is not provided.

The wind turbines are expected to be operational for 30 years. With the exception of routine scheduled and unscheduled maintenance, the turbines are expected to be capable of producing energy for 24 hours a day, 7 days a week, assuming appropriate wind conditions and the absence of events or stipulations that would lead to curtailing energy generation (i.e., faults with the local electricity grid).

2.6 Author of the Environmental Screening Report/Environmental Impact Statement

AET retained Golder Associates Ltd. (Golder) to complete the ESR/EIS for the Project. This document reflects the combined input of the proponent and Golder.

The Golder contact for the Project is:

Golder Associates Ltd.
Name: Anthony Ciccone, Ph.D., P.Eng., Principal
Address: 2390 Argentia Road, Mississauga, ON L5N 5Z7
Phone: (905) 567-4444
Fax: (905) 567-6561
Email: aciccone@golder.com

2.7 Project Need, Advantages and Disadvantages

The following outlines the need for the Project, as well as the expected advantages and disadvantages associated with the Project.

2.7.1 Project Need

The Province of Ontario faces a serious challenge in meeting its energy needs while at the same time phasing out coal-fired generation. The Government of Ontario sees renewable power as playing an important part in meeting current and future energy needs, while reducing the environmental cost of energy production. In June 2006, the Minister of the Environment issued Ontario's Supply Mix Directive to the Ontario Power Authority (OPA), which called for production of renewable energy (from hydroelectric, wind, solar and biomass sources) to increase to a total capacity of 15,700 MW by 2025. In August 2007, the OPA filed the Ontario Integrated Power System Plan (IPSP) with the Ontario Energy Board. The plan called for an additional 6,400 MW of new inputs of renewable energy to be commissioned between 2010 and 2025. It forecasted that 47% of the requirement would come from new wind development projects, and the plan specifically called for the implementation of 1,000 MW of large-scale wind projects between 2011 and 2015. It defines the areas of interest as Bruce County, Eastern Ontario and southwestern Ontario. At the direction of the Minister of Energy and Infrastructure, the IPSP is being revised by the OPA to determine if additional opportunities exist for even higher levels of renewable energy generation and conservation. The OPA is revising the IPSP, and had initially planned to provide the revised version to the Ontario Energy Board in March 2009. Recently, the province further committed to an increase in the contribution of renewable energy sources to Ontario's energy mix through the passing of the *Green Energy and Green Economy Act*, tabled as Bill 150 in the Legislative Assembly of Ontario during First Reading on February 23, 2009 and passed on May 14, 2009 (Ontario Legislative Assembly, 2009). The Act introduces the *Green Energy Act*, amends numerous existing provincial statutes and promotes new renewable energy generation in the province. In light of the new *Green Energy and Green Economy Act*, the OPA will be taking more time to revise the IPSP. A new date for submission of the revised IPSP has not been established, but according to a letter from the OPA to the Ontario Energy Board dated March 12, 2009 (Lyle, 2009), the revisions to the IPSP are expected to occur in the summer of 2009.

2.7.2 Project Advantages

The numerous benefits of generating electricity from wind energy are well documented. Wind power generated from the Project will have the following advantages:

- Uses renewable energy source to generate electricity that is reliable, efficient, and sustainable;
- Wind energy represents a predictable cost that, once built, incurs minimal future costs and is not susceptible to increases in commodity costs (unlike fossil fuels);
- Wind energy is a clean source of energy which does not emit greenhouse gases or produce toxic or hazardous wastes;
- Reduction in Ontario's contribution to global climate change, since wind energy assists in offsetting the emissions from other energy sources (i.e., coal and natural gas);
- Using wind energy in place of conventional carbon-based energy reduces the generation of smog and acid rain;

- The creation of a number of temporary construction jobs (approximately 200) and approximately six to eight permanent on-site jobs related to turbine and other infrastructure maintenance;
- There will be taxes paid to the province, county, township, and education system with very minimal demand for government services;
- Wind power allows farmers and landowners to stay on the land, in turn helping to keep agricultural lands in active production through a reliable stream of income to participating landowners;
- Increased demand for wind power infrastructure, such as wind turbines and tower sections, creates an opportunity for new manufacturing jobs in Ontario;
- On-going local contracts for snow removal and maintenance of access roads, etc.; and
- Potential for increased tourism to an area and secondary economic benefits.

2.7.3 Project Disadvantages

From an environmental perspective, wind power is relatively benign compared to other forms of electricity generation. However, there are both real and perceived disadvantages to wind power which include the following:

- Wind is intermittent by nature and thus, the actual electricity generated by a wind turbine, measured by capacity factor, will be a percentage of the rated capacity;
- A small area of agricultural land is taken out of production over the lifespan of the Project;
- Potential for bird or bat collisions with turbines resulting in injury or mortality;
- Potential for birds and bats to alter migratory routes to avoid turbines;
- New sources of sound which could result in nuisance noise at nearby receptors;
- Potential public health and safety issues related to falling ice, ice throw, noise, shadow flicker and catastrophic failure (i.e., collapse) of the structures;
- There will be a change in the landscape/viewscape over the lifespan of the Project, which will alter the rural character of the area; and
- There is a perceived, although unsubstantiated potential for reductions in property values within the viewshed.

3.0 OVERVIEW OF REGULATORY REQUIREMENTS

3.1 Canadian Environmental Assessment Act

In October 2006, the Government introduced Canada's *Clean Air Act* in Parliament. The *Act* outlines the Government's approach towards the regulation of air emissions in Canada. To complement the *Act*, the Government also introduced a series of ecoENERGY initiatives to reduce smog and greenhouse gas emissions. These initiatives are a set of focused measures to help Canadians use energy more efficiently, boost renewable energy supplies and develop cleaner energy technologies.

An important component of the ecoENERGY initiative is the $1.5 billion ecoENERGY for Renewable Power program, which was announced on January 19, 2007. This 14-year program is intended to encourage the production of enough low-impact renewable energy sources to power approximately one million homes. The ecoENERGY for Renewable Power program will provide an incentive of one cent per kilowatt-hour for up to 10 years to eligible low-impact, renewable electricity projects constructed between April 1, 2007 and March 31, 2011.

Projects that receive funding from the Government of Canada are required to complete an environmental assessment (EA) under the *Canadian Environmental Assessment Act* (CEAA). AET registered the Adelaide Wind Farm Project under the ecoENERGY for Renewable Power Program on March 11, 2008 (Registration Number 5911-A17-1). Recent changes to the ecoENERGY CEAA process have altered the point at which a federal EA is triggered with regards to federal funding. Previously, the registration of the Project on the ecoENERGY registry was the trigger for CEAA. Under the new Terms and Conditions issued in August 2008 (NRCan, 2008), this trigger has been delayed and now occurs following the submission of the Technical Project Information (TPI) form and signing of a Contribution Agreement (CA) with Natural Resources Canada (NRCan). This harmonized ESR/EIS document has been written to meet the requirements of CEAA because AET aims to submit their TPI and intends to sign a CA with NRCan assuming NRCan funding remains available for AET to apply for and receive. If the project remains eligible for ecoENERGY funding, the total requested incentive funding over the entire 10-year period is estimated to be approximately $20 million, based on an annual output of 201 GWh at a rate of one cent per kilowatt-hour for 10 years. A significant portion of this total may be payable directly to the OPA, depending on the conditions of the OPA FIT Program, which was not finalized at the time of completion of this document.

As the ecoENERGY program is administered by NRCan, they would be a Responsible Authority (RA) under CEAA subject to a CEAA trigger occurring. Other RAs and key federal agencies may be determined later in the assessment; however, this ESR/EIS establishes that there are no other federal triggers.

The contact information for the RA at NRCan is:

ecoENERGY for Renewable Power
Natural Resources Canada
615 Booth Street, Room 160
Ottawa ON K1A 0E9

As the RA, NRCan will determine the scope of the EIS and is responsible for its review. The EIS will also be reviewed by identified expert Federal Authorities. Once accepted, the EIS will be used by NRCan as the basis for the Screening Report for this Project.

Once a CA is signed, NRCan will establish a public registry for the Adelaide Wind Farm EIS, as required by Section 55 of the CEAA. This includes identification of the EIS in the Federal Environmental Assessment Index, which interested parties and stakeholders will be able to access on the Canadian Environmental Assessment Agency website (www.ceaa.gc.ca).

3.2 Federal Agency Consultation

Stakeholder consultation represents an integral requirement of assessments conducted under the *Canadian Environmental Assessment Act*. As part of the Project consultation program, several federal departments were consulted, including but not limited to:

- Natural Resources Canada;
- Fisheries and Oceans Canada (DFO);
- Indian and Northern Affairs Canada (INAC);
- Transport Canada;
- Environment Canada/Canadian Wildlife Service;
- Health Canada; and
- Canadian Environmental Assessment Agency.

More detailed information on federal agency consultation undertaken as part of the ESR/EIS is provided in Section 6.0.

3.3 Other Federal Permits and Approvals

In addition to the requirements that have been met through this ESR/EIS under CEAA, the Project may require a number of other federal permits and approvals (Table 3.3-1).

Table 3.3-1: Key Federal Project Permit and Approval Requirements

Permit Authorization	Administering Agency	Reason Required
Regulation of Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses	Conservation Authority having jurisdiction (on behalf of DFO)	Required where Project components (e.g., access roads) are to be constructed within Regulated Areas may result in interference with wetlands or alterations to shorelines or watercourses.
Aeronautical Obstruction Clearance	Transport Canada – Aerodrome Safety Branch	Turbine height and lighting and marking requirements.
Land-Use Clearance	NAV Canada	Aeronautical safety mapping and designations, also addresses issue of electromagnetic interference.

Additional federal acts and regulations that will likely not require specific notification, authorization or approvals but may be applicable to construction and operation of the Project include, but may not be limited to, the following:

- *Species at Risk Act* (SARA);
- *Migratory Birds Convention Act*; and
- *Transportation of Dangerous Goods Act.*

3.4 Ontario Environmental Assessment Act

The Project will have a capacity greater than 2 MW and is therefore classified as a Category B project under the Electricity Project Regulation (Ontario Regulation 116/01). Category B projects are subject to Ontario's *Environmental Assessment Act* and are required to undergo an EA, the process and results of which are to be documented in an ESR.

Although the provincial EA process is proponent-driven, the provincial agency that will lead the review of any elevation requests received for the EA is:

Environmental Assessment and Approvals Branch
Ontario Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, ON M4V 1L5

3.5 Provincial Agency Consultation

As part of the Project consultation program, several provincial ministries, agencies and crown corporations were contacted, including but not limited to:

- St. Clair Region and Ausable Bayfield Conservation Authorities;
- Ministry of Aboriginal Affairs;
- Ministry of Energy;
- Hydro One Inc.;
- Ministry of Agriculture, Food and Rural Affairs;
- Ministry of Culture;
- Ministry of the Attorney General;
- Ministry of the Environment;
- Ministry of Municipal Affairs and Housing;
- Ministry of Natural Resources;
- Ministry of Public Infrastructure Renewal;
- Ministry of Tourism; and
- Ministry of Transportation.

More detailed information on provincial agency consultation undertaken as part of the ESR/EIS is provided in Section 6.0.

3.6 Provincial Policy Statement

The Provincial Policy Statement (PPS), issued under the authority of Section 3 of the *Planning Act*, came into effect on March 1, 2005. The PPS provides policy direction on matters of provincial interest related to land use planning and development (MMAH, 2005).

The sections of the PPS that are of particular relevance to the development of the Project are as follows:

- Energy and air quality;

- Natural heritage;
- Agriculture; and
- Cultural heritage and archaeology.

3.6.1 Energy

As discussed in Section 2.7.1, the Government of Ontario has made the construction of new renewable energy projects a priority. Provisions relating to energy generation, and specifically renewable energy, are also an integral part the PPS (MMAH, 2005) as follows:

> *"Increased energy supply should be promoted by providing opportunities for energy generation facilities to accommodate current and projected needs, and the use of renewable energy systems and alternative energy systems, where feasible.*
>
> *Alternative energy systems and renewable energy systems shall be permitted in settlement areas, rural areas and prime agricultural areas in accordance with provincial and federal requirements. In rural areas and prime agricultural areas, these systems should be designed and constructed to minimize impacts on agricultural operations."*

3.6.2 Natural Heritage

The Provincial Policy Statement (MMAH, 2005) states that:

> *"Natural features and areas shall be protected for the long term. The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features."*

The PPS defines eight types of natural heritage features that are to be protected. Some of these are absolutely protected and the PPS states:

"*Development and site alteration shall not be permitted in:*

- *Significant habitat of endangered species and threatened species;*
- *Significant wetlands in Ecoregions 5E, 6E and 7E; and*
- *Significant coastal wetlands.*

Other features are protected but development and site alteration is permitted on lands containing these features if it can be demonstrated that there will be no negative impacts on the natural features or their ecological functions. These features are:

- *Significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E;*
- *Significant woodlands south and east of the Canadian Shield;*
- *Significant valleylands south and east of the Canadian Shield;*
- *Significant wildlife habitat; and*
- *Significant Areas of Natural and Scientific Interest (ANSI).*

In addition, development and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements (MMAH, 2005).

3.6.3 Agriculture

Prime agricultural land is an important resource in the province of Ontario and the need to protect this resource is strongly reflected in Ontario's PPS (MMAH, 2005). The PPS states that planning authorities may only exclude land from prime agricultural areas for:

- Expansions of or identification of settlement areas (in accordance with policy 1.1.3.9);
- Extraction of minerals, petroleum resources and mineral aggregate resources, (in accordance with policies 2.4 and 2.5);
- Limited non-residential uses, provided that:
  - the land does not comprise a speciality crop area;
  - there is a demonstrated need within the planning horizon (provided for in policy 1.1.2) for additional land to be designated to accommodate the proposed use;
  - there are no reasonable alternative locations which avoid prime agricultural areas; and
  - there are no reasonable alternative locations in prime agricultural areas with lower priority agricultural lands.
- Impacts from any new or expanding non-agricultural uses on surrounding agricultural operations and lands should be mitigated to the extent feasible.

3.6.4 Cultural Heritage and Archaeology

The PPS recognizes the importance of cultural heritage and archaeology and states that:

> *"Development and site alteration shall only be permitted on lands containing archaeological resources or areas of archaeological potential if the significant archaeological resources have been conserved by removal and documentation, or by preservation on site. Where significant archaeological resources must be preserved on site, only development and site alteration that maintains the heritage integrity of the site may be permitted."*

As with natural heritage features, any development adjacent to cultural heritage and archaeological resources/areas must also ensure its preservation.

3.7 Other Provincial Permits and Approvals

In addition, due to requirements under the *Environmental Assessment Act*, the PPS and other provincial legislations, the Project will also require a number of provincial permits and approvals (Table 3.7-1).

Table 3.7-1: Key Provincial Project Permit and Approval Requirements

Permit Authorization	Administering Agency	Reason Required
Certificate of Approval, Air – *Environmental Protection Act*	Ministry of the Environment	Required to show compliance with provincial regulations with respect to noise emissions.
Permit to Take Water (PTTW)	Ministry of Environment	Potentially required under Section 34 of the *Ontario Water Resources Act* if water takings of over 50,000 L/day will be required during construction.
Certificate of Approval – *Ontario Water Resources Act*	Ministry of Environment	Potentially required if there will be any discharge of wastewater to the environment during construction.
Archaeological Clearance – *Heritage Act*	Ontario Ministry of Culture	Potential for Archaeological and historical resources.
Built Heritage Clearance – *Heritage Act*	Ontario Ministry of Culture	May be required if built heritage resources are found on-Site.
Generator's License	Ontario Energy Board	Required to supply electricity for sale to Hydro One's transmission and distribution system.
Transmitter License	Ontario Energy Board	Required for the transmission of electrical power to interconnect with provincial grid.
Heavy/Oversize Load Transportation Permit	Ontario Ministry of Transportation	Compliance with provincial highway traffic and road safety regulations.

Table 3.7-1: Key Provincial Project Permit and Approval Requirements (continued)

Permit Authorization	Administering Agency	Reason Required
Encroachment Permit	Ontario Ministry of Transportation	Permit required for any works or structures that may cause material to interfere in any way with the land within the limits of a highway, roadway or any structure forming a part of the highway.
Commercial Access Permit	Ontario Ministry of Transportation	Permit required for upgrade of any access from a provincial highway.
Land-Use/Building Permit	Ontario Ministry of Transportation	Permit required for any construction within 180 metres of an MTO-regulated intersection.
System Impact Assessment	Independent Electricity Supply Operator	Potential effects from integration of Project with Hydro One's transmission and distribution system
Connection Approval	Independent Electricity Supply Operator	Approval required for the electrical interconnect with Independent Electricity System Operator (IESO) grid regulated network.
Customer Impact Assessment	Hydro One Inc.	Required to assess potential impact to hydro customers.

3.8 Municipal Permits and Approvals

In addition to the federal and provincial project requirements, the Project will require a number of municipal permits and approvals. Although the list may not be exhaustive, Table 3.8-1 shows a number of the permits and approvals that may be required prior to construction. This list will be refined during the detailed design process.

Table 3.8-1: Key Municipal Project Permit and Approval Requirements

Permit Authorization	Administering Agency	Reason Required
Entrance and Work Permit Application	County of Middlesex	Requirement of the County of Middlesex
County Encroachment Bylaw	County of Middlesex	Required for permanent encroachments upon, under or over highways within the County of Middlesex
Application to Move Oversize Loads on Middlesex County Roads	County of Middlesex	Required for oversize and/or overweight loads and vehicles travelling on county roads
Woodlands Conservation (Tree Cutting) By-Law	County of Middlesex	Potentially required if trees will be removed under Woodlands Conservation By-law
Approval for meteorological (met) mast installation	Township of Adelaide Metcalfe	Only required if permanent met mast is erected
Application for Official Plan and Comprehensive Zoning By-Law Amendment	Township of Adelaide Metcalfe	Land use compatibility.
Building Permit Application	Township of Adelaide Metcalfe	Compliance with land use requirements, setbacks, and compliance with building code.
Site Specific Zoning Amendments	Township of Adelaide Metcalfe	Required for construction of new buildings (including wind turbines and substation)

4.0 PROJECT DESCRIPTION

AET is moving forward with the Project in response to the need and desire of society in both Canada and Ontario for new sources of renewable energy. A portion of the Project area was first offered by a land owner to AET in late 2006 in response to an advertisement placed by AET in a regional farming magazine. The project was being considered as a potential 10 MW Standard Offer Contract (SOC). AET evaluated the area and identified the potential for a larger Project. Further consultation and feedback from surrounding land owners prompted the completion of a detailed feasibility study. The feasibility results were encouraging and AET began developing the site as a larger Project with the intention of submitting it to the anticipated further procurement rounds issued by the OPA. The OPA initiated a process to procure 500 MW of wind energy capacity by issuing a request for proposals (RFP) on June 5, 2008 under Renewable Energy Supply III (RES III). AET submitted the Project into the RES III procurement round, but were unsuccessful in being awarded a contract. AET is now examining the Project in relation to the *Green Energy and Green Economy Act, 2009* and the associated Feed-in Tariff, a renewable energy contracting mechanism being developed by the OPA.

4.1 Purpose of the Project

Interest in wind power as a source of electricity has grown significantly over the past few years. In Ontario, the government has demonstrated its commitment to wind energy production by introducing three renewable energy Requests for Proposals, resulting in the first commercial-scale wind projects in the province. According to the Independent Electricity System Operator's (IESO) December 2007 Ontario Reliability Outlook, wind power is expected to take on an increasingly significant presence in Ontario's supply mix over the next decade. As of January 31, 2009, the Ontario Power Authority was managing 1575.7 MW of wind power contracts, 704.3MW of which were in commercial operation. The remaining contracts are expected to come on-line by 2012 (OPA, 2009).

Increased energy supply from renewable sources is also strongly encouraged in Ontario's PPS which states:

> *"Increased energy supply should be promoted by providing opportunities for energy generation facilities to accommodate current and projected needs, and the use of renewable energy systems and alternative energy systems, where feasible."*

The PPS further elaborates that:

> *"Alternative energy systems and renewable energy systems shall be permitted in settlement areas, rural areas and prime agricultural areas in accordance with provincial and federal requirements".*

Renewable energy is also encouraged by the federal government. In 2007, the ecoENERGY Renewable Initiative was introduced, which replaced the previous Wind Power Production Incentive (WPPI) program. The ecoENERGY initiative encourages developers, such as AET to develop wind power Projects and to gain experience in this emerging energy market. Through the ecoENERGY program, the Government of Canada is investing more than $1.5 billion to make clean, low-impact renewable energy more available and less expensive. The goal of this initiative is to increase Canada's supply of renewable electricity by 4,000 MW. The ecoENERGY program will provide financial support for the operation of new wind power capacity over the next four years, with an incentive of one cent per kilowatt-hour for up to 10 years. This incentive will also help establish wind power as a competitive energy source in the marketplace.

Provincially, the *Green Energy and Green Economy Act, 2009*, was introduced as a bill in February 2009 and was passed on May 14, 2009. This legislation is aimed at greatly increasing the number of renewable energy projects in the province (using wind as well as solar, hydro, biomass and biogas as energy sources), creating up to 50,000 jobs within the first three years, and supporting the province's plan to make Ontario a leading green economy in North America (Ontario Ministry of Energy and Infrastructure, 2009).

AET is interested in developing renewable energy projects in Quebec and Ontario to provide a source of renewable, emissions-free energy. The purpose of this Project is to provide up to 72 MW of electricity generating capacity from a renewable source that contributes to meeting Ontario's targets for renewable energy use.

4.2 Project Location

The Project is located in a rural area on privately owned, primarily agricultural lands (See Figure 2.3-1) within the Township of Adelaide Metcalfe, Middlesex County, Ontario. The Project Site Study Area (herein referred to as the SSA) spans north and south of Highway 402, in the north-eastern corner of the geographic Township of Adelaide Metcalfe. Adelaide Metcalfe is bordered by the Municipality of North Middlesex to the north, the Township of Strathroy-Caradoc to the southeast, and the Township of Warwick to the west. The Township of Adelaide Metcalfe is part of a two-tiered municipal system. The County of Middlesex makes up the upper tier of the region, while Adelaide Metcalfe, North Middlesex and Strathroy-Caradoc, along with five additional townships and municipalities, have lower tier municipal status. Agriculture is the predominant economic activity and land use in the County of Middlesex.

The topography of the Project area is flat to gently rolling. The rural landscape consists primarily of agricultural fields, with several land parcels containing small remnant woodlots located at the opposite end of the parcel from the existing residence. Residences and farm outbuildings are typically located at or within the front quarter closest to the roadside. Schedule A-1 Land Use Plan of the Township of Adelaide Metcalfe confirms that land use in the Project area consists primarily of agriculture. The Project area is located in the headwaters of the Ausable River watershed (primarily north of Highway 402) and the Sydenham River watershed (primarily south of Highway 402). Predominantly first to third order watercourses, many of which are Municipal Drains, meander through the agricultural landscape. Two Natural Environment Areas are located within the Project area to the northwest of the Hamlet of Adelaide within Concession I and II, Lots 8 and 9 and AET has considered this in arriving at the final Project design. AET has avoided placement of turbines or access roads within these more environmentally significant areas, and has also incorporated a significant set back distance to minimise impacts on these areas.

No First Nations Reserves or lands with Comprehensive Land Claims are located within the Project area and discussions with local planning authorities have revealed that there is no known history of claims within the Township of Adelaide Metcalfe. However, to ensure Aboriginal interests are considered fully, consultation has been undertaken with several provincial and federal authorities and some Aboriginal communities have been identified as having a potential interest. Stage 1 and Stage 2 Archaeological Assessments of properties containing turbines, temporary and permanent access roads and underground cable routes within the SSA have been conducted as part of the EA process. The Stage 1 assessment is complete, and determined the archaeological potential for pre-contact Aboriginal and Euro-Canadian sites is moderate to high on the properties surveyed. The historic Euro-Canadian potential was based on documentation indicating early 19th century occupation, abandoned villages and the continued existence of historic transportation routes (e.g., Egremont Road). As a result, a Stage 2 Archaeological Assessment is required, and has been initiated for all areas to be disturbed during turbine and access road construction and interconnections.

A more detailed description of the environmental context for the Project is provided in the existing environment subsections of Sections 7.1 to 7.13.

4.3 Project Layout

The SSA is illustrated in Figure 4.3-1. AET considered a variety of factors when siting wind turbines and other Project infrastructure and conducted constraints mapping as part of the pre-planning stage for the Project. AET retained Helimax to prepare initial constraints analysis for telecommunication links and other electromagnetic interference (EMI). Further detailed environmental constraints mapping was conducted by Golder and was used to further refine the Project layout. The Golder constraints analysis, which considered several turbine location scenarios, included natural environment (terrestrial and aquatic), geological, archaeological, socio-economic, and land use-related considerations and served to assist in identifying the least constraining options for land parcels with existing land owner agreements. A combination of the output of all constraints analysis exercises was used by AET to site turbines and other Project infrastructure. As the Project layout evolved through several iterations, the primary environmental, social and regulatory constraints of greatest consideration included:

- Meteorological conditions;
- Electricity production by the Project;
- Lands under option to AET;
- Landowner preferences and maintenance of existing land use and function;
- Site access;
- Minimizing the lengths of transmission lines and access roads;
- Results of the archaeological and noise assessment reports (as available prior to finalization of the Project layout);
- Proximity to environmentally sensitive features;
- Minimizing the number of watercourse crossings (access roads and underground cable);
- Minimizing electromagnetic interference (EMI); and
- Municipal and provincial government minimum setback requirements to environmentally sensitive features and other infrastructure (e.g., wetlands, roads, property lines; structures etc.).

For purposes of the Project design, specific minimum setback distances were considered and applied where possible (see Table 4.3-1). The source of these setbacks varied; some were based on municipal and provincial requirements, while others were developed by AET based on industry standards, environmental best practices and operational risk assessment. In some cases there is more than one possible setback distance for a single feature (e.g., pipelines), in these cases, the most conservative (i.e., larger) setback distance was used. To minimize potential impacts to agriculture and limit the loss of productive agricultural land, it was necessary to locate some access roads within the County of Middlesex adjacent land boundary of 50 m from

Significant Woodlands. This was conducted in consultation with Adelaide Metcalfe and Middlesex County planners.

Table 4.3-1: Turbine Minimum Setback Distances

Consideration	Minimum Setback Distance/Consultation Zone	Source
Electromagnetic Interference		
Wireless Broadband Link	Outside calculated exclusion corridor	RABC/CanWEA EMI Guidelines (RABC/CanWEA, 2007) and advice from independent Telecom impact consultants
Wireless EMI Link	Outside calculated exclusion corridor	RABC/CanWEA EMI Guidelines and advice from independent Telecom impact consultants
Civilian Air Traffic Control Radar	60 km Consultation Zone	RABC/CanWEA EMI Guidelines
Seismological Monitoring Equipment	10 km	RABC/CanWEA EMI Guidelines
Weather Radar	80 km Consultation Zone	RABC/CanWEA EMI Guidelines
Natural and Cultural Environment		
Watercourses	50 m from turbine base	AET best practice
Regulation Limit as per O. Reg. 147/06 (ABCA)	Avoided works within Regulation Limit where possible	Ausable Bayfield Conservation Authority
Regulation Limit as per O. Reg. 171/06 (SCRCA)	Avoided works within Regulation Limit where possible	St. Clair Region Conservation Authority
Significant Woodlands	50 m from turbine base	County of Middlesex Official Plan
Environmentally Significant Areas	Avoidance	Township Of Adelaide Metcalfe Official Plan Environmental Constraint Areas Map
Provincially Significant Wetlands	Avoidance	Township Of Adelaide Metcalfe Official Plan Environmental Constraint Areas Map
Provincially Significant Wetlands	Avoidance of feature + hydrologic zone of influence	Ontario Ministry of Natural Resources
Archaeological sites	Avoidance	Ontario Ministry of Culture
Infrastructure and Municipal Planning-related		
Pipeline	150 m from turbine base	AET best practice
Pipeline	15.24 m (50 feet) from turbine base	Imperial Oil

Table 4.3-1: Turbine Minimum Setback Distances (continued)

Consideration	Minimum Setback Distance/Consultation Zone	Source
Major Airport (International)	30 km	AET best practice
Transmission Lines	150 m from turbine base	Hydro One Inc.
MTO Highway	Hub height + 1 blade length from highway property boundary and 14 m from property boundary line	Ontario Ministry of Transportation
MTO Highway	250 m from road easement	AET best practice
County Road	1.2 x Total Height (tower + blade at highest point); 168 m total (with Vestas turbine model used)	AET best practice in line with Township of Adelaide Metcalfe Guidance/Zoning
Municipal Road	1.2 x Total Height (tower + blade at highest point); 168 m total (with Vestas turbine model used)	Township Of Adelaide Metcalfe Zoning By-law
Lot Line	20 m + blade length	Township Of Adelaide Metcalfe Zoning By-law
Lot Line (adjacent property within same wind farm development)	0 m	Township Of Adelaide Metcalfe Zoning By-law
Urban Areas	600 m	Township Of Adelaide Metcalfe Zoning By-law
Noise Sensitivity On-site dwellings Off-site dwellings	 500 m 600m	AET best practice (in excess of Adelaide Metcalfe By-law requirements as outlined below)
Noise Sensitivity (dwellings located off-site)	400 m	Township Of Adelaide Metcalfe Zoning By-law
School	1200 m	AET best practice

4.4 Project Components

The Project components and infrastructure were selected to optimize the power output while minimizing negative effects and potential residual impacts. The site layout is shown in Figure 4.3-1. The Project will consist of the following major components:

- 40 x 1.8 MW wind turbines;
- Approximately 24.5 km of new gravel access roads originating at the existing road network and extending to and between turbine sites;
- Approximately 26.6 km of buried 34.5kV distribution lines primarily located along the access roads between turbines;
- Approximately 12.7 km of overhead 34.5kV distribution line connecting to the substation via junction boxes;
- A 115/34.5kV kV transforming substation; and
- A permanent wind measurement mast of up to 100 m height equipped with aviation lighting if required.

4.4.1 Turbines

The Project will involve the installation of 40 wind turbines for a total capacity of 72 MW. The turbines will each have a nameplate capacity of 1.8 MW. The wind turbine specifications are outlined below in Table 4.4-1 and the dimensions are illustrated in Figure 4.4-1.

Table 4.4-1: Vestas V90 1.8 MW Turbine Technical Specifications

Component	Specification
Rated capacity	1.8 MW
Cut-in wind speed	3.5 m/s
Cut-out wind speed	25 m/s
Rated wind speed	12 m/s
Number of blades	3
Rotor Diameter	90 m
Swept area	6362 m^2
Rotor speed (variable)	9.0 – 14.5 rpm
Rotor speed regulation	Pitch regulated
Tower (hub) height	95 m
Gearbox	1 planetary stage/2 helical stages
Generator	3-phase asynchronous generator

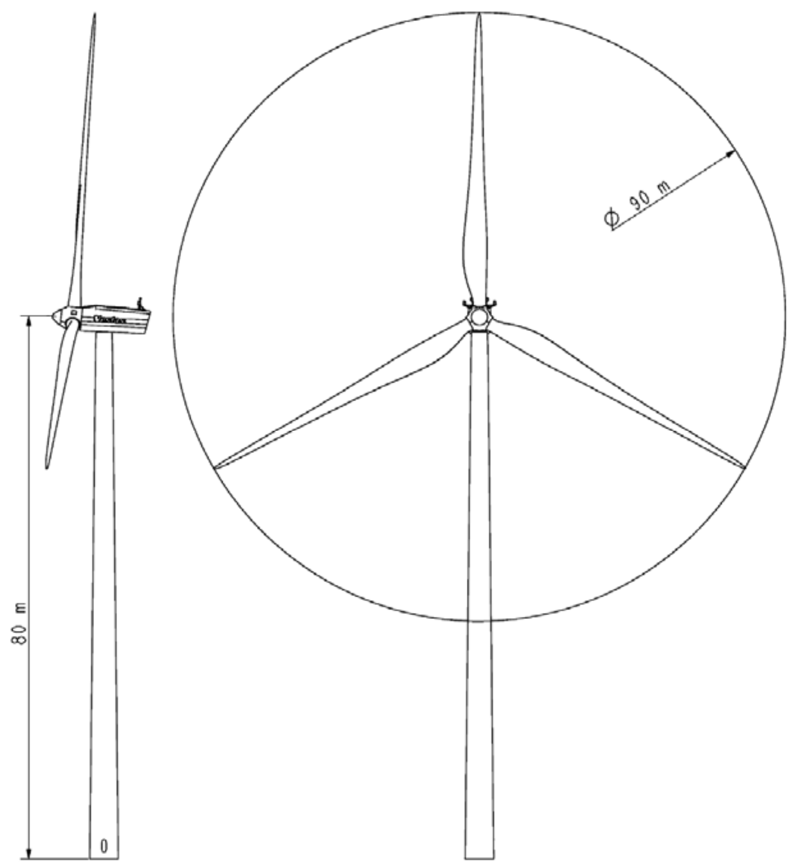
Table 4.4-1: Vestas V90 1.8 MW Turbine Technical Specifications (continued)

Component	Specification
Converter	Double conversion online
Braking system (fail-safe)	Mechanical disc brake
Yaw system	Plain bearing system with built in friction
Control system	VMP 5000 multiprocessor control system comprised of 4 main processors
Noise reduction	VMP 5000 multiprocessor control system (noise emission control)
Lightning protection system	Lightning receptors, down conducting system and earthing System consistent with International Electrochemical Commission (IEC) Design Codes.
Tower design	Tapered tubular steel

Source: Vestas, 2008

Modern commercial-scale wind turbines consist of four large main components: a foundation, tower, nacelle (turbine housing), and a 3-bladed rotor (See Figure 4.4-1). Each turbine will be equipped with a step-up transformer inside the tower which will raise the voltage from 690 V to 34.5 kV. Due to the large size of the steel tower (95 m height), it is delivered to the Project site in four sections.

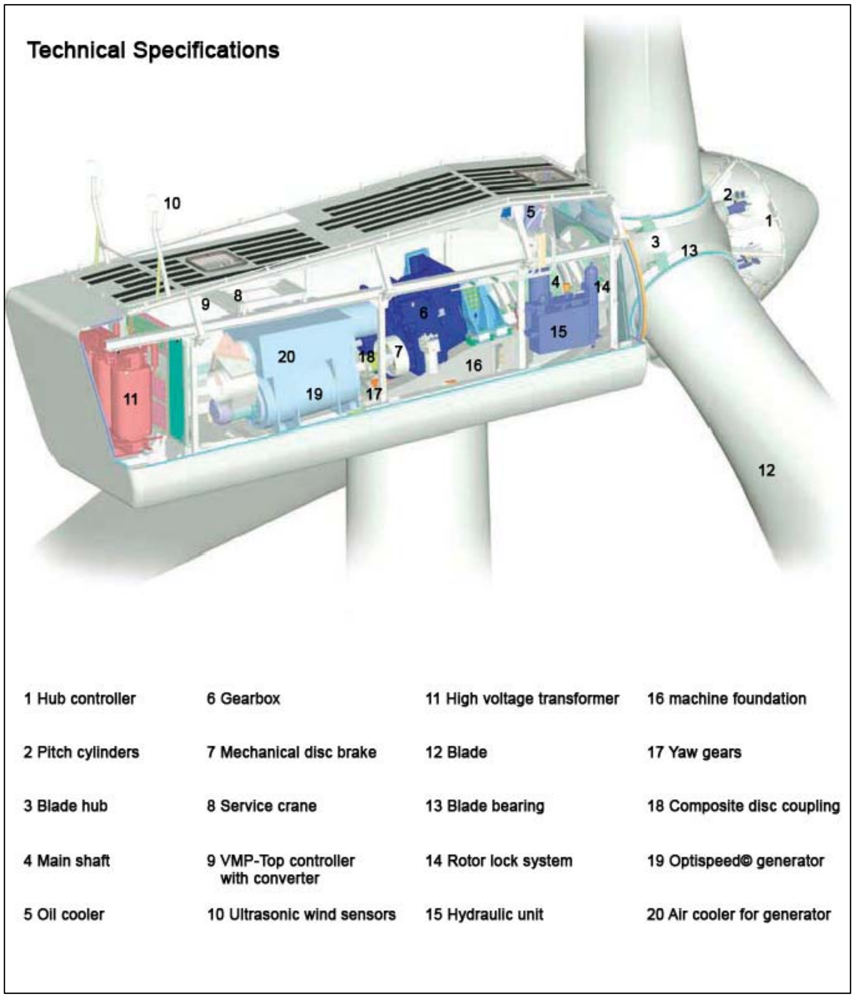
Figure 4.4-1: Dimensions of Vestas V90 1.8 MW Turbine



Source: Vestas, 2008

NB: The drawing above is for reference only. It indicates a hub height of 80 m, however Vestas are currently working on a 95m tower to maximise yield from Class II-III wind speed sites. AET is proposing to use the 95 m hub height model at the Adelaide Wind Farm.

Figure 4.4-2: Schematic of the Vestas 1.8 MW Wind Turbine Nacelle



Source: Modified using Vestas, 2008.

As seen in Figure 4.4-2, most of the equipment used to convert wind energy into electricity is contained in the nacelle of the turbine, which is also sound insulated to minimize noise emission. In order to maximize production of electricity, modern wind turbines are designed to automatically rotate (yaw) into the wind at all times. Turbines are also able to change the pitch of their blades to capture as much kinetic energy from the wind as possible.

The wind turbine is equipped with lightning protection which protects the entire turbine from the tip of the blades to the foundation. The system enables the lightning current to by-pass all vital components within the blade, nacelle and tower therefore limiting the potential for damage. As an extra safety precaution, the control units and processors in the nacelle are protected by an efficient shielding system. The lightning protection is designed according to IEC 61024 – "Lightning Protection of Wind Turbine Generators".

Lightning detectors are mounted on all three rotor blades. Data from the detectors are logged and enable the operator to identify which blade(s) were hit, the exact time of the strike and how powerful the lightning was. These data are useful for making a remote estimate of possible damage to the turbine and evaluating the need for inspection.

The lightning protection system design is based on and complies with the following international standards and guidelines:

- IEC 62305-1 Ed. 1.0: Protection against Lightning – Part 1: General principles;
- IEC 62305-3 Ed. 1.0: Protection against lightning – Part 3: Physical damage to structures and life hazard;
- IEC 62305-4 Ed. 1.0: Protection against lightning – Part 4: Electrical and electronic systems within structures;
- IEC/TR 61400-24. First edition. 2002-07. Wind turbine generator systems - Part 24: Lightning protection;
- IEC 60364-5-54. Second edition 2002-06. Electrical installations of buildings - Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors; and
- IEC 61936-1. First edition. 2002-10. Power installations exceeding 1kV a.c.- Part 1: Common rules.

A range of obstruction lighting scenarios can be used to comply with the local aviation regulations. The following standard integrated aviation light options are available:

1. Low intensity. Red 10-200 cd/m^2.
2. Medium intensity. Red/white/dual 200-2000 cd/m^2.
3. Medium intensity. Red/white/dual 2000 - 20000 cd/m^2.

The Project is located approximately halfway between the London Airport (40 km to the East) and Sarnia Airport (40 km to the West). Aviation concerns are being addressed though Transport Canada (Aeronautical Obstruction Clearance) and NAV CANADA (Land Use Clearance) approval processes. AET consulted with Transport Canada to ensure appropriate lighting of the wind turbines. The lighting plan is designed to ensure there is a balance between aviation safety and minimization of environmental/socio-economic effects and reflects the most appropriate layout as per the Transport Canada guideline CAR 621.19. The lighting plan outlined on the Aeronautical Obstruction Clearance Form submitted by AET on April 1, 2009 was approved by Transport Canada on April 22, 2009 (a copy of the approved Aeronautical Obstruction Clearance

Form is provided in Appendix A.2). Consultations with NAV CANADA are on-going. Groups with local aviation interests will be informed about the Project prior to construction to ensure turbines and temporary infrastructure are added to relevant aviation mapping where required. AET will also liaise with NAV CANADA and Transport Canada prior to construction to ensure the cranes used to erect turbines receive appropriate clearances.

In addition to major airports, initial constraints mapping performed by AET indicated that there was one known small airfield located north of the SSA, near the intersection of Townsend Line and Centre Road. AET staff visited the location of the mapped airfield on August 14, 2007 and discovered that it was no longer in use as an airfield but was now used as a golf driving range.

The geographic coordinates and base elevation for the 40 wind turbines, substation and permanent wind measurement mast are provided in Table 4.4-2.

Table 4.4-2: Geographic Coordinates and Base Elevations of Turbines, Substation and Permanent Wind Measurement Mast (UTM Zone 17 NAD 83)

ID	Easting	Northing	Elevation (masl)
1	441693	4762865	235.037292
2	441963	4763325	234.999893
3	442240	4762859	236.008423
4	442610	4762657	240.056488
5	444245	4762845	240.40271
6	445115	4762836	237.315323
7	445631	4763125	235.858902
8	445546	4762665	237.682922
9	445939	4762693	239.325974
10	446360	4762314	244.792938
11	446370	4762735	243.118805
12	437710	4759955	245.650116
13	438055	4759832	248.567429
14	438237	4758255	238.739594
15	438165	4759414	246.241058
16	438465	4759952	249.168304
17	438593	4758143	240.14212
18	438837	4759917	247.217834
19	439187	4759817	246.406921

Table 4.4-2: Geographic Coordinates and Base Elevations of Turbines, Substation and Permanent Wind Measurement Mast (UTM Zone 17 NAD 83) (continued)

ID	Easting	Northing	Elevation (masl)
20	439847	4759939	244.995132
21	440587	4759274	246.166077
22	440261	4759935	245.381195
23	440365	4758006	247.157349
24	440616	4759846	245.000046
25	440629	4757751	248.4077
26	440941	4757571	246.226471
27	441625	4759702	241.18837
28	441641	4757570	246.657043
29	441992	4759773	240.831757
30	442062	4757616	247.104568
31	442430	4759661	243.641846
32	444335	4758300	246.380127
33	444699	4758283	246.134293
34	445175	4759905	246.317383
35	445215	4759484	247.295105
36	445687	4759898	249.21196
37	446031	4759766	249.847778
38	445411	4763431	240.557266
39	438101	4757738	235.849106
40	444717	4759896	245.28656
Substation	439529	4759744	246
Wind Measurement Mast	439155	4758367	245

4.4.2 Access Roads

The Project area will be accessed via existing road right-of-ways. Access to the turbine sites will require the construction of approximately 24.5 km of new unpaved access roads. For the purposes of this ESR/EIS document, all newly created gravel roadways constructed to allow access to turbines are referred to as "access roads". These are not intended to function as permanent or publicly accessible roads, and will only be actively used during construction and for periodic maintenance that will be carried out over the life of the Project (i.e., 30 years). In most cases the access roads will share routing with the underground connection cables.

Depending on ground conditions, final crane selection and crane availability, the access roads for the Adelaide Wind Farm will be either *Access Road Type 1*: 5-6 m during construction and for the operational lifetime of the Project, or *Access Road Type 2*: 10 m during construction, then reinstated back to 5-6 m to facilitate maintenance during the lifetime of the Project. A typical cross-section of a 5 m permanent access road (*Access Road Type 1*) is provided in Figure 4.4-3. In order to meet turbine manufacturer's specifications for component delivery, access road curves will be built with a minimum turning radius of 45 m.

The reason for the difference in road widths is based on final crane selection. A crawler crane requires a wider access track for wind turbine erection, as it is situated on tracks or "crawlers" and relies on these for stability instead of out-riggers (See Figure 4.4-4).

Figure 4.4-4: Example of a Crawler Crane

Source: KR Wind

This type of crane can be used in poorer ground conditions and can move around site with very little set-up, as it does not require out-riggers. The disadvantage is that moving this type of crane from one cluster of turbines to another is very difficult and usually requires that the crane be dismantled and moved by truck to the next location. This may however be the most suitable crane or the only type available at the time of construction and would require *Access Road Type 2* to be constructed.

AET would preferentially seek to use a hydraulic, road-going crane which would only require a 5-6 m access road for erecting turbines, as it is much narrower than the crawler crane and relies on out-riggers for support as opposed to wider “crawler” tracks (See Figure 4.4-5).

Figure 4.4-5: Example of a Hydraulic Road-Going Crane (Hydraulic Mobile Crane LG1550)

Source: Liebherr

The difficulty is that hydraulic road-going cranes with the lifting capacity required to construct commercial scale wind turbines are in limited supply in Ontario. Availability of these cranes at the time of construction will influence the final access road design. If this type of crane is suitable and available then AET would use *Access Road Type 1*.

Gravel to construct access roads will be sourced from local suppliers to the extent available. AET will also make use of existing roads and laneways wherever possible. Where not possible, construction of new access roads is required. The alignment of access roads will typically be parallel to property boundaries and located in areas that minimize disturbance to agricultural operations and the requirement for watercourse crossings. Locations have been determined, in part, through detailed consultation with land owners (in order to minimize disruptions to existing uses) and through discussions with local planners and municipal and county engineering staff.

4.4.3 Electrical Transmission System

From the base of each turbine, power is transferred through 34.5 kV underground cables to either an adjacent wind turbine (wired in series) or to a junction box connected to several other turbines. The power is then transferred either directly to the Project substation or via a 34.5 kV overhead cable before connecting to the Project transforming substation. The 34.5 kV overhead collection system will be designed to use standard utility equipment and cables. Connection between the individual turbines and the substation will be achieved through a combination underground and overhead transmission lines across the SSA. Overhead transmission will occur through stringing and installation of new overhead lines or upgrading of existing lines. In July 2007, AET and their grid consultant met with Independent Electricity System Operator (IESO) to discuss the local grid connection. A Part 1 System Impact Assessment has been completed by the IESO, and AET is currently in discussions with IESO to finalize the system connection arrangements. After power is “stepped up” to 115 kV at the substation, power will be fed into the existing 115 kV transmission spur (Circuit W2S), which runs parallel to the east shoulder of Kerwood Drive, where it will normally feed the Buchanan 115 kV Bus.

The substation components include: an isolation switch, circuit breaker, step-up power transformer, distribution switch-gear, instrument transformers, grounding, revenue metering, reactive power compensation, and a substation control and operations building. The substation design may allow for future expansion of the Project. Substation grounding will follow Canadian Electrical Code (CEC) standards. The substation will be fenced and secured based on standard utility practices and will include an oil containment system to prevent soil contamination in the event of a leak from the main transformer.

From the substation, electricity will be delivered to the existing 115 kV Hydro One owned transmission line via a newly constructed overhead connector line of approximately 100 m length.

4.4.4 Permanent Wind Measurement Mast

A permanent wind measurement mast (also known as a meteorological or “met” mast) is required and would be erected on-site for monitoring climatic conditions throughout the lifetime of the Project. This mast would be approximately the same hub height as the turbines used and could be up to 100 m in height. The wind measurement mast consists of a lattice tower structure with a concrete foundation.

4.5 Detailed Project Activities

The works and activities undertaken during the Site Preparation and Construction, Operation and Maintenance, and Decommissioning phases of the Project are discussed in the following subsections.

4.5.1 Site Preparation and Construction Phase

The Site Preparation and Construction Phase includes all of the preliminary surveys and planning work required to develop the Project and all works and activities required during construction. Typical construction equipment to be used for site preparation and/or assembly of the turbines, substation, access roads and buried lines includes: tracked bulldozers, excavators, compactors, graders, concrete pump or elevator, tippers and dumpers, mobile cranes for general use and an approximately 800-1000 tonne crane for tower section, nacelle and blade erection.

4.5.1.1 Surveying and Wind Turbine Siting

The boundaries of the construction areas, including turbine sites, transforming substation site, access and connection cable routes, and temporary workspace will be staked. All existing buried infrastructure, such as pipelines and cables will also be located by the appropriate personnel and marked.

Surveying for site design is expected to occur over a 1-3 week period, and the sites will be re-surveyed and staked over a two-week period prior to construction.

4.5.1.2 Land Clearing

Because the Project will be located on properties that are under active agriculture, most of the land that will contain infrastructure has already been cleared of native vegetation. No vegetation cutting or clearing is required within any Significant Woodlots, as identified in the County of Middlesex Official Plan. A minimum setback distance of 50 m to woodlots was considered during turbine siting. However, protection of agricultural land was prioritized in line with guidance point 4.6 (d) of the Middlesex County Official Plan, creating the need for access roads to be closer than 30 m to woodlots in some instances. This was requested by landowners and done in consultation with local and county planners.

4.5.1.3 Delivery of Equipment

Project construction will require the delivery of construction equipment, fuel and lubricant, turbine components, and construction material by large truck and trailer combinations. Turbine components will be delivered by tractor trailer, requiring approximately 360 to 520 loads (9-13 per turbine). Equipment will be delivered as needed throughout the construction phase, and will be timed so that it is delivered to each turbine site and stored temporarily just before it is constructed. It will only be stored at a temporary storage area if necessary (bad weather delays, etc.). Additional vehicles will be used for personnel and small equipment transport to and at the site.

The primary roads used for equipment delivery will be a combination of highways, arterial roads and municipal right of ways. In some cases temporary lane widening may be required to allow for a sufficient turning radius for delivering turbine blades. A traffic management plan will be created, based on consultation with the township, county and Ministry of Transportation (MTO), and will be designed to limit traffic disturbance during equipment delivery, particularly to school bus traffic, on public roads.

4.5.1.4 Access Roads

Access roads for use during construction will be built using tracked bulldozers and excavators to strip topsoil and subsoil, as required, to create an even travel surface. The travel surface will be compacted to achieve proper load bearing capacity. The travel surface also will be crowned with a grader in order to ensure adequate draining. Culverts, ditches or other drainage structures will be required to maintain adequate road drainage. The conveyance function of any existing drainage or tiling that is intercepted will be maintained throughout the Project.

Access road foundations will be constructed of pit run gravel to an approximate depth of 0.25 to 1 m, as well as a running surface constructed of 0 to ¾ inch gravel of 150-300 mm thickness. Foundations will have a load bearing capacity of no less than 15 metric tons per axle, as well as a compaction of 90%. During the construction process, access road right-of-ways will be 10 m wide, with additional width required as needed at turning radii (minimum turning radius of 45 m). Access road right-of-ways, if required, will be reduced to a width of 5-6 m within 12 months of completion of the construction phase.

Soil management will be incorporated into the access road construction process to facilitate site reclamation. Existing vegetation (crop stubble) will be stripped with the topsoil, and will be stockpiled separately from subsoil and stabilized to prevent erosion and growth or transfer of noxious weeds. Once Project construction is complete, the gravel from the 5 m wide area along the access roads that will be returned to agricultural use will then be removed, and stripped subsoil and topsoil will be replaced from the 5 m wide area. Any access road construction occurring in and around watercourses will employ Best Management Practices (BMPs), such as the erection of silt fencing, to ensure no net loss of fish habitat, destruction of fish or water quality or quantity impairments (discussed further in Section 7.2).

Access road construction is expected to take 40-50 working days with three road construction crews. Temporary access roads are required for less than 6 months.

4.5.1.5 Temporary Staging/Laydown Areas

Equipment, construction material, fuels and lubricants, and turbine components delivered to the site will be stored in temporary laydown areas until used. There are currently two proposed staging/laydown areas proposed for the Project; the primary laydown area will be 300 m x 300 m in size and will likely be located on Kerwood Road, south of Highway 402, and the second is 400 m x 200 m in size and will likely be located immediately South of Cuddy Road, east of School Road. These areas were selected because they are not used for crops, already have existing access, and contain hard standing and existing buildings which may prove suitable as site offices/storage etc., thus minimizing potential environmental effects.

Both of these proposed temporary laydown areas are shown on Figure 4.3-1. Trailers or other temporary structures will be located within one of these areas and will serve as the operations and maintenance office space for the duration of the construction phase.

In addition, a temporary laydown area of 60 m x 60 m will be located adjacent to each wind turbine. Turbine equipment will be delivered to these areas, and stored prior to turbine erection. Also within this 60 m x 60 m area, a temporary crane pad will be constructed to provide a support area for the crane used to erect turbine components. A drawing of the likely turbine assembly schematic is provided in Figure 4.5-1.

The locations of temporary storage areas will be sited to avoid environmental features within each lot and in consultation with landowners. Although a temporary storage area at each turbine of 60 m x 60 m is considered in this assessment, a smaller area may be sufficient, depending on the delivery schedule. The delivery schedule will be determined as part of contractual negotiations with the manufacturers.

Parking lots will not be required during site construction. Some vehicle parking will occur at the construction sites in the temporary workspaces and laydown areas. Upon completion of construction work, temporary facilities will be removed and areas restored to their original states.

4.5.1.6 Turbine Foundations

Two existing concrete batching plants have been identified in close proximity to the site area (5 km and 25 km away, respectively). It is likely that the concrete required for the foundations will be delivered by truck to the site from one or both of these facilities. It is estimated that a total of 1000 loads of concrete using 16 m^3 trucks will be required to supply 16 000 m^3 of concrete.

For the wind turbine foundations, it is anticipated that the turbine base will be constructed as a gravity reinforced concrete foundation. The excavation for the turbine base will be approximately 25 m by 25 m by 3.5 m to accommodate the foundation of approximately 17.5 m by 17.5 m by 3.3 m and tower turbine inserts. The turbine construction area will be excavated using a tracked excavator. A cross-sectional and top view drawing of the typical foundation to be used for this Project is provided in Figure 4.5-2. Depending on the detailed engineering design, the foundation may be supported by a number of piles. Formwork and rebar will be installed to construct the foundation. Formwork will be struck after 24 hours and the excavated area will be back filled and compacted until only the tower base portion of the foundation is left above ground. The turbine tower will be anchored to the foundation by large anchor bolts that are set in the concrete. These stages of turbine foundation construction are illustrated in Figure 4.5-3. Please note, this figure is for illustration purposes only, as it is a series of photographs showing construction of an Enercon turbine foundation (not Vestas).

Figure 4.5-3: Example of Turbine Foundation Construction Stages

Photos courtesy of Enercon

Water container trailers for each site will transport water to the site from a nearby water source making trips as required. If a water source is less than 100 m from a foundation site, then a temporary pipeline may be laid and water pumped to the site. Permanent washroom facilities on the site are limited to the operations and maintenance office to be located in one of the temporary staging/laydown areas. Temporary portable toilets will be provided during the construction phase of the Project. Sanitary sewage will be collected by a licensed hauler and properly disposed of off-site.

Foundation excavation and installation is expected to take approximately 4-9 months.

Concrete pumps, or elevators, will be used to construct the turbine foundations, and two cranes will be used to erect the turbine towers. A temporary concrete batching plant may be used if the required quantities of material cannot be sourced locally; however it is more likely that concrete will be delivered to the site by truck.

4.5.1.7 Turbine Assembly and Erection

The wind turbine towers will be delivered on large tractor trailers in four sections. The towers will be assembled on-site and will be erected using two cranes. The tower section will be bolted to the foundation using holding down bolts that are set in the concrete.

The turbine nacelle and the three turbine blades will also be delivered on large tractor trailers to the temporary workspace adjacent to the turbine foundation. The nacelle and its components are lifted into place on the tower. Once the three blades are attached to nose cones on the ground, the assembled rotor is then lifted and assembled to the nacelle. Each turbine will be 95 m high to the hub, with a 90 m diameter rotor.

The turbine assembly and installation is expected to take from 4-6 months.

4.5.1.8 Collector System

The electrical collector system will consist of a mixture of underground cable and overhead lines that will be constructed using Standard wooden poles and ACSR (Aluminum Conductor, Steel Reinforced) conductors. The installation of interconnection cabling is expected to be completed over a 6 month period. The on-site collector system will consist of a combination of overhead and buried 34.5 kV standard utility cables, with buried cable between turbines, or junction boxes, that are then directed to a central transforming substation located near the intersection of Mullifarry Drive and Kerwood Road. From here, overhead cable will be used to connect to the main Hydro One transmission line at 115 kV. The underground collector system routes will primarily follow the access routes or directly link turbines in some cases where this is more practical. All overhead sections of the collector system will be along existing roads and/or highways.

A combination of ploughing and trenching (either by trenching machine or backhoe) will be used to install the underground cables, depending on terrain. Soil management will be incorporated into this process to facilitate site reclamation. Typically, lines are trenched over short distances where manoeuvrability of the ploughing equipment is difficult or where it has been identified that ploughing poses an unacceptable hazard to existing tile drainage or other underground services. A track-mounted plough mechanism, which cuts a narrow trench, will be used to install the underground distribution lines. A plough seam will be excavated to a depth of approximately 1 to 1.5 m and a width of approximately 1 m, into which the cable is placed. The plough seam will be backfilled immediately to prevent soil loss from erosion. Alternatively, a wheel-ditcher or Ditch Witch (a wheel-like or bar-like mechanism similar to a chainsaw) will be used to cut a narrow trench into which the cable is placed (See Figure 4.5-4). Trenching equipment for underground cable is smaller than that used for pipeline construction, usually mounted on a bobcat or small backhoe. The soil removed from the trench is situated immediately adjacent to the trench. Once the cable has been covered with sand, a backhoe or small bobcat will be used to push the soil back into place to re-contour the disturbed area.

Figure 4.5-4: Example of a Cable Trenching Machine or "Ditch Witch"

Underground cabling will be buried at a depth that will not interfere with normal agricultural practices. In addition, all underground cabling within private lands will be mapped and all landowners will be provided with detail of the cable locations. AET will also create a toll-free call-in number for landowners to request detailed information regarding the location of underground or overhead cables on their property. This number would also be available to the wider community and relevant local and county authorities. For areas where the underground cable leaves private lands, the locations will be indicated by standard cable markers where appropriate (See Figure 4.5-5). All cable installation works on county or municipal controlled lands will be done in conjunction with relevant authorities and to the appropriate required standards.

Figure 4.5-5: Examples of Underground Cable Markers (Post and Tape)

Where the underground cable will cross watercourses, the DFO Operational Statement for Isolated or Dry Open Cut stream crossings will be followed (DFO, 2008). A permit for working within a Regulation Limit will also be attained following consultation with the Ausable Bayfield Conservation Authority (ABCA). A more detailed survey of the watercourse at the crossing location may need to be conducted prior to construction to satisfy the ABCA permit application requirements.

Where the underground cable must be spliced (e.g., at the end of a reel or to pass underneath another utility cable) a splice pit is typically required. These pits are roughly 1.5 m deep, 1 m wide, and up to 5 m long (but usually 1 to 2 m long). At these locations, the topsoil will be stripped and stockpiled. After the procedure is complete, soil will be replaced and contoured.

Overhead lines will be used to connect the junction points from groups of turbines to a single junction box terminating at the substation.

4.5.1.9 Transforming Substation and Electrical Interconnection

The transforming substation site will measure no more than 80 m by 80 m and will be located east of Kerwood Road, south of Highway 402 (see Figure 4.3-1). A temporary workspace will also be created within this area; however, once the substation building is finished, the remaining space will be converted for use as parking, and will not be returned to agricultural use.

The transforming substation site will be prepared using tracked bulldozers and excavators to strip topsoil and subsoil, as required, to create an even work surface. Soil management will be incorporated into this process to facilitate site reclamation. Existing vegetation (crop stubble) will be stripped with the topsoil, which will be stockpiled separately from stripped subsoil. The substation site will be gravelled and contoured for effective surface drainage.

After construction is complete, stripped subsoil and topsoil will be replaced at the temporary workspace or hauled to a nearby participating farm to be used by the landowner at their discretion. Clean topsoil stripped from the substation foundation area will be re-distributed to adjacent lands as appropriate.

The Hydro One 115 kV transmission line is located on privately owned land; AET has a long term Option/Lease agreement in place with the landowners, which will allow direct connection to the main transmission line from the substation.

Installation and connection of the substation is expected to take 3-6 months.

4.5.2 Summary of Project Construction Activities

Table 4.5-1 provides a summary of the Project construction activities described above. Construction is expected to span 10 months from the start of excavations to completion of turbine erection.

Table 4.5-1: Project Construction Activities

Project Phase and Activity	Description
SITE PREPARATION AND CONSTRUCTION	
Surveying and Siting Operations	• The boundaries of the construction areas will be staked and buried infrastructure (e.g., pipelines and cables) will be located and marked. • Surveying for site design will take place over a 1-3 week period. The sites will be re-surveyed and staked prior to construction and checked at regular intervals during construction.
Land Clearing	• Minimal removal of vegetation will be required. A minimum setback distance of 50 m to woodlots was considered during siting, however, protection of arable land was prioritized, creating the need for access roads to be closer than 30 m to woodlots in some areas.

Table 4.5-1: Project Construction Activities (continued)

Project Phase and Activity	Description
Access Roads	• Access will occur via existing road right-of-ways and construction of ~ 24.5 km of new unpaved access roads. Access roads will share routing with underground connection cables where possible. • Access road right-of-ways will either be 5-6 m wide (*Access Road Type 1*) or 10 m wide (*Access Road Type 2*) during construction and reduced to 5-6 m wide during operation; both will have a minimum turning radius of 45 m to meet turbine manufacturer's specifications for component delivery. • Access roads will be built using tracked bulldozers and excavators, compactors and graders. Crowning, culverts, tiling or other drainage structures will be required to maintain site drainage. • Soil management will be incorporated and stripped subsoil and topsoil will be replaced following construction. • Access road construction will take 40-50 working days with three road construction crews. Temporary access roads are required for less than 6 months.
Delivery of Equipment	• Equipment will be delivered by truck and trailer, requiring 360 - 520 loads (9-13 per turbine). • The equipment delivery route will be use a combination of highways, arterial roads and municipal right-of-ways. A traffic management plan will be prepared to limit traffic disturbance on public roads.
Temporary Laydown/ Staging Areas	• Temporary storage/laydown areas will be used during construction for equipment and materials storage, designated fuelling areas and will house field offices for the construction phase of the Project. • Temporary storage/laydown areas to be approximately 300 m x 300 m and 200 m x 400 m.
Turbine Site Construction	• Turbine sites will be prepared using tracked bulldozers and excavators to strip topsoil and subsoil, as required. • The temporary workspaces around the turbine sites are approximately 60 m x 60 m; this is reduced to a footprint of the turbine base of 6 m diameter during operation. • The workspace along access and cable routes is an additional 5 m wide if crawler cranes are required, with additional workspaces required at bends in the route (minimum turning radius of 45 m). • Soil management will be incorporated to facilitate site reclamation. After construction, subsoil will be ripped as necessary to alleviate compaction, and stripped subsoil and topsoil will be replaced where appropriate. • Turbine site construction is expected to take approximately 6-8 months.

Table 4.5-1: Project Construction Activities (continued)

Project Phase and Activity	Description
Foundation Construction	• Concrete will be delivered to the site by truck, requiring 1,000 loads of 16 m^3 trucks. • Subject to final design, the wind turbines will have gravity reinforced concrete foundations. The excavation area will be approximately 25 m by 25 m by 3.5 m, allowing for a foundation of 17 m by 17 m by 3.3 m. Formwork and rebar will be installed to construct the foundation and concrete pumps or elevators will be used to place the concrete. Formwork will be struck after approximately 24 hours and the excavated area will be back-filled and compacted until only the tower base portion of the foundation is left above ground. • Water trailers will transport water to the site from a nearby water source making trips as required. If a water source is less than 100 m from a site, then a temporary pipeline may be laid and water pumped to the site. • Foundation excavation and installation is expected to take approximately 4-9 months.
Tower and Turbine Assembly and Installation	• 40 turbines are to be erected. Turbine towers arrive in four sections that are assembled on-site and are erected using two cranes. Each turbine will be 95 m high to the hub, with a 90 m diameter rotor. • The turbine assembly and installation is expected to take 4-6 months.
Collector System	• The collector system will be a mixture of underground cable and overhead lines. The on-site collector system will consist of buried and overhead, 34.5 kV standard utility cable and will connect turbines to each other or junction boxes and then onwards to the proposed Project transforming substation. • A combination of ploughing and trenching will be used to install the cables, depending on terrain. Soil management will be incorporated into this process to facilitate site reclamation. • A plough seam for the underground cable will be excavated to a depth of ~ 1 – 1.5 m and a width of ~ 1 m. The seam will be backfilled immediately to prevent soil loss from erosion. Trenching is accomplished in a manner similar to ploughing. Ploughing and trenching will be achieved by either trenching machine or backhoe. Underground cable routes will be marked as appropriate. • Where the underground cable will cross watercourses the DFO Operational Statement regarding isolated or dry open cut stream crossings will be followed (DFO, 2008). • Where the underground cable must be spliced, a splice pit is typically required. These pits are ~ 1.5 m deep, 1 m wide, and up to 5 m long (but usually 1 to 2 m long). Soil will be replaced and contoured. • Installation of the overhead 115 kV interconnecting cable from the Project transforming substation to the existing 115 kV transmission line, is expected to be completed over a 6 month period.

Table 4.5-1: Project Construction Activities (continued)

Project Phase and Activity	Description
Transforming Substation Construction	• The transforming substation footprint will be ~ 80 m by 80 m, and this area will incorporate any temporary workspaces required. • The transforming substation site will be prepared with tracked bulldozers and excavators. Soil management will be incorporated. The substation site will be gravelled and contoured for effective surface drainage. • After construction is complete, stripped subsoil and topsoil will be replaced at the temporary workspace. Topsoil from the substation footprint will be re-distributed to adjacent land as appropriate. • Installation and connection of the transforming substation is expected to take 3-6 months.
Transforming Substation and Electrical Interconnection	• Hydro One transmission line is located on privately owned land; AET have site control (i.e., long term leasing agreements with land owners) which allows direct connection to the main transmission line.
Fencing/Gates	• The transforming substation will be fenced and secured based on standard utility practices; turbine sites will only be fenced or gated if requested by the land owner.
Parking Lots	• No parking lots will be required during site construction. Some vehicle parking will occur at the construction sites in the temporary workspaces.
Clean up and Reclamation	• Construction debris collected and disposed of at an approved location. If spills occurred during construction, affected areas will be remediated as appropriate. An adequate amount of emergency oil spill kits will be maintained on site during the construction and operation of the Project. • Stripped soil will be replaced and re-contoured and disturbed areas (including trenches and plough seams) will be re-seeded, subject to crop rotation and relative timing of works. • Site clean-up and reclamation will be conducted concurrently with construction, and will be completed within 2 months of installation of the Project infrastructure.

The planned Project construction schedule is outlined in Table 4.5-2. The construction schedule was designed to account for minor delays that could result from an extended regulatory process, delayed equipment arrival and adverse weather conditions. If regulatory approval is substantially delayed, there could be subsequent construction delays due to poor weather (i.e., difficulties for construction during high wind or severe conditions in the winter).

Table 4.5-2: Project Preparation and Construction Schedule

Activity	Estimated Start Dates
Turbine Siting	September 2008
Detailed construction design surveys	October 2009
Surveying	October 2009
Development of access roads	April 2010
Land clearing	April 2010
Topsoil stripping and salvage	April 2010
Grading	April 2010
Ploughing and trenching for underground collection line	May 2010
Turbine foundation excavation	May 2010
Installation of turbine foundations	May-June 2010
Equipment lay down and assembly	May-June 2010
Installation of substation components	May-June 2010
Clean-up and reclamation	May 2011
Commissioning	October-November 2010
In-service	December 1, 2010

4.5.3 Operation and Maintenance Phase

Turbine commissioning will occur once the wind turbines have been fully installed and when the OPA/IESO is ready to accept grid interconnection. Testing and inspection of electrical, mechanical, and communications operability will also be required prior to Project commissioning and a detailed set of operating instructions must be followed in order to connect with the electrical grid. To undertake this in a controlled fashion, a Project commissioning plan will be produced and approved by all relevant parties.

The wind turbines selected for the Project are automated and have few maintenance requirements. The wind turbines require no fuel to produce power; however, oil in the gearbox and hydraulic systems needs to be changed and maintenance completed periodically as per manufacturer specifications. Used oil and other wastes will be disposed of at an approved facility following each maintenance visit. Each wind turbine generator will have regular scheduled preventative maintenance after a short period of initial operation (approximately 500 hours after initial commissioning) and every six months thereafter. This maintenance will include a complete inspection of the turbine's components and the tower. Functionality testing, replacement of worn parts, bolt tightening and lubrication of moving parts are the key activities occurring at each scheduled maintenance visit. Corrective maintenance will include the repair and replacement of any damaged or defective parts in the turbine.

If a crawler crane is used, the access roads created for turbine construction will be reduced from 10-12 m to 5-6 m width post-construction, and will be maintained by AET during the operation and maintenance phase. All site access will follow the approved access routes and will occur in consultation with landowners where appropriate.

The Project operation and maintenance activities are summarized in Table 4.5-3.

Table 4.5-3: Project Operation and Maintenance Activities

Project Phase and Activity	Description
OPERATION AND MAINTENANCE	
Wind Turbine Operation	• Testing and inspection of electrical, mechanical, and communications operability required at commissioning.
Maintenance Activities	• Turbines require routine oil changes in the gearbox and hydraulic systems as per manufacturer specifications. • Generators have scheduled maintenance after initial operation and every 6 months thereafter. Corrective maintenance includes repair and replacement of damaged or defective parts.

4.5.4 Decommissioning Phase

The initial service period of the turbines is expected to be 25-30 years. At the end of this time (or within this period), turbines may be replaced or reconditioned, depending on future technology and the demand for wind power at that time. Alternatively, the Project infrastructure may be decommissioned and removed to a depth of 1 m below existing ground level. If decommissioning occurs, the creation of new temporary workspaces will be required, and will use equipment similar to that used for Project construction.

Decommissioning will require a temporary workspace and the use of equipment similar to that used for Project construction. During decommissioning, the turbines and substation would be disassembled and removed from the site. Turbine concrete foundations and any piles would be removed to a depth of 1 m below surface, and the excavation backfilled with subsoil to match the natural grade. Underground cables will be terminated at connection points and removed to 1 m below surface using backhoes. After the infrastructure is removed, the turbine and transforming substation sites, and access/cabling routes may be deep ploughed as appropriate to alleviate soil compaction, and graded to restore terrain profiles. Topsoil would be replaced and prepared for seeding (to facilitate the return to agricultural use).

Recyclable materials will either be sold or transferred to a licensed recipient (WTG tower material, copper wiring, aluminum conductor, machine head (nacelle), down tower assembly and hub material) which will likely have some value in their respective scrap metal markets (see Section 7.7 Socio-Economic Resources for a more detailed description). Gravel from access roads will also be removed from the sites and sold.

The entire Decommissioning Phase is expected to occur over a one-year period. The Project decommissioning activities are summarized in Table 4.5-4.

Table 4.5-4: Project Decommissioning Activities

Project Phase and Activity	Description
DECOMMISSIONING	
Removal of Turbines and Ancillary Equipment	• Expected lifespan of the turbines is ~ 25-30 years, during or after this time they may be replaced or reconditioned, or decommissioned. • Decommissioning will require a temporary workspace and use of equipment similar to construction phase. • Turbines and substation would be disassembled and removed from the site. • Foundations will be removed to a depth of 1 m below ground level.
Removal of Buildings and Waste	• Removed equipment, parts and other materials will be recycled where possible. • Gravel will be removed and sold.
Removal of Power Line	• Underground cables will be terminated at connection points and removed from underground using backhoes.
Site Remediation	• After infrastructure is removed, footprints may be deep ploughed to alleviate soil compaction, and graded to restore terrain profiles. Disturbed areas will be re-seeded as required and returned to pre-development use. • All waste material and equipment will be removed from the site.

4.5.5 Future Phases of the Project

The Project site has not currently been designed to support expansion; however there may be a possibility to upgrade in the future if more capacity becomes available on the local transmission system. Re-powering of the turbines may also occur depending on the technology available at the end of the life of the Project.

5.0 ASSESSMENT METHODS

As stated in Sections 3.1 and 3.2, the Project is being assessed under both the *Canadian Environmental Assessment Act* and the Ontario *Environmental Assessment Act*. This report has been prepared to meet both the federal and provincial environmental assessment requirements. Although there are some subtle differences in approach, the fundamental steps required for the assessment are the same and are as follows:

- Scoping;
- Analysis of effects;
- Identification of mitigation measures;
- Assessing significance of residual effects; and
- Determining appropriate follow-up.

In addition to these five steps, stakeholder consultation represents an integral part of any comprehensive assessment. AET ensured that consultation formed a key part of their development strategy from the inception of the Project.

5.1 Stakeholder Engagement

The purpose of consultation in the EA process is to provide an opportunity for the proponent to disclose information to stakeholders and to allow stakeholders the opportunity to identify any concerns regarding the Project and provide input into the Project design. Public, Aboriginal and government agency engagement was conducted throughout the assessment process by AET.

Several consultation techniques were used to inform the public, agencies and interested parties about the Project and to solicit their comments. Techniques included mailings, newspaper notices, meetings, two public open houses and updates on the TCI/AET website. These methods and feedback received from stakeholder engagement are described in detail in Section 6. Copies of consultation material are provided in Appendix A.

As part of the public engagement process, the ESR/EIS will be made available to the public on the TCI/AET company website upon publication of the Notice of Completion. The report will also be made available at selected publicly accessible locations in the local area. In addition, AET has maintained a communications database throughout the EA process which documents correspondence between AET and various stakeholders (e.g., government agencies, the public). Supporting information and copies of all correspondence related to the stakeholder engagement process can be made available for public or agency review if requested. This is in keeping with

Section A.6.2.5 on documentation in the MOE Guide to Environmental Assessment Requirements for Electricity Projects (MOE, 2001). In addition to the above, local residents and stakeholders have been kept informed and have had input through the local zoning by-law amendment process under which two applications for 12 of the turbines have been made and approved.

5.2 Scope of the Project

Under CEAA, the Responsible Authority (RA) is required to make scoping decisions. The scope identifies the elements of the Project that will be assessed. Both CEAA and the MOE Guide to EA Requirements for Electricity Projects (the Guide) require that the scope of the Project include construction, operation and decommissioning of the Project. These phases represent the temporal boundaries of the Project. The spatial boundaries of the Project Site Study Area (SSA) have been identified in Section 2.3. No other Project construction activity will occur outside of the SSA.

The Guide states that a Project cannot be broken down into smaller projects and that the Project must be assessed as a whole. An example relevant to wind projects is the erection and operation of wind turbines and the construction and operation of the substation using electricity produced by the same wind turbines. Within the ESR/EIS, these two activities must be considered and assessed as a single Project.

5.2.1 Scope of the Assessment

5.2.1.1 Valued Ecosystem Components

To adequately describe and assess the environmental and social effects of the Project, Valued Ecosystem Components (VECs) were selected. VECs are any part of the environment that is considered important by the proponent, members of the public, scientists and government involved in the assessment process (NRCan, 2003). The importance of VECs is based on cultural values or scientific concern. The importance of VECs selected for the Adelaide Wind Farm Project was based on proponent and assessor experience with similar projects, regulatory requirements, and stakeholder consultation. The selected VECs are used as assessment endpoints; therefore it is important that they represent meaningful measures of the potential environmental effects of the Project.

The rationale for the selection of these VECs is outlined in Section 7 and is based on the potentially affected environmental and social characteristics to be considered, as recommended in the WPPI Environmental Impact Statement Guidelines (NRCan, 2003).

5.2.1.2 Temporal and Spatial Boundaries

Whereas the scope of the provincial assessment must include all social and environmental disciplines and potential effects, the RA may scope a project differently and only consider Project components or activities that have federal regulatory implications.

In addition to representing the scope of the Project, the Construction, Operation and Decommissioning phases also represent the temporal boundaries of this ESR/EIS. All Project activities encompassed by these Project phases, as outlined in Section 4.5, will be assessed in this ESR/EIS. The temporal scope of the Project is considered to be the expected life of the turbines, which is 30 years, plus the decommissioning of equipment and reclamation of the site, which is predicted to occur over an additional one year period.

Spatial boundaries define the geographic extent(s) within which the assessment is conducted. As such, these boundaries have become the study areas adopted for the assessment. The spatial boundaries of this assessment have been determined on a discipline-specific basis in Sections 7.1 to 7.13. This approach has been adopted recognizing that the geographic extent (site, local, or regional study area), over which there is potential for Project interactions with the environment, can be very different between each discipline (i.e., air, wildlife, or surface water). The ecoENERGY/WPPI EIS Guidelines (NRCan, 2003) state that the study areas considered in the assessment must encompass the environment that can reasonably be expected to be affected by the Project, or which may be relevant to the assessment of cumulative effects.

The potentially affected environmental and social components that may interact with the Project are collectively referred to as Valued Ecosystem Components (VECs) and are described and assessed for each discipline in Sections 7.1 to 7.13.

5.2.1.3 Screening for Potential Project-Environmental Interactions

The first step in analyzing the potential for Project activities to result in environmental effects is called “screening”. Screening identifies potential adverse and beneficial environmental effects associated with the proposed Project and advances only those effects that may be adverse and therefore require further assessment. In this manner, those effects that are deemed beneficial or do not have predicted adverse effects are not assessed. For example, if it is known that there are no on-site drainage features or drainage features adjacent to the Project site, it is reasonable to conclude that there are no anticipated effects on the aquatic environment, further study of this issue is not required and therefore effects to the aquatic environment can be “screened out”. Once environmental components have been “screened out”, they are no longer considered or assessed.

A preliminary screening of the potential effects of the Adelaide Wind Farm is provided in Table 7-1 (Section 7.0), and is based on the MOE Guide to Environmental Assessment Requirements for Electricity Projects (MOE, 2001).

5.3 Analysis of Environmental Effects

5.3.1 Baseline Data Collection

It is necessary to collect baseline data to adequately describe the existing conditions within the Project site and broader SSA, LSA and RSA. The baseline data also allows for the identification of the Project-environment interactions and the ultimate assessment of residual effects and their significance. For some disciplines, the ESR/EIS assessment predictions rely on existing information available from various sources, whereas for other disciplines (e.g., terrestrial environment), it was necessary to acquire baseline data through field studies conducted by Golder, AET or the broader study team.

Section 2 of the *Canadian Environmental Assessment Act* (Department of Justice Canada, 1992) defines the "environment" as components of the Earth which include:

a) "Land, water and air, including all layers of the atmosphere;
b) All organic and inorganic matter and living organisms; and
c) The interacting natural systems that include components referred to in paragraphs (a) and (b)."

For the purposes of assessment and this ESR/EIS report, environmental components have been separated into the following categories:

- Geophysical environment;
- Aquatic environment;
- Terrestrial environment;
- Atmospheric environment;
- Noise environment;
- Visual landscape;
- Socio-economic resources;
- Cultural heritage and archaeology;
- Land use;
- Aboriginal use;
- Traffic;

- Electromagnetic interference (EMI); and
- Public health and safety.

Baseline data for these components were assembled through a review of existing literature and publications, correspondence with government agencies and the public and where pertinent, field surveys. A summary of agency consultation is provided in Appendix A.

To gain a better understanding of existing conditions, field surveys were conducted in 2008 for the following components:

- Avian and bat surveys;
- Reconnaissance-level aquatic habitat survey;
- Visual evaluation of the SSA for archaeological potential; and
- Assessment of background noise levels.

During all site visits, incidental wildlife observations were recorded and any significant natural areas within the SSA that were previously identified through agency consultation or desktop studies and had the potential to be affected by the Project were investigated further.

A Natural Environment report is provided in Appendix B and includes a detailed description of survey methods used for baseline data collection. Similarly, descriptions of survey methods are also included in the noise assessment report (Appendix C) and the Stage 1 Archaeological Assessment (Appendix D).

5.3.2 Assessment of Potential Project-Environment Interactions

In order to determine the significance of potential Project-environment interactions, it was necessary to define the levels of magnitude used to assess the effects of the Project on VECs. Magnitude is a measure of the change in environmental conditions that can occur as the Project proceeds. These changes can be negligible (within background conditions), low (above background conditions, but within established criteria or scientific thresholds and the range of natural variability), moderate (substantially above background conditions, but with established criteria or scientific threshold and the range of natural variability), or high (predicted to exceed established criteria or scientific thresholds and will likely cause detectable change beyond the range of natural variability). The definition of the magnitude of an effect can differ between disciplines, and is based on a number of technical criteria. As such, the levels of magnitude used for each discipline is defined specifically in each component section (Sections 7.1 to 7.13). Project-environment interactions and their effects on VECs were determined after collection of baseline data. The use of key indicators provides a measurable endpoint to assess the effects of the Project on a VEC, although sometimes a key indicator may be the VEC itself. An example of a key indicator for air quality is atmospheric levels of sulphur dioxide or dust.

Table 5.3-1 illustrates how a VEC-specific definition of magnitude can be applied to the terrestrial environment using birds as an example VEC.

Table 5.3-1: Example of a Valued Ecosystem Component Magnitude Definition for Birds

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Number of Bird Species and Individuals	No change from baseline.	5% of population of one species or migration patterns of a few species affected; mortality rare (<2 birds/turbine/year).	Bird mortality up to 4 birds/turbine/year; varying population and migration changes detected across majority of species.	Bird mortality in excess of 4 birds/turbine/year sufficient to affect population and significant change to migratory patterns.

Using the MOE environmental screening criteria questions (Table 7-1), the potential interactions between the Project and VECs were identified individually for each Project work and activity and for each phase of the Project (Site Preparation and Construction, Operation and Maintenance, and Decommissioning). The potential effects resulting from the Project-environment interactions were then assessed and the need for additional mitigation was determined. If after the assessment, it was determined that there were no effects of the Project on a VEC or component, it was not carried further into the assessment process.

5.3.3 Development of Mitigation Measures

Mitigation measures are defined as anything that eliminates, reduces or controls adverse environmental effects (including restitution through replacement, restoration, compensation or any other means) for any damage caused to the environment by the Project (NRCan, 2003). Based on the analysis of environmental effects conducted for each environmental component, mitigation measures were developed in order to reduce predicted negative effects to the extent possible, and to comply with regulatory requirements.

5.3.4 Assessment of Residual Effects

The assessment of residual effects represents the assessment of negative or adverse environmental effects after all of the proposed mitigation measures have been applied. The assessment of residual effects uses the same five measurement criteria that are used in the assessment of potential Project-environment interactions and screening before mitigation was applied (i.e., magnitude, geographic extent, duration, frequency of occurrence, irreversibility).

Once residual effects are determined, they are assessed according to the following five criteria or assessment measures (Table 5.3-2). The significance of the four levels for each assessment measure is arranged in this table from left to right, from lowest to highest; Level I being the lowest and least significant and Level IV being the highest and most significant.

Table 5.3-2: Assessment Measure Levels and Definitions for Residual Effects

Assessment Measure	Levels for Measures			
	I	II	III	IV
Magnitude	Negligible	Low	Moderate	High
Extent	Impacts are restricted to the Site Study Area (SSA).	Impacts are confined to the Local Study Area (LSA).	Impacts are confined to the Regional Study Area (RSA).	Impacts are expected to extend beyond the Regional Study Area (RSA).
Duration	Impacts are immediate; limited to a few days or weeks.	Impacts are short-term; limited to a few months (e.g., the construction phase).	Impacts are medium-term, (i.e., limited to the operations phase).	Impacts are long-term, extending many years and possibly into perpetuity.
Frequency	Impacts occur occasionally (once or a limited number of times).	Impacts occur less than approximately once a week.	Impacts occur daily.	Impacts occur on a continuous or near-continuous basis.
Irreversibility	The receptor has the ability to return to an equal or improved condition; the effects of the impact are fully reversible.	The receptor has the ability to return to a state that mostly reflects the original pre-disturbance condition; more than 50% of the original value can be regained.	The receptor has the ability to return to a state that somewhat reflects the original pre disturbance condition; less than 50% of the original value can be regained.	The receptor has no ability to return to an equal or improved baseline condition; the effects of the disturbance are irreversible.

Determination of the importance of residual effects in this ESR/EIS is based on the best professional judgment of experienced environmental assessment specialists considering existing science, the sensitivity of each VEC, and known or predicted effects expected to occur based on reviews of reports on existing wind farm Projects. The level of importance of residual effects to each VEC following the application of mitigation measures is defined as high, medium, low, or minimal. These definitions, as provided in Table 5.3-3, are directly from the ecoENERGY/WPPI Environmental Impact Statement Guidelines (NRCan, 2003).

Table 5.3-3: Level of Importance of Residual Effects

Level	Definition
High	Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recover initiatives should be considered.
Medium	Potential impact 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 impact may result in a slight decline in resource in study area during the life of the Project. Research, monitoring and/or recovery initiatives would not normally be required.
Minimal	Potential impact may result in a slight decline in resource in study area during construction phase, but the resource should return to baseline levels.

5.3.5 Follow-up

A follow-up program is a program implemented after the EA process that is designed to verify the accuracy of environmental effects predictions made in the EA and to determine the effectiveness of any mitigation measures implemented (NRCan, 2003). For example, post-construction field monitoring surveys (i.e., avian or bat mortality surveys) may be required to confirm the predicted effects of turbine operation on birds and bats. Follow-up has been recommended for certain environmental components and is summarized in Section 8.3. The methods and details of follow-up monitoring programs may require further refinement subject to additional permit requirements and consultation with responsible agencies.

5.3.6 Uncertainty and Data Gaps

A component of the EA process is the identification of data gaps that exist and the associated degree of uncertainty in the EA predictions. This process usually occurs during the scoping of the discipline-specific effects assessments, and upon completion of the EA. Data gaps are initially identified following a review of environmental information available from government agencies, scientific literature, discipline experts, and through stakeholder consultation. A field program is then designed and initiated to fill in the identified gaps and the prediction of environmental effects can be conducted using the data collected. Following determination of residual effects, any outstanding data gaps are considered and if required, follow-up monitoring is recommended.

5.4 Cumulative Effects Assessment

Cumulative effects are defined in the Canadian Environmental Agency's Cumulative Effects Practitioners Guide (Hegmann et al., 1999) as being "changes to the environment that are caused by an action in combination with other past, present, and future human action". In other words, the Project effects must be considered in combination with effects occurring from other Projects in the area where the effects may overlap or accumulate. There are a number of ways that a cumulative effect may occur, including:

- **Physical-chemical transport**: physical or chemical material is transported from a project via "a pathway", and then interacts with another action or project component.
- **Nibbling loss**: several activities compound the loss of land or habitat.
- **Spatial and temporal crowding:** effects resulting from too much activity within too small an area or too short an amount of time. Temporal crowding occurs when a VEC is not allowed enough time to recover from an activity.
- **Growth-inducing potential:** where each activity encourages subsequent activities that compound an effect. These actions are often called "spin-off actions" or relate to the "domino effect".

As indicated in the Cumulative Effects Assessment Practitioners Guide, a Cumulative Effects Assessment (CEA) can be broken down into the same five steps used for the analysis of project effects (Section 5.3). Table 5.4-1 illustrates the CEA tasks required for each of the five steps.

Table 5.4-1: Cumulative Effects Assessment Tasks

Basic Environmental Assessment Steps	Cumulative Effects Assessment Tasks
1. Scoping	• Identify regional issues of concern • Select appropriate regional VECs • Identify spatial and temporal boundaries • Identify other actions that may affect the same VECs • Identify potential effects due to actions/projects
2. Analysis of Effects	• Complete the collection of regional baseline data • Assess effects of proposed action on selected VECs • Assess effects of all selected actions on selected VECs
3. Development of Mitigation Measures	• Recommend mitigation measures
4. Determination of Residual Effects	• Evaluate the significance of residual effects • Compare results against thresholds or land use objectives and trends
5. Follow-up	• Recommend regional monitoring and effect management

5.5 Addendum Provisions

Following submission of the Statement of Completion, AET will maintain the option of modifying certain aspects of the Project prior to the commencement of construction (scheduled for April 2010). These modifications will most likely be limited to a change in specific project components to take advantage of improved or more efficient technology, but may also include micrositing of turbines and other Project infrastructure based on the presence of archaeological findings (that would be identified through on-going Stage 2 field assessments), or other environmental constraints not known at the time of the Notice of Completion. Any such modification will be assessed in a manner consistent with the approach taken in this ESR/EIS and following the Addendum Provisions of the MOE Guide to Environmental Assessment Requirements for Electricity Projects (MOE, 2001). If required, an Addendum will be prepared, and a Notice of Filing of Addendum will be provided to all stakeholders and review agencies.

6.0 STAKEHOLDER CONSULTATION AND DISCLOSURE

6.1 Consultation Activities

Meaningful stakeholder consultation is a legislated requirement under the *Environmental Assessment Act* to determine the issues that are important to stakeholders. Stakeholder consultation in the environmental assessment (EA) process is a two-way communication procedure between a project proponent and interested and affected individuals, organizations and agencies. It should occur throughout the planning, implementation and monitoring processes (MOE, 2007).

The study area for stakeholder consultation and disclosure has been defined by Air Energy TCI (AET) to include all agencies and parties who have a vested interest in the Project, and does not have a specified spatial boundary.

This chapter is based on a compilation of information regarding communication and engagement with the public and stakeholders by AET and Golder Associates (Golder). Golder has documented information pertaining to public correspondence, as provided by AET for the purposes of this Environmental Screening Report. Consultation activities included the Notice of Commencement, agency consultation, meetings with the local government and landowners, two public open houses and communications with Aboriginal communities.

6.1.1 Notice of Commencement/Project Description

The EA process requires that a Notice of Commencement be published in local newspapers, made available on the internet, posted on the AET website and distributed to stakeholders. The Notice of Commencement contained a basic description of the Project, a map displaying the Project site, and AET contact information for the EA.

The Notice of Commencement for the Project was published January 30, 2008 in the Strathroy Age Dispatch. The NOC and the January 2008 Adelaide Wind Farm Project Description was circulated to the federal, provincial and municipal governments and agencies on the stakeholder list. Please see Appendix A.1 for the Notice of Commencement.

The amended Project Description, October 2008, was also sent to the stakeholder list. Copies of the amended Project Description were posted for review at the Adelaide Metcalfe Municipal Office and were made available to the public electronically by contacting AET.

From March to June 2008 AET received comments in response to the NOC and Project Description. AET responded to requests for additional information. Table 6.1-1 provides a list of federal and provincial agencies and other parties who responded to the Notice of Commencement.

Table 6.1-1: List of Government and Other Agency Responses to the Notice of Commencement

Stakeholder Type	Agency Affiliation	Date
Federal Government	Transport Canada	2/5/2008
	Environment Canada	2/21/2008
	Natural Resources Canada	3/4/2008
Provincial Government	Government Mobile Communications Office	2/22/2008
	Ministry of Municipal Affairs and Housing	3/12/2008
	Ministry of Culture	3/17/2008
	Ministry of Culture	3/18/2008
	Ministry of Transportation	4/2/2008
	Hydro One Networks, Inc.	6/6/2008
Industry/Business	Imperial Oil Sarnia Products Pipeline	3/19/2008

6.1.2 Government and Agency Consultation

Correspondence with all levels of government is important to the Environmental Assessment (EA) process and was maintained throughout the course of the EA. Communication with government officials included correspondence about the Notice of Commencement, inquiries regarding regulatory requirements and standards, and general information requests. Table 6.1-2 identifies all of the government agencies that AET consulted. As per Section A.6.2.5 (Documentation) in the Guide to EA Requirements for Electricity Projects (MOE, 2001), copies of all correspondence related to the Environmental Screening Process can be made available for public or agency review upon request.

Table 6.1-2: Government and Agency Stakeholders Consulted

Category	Department or Agency
Federal Government	Canadian Coast Guard
	Canadian Environmental Assessment Agency
	Department of Defence
	Environment Canada

Table 6.1-2: Government and Agency Stakeholders Consulted (continued)

Category	Department or Agency
Federal Government (continued)	Fisheries and Oceans Canada
	Geological Survey of Canada
	Health Canada
	Indian and Northern Affairs Canada
	Industry Canada
	National Energy Board
	Navigation Canada
	Natural Resources Canada
	Radio Advisory Board of Canada
	Royal Canadian Mounted Police
	Transport Canada
Provincial Government	Ausable Bayfield Conservation Authority
	St. Clair Region Conservation Authority
	Government Mobile Communications Office
	Hydro One Inc.
	Ministry of Aboriginal Affairs
	Ministry of Agriculture, Food and Rural Affairs
	Ministry of the Attorney General
	Ministry of Citizenship and Immigration
	Ministry of Culture
	Ministry of Energy
	Ministry of Environment
	Ministry of Municipal Affairs and Housing
	Ministry of Natural Resources
	Ministry of Public Infrastructure Renewal
	Ministry of Transportation
	Ministry of Tourism
	Ontario Power Generation
Municipal Contacts	Middlesex County
	Township of Adelaide Metcalfe
	Township of Warwick

Table 6.1-2: Government and Agency Stakeholders Consulted (continued)

Category	Department or Agency
Municipal Contacts (continued)	Municipality of Southwest Middlesex
	Municipality of North Middlesex
	Municipality of Middlesex Centre
	Township of Strathoy Caradoc
	Township of Brooke-Alvinston
	Village of Newbury

6.1.2.1 Notice of Commencement and Project Description

AET has been in communication with federal and provincial agencies and municipalities since March 9, 2007. Formal consultation was initiated with the release of the NOC and Project Description in January 2008. All parties listed in table 6.1-2 were sent an NOC and Project Description and were invited to ask questions and make comments.

6.1.2.2 Ongoing Government and Agency Correspondence

In addition to communicating with agencies about the NOC and Project Description, AET was in regular contact with agencies listed in Table 6.1-1 regarding the progress of the Project. Communications included information requests about the regulatory process and local environment; discussions about the Project application and associated roles and responsibilities; discussions about the Project design; Project updates; and discussions about electromagnetic interference (EMI). These communications provided AET with a thorough understanding of the physical, biological and human environment of the area and helped refine the project design and application process. Please see Appendix A.2 for detail on communications between AET, government and other agencies.

6.1.2.3 Pre-submission Agency Review of Draft ESR/EIS

As per section B.2.3 of the Guide to Environmental Assessment Requirements for Electricity Projects (MOE, 2001), proponents are strongly encouraged to submit draft sections of the ESR/EIS to agencies for comment prior to commencement of the formal 30-day Public and Agency review period. In keeping with this recommendation, AET sent relevant section of the draft ESR to the agencies identified below:

- Ministry of the Environment Environmental Assessment and Approvals Branch
    - Sections 1-5 – Introduction, Project Summary, Overview of Regulatory Requirements, Project Description and Assessment Methods

  - Section 7.0 – MOE Screening Criteria Checklist
  - Section 7.5 – Environmental Noise
  - Appendix C – Noise Impact Assessment
- Ministry of Natural Resources
  - Sections 1-5 – Introduction, Project Summary, Overview of Regulatory Requirements, Project Description and Assessment Methods
  - Section 7.0 – MOE Screening Criteria Checklist
  - Section 7.3 – Terrestrial Environment
  - Section 7.5 – Land Use
  - Appendix B – Terrestrial Support Documentation
- Environmental Canada – Canadian Wildlife Services
  - Sections 1-5 – Introduction, Project Summary, Overview of Regulatory Requirements, Project Description and Assessment Methods
  - Section 7.0 – MOE Screening Criteria Checklist
  - Section 7.3 – Terrestrial Environment
  - Appendix B – Terrestrial Support Documentation

A disposition of comments received from these agencies is provided in Appendix A.2.

6.1.3 Stakeholder Meetings, Presentations and Engagement

Stakeholders, including land-owners, municipalities and community groups were contacted about the Project. The local snowmobile club requested information about the proposed access roads and final layout, and stated that they had no objections to the Project. Meetings were held with both landowners and municipalities. The details of these meetings are outlined below.

6.1.3.1 Landowner Meetings

Meetings with individual landowners have been ongoing since late 2006. A portion of the Project area was first offered by a land owner to AET in late 2006 as a potential 10 MW standard offer project in response to an advertisement placed by AET in a local farming magazine. AET realized the area had great potential for the Project. Further consultation with and feedback from surrounding landowners prompted a detailed feasibility study. The feasibility results were encouraging and AET began developing the Project. These meetings were directed by TCI development staff with the intent to describe the option and lease agreement to all participating landowners in the SSA. On July 18, 2007, AET met with landowners and local planners and gave a presentation about the Project. Since 2007, AET has secured the Project entirely within portions of privately owned land parcels. AET has secured license and option agreements on approximately 2,720 ha within the Project area. Since the conception of the Project, AET has received three letters from landowners in support of the Project. These letters can be found in Appendix A.3. In addition AET has received authorization letters from all landowners who have Project infrastructure located on their properties and who have been part of the zoning process (23 in total to date) enabling AET to act as Agents on their behalf and confirming agreement with the locations of the turbines as set out in Figure 4.3-1. It is estimated that the remaining 8 authorization letters will be acquired by mid-June 2009. An example of a zoning change authorization letter is provided in Appendix A.3.

6.1.3.2 Municipal Meetings

AET initially discussed the proposed wind farm project with County of Middlesex and Adelaide Metcalfe representatives on February 22, 2007. This included the County Planner, Local Planner, Economic Development Officer and Local Building Control who confirmed the County promoted the use of renewable energy. As mentioned in the previous section, on July 18, 2007, AET gave a presentation about the Project to local planners and landowners. Table 6.1-3 includes a summary of these meetings and presentations. Please see Appendix A.2 for more detailed communications.

Table 6.1-3: Summary of Municipal Meetings

Date	Type of Meeting/Contact	Agencies Involved	Reason for Meeting
February 22, 2007	Meeting	County and local representatives	Initial discussion on the Project
July 18, 2007	Presentation	Local planners and landowners	Presentation on the Project
October 15, 2007	Presentation	Local Council and planner	Presentation on the Project
January 9, 2008	Meeting	Local planners	Further discussions regarding rezoning and set back distances of the proposed turbine locations
August 15, 2008	Consultation/ Meeting	County Engineer Local planner Local roads supervisor Local drainage inspector Building inspector	Design/construction meeting to identify issues and discuss the Project in detail. To identify required permits and go over application process with various officials.
November 19, 2008	Meeting	Local Council and public	Public meeting regarding zoning amendment application
March 2, 2009	Meeting	Local Council and public	Public meeting for zoning application

Table 6.1-3: Summary of Municipal Meetings (continued)

Date	Type of Meeting/Contact	Agencies Involved	Reason for Meeting
March 2, 2009	Meeting	Township planners and lawyers	Discuss the development of a community contribution agreement
April 9, 2009	Presentation	Middlesex Municipal Association	Presentation at the 62nd Annual Meeting – Theme: A Green Middlesex

Community Contribution Agreement

AET first presented the project to the Adelaide Metcalfe Council on October 15, 2007. The Project was well received and no objections were raised. The local planner was also in attendance and described wind energy, focusing on the positive impacts available to the community. AET discussed a community contribution agreement with the Township of Adelaide Metcalfe. After teleconferencing with the Township and their lawyers to answer questions regarding the details, the parties met on March 2, 2008 to further develop the agreement. It is anticipated that AET and the Township of Adelaide Metcalfe will be in contact until the agreement is finalized.

Zoning Applications

AET has been in regular contact with the planning department of the Township of Adelaide Metcalfe. On January 9, 2008 AET met with Township of Adelaide Metcalfe planners regarding rezoning and setback distances for the proposed turbine locations. AET made the first zoning application for two turbines on October 7, 2008. Notification of the zoning application was sent by the Township of Adelaide Metcalfe to Ausable Bayfield Conservation Authority and St. Clair Region Conservation Authority; the County of Middlesex Planner; the Township of Adelaide Metcalfe's planner, roads supervisor, and drainage supervisor; landowners and all neighbours within 1000 feet of the turbines. No objections were made and at a Public Meeting on November 17, 2008 and Council passed the application for zoning amendment.

AET made a second zoning application for ten wind turbines on December 19, 2008. Again, the Township of Adelaide Metcalfe sent notifications to the groups listed in the first zoning application notification (see above) plus the Ministry of Transport. A neighbour sent a letter requesting the delay of the approval process until a health study could be completed. The Local Planner reviewed a study completed by Municipality of Chatham Kent and found the data to be sufficient enough to recommend that the application go forward to a Public Meeting. On March 2, 2009 approximately 40 stakeholders attended the Public Meeting for the second zoning application. Although many questions were raised, including topics such as health, stray voltage, the *Green Energy Act,* and property prices, these were answered by AET and there were no formal objections raised. Council passed the second application for zoning amendment. A third and final zoning application was submitted and received by the Township of Adelaide Metcalfe Clerk on May 20, 2009. Further discussions on how this application will be handled are on-going between AET and the Township of Adelaide Metcalfe in light of the passing of the *Green Energy Act* and the legislation regarding zoning requirements.

6.1.4 Community Open Houses

Open Houses are public events designed to inform the community and stakeholders about the project and the EA process and to solicit their input. They are informal events designed to allow people to drop-in and obtain information at their convenience. Typically they consist of display panels complemented by handout materials. They also provide an opportunity to answer questions and identify concerns or issues that stakeholders may have. All questions and comments are recorded and addressed as part of the EA.

6.1.4.1 Open House #1

The first Open House was held very early in the environmental screening process in order to take on comments and feedback from the public before a turbine layout had been realized. A mail-out of the NOC and an invitation to the first community Open House was sent to the municipal mailing list two weeks prior to the Open House. On February 12, 2008, an Open House was held at the hall of the local township office for Adelaide Metcalfe, 2340 Egremont Drive, Strathroy, Ontario. The purpose was to provide an overview of the Project and invite public involvement.

AET provided the following information at the Open House (see Appendix A.4 for Open House #1 materials):

- Display Panels;
- Project Information Sheet; and
- Comment Forms.

Members of the Adelaide Wind Farm Project team were available to answer questions.

Forty-three people signed into the Open House and eight people filled in the comment forms. All respondents indicated that they were generally in favour of increasing the amount of electricity produced from wind turbines and six indicated they were generally in favour of the proposed Project. Table 6.1-4 shows the full results of the comment sheet responses.

Table 6.1-4: Summary of Open House #1 Comment Sheet Responses

Comment Form Questions	Number of Responses
WIND ENERGY IN GENERAL	
I am generally in favour of increasing the amount of electricity produced from wind turbines.	8
I require further information before I am able to form an opinion regarding whether I am in favour, or opposed to increasing the amount of electricity produced from turbines.	3
I have seen, at reasonably close proximity, an operating wind farm.	6
ADELAIDE WIND FARM PROJECT	
I am generally in favour of the proposed scheme.	6
I would support an increase in the number of turbines.	2
I have a financial interest in the project (i.e., lease payments, etc.)	2
Please provide any comments you have regarding the project. (See below.)	1
Comment verbatim: "*I support the project as long as farming of the land is not negatively affected.*"	

The Strathroy Age Dispatch published a story on February 21, 2008 about the Project, and some details on the Open House were provided. Please see Appendix A.4

6.1.4.2 Open House #2

A mail-out of the NOC and an invitation to the second community Open House was sent to the municipal mailing list two weeks prior to the Open House. On March 26, 2009, a second Open House was held at the rental hall of the local township office for Adelaide Metcalfe, 2340 Egremont Drive, Strathroy, Ontario. The purpose was to provide an overview of the Project, share the results of the EA and invite public involvement. The following people attended from AET and Golder:

AET

Mark Gallagher (Development Manager)

Brett O'Connor (Operations Director)

Gareth McDonald (Project team)

Golder

Jeff Wright (Project Manager)

Leigh Holt (Project Coordinator)

Joe Tomaselli (noise expert)

Samuel Isono (noise expert)

AET and Golder provided the following information at the open house (see Appendix A.5 for Open House #2 materials):

- Information panels describing the Projects, the EA process and the results of the ESR;
- Photo montages of the site study area with proposed turbines;
- Google Earth-based fly-though demonstration of the wind farm;
- CanWEA fact sheets; and
- Comment Forms.

Fifty-four people signed into the Open House and 17 people filled in the provided comment forms. All of the respondents indicated that the Open House met their information needs, and furthermore, if they asked questions at the Open House that they got a satisfactory response. After attending the Open House 15 of the respondents indicated support for the Project and 2 respondents were neutral. None of the respondents were unsatisfied with the level of assessment completed, 12 indicated full satisfaction and 3 indicated that they were somewhat satisfied. Table-6.1-5 shows the full results of the comment sheet responses.

Table 6.1-5: Summary of Open House #2 Comment Sheet Responses

Comment Form Questions	Number of Responses
1. Did this Open House meet your information needs?	
Yes	17
Somewhat	0
No	0
Comments	
"Have been and continue to be impressed with TCI"	
2. If you asked questions during the Open House, did you get a satisfactory response?	
Didn't speak to anyone	0
Yes	17
Somewhat	0
No	0
Comments	
"Two gents very informative; able to answer any questions I had in language I could understand"	
"Very helpful/informative"	
3. After attending the Open House, how do you feel about the Project?	
Support	15
Neutral	2

Table 6.1-5: Summary of Open House #2 Comment Sheet Responses (continued)

Comment Form Questions	Number of Responses
Oppose	0
Comments	
"I believe in wind power for our well-being. Good luck!"	
"Gents were honest and answered my concerns"	
4. Are you satisfied with the level of assessment completed?	
Yes	12
Somewhat	3
No	0
Comments	
"I don't know"	
"As far as I know – live outside this area but have reached out to let us know what's going on"	
Please provide your comment or question in the space provided below.	
"More power to you!"	
"Map of plan" [request for map of site layout]	
"Please send me turbine layout details please."	
"I would like to be contacted."	

Two people asked for the detailed maps of the turbine layout. These were provided to them by email the week following the Open House.

6.1.5 Summary of Consultation Activities

Table 6.1-6 provides a summary all consultation activities and efforts undertaken by AET.

Table 6.1-6: Summary of Consultation Activities

Activity	Type of Stakeholder Involved	Summary
Notice of Commencement	Federal government Provincial government Municipal government Landowners Print and broadcast media Residents (through print and broadcast media) NGOs and local interest groups (through print and broadcast media)	Published January 30, 2008 in the Strathroy Age Dispatch Hand-delivered to landowners adjacent to the Project site Mailed to all agencies in Table 6.1-1 Posted on website on February 2008
Community Open House	Federal government Provincial government Municipal government Landowners Print and broadcast media Residents NGOs and local interest groups	Open House #1 - February 12, 2008 March 26, 2009 at the hall in the township offices for Adelaide Metcalfe (2340 Egremont Drive, Strathroy, ON) Open House #2 – March 26, 2009 at the hall in the township offices for Adelaide Metcalfe (2340 Egremont Drive, Strathroy, ON)
Government and Agency Meetings and Presentations	Municipal government IESO	Government and agency meetings and presentations occurred between February 2007 and January 2008. These are summarized in Table 6.1-4
Issues Identification and tracking	Federal government Provincial government Municipal government Landowners Print and broadcast media Residents NGOs and local interest groups Self-identified stakeholders	Correspondence summarized in Table 6.1-3 Developed Issues Identification and Tracking Database Updated database with communication between AET and stakeholders Addressed issues in the Environmental Screening Report

6.2 Stakeholder Issues and Resolution

Table 6.2-1 provides a summary of key comments and questions identified by stakeholders throughout the EA process and the location in the ESR/EIS where these issues have been addressed. Copies of all correspondence can be made available for public or agency review upon request.

Table 6.2-1: Key Questions and Comments

Comment/Question	Location in the Report
I support the project as long as farming of the land is not negatively affected.	Land Uses 7.9
All of the properties considered for the Project have archaeological potential with either multiple registered archaeological sites within the properties or in close proximity.	Heritage Resources 7.8
According to the Local Architectural Committee, does the project have any property subject to designations under Part IV or V of the *Ontario Heritage Act?*	Heritage Resources 7.8
The Project has numerous VHF radio systems operated by local farming operations, numerous cellular towers and their associated microwave links can be found in all directions around the proposed area, civilian ATC aircraft radar and weather radar stations within the site, Canadian Coast Guard Vessel Traffic Radar within 60 kilometres of the site, University of Western Ontario Seismological monitoring equipment, and various licensed radio communications systems in the Town of Strathoy.	Electromagnetic Interference 7.12
Concerned with the effect on the noise and the effects on sensitive microbarograph instruments installed at the Elginfield Observatory.	Electromagnetic Interference 7.12
According to a Natural Heritage Study report, there are genetically significant woodlands in Middlesex County.	Terrestrial 7.3
There are some limited issues with access roads, such as, an access road crossing, an underground cable crossing and a section of access road along the bank of the Morgan Drain.	Socio-Economic Resources 7.7 Traffic 7.4

The preceding sections summarize AET's engagement with the community, government agencies and other stakeholders. Stakeholder consultation post-submission will be ongoing with potentially affected or interested parties.

6.2.1 Agriculture

Local stakeholders are concerned that the possibility of wind turbines could have a negative effect on the farming of the land. Agriculture is very prevalent in the local economy and dominates the majority of the land use in the SSA. The Land Uses assessment found that Site Preparation and Construction and Operation and Maintenance Phases of the Project would have adverse effects on agriculture. However, based on the significance criteria found in Table 7.9-3, the effects were determined to be minimal. Please see Section 7.9 for more detail. Additionally three agricultural landowners wrote letters of support for the Project confirming AET's consultative approach with landowners. To-date, all landowners involved in a zoning application have confirmed that they agree to the locations of wind turbines on their farms. Copies of landowner support letters and an example of the zoning authorization letter are provided in Appendix A.3.

6.2.2 Local Heritage

According to the Ministry of Culture all properties considered in the Project all have local archaeological significance. The Heritage Resources assessment found that Site Preparation and Construction Phase would have adverse effects on archaeological resources and cultural heritage landscapes. Cultural heritage landscapes would also be affected by the Operation and Maintenance and Decommissioning Phases of the Project. In each of these cases the effects were determined to be minimal. Please see Section 7.8 for more detail.

6.2.3 Electromagnetic Interference

There are numerous VHF radio systems and some civilian radars in the area and there is concern about the effect of turbines on these systems. The effects of EMI are restricted to the Operation and Maintenance Phase of the Project, with wind turbine operation being the only Project activity that will create this effect. Wind turbines cause EMI by three pathways; 1) near field effects; 2) diffraction; and 3) reflection/scattering. By siting turbines outside of broadcast, radiocommunication, radar and seismological system signal pathways, the potential for EMI is predicted to be negligible. This has been confirmed by the EMI assessment conducted by YRH & Associates Inc. and comments on EMI received from the contacts listed in Table 7.12-1. Please see Section 7.12 for more detail and Appendix F for the YRH & Associates Inc. report.

6.2.4 Natural Heritage

According to a study done by the Ministry of Natural Resources there are genetically significant woodlands in Middlesex County. The Terrestrial assessment found that ecosite composition and quantity, changes to bird species richness and abundance, bats, other wildlife, listed species and listed wetlands would be adversely affected by the Project. However, in all of these cases the effects were determined to be of minimal or low magnitude. The genetically significant woodlands in Middlesex County will not be affected by Project activities. Please see Section 7.3 for more detail.

6.2.5 Road Networks

Location of access roads is concerning some stakeholders. Careful consideration has been given to the placement of the access roads. New access road construction will be placed near the edge of lot lines to minimize disturbance to the farm land and agricultural activities. AET will undergo discussions about road construction with Adelaide Metcalfe and the County during the permitting process. Please see Section 7.7 for more detail.

6.3 Aboriginal Engagement

The First Nations consultation strategy by AET included identifying and consulting with appropriate Aboriginal groups in a meaningful engagement process in alignment with the guidance developed by the Ontario Power Authority, specifically for the Renewable Energy Supply III - Request for Proposals - Appendix T ("Best Practices, Good Business: Consulting with First Nation and Métis Communities").

AET also utilised the advice provided in the Draft Guidelines for Ministries on Consultation with Aboriginal Peoples Related to Aboriginal Rights and Treaty Rights (Government of Ontario, 2006).

Indian and Northern Affairs Canada (INAC) and the Ontario Ministry of Aboriginal Affairs (MAA) provided guidance on the compilation of AET's First Nations consultation list. The groups are listed in Section 6.3.1.

6.3.1 Aboriginal Claims to Land, Treaty and Title Rights

Indian and Northern Affairs Canada (INAC) indicated there are there are no federally owned lands within the Project area and no comprehensive land claims in Lambton and in Middlesex Counties. However, there are specific land claims. The specific claims for the two counties involve the Caldwell, Chippewas of Kettle and Stony Point, Chippewas of the Thames, Munsee-Delaware, Oneida of the Thames and Walpole Island First Nations. The Aboriginal communities suggested by INAC are as follows:

- Chippewas of the Thames (27 km);
- Delaware Nation (Moravian of the Thames) (30 km);
- Munsee-Delaware Nation (30 km);
- Chippewas of Kettle and Stony Point (32 km);
- Oneida of the Thames (32 km);
- Caldwell First Nation (77 km); and
- Bkwejwanong Territory (Walpole Island) (84 km).

AET had some preliminary consultation with INAC prior to the publication of the NOC. On September 25, 2008 an introductory letter inviting comment on the Adelaide Wind Farm, a summary of the Project, information on AET, and a description of wind power energy production were sent to First Nations. Walpole Island First Nation indicated an assertion of Aboriginal Title in the RSA and a large portion of the southeast corner of the SSA. Table 6.3-1 summarizes the correspondence between relevant government agencies, Aboriginal community leaders and AET. Please refer to Appendix A.6 for correspondence. No other outstanding land claims or treaty rights directly involving the SSA were identified. Please see Section 7.10.1.2 for details.

Table 6.3-1: Summary of Correspondence between Air Energy TCI and Aboriginal Community Leaders and Relevant Government Agencies

Date	Communication/ Engagement Activity	Remarks/Outcome
9/4/2007	INAC letter to AET.	Responded to a request for information about land claims in Lambton and Middlesex Counties. Stated there are specific claims in the two counties for the Caldwell, Chippewas of Kettle and Stony Point, Chippewas of the Thames First Nation, Munsee-Delaware Nation, Oneida Nation of the Thames, and Walpole Island First Nations. Also recommended that the following are kept informed of AET's intentions: Aamjiwnaang, Mississaugas of the New Credit, Six Nations of the Grand River, and Moravian of the Thames.
2/1/2008	MAA letter to AET.	Responded to an inquiry from AET and outlined the roles and responsibilities of the MAA and the relationship to the project (not the approval or regulatory authority – that is INAC) and provided contact information for First Nations in closest proximity to the Project: Chippewas of the Thames, Oneida Nation of the Thames, and Munsee-Delaware Nation.
2/8/2008	INAC letter to AET.	Confirmed there are no comprehensive claims in Middlesex County, Ontario.
8/11/2008	Bkwejwanong Territory (Walpole Island First Nation) letter to AET.	AET was invited to "The Walpole Island First Nation Exclusive Event For Wind Project Proponents and Government Agencies: Creating Opportunities and Overcoming Obstacles For Access To Our Traditional Territory".
10/15/2008	AET letter to Bkwejwanong Territory (Walpole Island First Nation).	AET responded that they were unable to attend, however offered to meet at another time. Additionally, AET had a concern that Walpole Island First Nation was also registering to participate in the Ontario Power Authority's Renewable Energy Supply III - Request for Proposals (RES III). Communication between participants was prohibited, so AET made no further attempts to contact them at this time.
10/25/2008	AET letter to Chippewas of the Thames.	Introductory letter inviting comment on the Adelaide Wind Farm, a summary of the Project, information on AET, and a description of wind power energy production.
10/25/2008	AET letter to Delaware Nation (Moravian of the Thames).	Introductory letter inviting comment on the Adelaide Wind Farm, a summary of the Project, information on AET, and a description of wind power energy production.

Table 6.3-1: Summary of Correspondence between Air Energy TCI and Aboriginal Community Leaders and Relevant Government Agencies (continued)

Date	Communication/ Engagement Activity	Remarks/Outcome
10/25/2008	AET letter to Munsee-Delaware Nation.	Introductory letter inviting comment on the Adelaide Wind Farm, a summary of the Project, information on AET, and a description of wind power energy production.
10/25/2008	AET letter to Chippewas of Kettle and Stony Point.	Introductory letter inviting comment on the Adelaide Wind Farm, a summary of the Project, information on AET, and a description of wind power energy production.
10/25/2008	AET letter to Oneida of the Thames.	Introductory letter inviting comment on the Adelaide Wind Farm, a summary of the Project, information on AET, and a description of wind power energy production.
10/25/2008	AET letter to Caldwell First Nation.	Introductory letter inviting comment on the Adelaide Wind Farm, a summary of the Project, information on AET, and a description of wind power energy production.
2/25/2009	AET letter to Bkwejwanong Territory (Walpole Island First Nation).	Upon announcement of the RES III, AET offered to meet and sent an introductory letter inviting comment on the Adelaide Wind Farm and a summary of the Project.
2/25/2009	AET letter to Chippewas of the Thames.	Follow-up letter to introductory letter describing the Project and inviting comment.
2/25/2009	AET letter to Delaware Nation (Moravian of the Thames).	Follow-up letter to introductory letter describing the Project and inviting comment.
2/25/2009	AET letter to Munsee-Delaware Nation.	Follow-up letter to introductory letter describing the Project and inviting comment.
2/25/2009	AET letter to Chippewas of Kettle and Stony Point.	Follow-up letter to introductory letter describing the Project and inviting comment.
2/25/2009	AET letter to Oneida of the Thames.	Follow-up letter to introductory letter describing the Project and inviting comment.
2/25/2009	AET letter to Caldwell First Nation.	Follow-up letter to introductory letter describing the Project and inviting comment.
3/11/2009	Call from William Big Bull from Bkwejwanong Territory (Walpole Island First Nation).	Indicated that they had received the Project Description and letter and would be interested in a meeting. Mark Gallagher suggested the week of March 26. March 26 was not a good week to meet and current discussions are underway with respect to setting up a meeting.
4/9/2009	AET called William Big Bull from Bkwejwanong Territory (Walpole Island First Nation).	Followed up on previous meeting request. An update on the archaeological assessment work was provided and a future meeting in May was suggested. Dates TBD.

Based on the Aboriginal Interests assessment, these communities are considered to not be directly affected by the Project; however, as valued community members, AET will continue to keep these groups informed regarding the development of the Project. Please see Section 7.10 for more detail.

7.0 ENVIRONMENTAL EFFECTS OF PROJECT ACTIVITIES

This section assesses the potential effects of Project activities (Table 4.5-2) according to the methods presented in Section 5. The first stage of this assessment is a screening of potential environmental effects using the MOE screening criteria in the "Guide to Environmental Assessment Requirements for Electricity Projects" (MOE, 2001). The screening is used to help assess whether the Project could have an effect on selected criteria (e.g., water quality), and whether further analysis is required. Essentially, use of this primary screening process helps focus the assessment on the relevant issues that require further analysis and consideration of mitigation measures to reduce negative Project effects. The analyses linking these screening criteria to the Project design and mitigation measures are found in Sections 7.1 to 7.13. Any screening questions which have been "screened out", or for which no potential environmental effect has been identified in this primary screening process, are not assessed further. Screening questions that have been forwarded to Sections 7.1 to 7.13 undergo a secondary screening or assessment.

Table 7-1 details the screening of potential environmental effects considered for the Project. Each of these questions are meant to be preceded with the phrase: "*Will the Project…*". Section 7.14 provides a summary of the predicted residual environmental effects following the application of mitigation measures.

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project

Number	MOE Screening Criterion	Considered for this Project?		Rationale	Report Section
		Yes	No		
Surface and Ground Water					
1.1	Have negative effects on surface water quality, quantities or flow?	√		Effects on surface water quality, quantity or flow may result from potential changes to surface drainage patterns, or sedimentation of on-site watercourses, especially during construction.	7.2
1.2	Have negative effects on ground water quality, quantity or movement?	√		Excavation associated with installing turbine foundations and potential dewatering activities represent potential changes to shallow groundwater flow directions.	7.1

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project (continued)

Number	MOE Screening Criterion	Considered for this Project?		Rationale	Report Section
		Yes	No		
1.3	Cause significant sedimentation, soil erosion or shoreline or riverbank erosion on or off site?	√		As with criterion 1.1, it is noted that sedimentation of the on-site watercourses has the potential to result from construction activities. Excavation activities associated with access road construction and turbine foundation construction will require grading topsoil and subsoil stockpiling. Runoff from these piles has the potential to result in sedimentation of the on-site watercourses. Soil erosion has the potential to occur due to in-water or shoreline works such as construction of access roads and installation of underground distribution cables.	7.2
1.4	Cause potential negative effects on surface or ground water from accidental spills or releases to the environment?	√		Accidental spills or releases of fuel or lubricating oils may occur, and have the potential to affect ground and surface water quality.	7.1/7.2
Land					
2.1	Have negative effects on residential, commercial or institutional land uses within 500 metres of the site?	√		There are lands within 500 m of the Site zoned as having residential, commercial or institutional land use.	7.9
2.2	Be inconsistent with the Provincial Policy Statement, provincial land use or resource management plans?	√		Land clearing and turbine operation have the potential to affect significant natural heritage features identified in the Provincial Policy Statement (PPS). The Project has the potential to affect archaeological resources and the cultural landscape. With regards to Land Use, this question has been “screened-out” and will not be assessed.	7.3/7.8/7.9

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project (continued)

Number	MOE Screening Criterion	Considered for this Project?		Rationale	Report Section
		Yes	No		
2.3	Be inconsistent with municipal land use policies, plans and zoning by-laws?		√	The Project will be designed to ensure compatibility with the municipal land use policies, plans and zoning by-laws as they relate to the Site and the adjacent property land uses. This will be further enforced through the application for a zoning by-law amendment. This question has been "screened-out" and will not be assessed.	7.9
2.4	Use hazard lands or unstable lands subject to erosion?	√		Hazard lands may be associated with on-site watercourses and their presence will be confirmed by the local Conservation Authorities. As with criteria 1.1 and 1.3, activities such as construction of access roads and installation of underground distribution cables through riparian areas or across watercourses have the potential to affect associated hazard lands.	7.2
2.5	Have potential negative effects related to the remediation of contaminated land?		√	The Site is a mix of agricultural land and woodlots with limited potential for contamination of the Project site (i.e., the area is primarily rural). In addition, during the Decommissioning Phase, the Site will be returned to its original land use. This question has been "screened-out" and will not be assessed.	7.9
Air and Noise					
3.1	Have negative effects on air quality due to emissions of nitrogen dioxide, sulphur dioxide, suspended particulates or other pollutants?	√		There is the potential for operation of construction equipment engines during construction and decommissioning to result in the minor, temporary emission of pollutants.	7.4

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project (continued)

Number	MOE Screening Criterion	Considered for this Project?		Rationale	Report Section
		Yes	No		
3.2	Cause negative effects from the emission of greenhouse gases (CO_2, methane)?	√		There is the potential for operation of construction equipment engines during construction and decommissioning to result in minor, temporary CO_2 emissions.	7.4
3.3	Cause negative effects from the emission of dust or odour?	√		There is the potential for temporary exposure of soil and soil stockpiles created during construction or decommissioning to result in the emissions of dust.	7.4
3.4	Cause negative effects from the emission of noise?	√		There are known noise emissions associated with construction activities and the operation of turbines and substation. Operational noise emissions will be modelled and assessed as part of a separate Noise Impact Assessment and will also be assessed in this ESR/EIS.	7.5/ App. C
Natural Environment					
4.1	Cause negative effects on rare, threatened or endangered species of flora or fauna or their habitat?	√		There is the potential for rare, threatened or endangered species or their habitats to occur within the Site.	7.3
4.2	Cause negative effects on protected natural areas such as ANSIs, ESAs or other significant natural areas?	√		There is the potential for ANSIs or ESAs to be present on, or adjacent to the Project Site.	7.3
4.3	Cause negative effects on wetlands?	√		There is the potential for non-provincially significant or provincially significant wetlands to be located on, or adjacent to the Site.	7.3

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project (continued)

Number	MOE Screening Criterion	Considered for this Project?		Rationale	Report Section
		Yes	No		
4.4	Have negative effects on wildlife habitat, populations, corridors or movement?	√		Wind turbines have large moving components (the rotating blades) that have the potential to affect avian wildlife and movement patterns of avian species. Clearing of vegetation, if required, has the potential to result in habitat loss or fragmentation.	7.3/ App. B
4.5	Have negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g., water temperature, turbidity, etc.)?	√		As with criteria 1.1, 1.3 and 2.4, activities such as construction of access roads and installation of underground distribution cables have the potential to result in sedimentation and changes in temperature resulting from construction of watercourse crossings or removal of riparian vegetation.	7.2
4.6	Have negative effects on migratory birds, including effects on their habitat or staging areas?	√		There is the potential for effects on migratory birds, resulting from collisions with operational turbines or by altering flight patterns (avoidance of the turbines).	7.3/ App. B
4.7	Have negative effects on locally important or valued ecosystems or vegetation?	√		The majority of land within the Site consists of fields under active cultivation; minimal tree removal will be required for access road and turbine foundation construction. However, there is the possibility that some tree removal may occur, or that wildlife within woodlots adjacent to access roads or turbines may be disturbed. These woodlot areas could potentially represent locally important or valued ecosystems or vegetation.	7.3

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project (continued)

Number	MOE Screening Criterion	Considered for this Project? Yes	No	Rationale	Report Section
Resources					
5.1	Result in inefficient (below 40%) use of a non-renewable resource (efficiency is defined as the ratio of output energy to input energy, where output energy includes electricity produced plus useful heat captured)?		√	The Project involves the potential production of energy from a renewable resource (wind power). This question has been "screened-out" and will not be assessed.	n/a
5.2	Have negative effects on the use of Canada Land Inventory Class 1-3, specialty crop or locally significant agricultural lands?	√		Construction of access roads and the turbine pad has the potential to remove Class 1-3 soils on the Project Site from agricultural production.	7.9
5.3	Have negative effects on existing agricultural production?	√		Construction of access roads and the turbine pads will likely remove some land from agricultural production for the duration of the Project.	7.9
5.4	Have negative effects on the availability of mineral, aggregate or petroleum resources?	√		Construction of turbine foundations and access roads may have the potential to affect the availability of these resources or access to them	7.9
5.5	Have negative effects on the availability of forest resources?	√		Although minimal tree removal will be required, there is the potential for the construction of access roads to affect the availability or access to forest resources.	7.9
5.6	Have negative effects on game and fishery resources, including negative effects caused by creating access to previously inaccessible areas?	√		There is the potential for the construction of access roads to increase access to game and fishery resources. The availability of fishery resources may be adversely affected by sedimentation of watercourses during construction as identified in Criterion 1.3.	7.9

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project (continued)

Number	MOE Screening Criterion	Considered for this Project?		Rationale	Report Section
		Yes	No		
Socio-Economic					
6.1	Have negative effects on neighbourhood or community character?	√		Presence of construction vehicles, machinery and cranes has the potential to temporarily affect the predominantly rural character of the area. The visual presence of wind turbines and the substation have the potential to affect the character affect the predominantly rural character of the area during operations.	7.7
6.2	Have negative effects on local businesses, institutions or public facilities?	√		Where possible, AET will use local companies to purchase materials required for the construction of the Project, resulting in benefits to local businesses. No negative effects on local businesses, institutions or public facilities are anticipated as a result of the Project.	7.7
6.3	Have negative effects on recreation, cottaging or tourism?	√		Although the Project site is located in a largely rural area that is not a major recreational, cottaging, or tourism destination, the potential for effects on recreation at local conservation areas and the potential creation of tourism activities due to the Project will be assessed.	7.7
6.4	Have negative effects related to increases in the demands on community services and infrastructure?	√		The Project has the potential to create an increase in the demands on community services and infrastructure.	7.7
6.5	Have negative effects on the economic base of a municipality or community?	√		Although no negative effects on the economic base of the community are anticipated, beneficial effects relating to job creation, local spending and payment of property taxes are likely, and will be described.	7.7

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project (continued)

Number	MOE Screening Criterion	Considered for this Project?		Rationale	Report Section
		Yes	No		
6.6	Have negative effects on local employment and labour supply?	√		Although no negative effects on local employment and labour supply are anticipated, beneficial effects relating to the use of local firms for construction works and activities are likely, and will be described	7.7
6.7	Have negative effects related to traffic?	√		Delivery of construction machinery and construction supplies will result in a temporary increase in the use of local roads, including the transportation of excess loads, which has the potential to affect traffic.	7.11
6.8	Cause public concerns related to public health and safety?	√		There is the potential for construction activities and turbine operation to create public health and safety concerns regarding ice accumulation on tower and blades, shadow flicker, noise and catastrophic failure.	7.13/ App. G
Heritage and Culture					
7.1	Have negative effects on heritage buildings, structures or sites, archaeological resources, or cultural heritage landscapes?	√		Archaeological resources may be present on the Site and are identified in a Stage 1 Archaeological Assessment, and further Stage 2 assessment work, if required. There is the potential for construction activities to have negative effects on heritage buildings, structures or sites, archaeological resources, or cultural heritage landscapes if these areas are not avoided or preserved.	7.8/ App. D
7.2	Have negative effects on scenic or aesthetically pleasing landscapes or views?	√		Construction activities and the presence of wind turbines have the potential to create a negative effect on scenic or aesthetically pleasing landscapes or views. Operation of aeronautical warning lights has the potential to affect the night-time rural character.	7.6/ App. E

Table 7-1: MOE Screening Criteria to be Considered for the Adelaide Wind Farm Project (continued)

Number	MOE Screening Criterion	Considered for this Project?		Rationale	Report Section
		Yes	No		
Aboriginal					
8.1	Cause negative effects on First Nations or other Aboriginal communities?	√		Preliminary consultation with government agencies has determined that local Aboriginal communities may have an interest in the Project as it relates to potential effects on traditional territories and activities.	6.0/7.10
Other					
9.1	Result in the creation of waste materials requiring disposal?	√		During the Decommissioning Phase, AET will endeavour to recycle and re-use as much of the materials from the site as possible; however, disposal may be required for material/equipment that cannot be recycled.	7.7
9.2	Cause any other negative environmental effects not covered by the criteria outlined above?	√		The issue of electromagnetic interference (EMI) by wind turbines is a required consideration for wind farm Projects that receive financial incentives from Natural Resources Canada, and has been addressed through the completion of a Preliminary Impact Study. The Project is not likely to cause any other negative environmental effects that have not already been addressed through this ESR/EIS.	7.12/ App. F

7.1 Geophysical Environment

This section pertains to the following questions from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Have negative effects on groundwater quality, quantity or movement?* (1.2); and
- *Cause potential negative effects on surface or groundwater from accidental spills or releases to the environment?* (1.4)

Any of the above questions that have been addressed, or "screened out" in the initial screening (Table 7-1) have not been carried forward into this assessment. For the Geophysical Environment all questions have been carried forward.

7.1.1 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VECs) for the Geophysical Environment. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project. The VECs can be individual valued species or environmental components.

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on the Geophysical Environment have been assessed by evaluating changes in geology and hydrogeology, specifically soil and groundwater. A description of seismicity in the vicinity of the Site Study Area (herein referred to as the SSA), is intended for use in the assessment of the effects of the environment on the Project (Section 7.15). Table 7.1-1 presents the VECs for the Geophysical Environment along with their rationale for selection and the specific indicators used in the assessment.

Table 7.1-1: Valued Ecosystem Components and Key Indicators Selected for the Geophysical Environment

VEC Selection	Key Indicator(s)	Measures	Selection Basis
Soil quality	Physical and chemical soil quality parameters	Changes in physical and chemical soil quality parameters Comparison of parameters to relevant environmental criteria or standards	A change in soil quality can affect receiving watercourses, associated biological components and their corresponding VECs
Groundwater quality	Physical and chemical groundwater quality parameters	Changes in physical and chemical groundwater quality parameters Comparison of parameters to relevant environmental criteria or standards	A change in groundwater quality can affect receiving watercourses, associated biological components and their corresponding VECs
Groundwater recharge	Infiltration rate and area being recharged	Changes in amount and/or type of ground surface cover	A change in the amount of infiltration may affect available groundwater resources and receiving watercourses
Groundwater flow	Groundwater flow direction, Groundwater quantity and Groundwater velocity	Change in the direction of groundwater flow, quantity and/or velocity	A change in the direction of groundwater flow, quantity and velocity can affect receiving watercourses, associated biological components and their corresponding VECs

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between VECs and the MOE Screening Criteria Questions that they address is provided in Table 7.1-2.

Table 7.1-2: MOE Screening Criteria Questions and VECs for the Geophysical Environment

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
*Have negative effects on groundwater quality, quantity or movement? (*1.2)	Soil quality
	Groundwater quality
	Groundwater recharge
	Groundwater flow
Cause potential negative effects on surface or groundwater from accidental spills or releases to the environment? (1.4)	Soil quality
	Groundwater quality

These VECs will be considered with respect to three general subcomponent headings of the Geophysical Environment. These subcomponents include:

- Geology: defined as the unconsolidated materials and bedrock formations underlying the Site;
- Hydrogeology: defined as groundwater quality, quantity, uses, recharge and discharge areas and direction of groundwater flow; and
- Seismicity: assessed as an effect of the environment on the Project only (see Section 7.15.1.3).

A description of the existing conditions and an assessment of the effects of the Project on the Geophysical Environment will consider the SSA shown on Figure 7.1-1.

The main sources of information used to describe the Geophysical Environment of the SSA include:

- Published, digital and paper, maps and reports concerning the surficial soils, quaternary geology, bedrock geology, hydrogeology, aggregate, mineral and oil and gas resources and seismicity database for the Townships/Counties within which the Study Area resides; and
- Databases for water wells, oil and gas wells and pools, aggregate and mineral resources and base mapping data from the MOE, MNDM, OGS and MNR.

To assess the extent, duration and irreversibility of effects of the Project on the Geophysical Environment within the SSA, the general criteria described in Section 5.3.2 are used. To more accurately assess the magnitude of effects, specific criteria for the VECs of the Geophysical Environment are defined in Table 7.1-3.

Table 7.1-3: Effects Assessment Criteria for the Geophysical Environment

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Physical and chemical soil quality parameters	No change from existing conditions	Effect nominal relative to existing conditions	Effect is measurable relative to existing conditions but below the MOE criteria [(a)]	Effect is measurable relative to existing conditions and above the MOE criteria [(a)]
Physical and chemical groundwater quality parameters	No change from existing conditions	Effect nominal relative to existing conditions	Effect is measurable relative to existing conditions but below the MOE criteria [(a,b)]	Effect is measurable relative to existing conditions and above the MOE criteria [(a,b)]
Infiltration rate and area being recharged	No change from existing conditions	Effect is nominal relative to existing conditions and is temporary	Effect is measurable relative to existing conditions, but is temporary and below range of seasonal variability	Effect is above the range of seasonal variability
Groundwater flow direction, Groundwater quantity, and Groundwater velocity	No change from existing conditions	Effect is nominal relative to existing conditions and is temporary	Effect is measurable relative to existing conditions, but is temporary and below range of seasonal variability	Effect is above the range of seasonal variability

(a) Ministry of the Environment Soil, Groundwater and Sediment Standards (SWGS) for Use under Part X.V.I of the Environmental Protection Act, Table 4: Stratified Site Condition Standards in a Potable Groundwater Condition, dated March 9, 2004.

(b) Technical Support Document for Ontario Drinking Water Standards (ODWS) Objectives and Guidelines, dated June 2006.

The following sections describe the existing conditions within the Geophysical Environment at the SSA, as well as the assessment of effects of the Project on Geophysical Environment VECs.

7.1.2 Existing Conditions

The main sources of information used to describe the Geophysical Environment of the Site include:

- Granular Resources Series – Map 2403, Parkhill, Southern Ontario, (OGS, 1977);
- Middle Ausable Watershed Report Card (ABCA, 2007);
- Middlesex-Elgin Groundwater Study (Dillon et al, 2004);
- MOE water well record database (MOE, 2007);

- Ontario Petroleum Institute Ontario Oil, Gas & Salt Resources Library (OOGSRL, 2005);
- Overburden and Bedrock Geology mapping from Ontario Geological Survey, Ministry of Northern Development and Mines (OGS, 2003);
- The Hydrogeology of Southern Ontario (Singer et al, 2003);
- The Physiography of Southern Ontario (Chapman and Putnam , 1984);
- The Soils of Middlesex County - Volume 1 (Ministry of Agriculture and Food , 1992); and
- Draft - Preliminary Geotechnical Investigation, Proposed Adelaide Wind Farm, Adelaide, Ontario, Reference No. T050051-A1. (Inspec-Sol Inc., 2008).

7.1.2.1 Physiography and Topography

The SSA is located centrally, in the western half of Middlesex County (see Figure 7.1-1). The SSA is located over a complex physiographic region. Within the SSA there are three main physiographic types, till plains, till moraines and clay plains. Till plains and till moraines consist of a heterogeneous mixture of clay, silt, sand and pebbles. Within the SSA, the till plains are characterized as being relatively flat and undrumlinized and the till moraines occur as mounds reflecting deposition. The Ekfrid Clay Plain within the SSA is essentially a till plain covered by shallow deposits of lacustrine clay (Chapman and Putnam, 1984). The Clay Plain is an area of low topographic relief, with occasional hummocky terrain which rises a few metres above the surrounding flat lands.

The topography throughout the SSA is generally flat with an average elevation of approximately 237 masl. The land slopes gently from south to north. The main topographic feature in the SSA is associated with surface water tributaries and streams. The SSA can be divided into a north and south sub-watershed. The north sub-watershed drains 69% of SSA flow through Mud Creek and Adelaide Creek which both flow northward to the Ausable River system. The southern sub-watershed drains the remaining 31% of surface water southward to the Sydenham River.

7.1.2.2 Geology

The landscape and distribution of overburden materials across the SSA was shaped primarily by glacial activity. There are five different surficial units identified within the SSA. The first unit is 5d on Figure 7.1-1 is the Rannoch Till formation and on the surface covers approximately 70% of the SSA. This unit is a glaciolacustrine deposit consisting primarily of silty to clayey till. The second unit, 8a, covering about 20% of the SSA, is a massive to well laminated silt and clay, with minor sand and gravel, glaciolacustrine deposit. The third unit, 6a on Figure 7.1-1, is composed of sand and gravel deposited in an ice-contact, stratified environment associated with moraines, eskers and kames. It has been identified as having potential small scale aggregate resource potential. There are two minor units 19 and 9 that cover much less area and are classified as being related to modern alluvial deposits of varying grain size and a coarse textured fine to medium grained sand, glaciolacustrine deposit, respectively.

Based upon geological mapping and overburden thickness there is no exposed bedrock outcrops within the SSA. MOE water well records within the SSA shows the overburden thickness ranges from approximately 13 to 57 metres below ground surface (mbgs) (42 to 187 ft bgs), with majority of the wells having a overburden thickness between 39 and 50 mbgs (127 and 164 ft bgs) (MOE, 2007). A geotechnical investigation (Inspec-Sol, 2008) reports variations in overburden types, vertically, as consisting of a near surface, stiff, silty clay layer, underlain by dense, moist to wet sand. Occasionally, it was found the sand layer was underlain by a stiff clay layer. The thickness of the shallow silty clay layer ranges up to approximately 15 mbgs. The moist to wet sand layer thickness varies across the boreholes. The SSA is underlain by the Upper Devonian and Mississippian Kettle Point Formation shale and siltstone and the Middle and Upper Devonian shales and limestones (Figure 7.1-2) of the Dundee Formation and the Hamilton Group. The Kettle Point Formation is located in the southwest corner of the SSA and is a black, laminated, organic-rich shale and siltstone. The Hamilton Group comprises six formations of alternating calcareous shales and lesser limestone beds. The majority of the SSA is underlain by Hamilton Group sedimentary rock. The Dundee Formation is found as a narrow section, trending northwest-southeast in the northeast corner of the SSA. The Dundee Formation consists of tan to brown medium- to thick-bedded limestones and lesser dolostones. The Dundee Formation is an important target for oil exploration in the region.

The Ontario agricultural soil classification describes the soil within the SSA as being mainly from the Brantford and Huron Associations. The Brantford Association consists of three drainage members and all three members are found within the SSA. The three members are the moderately well drained Brantford soil, the imperfectly drained Beverly soil and the poorly drained Toledo soil. The soils of the three members are generally a silty/clayey loam material with little or no gravel. Brantford and Beverly soils are more common throughout the area compared to Toledo soils. The Huron Association is comprised of three drainage members and all are found in varying degrees across the SSA. The three members are the moderately well-drained Huron soil, the imperfectly drained Perth soil and the poorly drained Brookston soil. The soil texture of the Huron Association is typically silt clay loam to silty clay, although it is also occasionally clay loam. The average gravel content is approximately 5%, but it can vary up to 20% (Ministry of Agriculture and Food, 1992). A minor soil unit in the SSA is a small pocket of the Bennington soil. Bennington Soil is a well to imperfectly drained silt to silt loam. Within the SSA there are also modern alluvial deposits associated with streams and rivers; however these deposits make up a much smaller portion of the SSA and wind turbines are not planned on these types of deposits.

A search of the MOE water well records indicated that there are 250 wells within the SSA (Figure 7.1-3). From the MOE records, 132 of the wells were completed in sand at a depth of greater than 10 m. There are 46 wells that were completed in bedrock and the remaining well records were incomplete. MOE water well records indicate that the majority of wells have been completed in overburden.

Soil Quality

There are no historical records of soil quality sampling on the SSA and soil sampling was not conducted as part of this EA. The soil within the SSA is typically a Class 2D (Department of Natural Resources Canada). Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices due to undesirable soil structure or low permeability.

A large proportion of the SSA supports agricultural uses, including crop production and pasture land [Statistics Canada (2006) Agriculture Community Profiles]. As a result, there is likely manure storage across different parts of SSA. In order to better understand the soil quality on-Site, soil quality testing will be conducted prior to the onset of Site Preparation and Construction Phase activities during the detailed geotechnical assessment.

7.1.2.3 Hydrogeology

The following section outlines the SSA hydrogeologic conditions, including the groundwater flow regime, groundwater quality and recharge characteristics. These conditions are described based on The Hydrogeology of Southern Ontario (Singer et al, 2003), Middlesex-Elgin Groundwater Study (Dillon et al, 2004), and the MOE Water Well Database (MOE, 2007).

Groundwater Use, Levels, and Direction of Flow

Within the SSA, there are three aquifers; an intermediate overburden aquifer, a deep overburden aquifer and a bedrock aquifer.

The source of drinking water within the SSA is from private drinking water wells. As noted above in Section 7.1.2.2, a search of the MOE water well records indicated that there are 132 wells completed in sand and 46 completed in bedrock.

Based on Dillon et al, (2004) and MOE water well records the intermediate overburden groundwater levels range from 10 to 30 mbgs, the deep overburden groundwater levels are >30 mbgs and the bedrock groundwater levels range from approximately 27 to 61 mbgs. It should be noted that there is a slight increase in bedrock groundwater levels for wells located beneath the permeable till moraine located near the center of the SSA. The SSA geotechnical report by Inspec-Sol Inc. (Inspec-Sol, 2008) shows groundwater was encountered at depths ranging from about 7.6 m to 15.8 mbgs at the time of drilling. As reported, these groundwater measurements do not represent stabilized conditions since they were measured immediately upon completion of drilling. They also note that groundwater levels are transient and tend to fluctuate with the seasons, precipitation and temperature. The geotechnical findings also state that there may be perched groundwater tables present within the shallow clayey soils in the upper reworked soils or if interbedded sand seams are present within the clayey till deposits. Perched groundwater tables will be more evident during wet seasons or after extended periods of wet weather.

Groundwater flow direction in the SSA is influenced by topography, geology and surface water drainage. It is not possible to gauge groundwater conditions in the overburden based on the water well record data or other available data, however, a number of observations can be presented, based on the geology, physiography and topography of the SSA. There are very few wells within the SSA which obtain groundwater from shallow overburden as the silty/clayey till soils near surface generally have low hydraulic conductivities, which inhibit rainfall infiltration into the subsurface, as well as groundwater movement and thereby resulting in poor well yields. Although the shallow overburden soils may be water-bearing, they are not considered an aquifer that can supply a sufficient reliable water supply for potable use. The exception to this are areas where the surficial expression of coarser grained material are located, as they possess higher hydraulic conductivity.

The primary aquifer within the SSA is the intermediate soil aquifer located between 10 to 30 mbgs and is approximately 10 m thick (MOE, 2007 and Singer et al, 2003). Wells completed at this depth are located primarily in fine to medium sand. This sand aquifer within the SSA is related to the heterogeneity of glacial deposits which varies locally. This aquifer has been sub-classified as part of The Ausable Aquifer (Singer et al., 2003). From Singer et al, (2003), well yields range from 5 to 275 L/min. As the SSA spans two conservation authorities, a second aquifer, the Coldstream Aquifer, is located in the southern and southwest portions of the SSA. This aquifer has similar geology, although more coarse grained, and comparable water yields of 5 to 275 L/min to the Ausable Aquifer (Singer et al., 2003).

Singer et al (2003) reviewed a total of 6,145 water wells located in the Kettle Point Formation shale/siltstone bedrock within southern Ontario. The 10^{th} and 90^{th} percentile range for the specific capacity of the Kettle Point Formation wells was estimated to be 0.5 and 37.3 L/min/m, with a geometric mean of 4.2 L/min/m. The 10^{th} and 90^{th} percentile range for transmissivity of these wells was estimated to be 0.9 and 82.8 m^2/day, with a geometric mean of 8.6 m^2/day. These estimates were indicative of a fair water-yielding capacity. Although none of these wells were within this SSA the results across the unit were quite consistent over the large number of wells and these results are likely indicative of specific capacity and transmissivity of the unit below the

SSA. A review of the pumping rates from the Kettle Point Formation by Dillon Consulting Limited (2004) shows that wells have average yields of 23 L/min. Deeper wells have lower pumping rates on average of approximately 19 L/min.

Singer et al (2003) also reviewed a total of 1,044 water wells located in the Hamilton Group shales and lesser limestones within southern Ontario. The 10^{th} and 90^{th} percentile range for the specific capacity of the Hamilton Group wells was estimated to be 0.3 and 27.7 L/min/m, with a geometric mean of 2.7 L/min/m. The 10^{th} and 90^{th} percentile range for transmissivity of these wells was estimated to be 0.6 and 63.5 m^2/day, with a geometric mean of 5.3 m^2/day. These estimates were indicative of a fair water-yielding capacity. Although none of these wells were within this SSA the results across the unit were quite consistent over the large number of wells and these results are likely indicative of specific capacity and transmissivity of the unit below the SSA. A review of the pumping rates from shales in the Hamilton Group by Dillon Consulting Limited, 2004 shows that wells have yields of less than 75 L/min, with an average of 18 L/min. Deeper wells have significantly less pumping rates of approximately 5 L/min.

Singer et al (2003) also reviewed 4,199 water wells located in the Dundee Formation limestones and lesser dolostones in southern Ontario. The 10^{th} and 90^{th} percentile range for the specific capacity of those Dundee Formation wells was estimated to be 1.6 and 74.6 L/min/m, with a geometric mean of 13.1 L/min/m. The 10^{th} and 90^{th} percentile range for transmissivity of these wells was estimated to be 3.1 and 169.1 m^2/day, with a geometric mean of 27.1 m^2/day. These estimates were indicative of a very good water-yielding capacity. Although none of these wells were within this SSA the results across the unit were quite consistent over the large number of wells and these results are likely indicative of specific capacity and transmissivity of the unit below the SSA. A review of the Dundee Formation limestone's pumping data by Dillon Consulting Limited, 2004 shows that the majority of the wells have pumping rates in the less than 150 L/min, with an average yield of 36 L/min and that the pumping rates from varying depths in the Dundee Formation do not vary significantly.

In the report by Dillon Consulting Limited (2004) the water level data indicates that the SSA is located on a groundwater divide with overburden and bedrock aquifers flowing north and south and away from the east-west trending till moraine located at the center of SSA. This groundwater flow mimics the SSA surface water flow which is northward toward the Ausable River which reports to Lake Huron and southward to the Sydenham River which reports to Lake St Clair.

Groundwater Quality

There are no historical records of groundwater quality sampling on the SSA and groundwater sampling was not conducted as a part of this EA. MOE water well records indicate that wells screened in clay or bedrock had a noticeable amount of sulphur and some wells have noticeable concentrations of salt. Dillon (2004) report the shale aquifers water quality as generally being poor, with high dissolved solids and elevated chlorine. The same study also reports the limestone water quality as being good, although with high hardness and commonly increased concentrations of chloride and iron. It should also be noted that a large proportion of the SSA supports agricultural uses, including crop production and pasture land, and there is likely manure storage across different parts of SSA. In order to better understand the SSA groundwater quality, a groundwater quality testing program will be conducted prior to the onset of the Site Preparation and Construction Phase activities during the detailed geotechnical assessments.

Groundwater Recharge and Discharge

As noted above, the silty to clayey till soils that are present at or near the surface across the SSA generally have low hydraulic conductivities, which inhibit rainfall infiltration into the subsurface, as well as groundwater movement in the shallow overburden. The infiltration rates for the surface soil types can be expected to range from 5 cm (2 in) to 12 cm (5 in) per year. However based upon the Middlesex-Elgin Groundwater Study (Dillon Consulting Limited, 2004) the SSA is located in an area with a high potential recharge in both intermediate and deep overburden aquifers and bedrock aquifers.

There are a number of streams and numerous man-made drainage ditches that traverse the SSA. These water courses tend to be narrow and shallow. There is insufficient data to determine whether shallow groundwater on the SSA will discharge to these streams/ditches. Should groundwater discharge, this baseflow contribution would likely vary seasonally.

7.1.2.4 Seismicity

The following description of seismicity in the vicinity of the SSA is intended for use in the assessment of the effects of the environment on the Project (Section 7.15) and should not be used for any geotechnical interpretation of Project activities.

Figure 7.1-4 shows a map of seismic events in southwestern Ontario from 1970 to the present. The Site is located in a zone of low seismic activity. As described above in Section 7.1.2.2, the surficial geology consists of till deposits overlying shale/limestone bedrock from the Dundee Formation/Hamilton Group. To infer the seismic hazard parameters we have assumed near-surface ground conditions as belonging to Class C (very dense soil or soft rock), which is the reference ground condition as defined by the 2005 National Building Code of Canada (NBCC, 2005). In accordance with the guidelines from the NBCC, the seismic hazard is estimated for a 2% probability of exceedance over a 50 year period, using both the 5% damped Spectral Acceleration (Sa) calculated at several periods ranging from 0.2 to 2 seconds, and the Peak Ground acceleration (GPA). Spectral acceleration at a period of 2 seconds shows a maximal acceleration of 0.012g, while the earthquake horizontal Peak Ground Acceleration is maximal at 0.135g. These calculations indicate that the site is located in a low seismic hazard zone. It should be noted that the above assessment was not developed for the calculation of the engineering building design parameters.

7.1.2.5 Potential Contaminant and Waste Disposal Sites

Within the SSA there were a few potential sources of contamination identified. There are two fuel storage areas, an active waste disposal site, a historic waste disposal site, an automotive junkyard and a number of oil and/or gas wells and pipelines. The locations of these potential sources are presented on Figure 7.1-2. One of the identified fuel storage locations is located near Turbine 32 and the second is not located near a turbine. The active waste disposal site is located between the Turbines 5 and 6 and the historic waste disposal site is in the same vicinity. The automotive junkyard is not located near any of the planned turbine locations. The location of oil and/or gas wells in the SSA are 500 m or greater from any of the proposed turbine locations but the pipelines cross the full extent of the SSA.

7.1.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on the Geophysical Environment is provided in Table 7-1 and is summarized as follows:

- Use of construction equipment and construction activities that change ground surface cover, including degree of soil compaction, and any necessary short term dewatering could potentially affect groundwater quality, quantity and movement;
- Spills or releases of materials used could occur, including small quantities of fuel, lubricating oils and greases or other chemicals that could cause potential negative effects to groundwater quality; and
- Construction of access roads and turbine pads could prevent access to aggregate, oil and gas resources, should they exist on the property.

An assessment of the interactions defined above, to determine where likely measurable changes to the Geophysical Environment exist as a result of the Project, are identified in Table 7.1-4.

In addition to the description of the Project provided in Section 4.5, the assessment of the effects of the Project on the Geophysical Environment is based on the following assumptions and limitations:

- A permanent concrete plant will not be located on the SSA.

- Any water needs during all Project phases will be less than 50,000 L/day and can be met with clean water sources.
- Fuels or other chemicals stored on-Site will be properly contained. Due to the widely dispersed locations of the turbines across the SSA, it is expected that fuel/chemical storage will be accomplished using one (or possibly several) central depots.
- Effects of sedimentation during construction and operations phase activities will be minimized using on-site engineering controls.
- All assumptions stated in the assessment of the Aquatic Environment also have been assumed for the assessment of the Geophysical Environment.

Table 7.1-4: Identification and Assessment of Potential Interactions with VECs of the Geophysical Environment

Relevant Project Activity	Soil Quality	Groundwater Quality	Groundwater Recharge	Groundwater Flow
Site Preparation and Construction				
Surveying and Siting operations	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality.	**(yes)** • Soil compaction from vehicles and equipment affects infiltration rates and recharge.	**(no)**
Land Clearing	**(yes)** • Reworking and/or stockpiling of overburden represents potential for erosion, sedimentation and change in soil quality. • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.
Road Construction/Modification	**(yes)** • Reworking and/or stockpiling of overburden represents potential for erosion, sedimentation and change in soil quality. • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.

Table 7.1-4: Identification and Assessment of Potential Interactions with VECs of the Geophysical Environment (continued)

Relevant Project Activity	Soil Quality	Groundwater Quality	Groundwater Recharge	Groundwater Flow
Delivery of Equipment	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality.	**(yes)** • Soil compaction from vehicles and equipment affects infiltration rates and recharge.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.
Temporary Storage Facilities	**(yes)** • Reworking and/or stockpiling of overburden represents potential for erosion, sedimentation and change in soil quality. • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality. • Storage of lubricants, oils, greases or other chemicals may cause accidental spills that could affect soil quality.	**(yes)** • Reworking and/or stockpiling of overburden represents potential for erosion, sedimentation and change in soil quality with a corresponding change in groundwater quality. • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality. • Storage of lubricants, oils, greases or other chemicals may cause accidental spills that could affect groundwater quality.	**(yes)** • Reworking and/or stockpiling of overburden, soil compaction and temporary storage areas affects infiltration rates and recharge.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.

Table 7.1-4: Identification and Assessment of Potential Interactions with VECs of the Geophysical Environment (continued)

Relevant Project Activity	Soil Quality	Groundwater Quality	Groundwater Recharge	Groundwater Flow
Foundation Construction	**(yes)** • Removal of 15 x 15 x 3 m area of overburden and/or bedrock and potential dewatering for each turbine base represents potential for erosion, sedimentation and change in soil quality. • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Removal of 15 x 15 x 3 m area of overburden and/or bedrock and potential dewatering for each turbine base represents potential for erosion, sedimentation and a corresponding change in groundwater quality. • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality. • Discharge from dewatering potentially affects groundwater quality.	**(yes)** • Installation of concrete cap, backfilling and compression of 15 x 15 x 3 m area of overburden and/or bedrock for each turbine base potentially affects infiltration rates and recharge.	**(yes)** • Installation of 12 piles per turbine into bedrock represent potential changes to shallow groundwater flow directions. • Potential temporary dewatering of turbine foundations may alter shallow groundwater flow.
Tower and Turbine Assembly and Installation	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.

Table 7.1-4: Identification and Assessment of Potential Interactions with VECs of the Geophysical Environment (continued)

Relevant Project Activity	Soil Quality	Groundwater Quality	Groundwater Recharge	Groundwater Flow
Interconnection from Turbines to Substation	**(yes)** • Reworking of overburden during trenching represents potential for erosion, sedimentation and change in soil quality. • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Reworking of overburden during trenching represents potential for erosion, sedimentation and a corresponding change in groundwater quality. • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge.	**(yes)** • Installation of trenches into overburden represent potential changes to shallow groundwater flow directions.
Fencing/Gates	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality.	**(yes)** • Soil compaction from installation of fences and gates affects infiltration rates and recharge.	**(no)**
Parking Lots	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks (e.g., oil, grease, fuel), affecting groundwater quality.	**(yes)** • Hardening of surfaces affects infiltration rates and recharge.	**(yes)** • Hardening of surfaces affects infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.

Table 7.1-4: Identification and Assessment of Potential Interactions with VECs of the Geophysical Environment (continued)

Relevant Project Activity	Soil Quality	Groundwater Quality	Groundwater Recharge	Groundwater Flow
Operation and Maintenance				
Wind turbine operation	**(no)**	**(no)**	**(no)**	**(no)**
Maintenance Activities	**(Yes)** • Presence of vehicles and equipment and/or on-site storage of oils and greases for maintenance and changing oil in the gearbox and hydraulic systems could result in leaks, affecting soil quality.	**(Yes)** • On-site storage of oils and greases for maintenance and changing oil in the gearbox and hydraulic systems could result in leaks, affecting groundwater quality. • Presence of vehicles and equipment could result in leaks, affecting groundwater quality.	**(no)**	**(no)**
Decommissioning				
Removal of Turbines and Ancillary Equipment	**(yes)** • Reworking overburden represents potential for erosion, sedimentation and change in soil quality. • Presence of vehicles and equipment could result in leaks, affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks, affecting groundwater quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge. • Removal of turbines and ancillary equipment, removal of concrete base and replacement of topsoil changes infiltration rates and recharge.	**(yes)** • Removal of turbines and ancillary equipment, removal of concrete base and replacement of topsoil changes infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.

Table 7.1-4: Identification and Assessment of Potential Interactions with VECs of the Geophysical Environment (continued)

Relevant Project Activity	Soil Quality	Groundwater Quality	Groundwater Recharge	Groundwater Flow
Removal of Buildings and Waste	**(yes)** • Reworking overburden represents potential for erosion, sedimentation and change in soil quality. • Movement of waste could result in leaks, affecting soil quality. • Presence of vehicles and equipment and/or movement of waste could result in leaks, affecting soil quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge and potentially groundwater quality. • Movement of waste could result in leaks, affecting groundwater quality. • Presence of vehicles and equipment could result in leaks, affecting groundwater quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge • Removal of buildings and replacement of topsoil changes infiltration rates and recharge.	**(yes)** • Removal of buildings and replacement of topsoil changes infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.
Removal of Power Lines	**(yes)** • Reworking overburden represents potential for erosion, sedimentation and change in soil quality. • Presence of vehicles and equipment could result in leaks, affecting soil quality.	**(yes)** • Presence of vehicles and equipment could result in leaks, affecting groundwater quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge.	**(yes)** • Soil reworking changes infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.

Table 7.1-4: Identification and Assessment of Potential Interactions with VECs of the Geophysical Environment (continued)

Relevant Project Activity	Soil Quality	Groundwater Quality	Groundwater Recharge	Groundwater Flow
Site Remediation	**(yes)** • Reworking overburden represents potential for erosion, sedimentation and change in soil quality. • Movement of waste could result in leaks, affecting soil quality. • Presence of vehicles and equipment and/or movement of waste could result in leaks, affecting soil quality.	**(yes)** • Movement of waste could result in leaks, affecting groundwater quality. • Presence of vehicles and equipment could result in leaks, affecting groundwater quality.	**(yes)** • Soil reworking and compaction affects infiltration rates and recharge. • Removal of buildings and replacement of overburden changes infiltration rates and recharge.	**(yes)** • Removal of buildings and soil replacement changes infiltration rates and recharge which could affect surface water flow and/or shallow groundwater flow.

7.1.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which soil quality, groundwater quality, groundwater flow and groundwater recharge may be affected by the various Project activities include:

- Effects to soil and shallow groundwater quality through redistribution of previously affected soil;
- Altered infiltration into the underlying aquifer(s) and interference with shallow groundwater flow patterns resulting from compaction, grading, paving, dewatering and/or construction or removal of structures; and
- Effects on soil and/or groundwater quality from a spill or leak of fuels, lubricants or other chemicals during the removal of wastes from the SSA.

During the initial assessment process, specific provincial screening questions are asked to identify potential interactions with the environment. The topics that were identified as having a potential interaction with the Geophysical Environment are as follows:

- Potential for adverse effects to groundwater quality, quantity, or movement; and
- Potential for adverse effects to groundwater from spills or releases to the environment.

The assessment of effects that follows only addresses these topics as no other interactions were determined to have an effect on the Geophysical Environment. The effects to soil quality have the potential to directly affect the groundwater quality, so that potential effects to soil quality are also a part of the assessment of effects. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and, if applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are advanced to Section 7.1.5 for an analysis of significance.

7.1.4.1 Geology

As determined through the secondary screening (Table 7.1-4), potential interactions were identified between Project activities during each of the three Phases and the VECs in the Geology subcomponent. These are described further below.

Soil Quality

Site Preparation and Construction

The survey and siting operations, land clearing, road construction/modification, delivery of equipment, temporary storage, foundation construction, tower and turbine assembly and installation, interconnection of turbines to substation and parking lots are the Project works and activities from the Construction Phase that have the potential to affect SSA soil quality through redistribution of existing soils.

Soils will not be imported as a part of the Project and pre-existing soil conditions will be taken into account during redistribution of soils so that no measurable effects on soil quality occur. Representative soil sampling will be conducted at each of the turbine locations across the SSA during the detailed geotechnical assessment to identify potential soil contamination from previous activities on the SSA. Based upon the soils analysis, the need for removal of contaminated soil and/or the installation of groundwater wells will be examined prior to site preparation or construction activities. Based on the current and historical land uses across the SSA, the presence of significant contaminated soil is not expected at the turbine locations and substation location. Also, during construction activities, some level of soil erosion is likely to occur during earth moving, excavation and stockpiling activities (i.e., during redistribution of soils). Although the surficial soil cover for approximately 70% of the SSA is silty to clayey till, about 20% of the SSA, is a massive to well laminated silt and clay, with minor sand and gravel, glaciolacustrine deposit and the remainder of the SSA has ice-contact deposits of sand and gravel moraines, eskers and kames the disturbed till can still be eroded by flowing water (i.e., during precipitation events), thereby resulting in suspension of fine particles. However, the wind turbines are generally within farm fields and separated at large (i.e., greater than 350 m) distances from each other across the SSA. Soil eroding off of stockpiles from normal precipitation events will generally settle a short distance from the stockpiles/graded soils and be re-introduced to the SSA as agricultural soil.

During foundation construction it may be required to de-water the areas where turbine foundations are being constructed (e.g., where foundation extends below groundwater table). In those cases, the dewatering should be conducted in such a way as to manage sedimentation, (i.e., through direct discharge via piping to surface water courses). Effective implementation of an appropriate Construction Phase Soil Management Plan (SMP) that addresses the potential for soil erosion, and which is specific to the physical activities of the Project, will be necessary to adequately mitigate this potential effect. This will be developed after the detailed engineering design and geotechnical assessment, but prior to applying for the building permits.

The erosion impacts on water and sediment quality can also be minimized by implementing Best Management Practices (BMPs) for construction. There are several guideline documents that outline these BMPs prepared by various conservation authorities (e.g., Toronto and Region Conservation Authority, Grand River Conservation Authority) and provincial ministries (MOE, MNR, CCME), which are detailed in the assessment of effects on the Aquatic Environment (Section 7.2).

It is anticipated that soil erosion effects will be minor, mitigable and restricted to the Site Preparation and Construction Phase of the Project. After construction, all exposed soils will be replaced and recontoured, disturbed areas will be reseeded.

Accordingly, based on the above assessment concerning soil erosion, the proposed mitigation measures are deemed appropriate and redistribution of soils is not predicted to have an adverse effect on soil quality.

Vehicles and equipment will be used for all activities during the Construction Phase and have been considered as a part of the Project. As well, the Project will require the storage of fuels and lubricants at one or more temporary storage facilities. Inappropriate handling, storage and/or disposal of equipment fuels and lubricants (i.e., antifreeze, transmission oil, hydraulic oil, grease etc.) during the Construction Phase can result in leaks or spills that may affect soil quality.

Mitigation measures to minimize any effects of a spill on soil quality include the development and effective implementation of an appropriate Construction Phase Emergency Management Plan (EMP), including a spill contingency plan. Such a spill contingency plan generally includes the following protocols:

- Proper maintenance of vehicles and construction equipment;
- Conducting refueling and maintenance in designated areas;
- Maintenance of a supply of spill control materials in the SSA (absorbent material, absorbent booms, etc); and
- Proper training of workers for spill prevention and containment.

The EMP will clearly identify the required measures to provide environmental protection according to the construction activity and the equipment used for the Project. Implementation of the spill contingency plan within the EMP will provide measures to preclude or minimize potential adverse effects related to soil contamination. This will be developed after the detailed engineering design and geotechnical assessment, but prior to applying for the building permits. Accordingly, the above mitigation measures are deemed appropriate for the spill scenarios identified above and there is a negligible risk to soil quality during the Site Preparation and Construction Phase.

Operation and Maintenance

During the Operation and Maintenance Phase, maintenance activities in the SSA may affect soil quality through spills resulting from inappropriate storage, handling or disposal of equipment fuels and lubricants. Spills or leaks may originate from oils, greases and/or other chemicals stored on-Site for maintenance of turbines and associated equipment, or from vehicles on the SSA conducting maintenance (i.e., antifreeze, transmission oil, hydraulic oil or grease from cranes or other vehicles).

Spill-related effects occurring on-site during the Operation and Maintenance Phase would also be effectively mitigated through the use of BMPs and a spill contingency plan, following the principles mentioned above in relation to the Construction Phase. Implementation of BMPs and a spill contingency plan will preclude or minimize many potential adverse effects related to soil contamination. Accordingly, the above mitigation measures are deemed appropriate for a spill as identified above and no residual effects to soil quality during operations are predicted. This is not carried forward in the assessment.

Decommissioning

During the Decommissioning Phase, all Project works and activities identified in Table 7.1.4 may have an effect on soil quality as a result of redistribution of existing affected soils, erosion of soils during redistribution, or as a result of leaks and/or spills from vehicles. Additionally, the removal of buildings and waste may result in effects to soil quality as a result of a spill during movement of wastes.

As discussed for the Construction Phase, prior to re-grading of soils, soil quality must be determined to ensure appropriate handling. As soil quality monitoring will be conducted prior to construction and mitigation measures exist to address soil contamination that may occur during the Construction and Operations Phases, there is a low potential for soil quality issues from soil redistribution. However, representative soil quality sampling will be conducted over the areas of the SSA where Project-related structures are to be removed will be conducted to confirm potential soil contamination from activities on the SSA prior to decommissioning. Based upon the soils analysis, the need for removal of contaminated soil will be examined prior to decommissioning.

During decommissioning activities, redistribution of soil creates potential for erosion to affect soil quality. As during the Site Preparation and Construction Phase, a detailed SMP and EMP will be prepared and implemented to ensure that potential soil erosion effects are mitigated.

Similar to the Site Preparation and Construction and Operation and Maintenance Phases, spill-related effects occurring on-site during the Decommissioning Phase would also be effectively mitigated through use of BMPs and a spill contingency plan following the principles mentioned above in relation to the Construction Phase. Implementation of BMPs and a spill contingency plan will preclude or minimize potential adverse effects related to soil contamination. Accordingly, the above mitigation measures are deemed appropriate for a spill and there is negligible risk to soil quality in the Decommissioning Phase.

Overall, no effects on soil quality as a result of the Project are predicted for any of the Project Phases and no further consideration of soil quality is warranted.

7.1.4.2 Hydrogeology

As determined through the secondary screening (Table 7.1-4), potential interactions were identified during three Phases of the project between project activities and the VECs in the Hydrogeology subcomponent.

Groundwater Quality

Site Preparation and Construction

All of the project works and activities associated with the Site Preparation and Construction Phase have the potential to affect groundwater quality. The main pathways for these effects are via increased potential for infiltration of contaminants to the ground where they may affect groundwater quality. This may happen either by:

- Redistribution of previously impacted soil or introduction of contaminants into excavations;
- Dewatering activities; or
- Spills of oil, grease and vehicle fuels during construction, refueling or maintenance activities (i.e., malfunctions and incidents).

As noted in Section 7.1.2.2, the SSA shallow overburden is low permeability silty to clayey till soils. As noted above, soil quality sampling will be undertaken at the existing SSA to identify and appropriately manage unexpected occurrences of contaminated soils. In addition, development and effective implementation of BMPS and an EMP, including a spill contingency plan, will provide the necessary mitigation measures to largely eliminate potential effects to groundwater quality.

During construction, temporary dewatering of the areas where turbine foundations are being constructed (e.g., where foundation extends below water table) may be required. If dewatering is anticipated then prior to the Site Preparation and Construction Phase, the characteristics of the near-surface “aquifer” will be assessed through the installation of monitoring wells during the detailed geotechnical assessment. If the aquifer characteristics suggest that dewatering at a given turbine location may be greater than 50,000 L/day, then an application for a Permit To Take Water (PTTW) will be prepared for submission to the MOE. As described above for soil quality, the dewatering should be conducted in such a way as to manage sedimentation. The EMP for the Construction Phase should account for appropriate monitoring, treatment and discharge during dewatering.

Based upon MOE water well records (Figure 7.1-3) there are no private wells within 100 m of the turbines on the SSA. If during construction private well(s) are within 100 m of the turbine foundation construction then, at the landowner's request, this well maybe monitored for change in the quality and quantity of the well(s) during construction activities. If the well water quality or quantity is altered as a result of the construction, AET will provide a temporary potable water supply until corrective measures are taken.

Groundwater quality could also be affected by inappropriate handling and disposal of equipment fuels and lubricants during the Construction Phase can result in spills thereby introducing the contaminants to the subsurface. The assessment of effects to groundwater quality from on-site spills during construction is the same as that for soil quality (see the previous section). Development and effective implementation of an EMP, including a spill contingency plan, will provide the necessary mitigation measures to minimize or eliminate potential effects to groundwater quality. As mitigation measures are in place and are deemed appropriate, there is negligible risk to groundwater quality during the Site Preparation and Construction Phase.

Operation and Maintenance

The main pathway by which the Project activities could affect groundwater quality during maintenance activities in the Operations Phase is through a spill or leak. Operation of the turbines themselves is not expected to create conditions for a spill. A leak or spill may include lubricants or other chemicals stored on the SSA for turbine maintenance or a spill of oil, grease or vehicle fuels from equipment during routine maintenance activities. As described above in relation to the Construction Phase, the assessment of effects to groundwater quality from on-site spills during the Operations Phase is the same as that for soil quality. Development and effective implementation of an EMP, including a spill contingency plan, will provide the necessary mitigation measures to largely eliminate potential effects to groundwater quality from a spill. As mitigation measures are in place and are deemed appropriate, there is negligible risk to groundwater quality during the Operation and Maintenance Phase activities.

Decommissioning

All Decommissioning Phase activities identified in Table 7.1.4 have potential effects on groundwater quality either through:

- Redistribution of previously impacted soil; or
- Leaks or spills of oil, grease and vehicle fuels or during movement of wastes as part of decommissioning activities (i.e., malfunctions and failures).

Soils and exposed bedrock are the mediums through which contaminants can migrate through the subsurface to affect groundwater quality.

As discussed for the Construction Phase, soil quality sampling will be undertaken at the existing SSA to identify and appropriately manage unexpected occurrences of contaminated soils. As soil quality monitoring will be conducted prior to construction and mitigation measures exist to address soil contamination that may occur during the Construction and Operations Phases, there is a low potential for soil quality issues to exist during the Decommissioning Phase that may affect groundwater quality. As well, it is advised that representative soil sampling over the areas of the SSA where Project-related structures are to be removed should be conducted to confirm potential soil contamination from activities on the SSA prior to decommissioning. These actions, in addition to the effective implementation of a Decommissioning Phase EMP, including a spill contingency plan, will provide the necessary mitigation measures to largely eliminate potential effects to groundwater quality during relocation of soils in the Decommissioning Phase. There is therefore negligible risk to groundwater quality during the Decommissioning Phase.

Groundwater Infiltration, Recharge, and Flow

Site Preparation and Construction

During the Construction Phase of the Project, alteration of groundwater infiltration, recharge, and flow from all site preparation and construction activities are considered. This includes survey and siting operations, land clearing, road construction/modification, delivery of equipment, temporary storage facilities, foundation construction, tower and turbine assembly and installation, interconnection from turbine to substation, fencing and gates, and parking lots. These works and activities may alter groundwater infiltration, recharge and/or flow via the following:

- Hardening of surfaces (i.e., buildings and roads);
- Redistributing soils; and
- Dewatering as part of foundation construction activities.

Hardening of Surfaces

Alteration in existing surface cover and/or compaction of soils can potentially affect the degree to which precipitation and surface water can infiltrate into the subsurface. The construction of above-ground structures such as temporary storage facilities, substation facilities and turbines, and other hardening of surfaces (i.e., roads and workspace areas), will cause compaction and decrease surface infiltration which could have a minor affect on shallow groundwater flow by reducing recharge to the shallow, near-surface groundwater system. A minor reduction in recharge to the near-surface groundwater system could potentially result in a measurable decline in groundwater levels, an increase in surface water runoff (discussed further in the Aquatic Environment Section 7.2) and a reduction in evapotranspiration.

The construction of structures and roads may also cause compaction of soils, affecting infiltration and groundwater recharge, and correspondingly groundwater flow. However, as shown in Figure 7.1-1, the proposed locations of the turbines, these structures will affect less than 1% of the leased lots across the SSA (i.e., if the Project works cover less than 1% of the SSA, then the maximum effect to recharge will also be less than 1%). When temporary workspaces around turbines and storage areas are removed following construction, compaction will be mitigated by ripping subsoils to reduce compaction prior to replacement of topsoil. Reduction of soil compaction through ripping will also occur along the road areas remaining when construction roads are reduced from 10 m to 5-6 m wide for permanent use, prior to replacement of topsoil. The deep ploughing of soils to reduce compaction following completion of the Construction Phase represents an effective mitigation inherent in the Project to minimize effects on infiltration, recharge and groundwater flow though changes in soil compaction. Accordingly, the above mitigation measures are deemed appropriate for mitigating changes to infiltration, recharge and groundwater flow and no residual effects are predicted; therefore this is not carried forward in the assessment.

The permanent hardening of surfaces for the Project occurs only for the turbine construction pads and substation, affecting much less than 1% of the SSA. These hardening of surfaces could reduce groundwater infiltration and recharge by creating a change in surface cover and causing compaction of soils, thereby potentially affecting groundwater flow within the immediate area. Similar to the access roads, the affected areas represent less than 1% of the leased lots across the SSA where turbines are to be located. These effects are not likely to be measurable as the native soils have very low permeability. It is more likely that water from precipitation will run-off of these surfaces, onto the surrounding ground surface, and the rate of infiltration across a given lot will remain largely unaffected. Although, theoretically, increased run-off could lead to a change in groundwater levels though increasing sheet flow to surface water bodies (or increasing evapotranspiration), this affect would only be observed in the immediate area of the turbine construction pads and substation footprint. As it is expected that the water table across the SSA will range from approximately 10 m to 60 m below ground surface, the loss of infiltration from hardened surfaces that will cover far less than 1% of the leased lots is considered to be negligible. Accordingly, no additional mitigation measures are warranted and no residual effects are identified for infiltration, recharge or groundwater flow.

Installation of the poured concrete foundation at each of the turbines could alter the near surface groundwater flow system through the creation of barriers (i.e., the installation of a 17 m x 17 m concrete slab with foundations to an approximate depth of 3 m). The groundwater flow velocities are expected to be very low and it is not likely that a measurable change in water level would be observed due to an “accumulation” of groundwater around the “barriers”. As stated above, the turbine footprint is less than 1% of the area of the leased lots within which they will be constructed. The effect of the installation of the turbine slabs and foundations on the local groundwater flow regime is considered to be negligible. Accordingly, no additional mitigation measures are warranted and no residual effects are identified for groundwater flow.

Redistribution of Soils

The construction of roads and structures are estimated to result in less than a 1% change in the surface cover over the leased lots within the SSA. Also, the workspaces around turbines and storage areas are temporary and the topsoil will be replaced (e.g., surfaces will be re-vegetated) following completion of the Construction Phase. Roads created for Construction Phase activities will be reduced from 10 to 5-6 m wide for permanent use, with the remainder having topsoil replaced following completion of the Construction Phase. This replacement of topsoil following completion of the Construction Phase represents effective mitigation inherent in the Project to minimize potential effects on groundwater infiltration, recharge and flow through changes in surface cover. Accordingly, the above mitigation measures are deemed appropriate for limiting changes to infiltration, recharge and groundwater flow and no residual effects are predicted.

Surface cover will not be altered during the placement of below-ground structures, as the native soils will be replaced immediately following the installation of the utilities and cables. The area of trench excavation will be returned to its natural state immediately upon completion of the activity. Accordingly, no additional mitigation measures are warranted and no residual effects are identified for infiltration, recharge or groundwater flow.

Below-ground structures such as utilities and cables could potentially have a minor affect on shallow groundwater flow through creation of a more permeable conduit for groundwater to flow. However, the scale of disturbance created by the utility trenches is relatively small compared to the size of the area of the leased lots, therefore it is unlikely to be measurable and would only potentially affect groundwater flow with the immediate area of the trench and not affect the Site-scale groundwater flow. As such, no additional mitigation measures are warranted, and no residual effects are identified for groundwater flow due to the existence of underground utility trenches, therefore this is not carried forward in the assessment.

Dewatering

Dewatering of foundation excavations may be required where the excavation depth is below the water table or where surface water run off may occur. Water will be pumped from the excavation and discharged. The dewatering activities would be temporary (required until foundations are completed), and are estimated to be a maximum of three months (Table 4.4.2). Accordingly, the effects of dewatering may have a measurable affect on groundwater flow in the immediate vicinity of the excavation and potentially for a period of 6 months (which is equal to 3 months of drawdown from dewatering plus 3 months of water level recovery after the cessation of pumping). The foundation pad depth is 3 mbgs therefore the drawdown would also extend to approximately 3 mbgs, and the zone of influence from pumping in low-permeability soils would be generally very limited (Powers, 1992). Based on MOE water well records there are no water wells within 100 m of the turbines. Accordingly, the change in the local groundwater flow regime due to short-term dewatering is considered to be negligible, and there are no residual effects identified for this activity. As described above, if the assessment of local shallow aquifer characteristics suggest dewatering volumes greater than 50,000 L/day, then a Permit To Take Water will be obtained form the MOE prior to the onset of Construction activities.

No measurable effects on infiltration, recharge or groundwater flow as a result of the Project are predicted for any of the Site Preparation and Construction Phase Project works and activities and no further consideration of effects on infiltration, recharge or groundwater flow is warranted.

Operation and Maintenance

No additional effects to groundwater infiltration, recharge or flow are predicted beyond those that were identified during Construction Phase activities that would result due to Operations Phase works or activities. Existing permanent and constructed roads, structures and work areas will be used for required maintenance activities. No further consideration of Operation and Maintenance Phase activities on groundwater infiltration, recharge or flow is warranted; therefore this is not carried forward in the assessment.

Decommissioning

All Decommissioning Phase works and activities have the potential to affect infiltration and recharge, and correspondingly, groundwater flow through change in surface cover, including the removal of structures, and changes to compaction.

The decommissioning of the SSA involves creation and subsequent removal of temporary roads and workspaces, the full removal of turbines (including foundations), the removal of substation and wastes, any contaminated soil, the removal of power lines and site remediation, including the grading and removal of gravel across the turbine locations. Soil for backfilling of excavations will be certified clean fill, if additional soil is required, and all excavations will be backfilled to the natural grade.

The temporary roads and workspaces will cause temporary compaction of soils, affecting infiltration and groundwater recharge, and correspondingly shallow groundwater flow. As during the Construction Phase, when temporary workspaces and road areas are removed, compaction will be mitigated by ripping subsoils to reduce compaction prior to replacement with topsoil. The deep ploughing of soils to reduce compaction and replacement of topsoil represents an effective mitigation inherent in the Project to minimize effects on infiltration, recharge and groundwater flow though changes in soil compaction.

Decommissioning will replace surface cover and create soil compaction similar to pre-construction conditions, infiltration, recharge and groundwater flow are expected to continue to be within the range of natural variation during and following decommissioning. The above measures for temporary workspaces and roads are deemed appropriate for mitigating changes to infiltration, recharge and groundwater flow during decommissioning, and no additional mitigation is warranted. No residual effects to infiltration, recharge or groundwater flow are predicted for the Decommissioning Phase.

Overall, no effects on groundwater infiltration, recharge and flow as a result of the Decommissioning Phase activities are predicted, and no further consideration of groundwater infiltration, recharge and flow is warranted, therefore this is not carried forward in the assessment.

Seismicity

Seismic conditions at the SSA are described in Section 7.1.2.4. The effects of seismicity on the Project are covered in Section 7.15 Effects of the Environment on the Project.

7.1.5 Residual Effects, Determination of Significance and Follow-up

The residual effects, after mitigation measures have been implemented, were assessed to determine their overall importance using the methods described in Section 5.3, and are summarized in Section 7.14.

There is only a negligible risk to soil and groundwater quality in the unlikely event that the mitigation measures, spill contingency plans, and BMPs fail. The overall magnitude of the effect is considered to be low (Table 7.1-3).

The level of importance, or significance, of the residual effects is based on Table 5.3-3. Based on the environmental interaction criteria the extent of the effects is limited to the SSA; the duration is immediate; the frequency occasional; and the irreversibility is low, in that more than 50% of the original value of the receptor could be regained.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Ongoing review and revision of the required BMP and EMP, including spill contingency plans which are required for all Project Phases, will be conducted to ensure that the plans are appropriate for mitigating the potential effects of leaks or spills in the SSA. No additional follow-up monitoring is recommended for the Geophysical Environment.

7.2 Aquatic Environment

This section pertains to the following questions from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Have negative effects on surface water quality, quantities or flow?* (1.1)
- *Cause significant sedimentation, soil erosion or shoreline or riverbank erosion on or off site?* (1.3)
- *Cause potential negative effects on surface or ground water from accidental spills or releases to the environment?* (1.4)
- *Use hazard lands or unstable lands subject to erosion?* (2.4)
- *Have negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g., water temperature, turbidity, etc.)? (4.5)*

Any of the above questions that have been addressed, or "screened out" in the initial screening (Table 7-1) have not been carried forward into this assessment. For the Aquatic Environment all questions have been carried forward.

7.2.1 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VECs) for the Aquatic Environment. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project. VECs can be individual valued species or guilds (representing important groups of species within food webs).

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on the Aquatic Environment have been assessed by evaluating changes in surface water flow and quality and aquatic habitat and species. Table 7.2-1 presents the VECs for the Aquatic Environment along with their rationale for selection and the specific indicators used in the assessment.

Table 7.2-1: Valued Ecosystem Components and Key Indicators Selected for the Aquatic Environment

VEC Selection	Key Indicator(s)	Selection Basis
Surface hydrology	Stream flow rates	Site development could potentially change volume of runoff.
Surface water quality	Total Suspended Sediment (TSS)	Construction and decommissioning activities have the potential to increase the suspended sediment in streams.
	Presence of fuels or lubricants (VOCs, PAHs)	Accidental spills of fuels or lubricants into watercourses could negatively affect surface water quality.
Sediment quality	Presence of fuels or lubricants (VOCs, PAHs)	Spills of fuels or lubricants into watercourses could negatively affect sediment quality.
Erosion potential	Deposition of sediment	Increased flows in the stream due to changes in the volume of runoff may increase erosion in downstream watercourses
Fish and fish habitat	Quantity and quality of fish habitat	The productive capacity of fish habitat may be affected by encroachments of access road in floodplain areas or by underground cable crossings.
	Warm water baitfish species	Some warm water fish species present in the watercourses in the SSA (e.g., Johnny darter) tend to avoid excessive siltation and turbidity therefore would be an indicator of fish habitat quality

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between VECs and the MOE Screening Criteria Questions that they address is provided in Table 7.2-2.

Table 7.2-2: MOE Screening Criteria Questions and VECs for the Aquatic Environment

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Have negative effects on surface water quality, quantities or flow? (1.1)	Surface hydrology
	Surface water quality
	Sediment quality
Cause significant sedimentation, soil erosion or shoreline or riverbank erosion on or off site? (1.3)	Surface water quality
	Sediment quality
	Erosion potential
Cause potential negative effects on surface or ground water from accidental spills or releases to the environment? (1.4)	Surface water quality
	Sediment quality
Use hazard lands or unstable lands subject to erosion? (2.4)	Surface hydrology
	Surface water quality
	Sediment quality
	Erosion potential
Have negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g., water temperature, turbidity, etc.)? (4.5)	Fish and fish habitat

For the purposes of the Aquatic Environment studies, the Site Study Area (SSA) is defined by the watercourses and waterbodies within the SSA boundaries (shown on Figure 4.3-1), and the Local Study Area (LSA) extends to the subwatersheds (Middle Ausable River subwatershed; East Sydenham River watershed),containing these local surface water features.

Surface hydrology for the SSA and the LSA was determined primarily from Ontario Base Maps (OBMs), and runoff coefficients were taken from the MTO Drainage Manual. The aquatic habitat resources within the SSA and LSA were assessed largely as a desktop exercise which involved gathering existing information from agency personnel and compiling information from agency websites and aerial photo interpretation. Existing fish and fish habitat information was obtained primarily through the following data sources:

- The Ministry of Natural Resources (MNR 2008) Aylmer office and the Ausable Bayfield Conservation Authority (ABCA 2008) supplied fish community information;
- Fisheries and Oceans Canada (DFO) London office supplied the DFO Red-line mapping of significant aquatic species (DFO 2008);
- DFO drain classifications were obtained from the St. Clair Region Conservation Authority (SCRCA 2004);

- Additional information on significant species was obtained from Natural Heritage Information Centre website (NHIC 2008);
- Species at Risk Act Public Registry (SARA 2008); and
- Mapping information, provided under license by the Ministry of Natural Resources (copyright the Queen's Printer of Ontario), obtained from Land Information Ontario interactive mapping website (http://www.lio.gov.on.ca/en/DataViews.htm).

In addition to gathering existing data pertaining to the aquatic resources in the SSA, a reconnaissance-level survey of the SSA was also conducted by Golder biologists and Mark Gallagher of Air Energy TCI on April 22, 2008. The purpose of this survey was to supplement the existing data and gain a general sense of the size of the watercourses and riparian conditions within the SSA which was then used to identify constraints for Project infrastructure siting and potential mitigation options.

To assess the extent, duration and reversibility of effects of the Project on the Aquatic Environment within the SSA, the general criteria described in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for the Aquatic Environment Key Indicators are defined in Table 7.2-3.

Table 7.2-3: Effects Assessment Criteria for the Aquatic Environment

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Stream flow rates	No change from baseline/existing conditions	Minor change in flow rates (<5%)	Moderate change in flow rates (5-10%)	High change in flow rates (>10%)
Total suspended sediment (TSS)	No change from baseline/existing conditions	Minor increase in TSS concentrations in streams (0-10 mg/L increase) during dry or wet weather	Moderate increases in TSS concentration in streams (<10 mg/L to 25 mg/L during dry weather and between 10 mg/L and the greater of 25 mg/L or 10% of the background level for wet weather)	Large increases in TSS concentration in streams (>25 mg/L during dry weather and more than the greater of 25 mg/L or 10% of the background level for wet weather
Input of VOCs/PAHs	No input of VOCs or PAHs into aquatic ecosystem	n/a	n/a	Input of hydrocarbons/ contaminants into aquatic system

Table 7.2-3: Effects Assessment Criteria for the Aquatic Environment (continued)

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Deposition of sediment	No change from baseline/existing conditions	n/a	n/a	Deposition of sediment which may result in the harmful alteration, disruption or destruction of fish habitat
Quantity and quality of fish habitat	No change in fish habitat quantity/quality from baseline/existing conditions and/or minor indirect or temporary effect on fish habitat which can be fully mitigated through the use of DFO Operational Statement	Temporary direct effect on fish habitat quality which can be largely mitigated through the use of standard and complex mitigation techniques	Permanent direct effect on fish habitat quantity and quality which can be largely mitigated through the use of complex mitigation techniques	Permanent direct effect on fish habitat quantity and quality which cannot be mitigated and a fish habitat compensation plan is required
Warm water baitfish species	Negligible or temporary effect on aquatic species which can be fully mitigated	Temporary effect on aquatic species which can be largely mitigated	Permanent direct effect on aquatic species	Significant permanent effects to aquatic species (sufficient to affect populations)

n/a= Not applicable.

The following sections describe the existing conditions of the Aquatic Environment within the SSA and LSA, and an assessment of the potential effects of the Project on Aquatic Environment VECs.

7.2.2 Existing Conditions

7.2.2.1 Surface Hydrology

The SSA is located within two major drainage areas; approximately 69% of the SSA drains toward the north into the Ausable River (via Mud Creek to the northeast and Adelaide Creek to the northwest) with the remaining 31% draining towards the south into the Sydenham River. The Ausable River ultimately drains to Lake Huron, whereas the Sydenham River ultimately empties into Lake St. Clair. The SSA drains to these watercourses via municipal drains and intermittent streams. Agriculture is the dominant land use in the area. Aerial photos show the majority of the land is used for row crops and ABCA surveys in nearby Middlesex and Lambton indicated that 13% of surveyed sites have been converted to closed tile drains (ABCA, 2001). The soil texture is typically silt clay loam to silty clay, and these soils have generally poor infiltration capacity. Discharge in the headwater streams is therefore highly variable, with short periods of high discharge and long periods with extremely low base flows (ABCA, 2001).

7.2.2.2 Surface Water and Sediment Quality

Watershed report cards from both the ABCA and the SCRCA provide limited information concerning water quality in the study area. Samples taken along the Ausable River and Sydenham River upstream of where SSA creeks join the rivers between 2001 and 2005 indicate an average total phosphorus concentration of 0.09 mg/L, which is above the MOE Provincial Water Quality Objective for nuisance plant growth of 0.03 mg/L. This is consistent with watercourses affected by agricultural runoff, and conditions within the SSA are likely to be similar.

There is limited information available to define TSS conditions in streams in the study area. The existing runoff from the site is generally expected to have low TSS concentrations during dry periods when the drainage is predominantly through sub-surface tiles (e.g., less than 25 mg/L). During periods of heavy rainfall or spring freshet the TSS concentrations can exceed 200 mg/L. Elevated TSS concentrations during these events are typical of the natural runoff expected from other nearby areas.

Since the area is predominantly cultivated, it is expected that the sediment quality has also been affected by field runoff.

7.2.2.3 Susceptibility to Erosion

The SSA drains three catchment areas situated within the jurisdictions of the ABCA and the SCRCA, namely Mud Creek, Adelaide Creek, and the Sydenham River. Regulation Limits have been defined for watercourses with the ABCA and SCRCA under Regulation 147/06 and Ontario Regulation 171/06 respectively. The Regulation Limit includes flood limits and hazardous lands that may be susceptible to erosion. Construction within the Regulation Limit requires permission under the Regulation applicable for the CA having jurisdiction. Regulation Limits, in digital and hard copy form were acquired from ABCA and SCRCA, respectively and are illustrated on Figure 7.2-1.

7.2.2.4 Fish and Fish Habitat

The majority of the SSA lies within the Ausable Bayfield watershed, specifically in the Middle Ausable subwatershed (ABCA 2001). The southern portion of the SSA occurs within the East Sydenham River watershed. The divide between these watersheds is illustrated on Figure 7.2.1.

The SSA is underlain by tight silt/clay soils which provide very little infiltration and discharge of groundwater (ABCA 2001). Thus the watercourses in the SSA typically have low to intermittent base flows, flashy runoff, turbid waters and warm temperatures. The majority of the watercourses in the SSA are classified under the Drainage Act as municipal drains. In general, the watercourses within the SSA that are classified as municipal drains have a trapezoidal cross-section and narrow riparian strips as a result of farming activity.

According to mapping provided by the SCRCA (2008) and the ABCA (2004), many of the creeks and drains in the SSA have been classified under the CA-DFO classification system. For the watercourses within the SSA these classifications include:

- Class F – intermittent
- Class C – warm water with no top predators
- Class E – warm water, top predators present, no channelization within 10 years
- Tiled
- Unclassified

Adelaide Creek is the main watercourse in the SSA and occurs within the Middle Ausable subwatershed. Adelaide Creek flows northerly across the SSA from its headwaters south of Highway 402 (near the center of the SSA) to its confluence with the Ausable River. The upper reaches (north of Highway 402 to midway between Cuddy Drive and Egremont Drive) of Adelaide Creek are classified as “warm water with no top predators”. Further downstream (north) within the northern part of the SSA, the reaches of Adelaide Creek are considered “warm water with top predators” (SCRCA 2004). Although not within the SSA, notable are the classifications of Cleland Drain, a tributary to Adelaide Creek, and Lenting Drain, a tributary of the Ausable River west of the SSA , that are considered “cold/cool water with no trout/salmon present” (SCRCA 2004).

The other main watercourse in the Middle Ausable subwatershed is Mud Creek. The headwaters of Mud Creek occur just north of Highway 402 and then flow northeasterly across the northeastern part of the SSA to its confluence with the Ausable River. Within the SSA the drainage classification for Mud Creek is “warm water with no indication of fish presence” (SCRCA 2004).

The main branch of Adelaide Creek within the SSA contains northern pike, white sucker, carp, common shiner, bluntnose minnow, creek chub, johnny darter, blackside darter and green sunfish (ABCA 2003). The western tributaries to Adelaide Creek (at stations along the western boundary of the SSA) such as Lenting Creek, contain similar warm water fish communities containing white sucker, bluntnose minnow, blacknose dace, creek chub, brook stickleback, johnny darter and green sunfish (ABCA 2003).

The southern portion of the SSA (south of Mullifarry Drive) contains numerous drains that flow southerly to their eventual confluence with the East Sydenham River. The majority of these drains are either tiled or unclassified according to the CA-DFO classification mapping (SCRCA 2004). Two of the drains in the SSA are classified as intermittent; Dortmans Drain and Stevenson Drain. There is no indication of fish species records within these watercourses. The available fish collection records provided by MNR Aylmer District for this area are limited to a watercourse outside of the SSA to the east called Stokman Drain. This watercourse is classified as “warm water with no top predators” (SCRCA 2004) and is known to contain brook stickleback, creek chub, blacknose dace, bluntnose minnow, mottled sculpin, pumpkinseed, common shiner and white sucker (pers. comm. Pud Hunter, MNR Aylmer Fisheries Biologist March 6, 2008).

MNR records indicate an element occurrence (EO) of wavy rayed lampmussel (*Lampsilis fasciola*) to the north of the SSA (NHIC 2008). Exact location of the wavy rayed lampmussel EO was not obtained as the 1km^2 species occurrence square was located entirely beyond the SSA, however from the general location of the square, this species occurs either within Adelaide Creek, Mud Creek or the Ausable River. DFO mussel SAR mapping indicates a “red” zone (watercourse reach which has habitat suitable for extirpated, endangered or threatened mussel species protected under SARA e.g., wavy rayed lampmussel) on the Ausable River upstream of the confluence of Mud Creek and an “orange” zone (watercourse reach which has habitat suitable for endangered or threatened mussel species to be protected under SARA imminently, e.g., rainbow mussel) downstream of the confluence of Mud Creek (including the confluence of Adelaide Creek). There is neither EOs nor mapped “SAR suitable habitat” for fish species of conservation concern on, or in the immediate vicinity of, the SSA (MNR 2008; DFO 2004).

A reconnaissance-level aquatic assessment was conducted within selected watercourses within the SSA on April 22, 2008. Two locations on Adelaide Creek and one on Mud Creek within the SSA were assessed to describe the watercourses in terms of fish habitat availability and to collect channel measurements at locations that potentially required crossings within a prior Project layout scenario. The locations of the assessment are depicted on Figure 7.2.1. The location on Mud Creek at the School Road crossing has an outlet pool on the east side of the road that was 3.7 m wetted width and an overall bankfull width of 7.7 m. Further downstream from this location the wetted channel narrowed and the exposed (non-wetted) channel bed contained the growth of grasses. At the time of the assessment, spring period, flow in this watercourse was very low. The channel form is typical for a system characterized by short periods of flashy flows and long periods of extremely low baseflow conditions (ABCA 2001). Substrates at this location are composed mainly of silt and narrow riparian strip (2-5 m wide) on each side of the channel is composed primarily of grasses with a few deciduous shrubs. Active bank slumping and erosion was also noted which is considered to be an indicator of the flashy flow regime and limited riparian function.

The assessment locations on Adelaide Creek averaged 9.1 m top-of-bank width, 3.4 m average channel width and 2.6 m average wetted width at the time of survey. Riparian vegetation was limited to mown grasses adjacent to the creek banks, and there was evidence of active bank slumping and erosion. Cyprinids (species undetermined) were observed in Adelaide Creek and at the Adelaide Creek tributary location. In general, the aquatic habitat observed during the site reconnaissance is typical for watercourses throughout the SSA. The Fish Habitat Management Plan document prepared by the ABCA (ABCA, 2001) confirms that flow conditions in these headwater tributaries of the Ausable River are highly variable. The high levels of nutrient input in combination with very low summer base flow promotes algae growth and the lack of riparian vegetation, the underlying surficial geology (i.e., clayey soils), and often unrestricted cattle access have all contributed to the high level of overland sediment transport, bank degradation, sedimentation and erosion in these watercourses.

7.2.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on the Aquatic Environment is provided in Table 7.2-4. The assessment of effects to the Aquatic Environment was based on the following assumptions and limitations:

- The assessment was conducted for the area encompassed by the SSA and the LSA (based on maps available on August 30, 2008).
- Existing public roads in the SSA are assumed to be 12 m wide paved roads.
- The existing private roads within the SSA are assumed to be dirt roads (no gravel, < 4 m wide).
- It was assumed that each access road will have a maximum temporary width of 10 m and that the road bed will be composed of clean materials (gravel road).
- Access road width is to be reduced to 5-6 m during the Operation and Maintenance Phase, and the unused area is assumed to revert to cultivated land use.
- Turbine laydown areas are assumed to be 3,600 m^2.

- It was assumed that reclaimed road width, laydown areas and construction areas can be represented as open/grassed areas that will eventually become cultivated again.
- Details of the designs of all crossings of drainage features (if necessary) will include input from a drainage engineer to ensure maintenance of proper drainage under new access roads.
- Encroachment into the ABCA/SCRCA Regulation Limit will require a permit under Ontario Regulation 147/06, Ontario Regulation 171/06, respectively. This regulation regulates the following activities:
    - Construct any building or structure or permit any building or structure to be constructed in or on a pond or swamp or in any area susceptible to flooding during a regional storm; (residences, buildings, additions, pools, culverts, bridges);
    - Place or dump fill of any kind or permit fill to be placed or dumped in the area described in the schedule, whether such fill is already located in or upon such area or brought to or on such area from some other place or places; (filling, grading); or
    - Straighten, change, divert or interfere in any way with the existing channel of a river, creek, stream or watercourse (erosion control works, culverts, natural channel realignment, footings for bridges/creek crossings, any water works associated with the physical bed or bank(s) of a watercourse.

A summary of the identification and assessment of potential interactions between the Project and the Aquatic Environment, according to the MOE screening criteria are found in Table 7.2-4.

Table 7.2-4: Identification and Assessment of Potential Interactions with VECs of the Aquatic Environment

Relevant Project Activity	Surface hydrology	Surface water quality	Sediment quality	Erosion Potential	Fish and fish habitat
Site Preparation and Construction					
Surveying and siting operations	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**
Land clearing	**(yes)** • Changes to site runoff quantity	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Changes to site runoff quantity • Erosion/or sedimentation	**(yes)** • Increased erosion potential from cleared or hardened ground	**(yes)** • Clearing of riparian vegetation • Change in stability of channel banks • Increase in erosion and sediment deposition in watercourses
Road construction/modification	**(yes)** • Changes to site runoff quantity	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Changes to site runoff quantity • Erosion/or sedimentation	**(yes)** • Increased erosion potential from gravel roads	**(yes)** • Construction of 10m wide access road within regulated floodplain areas immediately adjacent to stream channel • Change in stability of channel banks • Increase in erosion and sediment deposition in watercourses
Delivery of equipment	**(no)**	**(yes)** • Accidental spills of fuels and lubricants	**(no)**	**(no)**	**(no)**
Temporary storage facilities	**(yes)** • Changes to site runoff quantity	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Changes to site runoff quantity • Erosion/or sedimentation	**(yes)** • Increased erosion potential from cleared ground	**(yes)** • Stripping of topsoil around turbine sites (60m x 60m area) may encroach on the regulated floodplain areas • Increase in erosion and sediment deposition in watercourses
Foundation construction	**(yes)** • Changes to site runoff quantity	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Changes to site runoff quantity • Erosion/or sedimentation	**(yes)** • Increased erosion potential from foundations	**(yes)** • 3m deep excavation for foundations may require dewatering which in turn could affect baseflow in adjacent watercourses • Increase in erosion and sediment deposition in watercourses
Tower and turbine assembly and installation	**(yes)** • Changes to site runoff quantity	**(yes)** • Accidental spills of fuels and lubricants	**(no)**	**(no)**	**(no)**

Table 7.2-4: Identification and Assessment of Potential Interactions with VECs of the Aquatic Environment (continued)

Relevant Project Activity	Surface hydrology	Surface water quality	Sediment quality	Erosion Potential	Fish and fish habitat
Interconnection from turbines to substation	**(yes)** • Changes to site runoff quantity	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Changes to site runoff quantity • Erosion/sedimentation	**(yes)** • Increased erosion potential due to excavations and construction at water crossings	**(yes)** • Underground cable crossings of watercourses • Change in stability of channel banks • Increase in erosion and sediment deposition in watercourses
Transmission line to power line	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**
Fencing/gates	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**
Parking lots	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**
Operation and Maintenance					
Wind turbine operation	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**
Maintenance activities	**(no)**	**(yes)** • Accidental spills of fuels and lubricants	**(no)**	**(no)**	**(no)**
Decommissioning					
Removal of turbines and ancillary equipment	**(yes)** • Changes to site runoff quantity	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Changes to site runoff quantity • Erosion/sedimentation	**(yes)** • Increased erosion potential from cleared ground	**(yes)** • Removal of turbines may disturb regulated floodplain areas • Increase in erosion and sediment deposition in watercourses
Removal of buildings and waste	**(yes)** • Changes to site runoff quantity	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Changes to site runoff quantity • Erosion/sedimentation	**(yes)** • Increased erosion potential from cleared ground	**(no)**
Removal of power line	**(no)**	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Changes to site runoff quantity • Erosion/sedimentation	**(yes)** • Increased erosion potential from cleared ground • Increased erosion potential due to excavations and construction at water crossings	**(yes)** • Removal of underground cable crossings of watercourses • Change in stability of channel banks • Increase in erosion and sediment deposition in watercourses
Site remediation	**(no)**	**(yes)** • Accidental spills of fuels and lubricants	**(yes)** • Erosion/sedimentation	**(yes)** • Increased erosion potential from cleared ground	**(yes)** • Reinstating topsoil, reseeding and replanting within disturbed areas adjacent to watercourses

7.2.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which surface water quality and flow and aquatic habitat may be affected by the various Project activities include:

- Effects to surface drainage patterns, and habitat quantity and quality during the Site Preparation and Construction, Operation and Decommissioning Phases;
- Effects to aquatic habitat and species through sedimentation, loss of habitat (watercourse crossings) and riparian vegetation; and
- Effects on water quality from a spill or leak of fuels, lubricants or other chemicals during the Site Preparation, Operation and Construction Phase or through the removal of wastes from the SSA.

During the initial assessment, specific provincial screening questions are asked to identify potential interactions with the environment. The topics that were identified as having a potential interaction with the Aquatic Environment are as follows:

- Potential for adverse effects to surface water quality, quantity of flows;
- Potential for significant sedimentation, soil erosion or shoreline or riverbank erosion on or off site;
- Potential for adverse effects to surface water from spills or releases to the environment;
- Potential to cause erosion in regulation lands; and
- Potential for negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g., water temperature, turbidity, etc.).

The assessment of effects that follows addresses these topics as no other interactions were determined to have an effect on the Aquatic Environment. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and if applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are advanced to Section 7.2.5 for an analysis of significance.

7.2.4.1 Surface Hydrology – Changes to Surface Water Quantity

Surface water quantity from the SSA can be estimated by multiplying the drainage area, the runoff coefficient and precipitation amount. This can be done on a variety of time scales, from single storm events to annual basis. The project is not expected to affect the total drainage area to either the Ausable River or the Sydenham River, nor is it expected to affect precipitation amounts at the project site. The runoff coefficient, on the other hand, can be expected to change as the land use changes. A comparison of the runoff coefficients at various stages in the Project will therefore indicate the effect that the Project will have on surface water quantity.

As previously mentioned, runoff coefficient varies by land use. Land uses with high runoff per unit area values (such as rooftop sand parking lots) have high runoff coefficients, while land uses with low runoff per unit area values (such as forests) have lower runoff coefficients. The higher the runoff coefficient, the more runoff is expected to be produced from a given amount of rainfall. The area weighted runoff coefficient for an area is estimated by first determining the area of each land use (as a percentage of the total catchment area), multiplying the percentage by the runoff coefficient for that particular land use, and adding together the results for all the land uses in the catchment.

The area weighted runoff coefficients were calculated at each stage of the project for three drainage catchments leaving the SSA: The portion draining to Mud Creek to the northeast, the portion draining to Adelaide Creek to the northwest, and the portion draining to the Sydenham River to the south. A comparison of the runoff coefficients between phases provides an indication of the relative increase in the expected runoff from the SSA to each of the three catchments. The runoff is expected to increase by approximately 1.4% to 3.0% during the Site Preparation and Construction Phase. This increase would not be measurable since in stream flow measurements are generally only accurate to within ±5%. During the Operation and Maintenance Phase, the runoff from the SSA is expected to be within 0.1% and 0.2% of the existing runoff, once again not a measurable difference.

Table 7.2-5: Summary of Land Areas and Changes to Drainage

Mud Creek					
Land Area (% of the SSA)	**Existing Conditions**	**Construction Phase**	**Initial Operations Phase[a]**	**Final Operations Phase[b]**	**Runoff Coefficient[c]**
Cultivated Fields (ha)	1123.3	1095.7	1120.2	1120.2	0.35
Developed-Paved (ha)	11.6	11.6	11.6	11.6	0.90
Gravel - Roads and Turbines	0.0	27.6	3.1	3.1	0.50
Forested (ha)	109.2	109.2	109.2	109.2	0.25
Total (ha)[d]	**1244**	**1244**	**1244**	**1244**	
Weighted Runoff Coefficient	0.346	0.357	0.347	0.347	
Increase		3.0%	0.2%	0.2%	

Table 7.2-5: Summary of Land Areas and Changes to Drainage (continued)

Adelaide Creek					
Land Area (% of the SSA)	**Existing Conditions**	**Construction Phase**	**Initial Operations Phase[a]**	**Final Operations Phase[b]**	**Runoff Coefficient[c]**
Cultivated Fields (ha)	4031.1	3983.9	4023.1	4023.1	0.35
Developed-Paved (ha)	56.7	56.7	56.7	56.7	0.90
Gravel - Roads and Turbines	0.0	47.2	8.0	8.0	0.50
Forested (ha)	393.2	393.2	393.2	393.2	0.25
Total (ha)[d]	**4481**	**4481**	**4481**	**4481**	
Weighted Runoff Coefficient	0.348	0.353	0.349	0.349	
Increase		1.4%	0.1%	0.1%	
Sydenham River					
Land Area (% of the SSA)	**Existing Conditions**	**Construction Phase**	**Initial Operations Phase[a]**	**Final Operations Phase[b]**	**Runoff Coefficient[c]**
Cultivated Fields (ha)	2327.3	2288.0	2323.0	2323.0	0.35
Developed-Paved (ha)	20.9	20.9	20.9	20.9	0.90
Gravel - Roads and Turbines	0.0	39.3	4.3	4.3	0.50
Forested (ha)	225.9	225.9	225.9	225.9	0.25
Total (ha)[d]	**2574**	**2574**	**2574**	**2574**	
Weighted Runoff Coefficient	0.346	0.353	0.346	0.346	
Increase		2.1%	0.1%	0.1%	

Notes:
[a] Initial Operations Phase – Reclaimed areas as grassland;
[b] Final Operations Phase – Reclaimed areas as forest and pasture;
[c] Typical runoff coefficients (MTO 1997); and
[d] All area values are approximations based on available mapping.

Site Preparation and Construction

During the Site Preparation and Construction Phase, land clearing, road construction/modification, temporary storage facilities, foundation construction and the interconnection from turbines to the substation have the potential to affect runoff patterns by changing the existing surface cover. The runoff is expected to increase by approximately 3%, 1.4% and 2.1% in the Mud Creek, Adelaide Creek and Sydenham River tributaries, respectively, during the Site Preparation and Construction Phase. This is considered a low level of magnitude. Given that flow measurements are usually accurate to within ±15%, this change may not be measurable and therefore may be considered negligible. Furthermore, activities such as the interconnection of turbines to the substation will only result in short-term changes to runoff patterns as the existing cover will be restored after the distribution lines are installed and the trenches files and revegetated. Therefore, this is not carried further in the assessment.

As outlined in Table 7.2-5, the expected change in surface water quantity as a result of land clearing is minimal, and thus no mitigation is required. This has therefore not been carried forward in the assessment.

Operation and Maintenance

During the Operation and Maintenance Phase of the Project, the runoff from the SSA is expected to be within less than 1% of the existing runoff. This is not a measurable difference and is considered negligible, therefore is not carried further in the assessment.

Decommissioning

During the Decommissioning Phase, removal of turbines and ancillary equipment, removal of buildings and waste, and removal of power lines, and site remediation will all result in changes to runoff patterns. The changes in land use will then change from those during the operations phase, and revert to land use that is similar to the baseline conditions. Immediately after decommissioning, the areas around the turbines and access roads will be planted with an early successional vegetation community of open or grasslands. Site grading will be required and exposed soil may therefore be exposed for a short-term period while turbine foundations are removed. Similarly, roads will be removed. During decommissioning, the expected runoff is expected to be similar to the operational period. This is not a measurable difference and is considered negligible. Following decommissioning the restored open areas will revert to agricultural uses and the expected runoff is expected to be the same as the existing conditions.

Changes to Site runoff quantity/surface hydrology therefore has no residual effects and is not carried further into the assessment.

As outlined in Table 7.2-5, the expected change in surface water quantity as a result of decommissioning is minimal, and thus no mitigation is required. This has therefore not been carried forward in the assessment.

7.2.4.2 Surface Water and Sediment Quality

Site Preparation and Construction

Sedimentation

During the Site Preparation and Construction phase, land clearing, road construction/modification, temporary storage facilities, foundation construction and the interconnection from turbines to the substation have the potential to affect water quality by increasing suspended sediment contributions to local streams and ditches. These contributions can be the result of activities such as, but not limited to:

- Increased erosion in areas where vegetation has been removed;
- Increased erosion in local areas where storm runoff flows increase due to the development of the Site;
- Tracking of mud and soil onto local roads by construction equipment; and
- Movement of fine material from newly constructed gravel roads and construction areas.

The increases in sediment contributions are generally the highest during periods of heavy rainfall and snowmelt (spring freshet). During dry and frozen periods, there is no runoff from the construction areas and therefore, measurable effects on suspended sediment concentrations are not expected.

The removal of vegetation during land clearing will increase the surface runoff thereby creating the potential for soil erosion and sedimentation to watercourses. In particular, land clearing in riparian zones for access roads has the potential to affect bank stability and stream temperature. However, the increase in runoff is expected to be minimal (0.45% to 0.67%) and for the most part the clearing of riparian vegetation will be localized and in previously disturbed areas (existing roads will be widened), thus is expected to have a minor effect on aquatic species.

The erosion impacts on water quality can be further minimized by implementing Best Management Practices (BMPs) for construction. There are several guideline documents that outline these BMPs prepared by various conservation authorities (i.e., Toronto Region Conservation Authority, Grand River Conservation Authority) and provincial ministries (MOE, MNR). The following points outline some practices that are commonly included:

- Plan construction activities to minimize the disturbed area at any given time;
- Interception and diversion of storm runoff around disturbed areas;
- Stabilization of disturbed areas through grading and re-vegetation;
- Implanted buffer strips of vegetation between disturbed areas and watercourses;
- Minimization of off-site vehicle tracking of soil;
- Construction of any stormwater and sediment ponds prior to any other construction activities;
- Restriction of water use for dust control only;
- Installation of temporary erosion control fencing prior to any grading or excavation to minimize silt migration from the site and to delineate the limits of stripping and grading;
- Installation of erosion control fencing around all stockpiles, manholes and catchbasins;
- Placement of geotextile fabric under catch basin grates;

- Removal of accumulated sediment from control measures (ponds, fencing, etc) at completion of construction or after significant accumulation; and
- Minimize construction during wet weather.

A series of overhead and underground cables will connect the turbines to the substation. There are three underground cable crossings at Mud Creek, east of School Road between Cuddy Drive and Egremont Drive (adjacent to Turbine #6). Depending on the methods of construction, crossing watercourses with the cables may temporarily cause increased sedimentation which affects water quality and fish habitat. The magnitude and duration of the potential effects will depend on the characteristics of the watercourses (e.g., flow regime, water velocity, substrates and erodibility of banks) and the crossing technique used.

Construction of the underground cable crossings will take place during the fisheries window, at which time the intermittent streams are generally dry. Should in-stream works be required to be completed within the wetted channel, turbidity and TSS will be monitored during days where in stream construction is occurring. The monitoring will be based on comparative measurements of a single upstream control site and one to two downstream monitoring stations situated within the channel and proximal to the work area. The period of monitoring will extend from just prior to the start of in-stream work and following the work to the point that there is no appreciable difference in water quality between the control and monitoring stations. Any instance of particulate matter increases in downstream samples that are beyond CCME criteria will necessitate additional mitigation or modification of construction practices to reduce the duration, extent and magnitude of effects to an acceptable level.

Accidental Spills of Hydrocarbons

Accidental spills of hydrocarbons (diesel fuel, oil, etc.) during the construction phase are considered as potential sources of contamination which may affect water quality.

The potential impacts on water and sediment quality by accidental spills of hydrocarbons can be minimized by implementing a spill response plan. This plan will include:

- Conducting refueling and maintenance in designated areas;
- Proper maintenance of vehicles and construction equipment;
- Maintain a supply of spill control materials at the Site (absorbent material, absorbent booms);
- Regular maintenance of construction vehicles, including regular inspection of vehicles for leaking fluids; and
- Proper training of workers for spill prevention and containment.

These measures will be implemented by AET as appropriate as part of their overall environmental protection and mitigation plan.

Operation and Maintenance

Sedimentation

The operation and maintenance phase includes limited maintenance activities and little or no changes to the current traffic patterns, therefore no effects on water quality with respect to suspended sediment are expected during the operation and maintenance phase of the Project.

Accidental Spills of Hydrocarbons

During the operation and maintenance phase of the Project, the expected risk of spills is significantly lower due to the reduced vehicle traffic on the Site.

Decommissioning

Sedimentation

During the decommissioning and abandonment phase, removal of turbines and ancillary equipment, removal of buildings and waste, and removal of power lines, and site remediation could contribute to increased sediment load to the local watercourses. Best management practices, such as those described for the Site Preparation and Construction Phase, will be implemented by AET as appropriate as part of their overall environmental protection and mitigation plan.

Accidental Spills of Hydrocarbons

Accidental spills of hydrocarbons (diesel fuel, oil, etc.) during the decommissioning phases are considered as potential sources of contamination which may affect water quality. Best management practices, such as those described in the Site Preparation and Construction Phase, will be implemented by AET as appropriate as part of their overall environmental protection and mitigation plan.

7.2.4.3 Susceptibility to Erosion

Site Preparation and Construction

Sections of both Mud Creek, Adelaide Creek, and some drains draining south towards the Sydenham River have been designated as being within the Regulation Limit of the ABCA or SCRCA, which includes lands that are susceptible to erosion resulting from increased runoff from the SSA. As outlined in Table 7.2-5, the expected change in surface water quantity as a result of site preparation and construction is minimal, and thus no mitigation is required.

The water crossings associated with the construction of Turbines 6, 7 and 8 occur within the Regulation Limit. This land is potentially prone to increased erosion during the disturbance associated with the site preparation and construction work. Permission for this work must be obtained from the ABCA, in accordance with Ontario Regulation 147/06.

Operation and Maintenance

As outlined in Table 7.2-5, the expected change in surface water quantity as a result of operation and maintenance construction is minimal, and thus no mitigation is required. This has therefore not been carried forward in the assessment.

Decommissioning

As outlined in Table 7.2-5, the expected change in surface water quantity as a result of decommissioning is minimal, and thus no mitigation is required. This has therefore not been carried forward in the assessment.

7.2.4.4 Fish and Fish Habitat

Site Preparation and Construction

During the Site Preparation and Construction Phase of the Project, effects on fish and fish habitat through the alteration of riparian and regulated floodplain areas, and watercourse crossings are considered. The activities that have the potential to affect fish and fish habitat are land clearing, access road construction, temporary storage facilities, foundation construction and the underground cable connection between turbines.

The layout of turbine sites, cable routes and access roads was carefully planned to minimize potential effects on the natural environment and in particular, fish and fish habitat. The final layout avoids water crossings for access roads and minimizes the number of cable crossings. It also sites turbines outside of ABCA and SCRCA Regulation Limit boundaries. In essence, the final layout plan represents mitigation inherent in the Project that is effective in avoiding impacts to fish and fish habitat.

Direct impacts to aquatic habitat are limited to the activities associated with the underground cable crossings and the construction of an access road within a regulated floodplain area. There are three cable crossings on the Mud Creek system and one location where an access road is within the ABCA regulation limit adjacent to a tributary to Adelaide Creek as shown on Figure 7.2.1 (insets). All watercourses affected are classified as intermittent (Type F). There are other crossings of mapped drainage features; however these features do not contain fish habitat and in most instances are tile drained. Therefore, it is only the effects on those watercourses that are known or assumed to contain fish and fish habitat that are carried forward in this assessment.

The required land clearing activities for new access roads and the underground cable will include removal of riparian vegetation at the crossing location. For the most part, the riparian vegetation consists of a narrow strip of herbaceous vegetation between an agricultural field and the bank of the watercourse, however there are a few areas with treed riparian zones that will be affected by land clearing activities (specifically at the underground cable connection between turbine #6, #7 #8 on Mud Creek). The removal of riparian vegetation has the potential to reduce bank stability, alter thermal conditions and reduce organic inputs to the watercourse. For the most part, the clearing of riparian vegetation will be in agriculturally disturbed areas with few areas of woody riparian vegetation as stated above. The workspace associated with the underground cabling is a 5 m wide swath. Inherent mitigation in the project description is the immediate backfilling of the cable trench to prevent soil loss and erosion. Topsoil and subsoil will be replaced and the area regraded and reseeded immediately following construction to quickly restore vegetative conditions. The channel form will be reinstated to pre-disturbance conditions.

A 60 m by 60 m workspace around turbines will be cleared and topsoil will be stripped. There are five turbines located just outside of regulated floodplain areas on intermittent watercourses. The cleared workspace may encroach within the regulated floodplain areas, and result in riparian vegetation loss or increased potential for overland sediment transport to watercourses. However, these areas are only temporary and will be regraded and revegetated immediately after construction. Similarly, access roads created for the construction phase activities will be reduced from 10 to 5 m wide for permanent use (if *Access Road Type 2* is used), with the remainder having topsoil replaced and reseeded following completion of the Construction Phase.

There are three underground cable crossings of Mud Creek (Figure 7.2.1(inset)). Mud Creek is classified as an intermittent (Type F) watercourse. In consideration of this type of watercourse, it is recommended that the appropriate crossing method is the "Isolated or Dry Open Cut stream crossing" and the methods for constructing the crossing is to be consistent with the DFO Operational Statement (DFO 2008). The *Measures to Protect Fish and Fish Habitat when Carrying Out an Isolated or Dry Open-Cut Stream Crossing* addresses the required mitigation when using this technique to cross a watercourse. By following the conditions and measures set out in this operational statement the activities will be in compliance with subsection 35(1) of the *Fisheries Act*. For all watercourse crossings, the details of crossing techniques and the timing of construction (fisheries timing window) will be confirmed. Timing windows for in-stream work are specified by the MNR in order to ensure that work is not conducted during critical life stages of fish, such as migration and spawning. Typical timing windows prohibit in-stream work for several months in the spring for warm-water habitats.

At the request of the landowner, and to avoid impacts to agricultural activities, there is one proposed access road/underground cable alignment located immediately adjacent to a tributary of Adelaide Creek. This tributary, classified as intermittent (Type F), has been straightened historically and has a very narrow herbaceous riparian strip or agricultural field adjacent to the bank. However, the Regulation Limit adjacent to this tributary extends into the adjacent agricultural areas where the access road and underground cable are to be located. The construction of these facilities within the Regulation Limit has the potential to affect the bank stability by stripping the banks of vegetation and topsoil, constructing a semi-impermeable road surface immediately adjacent to the channel and allowing road runoff directly to the watercourse. In this instance however, the channel is straightened, the riparian strip is very narrow and consists of herbaceous vegetation only and the adjacent land is regularly plowed and planted. Therefore, this system is likely adapted to high runoff and high sediment loads and any effects related to the Project are likely to be immeasurable. Despite this, site conditions during the construction of this access road and cable crossing will be stringently managed through the mitigation measures recommended below in order to avoid harmful effects on fish and fish habitat.

Excavation for the turbine foundations and access roads will be required. Dewatering of foundation excavations may be required where the excavation depth is below the water table. As discussed in Section 7.2.2.4, baseflow in the streams in the SSA is very minimal (ABCA, 2001). Although site specific hydrogeological information is unavailable, groundwater contribution is expected to be nominal. In addition, it is stated in the hydrogeological section (see Section 7.1) that the zone of influence from pumping in low-permeability soils would generally be very limited. The dewatering activities would be temporary (required until foundations are completed), and would occur over a maximum of three months (Table 4.4.2). Therefore, it is unlikely that dewatering that may occur will affect the baseflow in the watercourses.

With the implementation of the following mitigation measures, effects on fish and fish habitat during the Site Preparation and Construction Phase will be minimized:

- Ensure proper containment and stabilization of all construction-generated sediment to minimize overland sediment transport.
- Design and install stringent erosion and sediment control measures (i.e., silt fence adjacent to watercourses in the areas in which access roads and/or turbine foundations/temporary storage facilities will be constructed) and maintain these measures throughout construction until disturbed areas are regraded and revegetated.
- Re-stabilize and re-vegetate exposed surfaces as soon as possible, using native vegetation. It is recommended that any woody riparian vegetation that is removed (trees and shrubs) be replanted with similar native tree and shrub species.
- Ensure a clear delineation of work site vegetation clearing zones and vegetation retention zones to minimize the risk of off-site vegetation impacts and avoid incidental impacts as

a result of temporary stockpiling, debris disposal and access during construction. Ensure the use of appropriate vegetation clearing techniques (e.g., trees to be felled away from the retained vegetation).

- Ensure appropriate clearing and disposal of all construction-related debris following construction.
- Employ proper handling of potentially toxic construction materials and adhere to spill management protocols.
- Ensure an adequate number of emergency spill kits are maintained on-site during construction and operation.
- Implement environmental inspection during construction to ensure that protection measures are implemented, maintained and repaired and remedial measures are initiated where warranted.

Operation and Maintenance

There are no anticipated effects on fish or fish habitat from the activities during the Operation and Maintenance Phase. This has therefore not been carried forward in the assessment.

Decommissioning

The removal of turbines, buildings, underground cables and site remediation has the potential to affect fish and fish habitat. Similar to the effects of facility construction adjacent to aquatic features, the removal of these facilities during the decommissioning of the Project also has the same potential effects. Decommissioning activities may disturb riparian vegetation, destabilize banks and contribute to sedimentation and erosion in watercourses.

In the case of underground cable crossings of intermittent watercourses, the cable can be removed during the low flow period when the channel is dry, so there is no need to isolate the work area, fish will not be affected and the disturbed channel bed can be reinstated without risk of sedimentation to the watercourse. As stated, this type of activity (Dry Open Cut Crossing) is addressed through a DFO Operational Statement and as such a trigger of the Fisheries Act will be avoided and this activity can proceed under a DFO Letter of Advice.

The removal of turbines that are situated near the Regulation Limit and consequently the exposure of bare soils have the potential to affect sedimentation and erosion in the aquatic features. However, site remediation involves regrading the turbine sites to restore terrain profiles and revegetating the sites. Overall, the temporary effect of exposed soils at these sites is completely mitigated through site remediation.

The mitigation measures outlined in the *Site Preparation and Construction* section are applicable to the activities associated with decommissioning as well. Specifically, installation and maintenance of erosion and sediment control measures, proper clearing and disposal of all decommissioned materials, site remediation activities (regrade and re-vegetate exposed surfaces as soon as possible using native vegetation), proper handling of potentially toxic materials and adherence to spill management protocols.

7.2.5 Residual Effects, Determination of Significance and Follow-up

The residual effects, after mitigation measures have been implemented, were assessed to determine their overall importance using the methods described in Section 5.3, and are summarized in Section 7.14. In terms of assessing the residual effects to fish, habitat and vegetation, their population and not the individuals were taken into account (i.e., when determining reversibility (Section 7.14), the ability of the fish populations to return to an equal or improved baseline condition was considered, rather than the individual fish that were affected. The level of importance of the residual effect was determined by considering the VEC as a whole and not the different methods by which it could be affected. For example, fish and fish habitat could be affected through sedimentation/erosion, spills of contaminants, or it could be affected directly through removal, however the level of importance of the residual effect reflects the overall effect of the Project on that VEC in each particular phase.

7.2.5.1 Surface Water and Sediment Quality

Site Preparation and Construction

Sedimentation

With the implementation of the BMPs the risk of sedimentation-induced surface water quality effects are anticipated to be minimal. However, should extreme weather occur during construction, there is the possibility of reduced effectiveness of some of the mitigation measures, resulting in increased sedimentation of watercourses; however, these occurrences, although extending beyond the SSA, would be temporary in duration, and similar in nature to natural processes occurring during extreme weather events. The overall magnitude of the effect of the Project on surface water quality (sedimentation) during this phase is considered low (Table 7.2-3). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on surface water quality (sedimentation) during this phase is restricted to the LSA; the duration is short-term (limited to the Construction and Site Preparation Phase); the frequency is negligible in that they are likely to occur occasionally, and the irreversibility is negligible in that the receptor has the ability to return to baseline. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECT: MINIMAL

Accidental Spills of Hydrocarbons

With the implementation of the above mitigation measures listed in previous sections, spills of hydrocarbons will be unlikely. Furthermore, given quantities of hydrocarbons that would be involved in a spill and the limited pathways for any spilled hydrocarbons to enter watercourses, the significance of this effect is considered to be negligible. As such, no residual effects are expected. There is always the potential, however that mitigation measures and BMPs will fail, therefore some minor residual effects have been accounted for. Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on surface water quality (spills of contaminants) during this phase restricted to the LSA; the duration is short-term (limited to each individual Project Phase); the frequency is negligible in that they are likely to occur occasionally, at most; and the irreversibility is low in that the receptor has the ability to return to more than 50% of the original value. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECT: MINIMAL

7.2.5.2 Fish and Fish Habitat

Site Preparation and Construction

No measurable effects on fish or fish habitat as a result of the Project are predicted for any of the Site Preparation and Construction Phase Project works and activities and no further consideration of effects on fish and fish habitat is warranted. Residual effects are expected to be negligible if any potential fish habitat alterations are mitigated for through appropriate crossing techniques (Dry Open Cut), revegetation of disturbed areas adjacent to watercourses, sediment and erosion control and appropriate spill management.

Based on the effect assessment criteria in Table 7.2-3, the overall magnitude of the effects of the Project on fish and fish habitat during this phase is negligible. In addition, the effects are restricted to the SSA; the duration short-term (limited to the Site Preparation and Construction Phase); the frequency is negligible in that they are likely to occur occasionally, and the irreversibility is low in that the receptor has the ability to return to more than 50% of the original value. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Decommissioning

For the most part, the effects on fish and fish habitat during the decommissioning of the Project are similar to those during the construction phase. The removal of access road and facilities adjacent to watercourses that have the potential to affect fish habitat will be mitigated and negligible to no residual effects are anticipated. The removal of underground cable will be performed in the dry channel period to mitigate effects on the fish and fish habitat in these areas. The overall magnitude of the effect of the Project on fish and fish habitat during this phase is considered negligible (Table 7.2-2). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on fish and fish habitat during this phase is restricted to the SSA; the duration is short-term (limited to the Site Preparation and Construction Phase); the frequency is negligible in that they are likely to occur occasionally, and the irreversibility is low in that the receptor has the ability to return to more than 50% of the original value. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

7.3 Terrestrial Environment

This section pertains to the following questions from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Be inconsistent with the Provincial Policy Statement, provincial land use or resource management plans?* (2.2)
- *Cause negative effects on rare, threatened or endangered species of flora or fauna or their habitat?* (4.1)
- *Cause negative effects on protected natural areas or other significant natural areas?* (4.2)
- *Cause negative effects on wetlands?* (4.3)
- *Have negative effects on wildlife habitat, populations, corridors or movement?* (4.4)
- *Have negative effects on migratory birds, including effects on their habitat or staging areas?* (4.6)
- *Have negative effects on locally important or valued ecosystems or vegetation?* (4.7)

For the Terrestrial Environment, none of the above questions have been addressed, or "screened out" during the initial screening (Table 7-1) and, therefore, all questions have been carried forward in this assessment.

7.3.1 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VECs) for the Terrestrial Environment. VECs are features of the environment selected to be a focus of the ESR/EIS because of their ecological, social or economic value and their potential vulnerability to effects of the Project. VECs can be individual valued species or guilds (representing important groups of species within ecosystems).

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on the Terrestrial Environment have been assessed by predicting changes in bird, bat, other wildlife, and endangered and threatened species richness and abundance. In addition, the effect of the Project on ecosite communities, and designated or environmentally significant areas, was also assessed. Table 7.3-1 presents the VECs for the Terrestrial Environment along with their rationale for selection and the specific indicators used in the assessment.

Table 7.3-1: Valued Ecosystem Components and Key Indicators Selected for the Terrestrial Environment

VEC Selection	Key Indicator(s)	Selection Basis
Flora and habitat types	Number of ecosites and their area based on Ecological Land Classification (ELC)	There is the potential for loss, fragmentation or alteration of habitat for floral and faunal species protected by legislation.
Birds	Number of species and their abundance	Birds are protected by federal and/or provincial legislation and the number of species and their abundance may be related to potential for turbine collision or habitat alteration.
Bats	Number of species and their activity	The use of areas by bats is expected to increase the probability of turbines impacting populations of some bat species that are protected by legislation.
Other wildlife	Abundance of other wildlife species (i.e., coyotes, hares, squirrels)	The Project could have direct or indirect impacts on other wildlife species that are protected by legislation.
Listed endangered and threatened species	Number of individuals of an endangered or threatened species observed	Species listed as endangered or threatened or their habitat protected by legislation.
Wetlands	Water quality and integrity of wetlands	Sedimentation, potential fuel spills and loss of vegetation during construction and decommissioning have the potential to affect water quality, hydrology and the integrity of the wetlands that are important from a provincial policy perspective.
Designated areas	Provincially significant wetlands (PSWs) and Areas of Natural and Scientific Interest (ANSIs)	PSWs and ANSIs are considered ecologically important from a provincial policy/legislation perspective.

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between VECs and the MOE Screening Criteria Questions that they address is provided in Table 7.3-2.

Table 7.3-2: MOE Screening Criteria Questions and VECs for the Terrestrial Environment

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Be inconsistent with the Provincial Policy Statement, provincial land use or resource management plans? (2.2)	Listed endangered and threatened species
	Designated areas
Cause negative effects on rare, threatened or endangered species of flora or fauna or their habitat? (4.1)	Flora and habitat types
	Listed endangered and threatened species
	Designated areas
Cause negative effects on protected natural areas or other significant natural areas? (4.2)	Designated areas
Cause negative effects on wetlands? (4.3)	Wetlands
Have negative effects on wildlife habitat, populations, corridors or movement? (4.4)	Flora and habitat types
	Birds
	Bats
	Other wildlife
Have negative effects on migratory birds, including effects on their habitat or staging areas? (4.6)	Birds
	Flora and habitat types
Have negative effects on locally important or valued ecosystems or vegetation? (4.7)	Flora and habitat types
	Designated areas

For the purposes of the Terrestrial Environment studies, the Site Study Area (herein referred to as the SSA) encompasses an area of approximately 8,299 ha and is defined by the optioned lots within the SSA boundaries (Figure 7.3-1). The Local Study Area (LSA) extends approximately 10 km in all directions from the SSA boundary.

The terrestrial resources within the SSA were assessed primarily based on data gathered during field studies (described in the next section), but also utilized existing information from agencies (e.g., Ontario Ministry of Natural Resources (MNR) and the Canadian Wildlife Service (CWS) and local naturalist groups, and through a compilation of information from agency websites and aerial photo interpretation. The terrestrial resources within the LSA were assessed primarily based on existing literature and data and incidental observations during field surveys.

The following is a detailed list of data sources used for the Project:

- Land Information Ontario interactive mapping website (http://www.lio.gov.on.ca/en/DataViews.htm);
- Ontario Ministry of Natural Resources Request For Values mapping (2007);
- OMNR Natural Heritage Information Centre (http://nhic.mnr.gov.on.ca/nhic_.cfm);
- Schedule 1 of the *Species at Risk Act* website (http://www.sararegistry.gc.ca/species/schedules_e.cfm?id=1);
- Species at Risk Ontario website (http://www.rom.on.ca/ontario/risk.php?region=4);
- Ontario Breeding Bird Atlas (http://www.birdsontario.org);
- Important Bird Area (http://www.ibacanada.com); and
- Holly Simpson, Area Biologist, Chatham District OMNR.

Subsequent to the collection of all available published data, an intensive field program was undertaken to supplement and verify the existing data and characterize baseline conditions with respect to VECs. The detailed study design and methods for this field program are provided in Appendix B.

To assess the extent, duration and irreversibility of effects of the Project on the Terrestrial Environment within the SSA, the general criteria described in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for the Terrestrial Environment Key Indicators are defined in Table 7.3-3.

Table 7.3-3: Effects Assessment Criteria for the Terrestrial Environment

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Number of ecosites and their area based on ELC	No change from baseline.	Less than 10% decline in area of one ecosite or decline within range of natural variation.	10-20% [1]decline in number or types of ecosites or decline approximately equivalent to limits of natural variation.	Greater than 20% change in number of ecosite types and their area or substantially exceeds range of natural variation.
Number of bird species and individuals	No change from baseline.	Local population of one species or migratory patterns of a few species affected; mortality rare (<2 birds/turbine/year)[2].	Bird mortality up to 4 birds/turbine/ year; varying population and migration changes detected across several of species.	Bird mortality in excess of 4 birds/turbine/year sufficient to affect local population and migratory patterns.

Table 7.3-3: Effects Assessment Criteria for the Terrestrial Environment (continued)

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Bat species and their activity	No change from baseline.	Mortality low (<4 bats/turbine/year) and limited to one bat species[2].	Bat mortality between 4-8 bats/turbine/year; varying local population and migration changes detected across several species.	Bat mortality in excess of 8 bats/turbine/year; sufficient to affect local population and change migratory patterns.
Abundance of other wildlife species	No change from baseline.	Mortality or disturbance effects rare and isolated to a few individuals, but insufficient to affect local population.	Mortality and/or disturbance effects anticipated to affect local population of one species.	Mortality and disturbance effects sufficient to affect local population, migratory or breeding patterns of majority of species.
Number of individuals of species listed as endangered or threatened	No change from baseline.	Disturbance effects limited to individual, but insufficient to affect population.	Disturbance effects sufficient to affect local population and migratory patterns.	Mortality of an individual is sufficient to affect local population, or disturbance that results in changes to migratory patterns.
Wetlands	No change in water quality from baseline/existing conditions and/or minor indirect or temporary effect on wetlands which can be fully mitigated.	Slight degradation of water quality and wetlands, but still within standard water quality guidelines and/or indirect or temporary effect on wetlands which can be largely mitigated.	Degradation of water quality and wetlands such that standard water quality criteria have been slightly exceeded and/or permanent direct effect on wetlands.	Degradation of water quality and wetlands such that standard water quality criteria have been measurably exceeded and/or significant permanent effects to wetlands.
Integrity of designated areas	No change from baseline.	Effect on feature attributes detected, but within range of natural variation; no effect on ecosystem function.	Effects on feature attributes approximately equivalent to limits of range of natural variation; effects on ecosystem function detectable.	Effects on feature attributes substantially exceed range of natural variation; ecosystem functioning harmed.

[1] Based on professional opinion.

[2] Mortality criteria were chosen based on known effects at other operational wind farms in Ontario.

The following sections describe the existing conditions of the Terrestrial Environment within the SSA and an assessment of the potential effects of the Project on Terrestrial Environment VECs.

7.3.2 Existing Conditions

7.3.2.1 Flora and Habitat Types

The SSA is located within the Lake Erie Lowland ecoregion of southern Ontario (Ricketts et al., 1999). This ecoregion is dominated by agriculture with small areas of mixed and deciduous forest. It is characterized by humid, warm to hot summers and mild, snowy winters.

The SSA is predominately agricultural (corn, soya and winter wheat) with small woodlots (<20 ha) of immature to mature deciduous forests present (see Figure 7.3-1). The deciduous forest ecosite represents 7.8% (646 ha) of the SSA, and tree species commonly associated with this habitat type include white elm (*Ulmus americana*), shagbark hickory (*Carya ovata*), white birch (*Betula papyrifera*), trembling aspen (*Populus tremuloides*), sugar maple (*Acer saccharum*), red maple (*A. rubrum*), red oak (*Quercus rubra*), black walnut (*Juglans nigra*), and eastern white pine (*Pinus strobus*). Approximately 1% of the SSA is classified as old field, cultural meadow and cultural thicket, some of which is being used for pasture. Hawthorn (*Crataegus spp.*), and apple trees (*Malus spp.*) are also present along the old field edges.

Based on historical (i.e., NHIC) records, the SSA does not contain any known federally or provincially rare or endangered plant species. All the vegetation communities found in the SSA and within the LSA are considered common in this area of Ontario. From a floristic and vegetation community point of view, the SSA contains few constraints for wind power development.

7.3.2.2 Birds

A reconnaissance-level habitat survey was conducted prior to selection of avian survey locations. The reconnaissance-level habitat survey was necessary to ensure monitoring locations were appropriately sited to capture optimal data to characterize avian use of the site. Intensive agricultural practices have nearly eliminated mature contiguous forests and wetlands from the SSA and, therefore, the SSA was judged to not provide high quality habitat for all but a few bird species. Field surveys, which found relatively low abundances of most bird species, support this conclusion. In fact, all species found within the SSA are common throughout much of southern Ontario. Appendix B lists all the species recorded during Avian Use Surveys (AUS). AUS and risk assessment studies identified 4,201 individuals of 77 species during the study period.

Spring migration surveys (including one raptor migration survey) conducted by Golder between April and May, 2008, identified 555 individuals of 42 species in the SSA. The most common species observed in the SSA during spring migration were red-winged blackbird (*Agelaius phoeniceus*), horned lark (*Eremophila alpestris)*, and common grackle (*Quisculus quiscula*). All species are typical of agricultural habitat types in southern Ontario.

Two breeding bird surveys were conducted by Golder in June, 2008. A total of 926 individuals of 38 species were identified during these surveys. The most common species recorded in the SSA during the breeding season were European starling (*Sturnus vulgaris*), red-winged blackbird and house sparrow (*Passer domesticus*).

A total of 2,053 individuals of 44 species were recorded during the fall migration (August to September, 2008). The most common species in the SSA during fall surveys were European starling, Canada goose (*Branta canadensis*), and mourning dove (*Zenaida macroura)*.

A total of 667 individuals of 12 species were recorded during winter surveys (January and February, 2008). The most common species in the SSA during winter surveys were American crow (*Corvus brachyrhynchos),* European starling and horned lark.

Due to potential differences in sensitivity of different bird groups (Kingsley and Whittam, 2005), data were summarized according to seven bird groups: gamebirds (including turkeys, partridges and grouse); waterfowl (including ducks, geese and swans); waterbirds (including herons, rails, and cormorants); shorebirds (including gulls, plovers and sandpipers); raptors (including hawks, falcons and eagles, and for the purposes of this summary, vultures); songbirds (including passerines and near passerine landbirds); and woodpeckers. Overall, passerines (songbirds) were the most abundant bird group recorded during surveys comprising 86.8% of all birds recorded, followed by waterfowl (9.7%) (see Table 7.3-4).

Birds observed within 40 m of the ground were considered to be below the sweep of the rotor blades, those flying from 40 – 120 m were considered to be within the sweep of the rotor blades, and those birds observed flying above 120 m were described as being above the rotor sweep. For all species and seasons combined, 76.5% of all flying birds, most of them passerines, were below (<40 m) the rotor-swept height, 18.1% were within (40 to 120 m) the rotor-swept height, and 5.4% were observed flying above (>120 m) the rotor-swept height. Large flocks of Canada geese, red-winged blackbirds, common grackles and European starlings, were the most common species flying through the SSA at rotor-swept height, particularly during fall migration.

7.3.2.3 Bats

In accordance with the OMNR guideline entitled "*Guideline to Assist in the Review of Wind Power Proposals: Potential Impacts to Bats and Bat Habitat*" (MNR 2007), the SSA was deemed to be classified as a low to moderate sensitivity for bats, and was therefore treated in the moderate classification for the design of the study program. A reconnaissance-level habitat survey was conducted prior to selection of bat monitoring locations. The habitat survey was necessary to ensure monitoring locations were appropriately sited to characterize bat use of the site. Based on a desktop literature review, reconnaissance-level survey and available mapping, it was determined that no significant caves or hibernacula are known to occur within the SSA or LSA. Several engineered structures and natural features (trees, rock piles) are however present in the area that could potentially be utilized as roosting locations for some portion of the year. Intensive agricultural practices have all but eliminated contiguous mature forest and wetlands in the SSA and, therefore, limited suitable roosting and foraging habitat is present. No substantial forested ridges are present in the SSA; however, there are small blocks of deciduous Carolinian forest and aquatic features. Similarly, although a number of agricultural outbuildings (barns and machine sheds) are present in the SSA, they were observed to be well lit and not likely suitable as roosting habitat for resident bats. Based on the reconnaissance-level habitat survey, available mapping and the OMNR protocol, it was concluded that the best time to assess bats was during the late swarming season and during fall migration. Golder utilized five Binary Acoustic Technology (BAT) ultrasonic bat detectors set at a total of seven stations distributed throughout the SSA. The monitoring station locations were selected to sample locations where swarming, migrating and feeding bats would most likely be associated and therefore detected. These primarily included wetlands, forest edges and hedgerows.

During fall migration surveys (between 30 July and 15 September, 2008), a total of 4,989 bat passes over 117 detector-nights, or an average of 42.6 bat passes per night, were recorded (Table 7.3-5; Appendix B). Acoustic analysis of the bat sonograms indicated that, of the individuals that could be assigned to species groups, the most common species group recorded during the season was the big brown bat (*Eptesicus fuscus*). Of the bat stations established in the SSA, the highest average passes per night (102.8 passes per night) was recorded at ADEL-05, which was located adjacent to Adelaide Creek. Three regional reference sites in southern Ontario where bat activity was suspected to be high, based on MNR criteria and professional judgment, were surveyed periodically during the study period using Anabat SD1 detectors to compare relative bat activity in the SSA. It is generally accepted that the detection probability will be similar between Anabat SD1 and BAT detectors, since no scientific literature has been published to suggest otherwise. In addition, although analysis of the reference sites was completed by the same person as the data collected within the SSA, greater species classification is possible using BAT detectors, thus resulting in more detailed species differentiation. For all bat species combined, the maximum number of bat passes per night recorded in the SSA (221) was substantially lower than the maximum number of bat passes per night recorded at any of the reference stations (range 1542 – 2160 maximum passes per night), within the migration and swarming period. These qualitative comparisons, suggest that bat activity in the SSA is generally low compared to the Southwestern Ontario reference sites.

Table 7.3-4: Bird Groups Detected in the Site Study Area

Bird Group	Fall			Spring			Summer			Winter			Overall		
	Individuals	Mean use	Percent Composition	Individuals	Mean Use	Percent Composition	Individuals	Mean Use	Percent Composition	Individuals	Mean Use	Percent Composition	Individuals	Mean Use	Percent Composition
Grouse	nd	nd	nd	1	0.05	0.18	nd	nd	nd	nd	nd	nd	1	0.04	0.02
Passerines	1612	45.87	78.52	473	21.50	87.75	891	28.00	96.22	657	32.85	98.50	3647	131.22	86.81
Raptors	18	0.60	0.88	22	1.00	3.96	5	0.17	0.54	8	0.40	1.20	53	2.08	1.26
Shorebirds	5	0.17	0.24	25	1.14	4.50	18	0.60	1.94	nd	nd	nd	48	1.88	1.14
Waterbirds	15	0.50	0.73	4	0.18	0.72	9	0.30	0.97	nd	nd	nd	28	1.10	0.67
Waterfowl	397	13.23	19.34	10	0.45	1.80	nd	nd		nd	nd	nd	407	15.96	9.69
Woodpeckers	6	0.20	0.29	6	0.27	1.08	3	0.10	0.32	2	0.10	0.30	17	0.67	0.40
Total	**2053**	**68.43**		**555**	**25.23**		**926**	**30.87**		**667**	**33.35**		**4201**	**164.75**	

Table 7.3-5: Total and Mean Bat Passes per Night Observed at Seven Stations within the SSA

Bat Activity	All Species		Eastern Red Bat		Silver-haired		Silver-haired/Big Brown		Big Brown		Hoary Bat		Little Brown Bat		Northern Long-eared Bat		Eastern Small-footed Bat		Myotis Unknown		Tricolored Bat		Uncertain	
	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night	Total Passes	Mean Per Night
SSA	4989	42.6	131	1.1	220	1.9	148	1.3	2569	22.0	101	0.9	1737	14.8	2	0.02	35	0.3	41	0.4	5	0.04	0	0

7.3.2.4 Other Wildlife

Historical occurrences of other wildlife within the LSA (i.e., mammals, reptiles, amphibians, insects and all taxa listed as 'special concern') were determined from available scientific literature. Records from the Atlas of the Mammals of Ontario (Dobbyn, 1994) indicated that 41 species of mammals have been recorded within the vicinity of the LSA. Similarly, the Ontario Herpetofauna Summary Atlas (Oldham and Weller, 2000) indicated that 25 species of reptiles or amphibians have been recorded within the vicinity of the LSA. It is important to note that the specific locations of species occurrences are not available from wildlife atlases. Therefore, it is possible that many of these mammal and herpetile species may not occur in the SSA. All these mammalian, and all but seven of the herpetofaunal species, are common or very common (S4 – Apparently Secure; uncommon but not rare, or S5 – Secure; common, widespread and abundant in the province) in Ontario. There were no historical occurrence records of uncommon or rare herpetile species within the SSA and none were observed during field studies.

The Ontario Breeding Bird Atlas (OBBA, 2008) identified breeding evidence of a red-headed woodpecker (*Melanerpes erythrocephalus;* listed as special concern provincially and federally*)* within the SSA between 2000 and 2005; however, no individuals were observed during field surveys.

During breeding and early fall surveys, several monarch butterflies (*Danaus plexippus*; listed as special concern provincially and federally) were observed flying near ground-level throughout the SSA. The SSA is not known as a migratory corridor for butterflies, unlike locations such as Point Pelee, Ontario, 130 km southwest of the SSA, where thousands of monarchs may land in a single day.

Tracks of three mammal species were observed on several occasions during summer and fall surveys including: white-tailed deer (*Odocoileus virginianus*), northern raccoon (*Procyon lotor*), and European hare (*Lepus europaeus*). Grey squirrels (*Sciurus carolinensis*) and eastern chipmunks (*Tamias striatus*) were also observed on several occasions near human residences and woodlots during summer and fall surveys. A red fox (*Vulpes vulpes*) was observed hunting along Adelaide Creek in January, 2008.

7.3.2.5 Listed Endangered and Threatened Species

Flora and Habitats

The *Species at Risk Act* (SARA) public registry, the *Species at Risk in Ontario* (SARO) List and the NHIC were consulted to develop a list of regulated endangered and threatened plant species with a potential to occur in the region. Endangered and threatened species are afforded similar protection under SARA and the *Endangered Species Act* (ESA) and were therefore considered together. No historical provincially- or federally-listed endangered or threatened plant occurrences were recorded within the LSA and none were observed in the SSA during field surveys.

Fauna

The SARA public registry, the SARO List, and the NHIC were consulted to identify any faunal species listed as endangered or threatened with a potential to occur in the region. Endangered and threatened species are afforded similar protection under SARA and the *Endangered Species Act* (ESA) and were therefore considered together. Historical records indicate a single observation of loggerhead shrike (*Lanius ludovicianus;* listed as endangered provincially and federally) in August 1995; however, the timing of this observation suggests that it may have been a migrant, as no other individuals have been recorded since. Historical records also indicate a single observation of American badger (*Taxidea taxu;* listed as endangered species federally and provincially) in 1979. There have been no other observations of American badger within the LSA or SSA since this record and none were observed during field surveys conducted by Golder.

7.3.2.6 Wetlands

Few natural wetlands remain in the SSA, a consequence of the highly intensified agricultural practices common in this area. There are no wetlands within the SSA that are designated as provincially or locally significant. Based on air-photo interpretation of ELC vegetation communities, the wetlands that occur within the SSA are classified as deciduous swamp (SWD), submerged shallow aquatic (SAS) and thicket swamp (SWT). These wetland communities cover <1% of the SSA and contain species such as silver maple (*A. saccharinum*), white elm and red maple.

The few wetlands that occur within the SSA are associated with the floodplain/riparian zones of Adelaide Creek and Mud Creek (Figure 7.3-1). These wetlands are therefore categorized as riverine (OWES 2003). Seasonal variation in flow occurs in Adelaide Creek and Mud Creek (refer to Aquatics Section 7.2), thus it is likely that the associated wetlands are accustomed to seasonal fluctuations in water level as well. Swamps contain woody vegetation that is more tolerant of seasonal flooding and drying than wetlands with herbaceous vegetation.

7.3.2.7 Designated Areas

According to the Provincial Policy Statement (PPS), development and site alteration is not permitted on, or adjacent to lands containing significant natural features such as Life Science Sites and PSWs, unless the ecological function of the site has been evaluated and it is demonstrated that there will be no negative impacts on the natural feature or on their ecological function. At the county level, Middlesex County has also designated Natural Heritage Features (many of which are also protected under the PPS), and these include: wetlands and adjacent lands, significant habitat of endangered or threatened species, floodplains and flood prone areas (as determined by local Conservation Authorities), significant woodlands and Areas of Natural and Scientific Interest (ANSIs), significant wildlife and valley lands, and fish habitat (Middlesex County, 2006). Development is not permitted within some of these designated features; however, for significant woodlands, ANSIs, and significant wildlife habitat and valley lands, development may be permitted within the feature following the completion of a Development Assessment Report (DAR). There are also feature-specific buffers applied around each Natural Heritage Feature, within which a DAR is required if development is to occur within the buffer area, but outside of the feature itself. The sizes of these buffers range from 120 m (for wetlands and adjacent lands), down to 30 m (for fish habitat). For Significant Woodlands, the DAR buffer is 50 m (i.e., a DAR would be required for any development occurring within 50 m of a Significant Woodland). Similarly, development (with a few exceptions), is not permitted within lands designated as Environmentally Significant Areas (ESA) according to the Township of Adelaide Metcalfe Official Plan (Adelaide Metcalfe Township, 2004).

No provincially-designated Life Science Sites or PSWs are located within the SSA or bordering the SSA; however, one municipally-designated ESA and 110 county-designated Significant Woodlands (which includes the township-designated woodlots greater than 4 ha in size) do occur within the SSA. The significance for these woodlots was established through the Middlesex Natural Heritage Study. The Middlesex Natural Heritage Study was finalized in 2003 and involved field surveys and collection of information on a number of forest health indicators (e.g., native species, non-native species richness) and landscape parameters (e.g., woodland patch area and woodland patch interior, nearest road/railroad, ANSI, ESA or wetland). Each woodlot was then evaluated using six criteria that ranked their regional significance (UTRCA and Middlesex Natural Heritage Study Steering Committee, 2003). These criteria included the size and type of woodland patch, the proximity to Natural Heritage Features, watercourses or other woodland patches, inclusion in larger corridors (Carolinian Canada Big Picture, Ausable River or North Branch of the Thames River), and sensitivity of groundwater resources, and it was determined that if a woodlot met any of the six criteria, it would be designated as a Significant Woodland. The municipally-designated ESA contains a portion of Adelaide Creek and its tributaries, and is illustrated in Schedule B Environmental Constraint Areas of the Township of Adelaide Metcalfe Official Plan (Adelaide Metcalfe Township, 2004). Significant Woodlands are illustrated on Schedule C Natural Heritage Features of the County of Middlesex Official Plan (Middlesex County, 2006) and woodlots greater than 4 ha are shown on Schedule B Environmental Constraint Areas of the Township of Adelaide Metcalfe Official Plan (Adelaide Metcalfe Township, 2004).

Two PSWs and seven Life Science Sites are located outside of the SSA, but within 5 km of the SSA boundary. The Sydenham River wetland complex is a 650 ha PSW made up of

15 individual wetlands, composed of two wetland types (80% swamp and 20% marsh, NHIC, 2008). The second PSW located within the SSA is Kerwood Swamp, a 144 ha wetland composed entirely of swamp (containing mainly deciduous species).

Two of the Life Science Sites are located approximately 1 km from the SSA and 2 km from the nearest turbine. Adelaide-5 wetland is a 17 ha, non-provincially significant wetland composed of a single wetland type; a deciduous silver maple swamp. Rookery Woodlot is a 20 ha Life Sciences Site that supports breeding waterbirds. It is composed of 60% deciduous swamp forest, whereas the remainder is marsh (30%) and hawthorn scrub (10%) (MNR/NHIC, 2008).

All the remaining Life Science and designated areas are located at least 2 km from the SSA, but within the LSA. Ausable River Near Sable is a 220 ha Life Science Site composed of maple-beech-oak floodplains bordering the Ausable River (MNR/NHIC, 2008). Adelaide Creek complex is a 160 ha area consisting of a network of channels sharply dissected by the Ausable River, Adelaide Creek and several other small tributary creeks. The Bear Creek source woodlot is a non-provincially significant wetland complex, made up of three individual wetlands composed of two wetland types (71% swamp, 29% marsh). Kerwood Woods located >2 km from the SSA, is a 160 ha site composed of a maple-dominated woodlot with some yellow birch (*Betula alleghaniensis*), slippery elm (*Ulmus rubra*), and American beech (*Fagus grandifolia*) (MNR/NHIC, 2008). Kerwood Bluff is an 80 ha, non-significant Life Science Site, that is generally flat except for the bluff (MNR/NHIC, 2008). A small stream and a drainage ditch cut through the clay plain and bluff which were formed by glacial Lake Whittlesey. All these areas are recognized as significant by the Provincial Policy Statement (PPS) and their natural heritage values must be considered in any planning decisions.

7.3.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on the Terrestrial Environment is provided in Table 7-1. The assessment of impacts to the Terrestrial Environment was based on the following assumptions and limitations:

- The assessment was limited to the SSA (based on maps made available on February 17, 2009);
- The amount of land that will be cleared has been minimized to the extent practical (i.e., using existing trails and roads to the extent practical);
- Where roads (private and public) on the SSA require upgrading, a maximum right-of-way (ROW) width of 10 m will be used and the road bed will be composed of clean materials (gravel road);

- The reclaimed road width, laydown areas, and construction areas can be represented as cultivated field or open grasslands (open grasslands may eventually become forested); and
- All recommended mitigation measures will be implemented and BMPs will be followed throughout the duration of the Project.

A summary of the identification and assessment of potential interactions between the Project and the Terrestrial Environment, according to the MOE screening criteria are found in Table 7.3-6. Question 2.2 dealing with the Provincial Policy Statement is inherent in all the screening questions dealt with in the table, as well as being dealt with in greater detail in Section 7.9 (Land Use) of this ESR/EIS.

Table 7.3-6: Identification of Potential Interactions with VECs of the Terrestrial Environment

Relevant Project Activity	Listed Endangered and Threatened Species	Designated Areas	Wetlands	Other Wildlife	Bats	Birds	Flora and Habitat Types
Site Preparation and Construction							
Surveying and siting	**(n/a)**[1]	**(n/a)**	**(n/a)**	**(n/a)**	**(n/a)**	**(n/a)**	**(n/a)**
Land clearing	**(yes)** • Habitat loss/alteration • Dust and debris • Sensory disturbance	**(yes)** • Sensory disturbance	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	(yes) • Habitat loss/alteration • Sensory disturbance	(yes) • Habitat loss/alteration • Sensory disturbance	**(yes)** • Habitat loss/alteration • Dust and debris
Road construction/modification	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Dust and debris
Delivery of equipment	**(yes)** • Wildlife-vehicle collision • Sensory disturbance • Dust and debris	**(n/a)**	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Wildlife-vehicle collision • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance	**(yes)** • Sensory disturbance • Bird-vehicle collision	**(yes)** • Dust and debris
Temporary storage facilities	**(yes)** • Sensory disturbance	**(n/a)**	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Sensory disturbance	**(yes)** • Sensory disturbance	**(yes)** • Sensory disturbance	**(yes)** • Dust and debris
Foundation construction	**(yes)** • Sensory disturbance	**(n/a)**	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Sensory disturbance	**(yes)** • Sensory disturbance	**(yes)** • Sensory disturbance	**(yes)** • Dust and debris
Tower and turbine assembly and installation	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance	**(yes)** • Dust and debris/spills	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Dust and debris
Interconnection from turbines to substation	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	**(n/a)**	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	**(yes)** • Habitat loss/alteration • Dust and debris
Transmission line to power line	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	**(n/a)**	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	**(yes)** • Habitat loss/alteration • Sensory disturbance • Dust and debris	**(yes)** • Habitat loss/alteration • Dust and debris

Table 7.3-5: Identification of Potential Interactions with VECs of the Terrestrial Environment (continued)

Relevant Project Activity	Listed Endangered and Threatened Species	Designated Areas	Wetlands	Other Wildlife	Bats	Birds	Flora and Habitat Types
Operation and Maintenance							
Wind turbine operation	**(yes)** • Wildlife-turbine collision • Sensory disturbance	**(yes)** • Sensory disturbance	**(yes)** • Accidental spills	**(yes)** • Wildlife-turbine collision • Sensory disturbance	**(yes)** • Bat-turbine collision	**(yes)** • Bird-turbine collision • Sensory disturbance	**(n/a)**
Maintenance activities	**(n/a)**	**(n/a)**	**(n/a)**	**(n/a)**	**(n/a)**	**(n/a)**	**(n/a)**
Decommissioning							
Removal of turbines and ancillary equipment	**(yes)** • Sensory disturbance • Dust and debris • Wildlife-vehicle collision	**(yes)** • Sensory disturbance	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Sensory disturbance • Dust and debris • Wildlife-vehicle collision	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance • Dust and debris • Bird-vehicle collision	**(yes)** • Dust and debris
Removal of buildings and waste	**(yes)** • Sensory disturbance • Dust and debris • Wildlife-vehicle collision	**(n/a)**	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Sensory disturbance • Dust and debris • Wildlife-vehicle collision	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance • Dust and debris • Bird-vehicle collision	**(yes)** • Dust and debris
Removal of power line	**(yes)** • Sensory disturbance • Dust and debris	**(n/a)**	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Dust and debris
Site reclamation	**(yes)** • Sensory disturbance • Dust and debris	**(n/a)**	**(yes)** • Dust and debris/spills • Erosion	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Sensory disturbance • Dust and debris	**(yes)** • Dust and debris

[1] na – no effects anticipated

7.3.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which floral and faunal abundance and distribution may be affected by the various Project activities include:

- Effects to individuals or populations of birds, bats, or other wildlife species during the Site Preparation and Construction, Operation, and Decommissioning Phase, or collisions with turbines during the Operation and Maintenance Phase;
- Effects to individuals or populations of flora, birds, bats, or other wildlife species through habitat loss or alteration, fragmentation, or degradation during the Site Preparation and Construction, and Decommissioning Phases;
- Effects to individuals or populations of birds, bats, or other wildlife species through sensory disturbance during all Project Phases, and dust deposition during the Site Preparation and Construction, and Decommissioning Phases; and
- Potential for adverse effects on wetlands, vegetation, locally important or valued ecosystems or other significant natural areas during all three Project Phases.

The assessment of effects that follows addresses these topics, as no other interactions were determined to have an effect on the Terrestrial Environment. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and if applicable, the need for further mitigation is evaluated. Residual effects (i.e., those remaining after mitigation) are advanced to Section 7.2.5 for an analysis of significance.

As determined through the secondary screening (Table 7.3-6), potential interactions were identified between Project activities during each of the three phases and the VECs. These are described further below.

7.3.4.1 Changes to Ecosite Composition and Quantity

Changes to the ecosite communities of the SSA would be the result of changes to the land types/uses through Project activities (e.g., road and foundation construction). There will be a small change (i.e., < 1%) in the amount of agriculture, pasture and grass in the SSA as a result of the construction of new access roads and turbine foundations. However, these roads and foundations will be reclaimed during the decommissioning phase of the Project. There will be no changes to forested or wetland ecosites during any phase.

Site Preparation and Construction and Decommissioning

Habitat Loss and Alteration

Activities associated with the Site Preparation and Construction Phase have the potential to affect ecosite (floral) communities by removing or degrading portions of existing ecosites or increasing the amount of dust and debris deposition. As all the turbines have been sited in agricultural fields or adjacent to woodlots, there is no planned removal of trees. Similarly, during the Decommissioning Phase of the Project, there may be some disturbance to regenerating (second-growth) vegetation during removal of turbines and reclamation activities. Recently cleared or disturbed land may also be at risk from colonization by invasive species (e.g., *Phragmites australis*) and weeds. Activities such as the interconnection of turbines to the substation are anticipated to result in shorter-term changes to floral communities, as the existing cover is expected to be restored after the distribution lines are installed and the trenches filled and revegetated.

To mitigate the potential effect of habitat loss and alteration, the layouts for access roads, turbines, and ancillary structures have been designed to minimize alteration of the existing native vegetative cover (e.g., by using existing roadways wherever possible). As appropriate, and prior to construction and decommissioning, the limits of vegetation clearing will be staked in the field. The Construction Contractor will be diligent so that no construction or decommissioning disturbance occurs beyond the staked limits and that woodlot edges and other sensitive areas adjacent to the work areas are not disturbed. Implementing these mitigation measures is expected to maintain the existing forest communities and cultivated lands and therefore no residual effects are anticipated.

Dust and Debris

In areas of natural vegetation (i.e., old pasture and forest) potential impacts to the health of native vegetation during land clearing, road construction and modification operations, and delivery of equipment may include increased dust deposition and debris. However, the impacts of these activities on the native flora are predicted to be minimal because they will be infrequent and relatively short-term in duration. To further minimize the amount of dust and debris that will be deposited on native flora, periodic watering of active construction roads will occur and the number of soil piles and actively disturbed areas will be limited. As a result of these mitigation measures no residual effects to vegetation resulting from dust deposition are anticipated.

Operation and Maintenance

The Operation and Maintenance Phase includes limited maintenance activities, but these do not normally affect flora or habitat types. Therefore, no residual effects on ecosite composition or quantity are expected during the Operation and Maintenance Phase of the Project. No mitigation is required, and this is not carried further into the assessment.

7.3.4.2 Birds

Site Preparation and Construction and Decommissioning

The activities associated with the Site Preparation and Construction and Decommissioning Phases have the potential to affect avian species richness and abundance by loss, degradation, fragmentation or sensory disturbance of bird habitat or through direct mortality to individuals or their eggs.

Sensory Disturbance

Sensory disturbance (visual and auditory), as a result of Site Preparation, Construction and Decommissioning activities may result, under exceptional circumstances, in habitat alienation, displacement, or nest desertion. Studies in the Netherlands suggest that landbird, and in particular woodland songbird, population densities begin to decline at an average noise level of 42 dB (Reijnen *et al.,* 1996). Forman and Hersperger (1996) further suggest that noise associated with traffic can affect bird populations by disrupting vocal communication required for mate selection, mate location, foraging communication, predator detection and avoidance, and parent-nestling communication. However, the noise associated with heavy machinery and construction activities is not expected to be dissimilar from the noise of agricultural machinery that regularly operates in the SSA. Moreover, potential sensory disturbance is expected to be mitigated by restricting activities that remove or alter vegetation outside of the breeding season (April until August) for most bird species. As required under the *Migratory Bird Conventions Act* (1994) or *Fish and Wildlife Conservation Act* (1997), should any construction activities be required on the SSA during the breeding season, avian nest surveys will be undertaken to identify the presence of nesting birds and appropriate species-specific setbacks will be created in consultation with EC/CWS and MNR and exclusion zones flagged from the work area(s). With the implementation of these mitigation measures, minimal residual effects associated with sensory disturbance to birds are anticipated.

Habitat Loss and Alteration

Habitat loss, primarily as a consequence of land clearing to accommodate turbines and ancillary components proposed to be sited in the agricultural and open habitats on the SSA, is predicted to affect limited bird species. Species such as bobolink, red-winged blackbird, and mallard, will nest in hayfields and other agricultural crops, but given that such a small area (<1%) of agricultural land is expected to be removed to accommodate turbines and ancillary components, minimal impacts are anticipated.

To mitigate the potential effects of habitat loss, ecologically sound siting of wind turbines and new access roads along existing trails and roadways was undertaken to the extent possible during the planning of the Project. Remaining access roads were sited on agricultural lands that are cultivated and harvested annually. Additional mitigation measures, as described in Section *7.3.4.1 Changes to ecosite composition and quantity,* will be employed to limit habitat loss in the SSA. Consequently, no residual effects associated with habitat loss or alteration to birds are anticipated.

Dust and Debris

Activities associated with the Site Preparation and Construction and the Decommissioning Phases of the Project, including land clearing, and transport of equipment may result in an increase in the quantity of dust and debris deposited on birds and their habitat adjacent to roadways. To minimize the amount of dust and debris deposition, the same mitigation measures outlined in Section *7.3.4.1 Changes to ecosite composition and quantity* will be used. As a result of this mitigation measure, no residual effects associated with dust and debris, as it relates to birds and bird habitat, are anticipated.

Bird-Vehicle Collision

Although bird-vehicle collisions may result in the mortality of some individuals during the Site Preparation and Construction and Decommissioning Phases of the Project, particularly during the transport of equipment, the number of collisions is not expected to increase above pre-construction levels because vehicles will be travelling at low speeds. Therefore, this activity does not warrant specific mitigation measures and no residual effects are anticipated.

Operation and Maintenance

Sensory Disturbance

Sensory disturbance effects and behavioural change as a result of turbine operation are generally considered to be more likely than direct mortality (Kingsley and Whittam, 2007). In exceptional circumstances, turbine operations may displace birds, cause nest abandonment and stress, obstruct avian flight paths, and result in reduced breeding success within localized areas of the Project (see Kingsley and Whittam, 2007). Although the noise level and movement associated with turbines may cause less disturbance than that associated with agricultural machinery that regularly operates in the SSA, the duration will be for the life of the Project. As such, it is possible that some residual effects associated with sensory disturbance will persist where turbines are located adjacent to woodlots particularly for area-sensitive and forest interior species that are more sensitive to such effects.

Bird-Turbine Collision

Bird mortality has been documented at operational wind development projects in North America and in southwestern Ontario. At a wind park along the Lake Erie shoreline in southwestern Ontario, bird mortalities ranged from 0-4 birds/turbine/year, with the highest rate of collision occurring at a turbine sited within 250 m of the shoreline (James, 2008). The mortalities have often been attributed to in-flight collisions with wind turbine blades and/or the tower structures. The hazard that wind turbines pose to birds varies by season and by species, with spring and fall migration typically being of the highest risk periods. Contrary to previous suggestions, a recent literature review indicates that there is no evidence of a transportation-lighting effect on the collision rates of nocturnally migrating birds at wind turbines (Arnett *et al.,* 2007; Kunz *et al.,* 2007).

Low avian species richness and low abundance in the SSA, along with few birds observed flying at turbine blade-heights, suggests that bird-turbine collisions at the SSA are likely to be low. The potential for bird mortality has been further reduced by following the principle of avoidance (e.g., Project siting considerations) and implementing good planning practices (e.g., lighting and marking selection). Based on these mitigation measures and publicly available data from other wind power projects in eastern North America, minimal residual effects associated with avian mortality are expected to persist throughout the life of the Project.

7.3.4.3 Bats

Site Preparation and Construction and Decommissioning

Activities associated with the Site Preparation and Construction and Decommissioning Phases of the Project have the potential to affect bat species richness and abundance by habitat loss, alteration or sensory disturbance of bat roosts or through direct mortality to individuals.

Habitat Loss

Habitat loss and alteration, primarily as a consequence of land clearing activities designed to accommodate turbines and ancillary components, may occur in the SSA. However, land clearing will be limited to agricultural lands and large trees that may provide roosting habitat for some bat species will not be removed and no mitigation is required.

Sensory Disturbance

Noise associated with Site Preparation, Construction, and Decommissioning activities has the potential to increase overall activity levels of bats at maternal roosts (Mann *et al.*, 2002), but the effects on those bat species that raise their young in snags is not well understood, nor have the effects of noise on swarming behaviour been well documented. There is recent research that suggests that increased ambient noise may adversely affect foraging activity of bats (Schaub *et* *al.*, 2008), but Construction and Decommissioning activities are expected to be limited to the daylight hours when bats are inactive. Therefore, no residual effects associated with sensory disturbance of bats are anticipated.

Dust and Debris

Activities associated with the Site Preparation and Construction and the Decommissioning Phases of the Project, including land clearing, and transport of equipment may result in an increase in the quantity of dust and debris deposited on birds and their habitat adjacent to roadways. To minimize the amount of dust and debris deposition, the same mitigation measures outlined in Section *7.3.4.1 Changes to ecosite composition and quantity,* will be used. As a result of this mitigation measure, no residual effects associated with dust and debris, as it relates to bats and bat habitat, are anticipated.

Operation and Maintenance

Bat-Turbine Collision

Although little is known about bat populations and distribution, particularly through the migration period, turbine operations could conceivably displace bats, cause roost or hibernacula abandonment, and result in reduced breeding success. Bat longevity is relatively high and reproduction rates are relatively low compared to birds, which as a result, potentially makes bat populations more vulnerable to effects (GAO, 2005; MNR, 2006b).

Mortality risk from turbine collisions is not necessarily related to bat activity, although often there is a direct relationship. An infrared study of flight patterns and avoidance behaviour indicated that bats often fly through the blade sweep zone of turbines and can avoid moving blades. The ratio of avoidance to contact is high (Horn et al., 2004), which means that collisions are rare compared to the number of bats present (EchoTrack, 2005). Nonetheless, bat mortality has been documented at operational wind development projects in southwestern Ontario (James, 2008) and elsewhere (Baerwald et al., 2008). The mortalities have often been attributed to in-flight collisions with wind turbine blades and/or the tower structures and barotrauma (Barclay, pers. comm., 2008; Baerwald et al., 2008). The risk that wind turbines pose to bats varies by season, with fall swarming and migration typically being the highest risk periods. For constructed wind power projects in Ontario, mortality rates during fall migration are generally estimated to be <4 bats/turbine/year (e.g., James, 2008) although the potential exists for much higher mortalities (i.e., >50 bats/turbine/year) at some wind parks outside of Ontario (e.g., MNR 2006b).

Relatively low bat activity in the SSA suggests that there will be limited bat-turbine mortality, although the recorded level of activity at some bat monitoring stations was ranked as moderate.

The potential for mortality to bats has been further reduced by following the principle of avoidance (e.g., Project siting considerations) and implementing good planning practices (e.g., lighting and marking selection). In addition, turbines in the SSA will generally be located away from buildings to address noise requirements, reducing the bat-turbine interaction, especially for species such as big brown bat. The siting process for the wind turbines has resulted in turbines being located at least 30 m away from all watercourses; areas where increased foraging activity is expected. Based on data from other wind power projects in Ontario (e.g., James, 2008), residual effects associated with bat-turbine mortality are expected to be limited over the life of the Project.

7.3.4.4 Other Wildlife

Site Preparation and Construction and Decommissioning

Activities associated with the Site Preparation and Construction and the Decommissioning Phases have the potential to affect other wildlife species populations, habitat, corridors or movement by loss, degradation or sensory disturbance of important seasonal habitats.

Habitat Loss and Alteration

Limited habitat loss and alteration, primarily as a consequence of land clearing, may occur as a result of activities designed to accommodate turbines and ancillary components sited adjacent to woodlots. Some wildlife species, including raccoon, porcupine (*Erethizon dorsatum*), and squirrels, that rely on agricultural crops or pasture may be adversely affected by the loss of these habitat types adjacent to woodlots. However, the final width of access roads will be more narrow (5-6 m width) and agricultural crops dominate the landscape of the SSA, so the overall quantity of available food resources is expected to remain nearly unchanged.

Wildlife species that rely on riparian areas are unlikely to be affected by construction or decommissioning activities as setbacks from watercourses and wetlands have been established. Nor are other species, such as the cavity-nesting red-headed woodpecker, expected to be affected by the removal of a small area of agricultural land and pasture.

A few individual monarch butterflies were observed on the SSA, but the preferred food of the monarch larva, milkweed (Family Asclepiadaceae), was not observed on the SSA.

To mitigate the potential effects of habitat loss, ecologically sound siting of wind turbines and new access roads was undertaken during the planning of the Project. Additional mitigation measures, as described in Section *7.3.4.1 Changes to ecosite composition and quantity,* will be employed to limit habitat loss in the SSA. With the implementation of these mitigation measures, no residual effects associated with habitat loss are anticipated.

Sensory Disturbance

Sensory disturbance to wildlife (Radle, 1997), as a result of heavy machinery and construction activities on the SSA, will be similar to the disturbance from agricultural machinery that regularly operates in the SSA. In addition, most of the wildlife species observed in the SSA are known for their adaptability to anthropogenically disturbed environments. Moreover, potential sensory disturbance is expected to be mitigated by restricting activities that remove or alter vegetation outside of the breeding season (April until August) for most wildlife species. As required under the *Fish and Wildlife Conservation Act* (1997), should any construction activities be required on the SSA during the breeding season, den and nest surveys will be undertaken to identify the presence of dens and birthing cavities and appropriate species-specific setbacks will be created in consultation with MNR and exclusion zones flagged from the work area(s). With the implementation of these mitigation measures, minimal residual effects associated with sensory disturbance to wildlife are anticipated.

Dust and Debris

Activities associated with the Site Preparation and Construction and the Decommissioning Phases of the Project, including land clearing, and transport of equipment may result in an increase in the quantity of dust and debris deposited on wildlife habitat adjacent to roadways. To minimize the amount of dust and debris deposition, the mitigation measures outlined in Section *7.3.4.1 Changes to ecosite composition and quantity* apply. As a result of this mitigation measure, no residual effects associated with dust and debris are anticipated.

Wildlife-Vehicle Collision

Although wildlife-vehicle collisions may result in the mortality of limited individuals during the Site Preparation and Construction and the Decommissioning Phases, particularly during the transport of equipment, the number of collisions is not expected to increase above pre-construction levels because construction vehicles will be traveling slowly. Therefore, these activities do not warrant specific mitigation measures and no residual effects are anticipated.

Operation and Maintenance

Sensory Disturbance

Incidental observations of other wildlife species during 2008 indicated variable species-specific use of the habitats within the SSA. Although many of the wildlife species observed in the SSA are generally described as habitat generalists and are known for their adaptability to anthropogenically disturbed environments, the sensory disturbance (noise and visual) associated with turbine operation is expected to be nearly constant and therefore has the potential to impact some wildlife species. However, these sensory effects have been reduced by following the principle of avoidance (e.g., avoid siting near wetlands and other important habitat) and implementing good planning practices (e.g., lighting and marking selection). With the implementation of these mitigation measures, no residual effects associated with sensory disturbance to other wildlife species are anticipated.

Wildlife-Turbine Collision

The risk of mortality to butterflies, specifically the monarch, from collisions with wind turbines, is expected to be low because only several monarchs were observed passing through the SSA and all were flying close to the ground. Under conditions where migrating monarchs would fly through the SSA, most individuals are expected to move well above the height of the wind turbines (Garland and Davis, 2002). Furthermore, given the relatively small size of the SSA when compared to the broad front of monarch movement through southern Ontario, the probability of large numbers of monarchs returning to the ground directly into the area of wind turbines is expected to be low. Therefore, residual effects associated with mortality to butterflies as a result of wind turbine operation are anticipated to be minimal.

7.3.4.5 Listed Threatened and Endangered Species

Site Preparation and Construction and Decommissioning

Site Preparation and Construction and Decommissioning activities are predicted to have few effects on species listed as threatened or endangered because none were observed on the SSA and only one has been historically recorded within the LSA.

Habitat Loss and Alteration

Habitat loss and alteration, and direct mortality, primarily as a consequence of land clearing to accommodate turbines and ancillary components is predicted to impact few, if any, threatened or endangered species as most listed species, with the exception of the loggerhead shrike that prefers grazed pasture with hawthorn, have habitat requirements not found on the SSA. Nonetheless, prior to Construction or Decommissioning activities, area-searches of proposed access roads, turbine work areas, and power lines will be conducted to identify the presence of threatened or endangered flora or fauna and appropriate species-specific setbacks will be implemented in consultation with MNR/CWS.

To mitigate the potential effects of habitat loss and alteration to species listed as threatened or endangered that could potentially use the habitats within the SSA, ecologically sound siting of wind turbines and new access roads was undertaken during the planning of the Project. Additional mitigation measures, as described in Section *7.3.4.1 Changes to ecosite composition and quantity,* will be employed to limit habitat loss and alteration in the SSA. As a result of these mitigation measures and the absence of threatened or endangered species observed or recently known to occur on the SSA, no residual effects to threatened or endangered species are anticipated.

Sensory Disturbance

Sensory disturbance to breeding threatened or endangered species as a result of heavy machinery and construction activities on the SSA may adversely affect an animal's energy budget, reproductive success, and long-term survival (Radle, 2007). However, no threatened or endangered wildlife species were observed during field surveys and none, within the last 10 years, are known to occur on the SSA. Therefore, these activities do not warrant specific mitigation measures and no residual effects are anticipated.

Dust and Debris

Activities associated with the Site Preparation and Construction and the Decommissioning Phases of the Project, including land clearing, and transport of equipment may result in an increase in the quantity of dust and debris deposited on threatened or endangered vegetation species, or habitat used by threatened or endangered wildlife species adjacent to roadways. To minimize the amount of dust and debris deposition, the same mitigation measures outlined in Section *7.3.4.1 Changes to ecosite composition and quantity* will apply. As a result of these mitigation measures, no residual effects associated with dust and debris as it relates to threatened or endangered species are anticipated.

Wildlife-Vehicle Collision

Although there is the potential for wildlife-vehicle collisions during the Site Preparation and Construction and Decommissioning Phases of the Project, particularly during the transport of equipment, collisions are not expected because vehicles will be traveling slowly and threatened and endangered species are not expected to be present on the SSA. Therefore, this activity does not warrant specific mitigation measures, and is not carried further in the assessment.

Operation and Maintenance

Wildlife-Turbine Collision

The risk of mortality to avian species listed as threatened or endangered as a result of wind turbines is expected to be low, as none have been recorded in the SSA. The historical observation of loggerhead shrike in the SSA has not been subsequently confirmed since 1995 or during field surveys. The risk of turbine collision with threatened or endangered wildlife species has been further reduced by following the principle of avoidance (e.g., Project siting considerations) and implementing good planning practices (e.g., lighting and marking selection). Based on these mitigation measures and the absence of endangered or threatened species in the SSA, no residual effects associated with threatened or endangered bird species are anticipated.

Sensory Disturbance

Sensory disturbance may adversely affect an animal's energy budget, reproductive success, and long-term survival (Radle, 2007). Although threatened and endangered species are not expected to be present in the SSA, sensory disturbance effects have been reduced by following the principle of avoidance (e.g., avoid siting near wetlands and other important habitat) and implementing good planning practices (e.g., lighting and marking selection). As a result, no residual effects from sensory disturbance to threatened or endangered species are anticipated during the Operation and Maintenance Phase of the Project.

Operation and maintenance of turbines is not expected to affect listed floral species that may occur in the SSA.

7.3.4.6 Designated Areas

Site Preparation and Construction and Decommissioning

Sensory Disturbance

Sensory disturbance to environmentally significant areas (ESA) such as heron rookeries, as a result of heavy machinery and construction activities on the SSA, may adversely affect an animal's energy budget, reproductive success, and long-term survival (Radle, 2007). However, the closest Life Science Site (Rookery Woodlot) will be at least 1 km from the nearest construction activity (i.e., road upgrade). Construction activities will also not affect the portion of Adelaide Creek and its tributaries that have been designated as an ESA under the Township of Adelaide Metcalfe Official Plan because construction will not occur within 500 m of the ESA.

Of the 110 Significant Woodlands located within the SSA, there are 20 locations where proposed locations of Project infrastructure (i.e., access roads, underground cable routes or turbines) are within the 50 m buffer that would trigger the need for a DAR. Within these 20, there are 4 locations where access road and/or underground cable routes are immediately adjacent to Significant Woodlands. However, multi-season bird surveys and incidental wildlife surveys have already been conducted across the SSA as part of the EA process (providing an assessment of the baseline conditions and an understanding of the function of these natural habitat features). Additionally, based on the primary land uses of the area identified in Official Plans and consultation with township planners, it is anticipated that agricultural land use is likely to be afforded greater priority than maintenance a DAR buffer, given that agricultural land use extends to the edge of the woodlot boundaries in most cases. Notably, Section 1.8.3 of the PPS states:

> *"Alternative energy systems and renewable energy systems shall be permitted in settlement areas, rural areas and prime agricultural areas in accordance with provincial*

and federal requirements. In rural areas and prime agricultural areas, these systems should be designed and constructed to minimize impacts on agricultural operations."

The final determination of whether a DAR is required is at the discretion of County and Township planners, however, as described above for birds and other wildlife, avian nest and den surveys will be undertaken within these 20 areas prior to commencement of construction activities (if they occur during the breeding season). In addition, appropriate species-specific setbacks will be created in consultation with MNR and EC/CWS, and exclusion zones (if required) will be flagged for avoidance within the work area(s). With the implementation of these mitigation measures, minimal residual effects associated with sensory disturbance to birds and wildlife within these Significant Woodlands are anticipated. Because sensory effects on Significant Woodlands are already considered under sensory disturbance to birds and wildlife, sensory disturbance at designated areas has not been carried further in this assessment.

Operation and Maintenance

Sensory Disturbance

Sensory disturbance of designated area may adversely affect an animal's energy budget, reproductive success, and long-term survival (Radle, 2007). Sensory disturbance effects have been reduced by following the principle of avoidance (e.g., avoid siting near wetlands and other important habitat) and implementing good planning practices (e.g., lighting and marking selection). The closest turbine situated to any ESA (Rookery Woodlot) is approximately 2 km. As a result, no residual effects are anticipated during the Operation and Maintenance Phase of the Project.

7.3.4.7 Wetlands

During the planning stages of the Project, efforts were made to locate Project facilities (access roads, turbine locations and underground cable routes) outside of the ABCA/SRCA Regulation Limit (which would also encompass wetlands) (Figure 7.3-1). In the final layout, there are no encroachments by Project facilities into wetlands.

Water quality and hydrology are discussed in Section 7.2. As stated in Section 7.2.4.1, runoff is expected to increase by approximately 1.4% to 3.0% during the Site Preparation and Construction Phase, which is a negligible change since stream flow measurements are generally only accurate to within ± 15%. In addition, the mitigation measures recommended in Section 7.2.4.2, such as erosion and sediment control (i.e., silt fence adjacent to watercourses in the areas in which access roads and/or turbine foundations/temporary storage facilities will be constructed), will help to avoid changes to water quality as a result of Project activities. As a result of these mitigation measures, no residual effects to wetland health are anticipated.

Operation and Maintenance

Accidental Spills of Hydrocarbons

The only potential effect on wetlands during the Operation and Maintenance Phase is the possibility of accidental spills. During this Phase, the potential for spills is expected to be low due to the infrequent traffic that is expected to be in the SSA and relatively long distance between most access roads and watercourses.

Mitigation measures to address the potential for accidental spills of contaminants have been addressed in Section 7.2 and will be employed. Therefore, this activity is not carried further in the assessment.

7.3.5 Residual Effects, Determination of Significance and Follow-up

The residual effects were assessed to determine their overall importance using the methods described in Section 5.3. In terms of assessing the residuals effects to the birds and bats, their population and not the individuals were taken into account (i.e., when determining irreversibility, the ability of the populations to return to an equal or improved baseline condition was considered, rather than the individual birds/bats that were impacted).

7.3.5.1 Changes to Bird Species Richness and Abundance

Site Preparation and Construction and Decommissioning

The overall magnitude of the residual effects of sensory disturbance associated with the Site Preparation and Construction and the Decommissioning Phases on bird species richness and abundance is expected to be slightly above background conditions (Table 7.3-3). Based on the environmental interaction criteria in Table 5.3-2, the spatial extent of the residual effects of the Site Preparation and Construction and Decommissioning Phases of the Project is expected to be local, as all impacts are predicted to be restricted to the SSA. The temporal duration of the residual effect would be short-term, limited to the Site Preparation and Construction and Decommissioning Phases. The impacts of sensory disturbance are expected to be frequent during these phases of the Project. The residual effects are expected to be reversible, as the bird communities have the ability to return to population levels similar to the original pre-disturbance condition.

The overall assessed level of importance of the residual effect of sensory disturbance to bird species is based on Table 5.3-3 and is predicted to be low because the impacts may result in a slight decline in a limited number of bird populations in the SSA during each phase of the Project. The stability of populations at a regional perspective, however, is not anticipated to be affected by the Project.

PREDICTED LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS TO CHANGES TO BIRD SPECIES RICHNESS AND ABUNDANCE: LOW

Operation and Maintenance

The overall magnitude of the residual effects of bird-turbine collisions and sensory disturbance associated with the Operation and Maintenance Phase on changes to bird species richness and abundance is expected to be slightly above background conditions (Table 7.3-3). Based on the environmental interaction criteria in Table 5.3-2, the spatial extent of the residual effects of the Operation and Maintenance Phase of the Project is expected to be local, as all impacts are predicted to be restricted to the SSA. The temporal duration of the residual effect would be medium-term, limited to the Operation and Maintenance Phase. The impacts of mortality as a result of turbine operation are expected to be infrequent during this phase of the Project, whereas sensory disturbance may be more frequent or nearly constant. The residual effects are expected to be reversible, as the bird communities have the ability to return to population levels similar to the original pre-disturbance condition.

The overall assessed level of importance of the residual effect of sensory disturbance and direct mortality to bird species is based on Table 5.3-3 and is predicted to be low because the impacts may result in a slight decline in a limited number of bird populations in the SSA during the life of the Project. The stability of populations at a regional perspective, however, is not anticipated to be affected by the Project.

PREDICTED LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS TO CHANGES TO BIRD SPECIES RICHNESS AND ABUNDANCE: LOW

Little information exists to assess the degree of direct (mortality) and indirect (sensory disturbance and habitat loss) effects on birds on the SSA. A post-construction monitoring study will be developed in consultation with MNR/CWS and EC. Elements of the post-construction monitoring program are expected to include:

- Mortality monitoring for birds at a subsample of turbines throughout the year for a period of one or more years. Searcher efficiency and scavenger trials will be conducted each year according to EC's protocols (2007b).

The monitoring program will be reassessed with MNR/CWS and EC at the end of the first monitoring year. Pending the reassessment results, the program methodologies, frequencies and durations may be reasonably modified by the parties to better reflect the findings.

7.3.5.2 Changes to Bat Species Richness and Abundance

Operation and Maintenance

The overall magnitude of the residual effects of sensory disturbance and direct mortality associated with the Operation and Maintenance Phase on changes to bat richness and abundance is predicted to be slightly above background conditions and, hence, has been rated as low (Table 7.3-3). Based on the environmental interaction criteria in Table 5.3-2, the spatial extent of the residual effects during the Operation and Maintenance Phase of the Project is expected to be local, as all impacts is predicted to be restricted to the SSA. The temporal duration of the residual effect is predicted to be medium-term, limited to the Operation and Maintenance Phase. The impacts of mortality as a result of turbine operation are expected to be infrequent (several times per year) during this phase of the Project, whereas sensory disturbance may be more frequent or nearly constant. The residual effects are reversible, as the bat communities likely have the ability to return to population levels similar to the original pre-disturbance condition.

The overall assessed level of importance of the residual effect of sensory disturbance and direct mortality to bat species is based on Table 5.3-3 and is predicted to be low because the impacts may result in a slight decline in bat populations in the SSA over the life of the Project. Stability of populations from a regional perspective, however, is not anticipated to be affected by the Project.

PREDICTED LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS TO CHANGES IN BAT SPECIES RICHNESS AND ABUNDANCE: LOW

No information exists to assess the degree of direct effects on bats in the SSA. Therefore, a post-construction monitoring study will be developed in consultation with MNR. The main elements of the post-construction monitoring program will include the following:

- Mortality monitoring for bats at a subsample of turbines throughout the year for a period of one or more years. Searcher efficiency and scavenger trials will be conducted each year according to MNR protocols (2007).

The monitoring program results will be discussed with MNR at the end of each monitoring year. Pending the outcomes of the monitoring program and discussions with MNR, the program methodologies, frequencies and duration may be modified as deemed necessary and as agreed to by the AET and MNR.

7.3.5.3 Changes to Wildlife Species Richness and Abundance

Site Preparation and Construction and Decommissioning

The overall magnitude of the residual effects of sensory disturbance associated with the Site Preparation and Construction and the Decommissioning Phases on wildlife species richness and abundance is expected to be slightly above background conditions (Table 7.3-3). Based on the environmental interaction criteria in Table 5.3-2, the spatial extent of the residual effects of the Site Preparation and Construction and Decommissioning Phases of the Project is expected to be local, as all impacts are predicted to be restricted to the SSA. The temporal duration of the residual effect would be short-term, limited to the Site Preparation and Construction and Decommissioning Phases. The impacts of sensory disturbance are expected to be frequent during these phases of the Project. The residual effects are expected to be reversible, as the wildlife communities have the ability to return to population levels similar to the original pre-disturbance condition.

The overall assessed level of importance of the residual effect of sensory disturbance to wildlife species is based on Table 5.3-3 and is predicted to be low because the impacts may result in a slight decline in a limited number of wildlife populations in the SSA during each phase of the Project. The stability of populations at a regional perspective, however, is not anticipated to be affected by the Project.

PREDICTED LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS TO CHANGES TO WILDLIFE SPECIES RICHNESS AND ABUNDANCE: LOW

7.4 Atmospheric Environment

This section pertains to the following questions from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Have negative effects on air quality due to emissions of nitrogen dioxide, sulphur dioxide, suspended particulates or other pollutants?* (3.1)
- *Cause negative effects from the emission of greenhouse gases (CO_2, methane)?* (3.2)
- *Cause negative effects from the emission of dust or odour? (3.3)*

Any of the above questions that have been addressed, or "screened out" in the initial screening (Table 7-1) have not been carried forward into this secondary screening. For the Atmospheric Environment all questions have been carried forward.

7.4.1 Assessment Methods

The first step of the assessment process is to identify VECs for the Atmospheric Environment. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project. VECs can be individual valued species or environmental components.

A VEC is considered to be the 'receptor' for both Project-specific effects and cumulative effects. The effects of the Project on the Atmospheric Environment have been assessed by evaluating changes in air quality. Table 7.4-1 presents the VEC for the Atmospheric Environment along with the basis for its selection and the specific indicators used in the assessment.

Table 7.4-1: VECs and Key Indicators for the Atmospheric Environment

VEC Selection	Key Indicator(s)	Selection Basis
Air Quality	Greenhouse gas emissions	Identified by the Ontario Ministry of the Environment (MOE) as important component of Atmospheric Environment
		Emissions of green house gases have been linked to climatic changes
	Indicator compounds: (NO_2, SO_2, TSP, PM_{10}, $PM_{2.5}$)	Identified by MOE as important component of Atmospheric Environment
		Emissions of these compounds into the atmosphere can affect Air Quality and lead to health and environmental concerns
	Odour at nearby residences	Identified by MOE as important component of Atmospheric Environment
		Odour is one of the main environmental nuisances
	Fugitive dust at nearby residences	Identified by MOE as important component of Atmospheric Environment
		Fugitive dust is one of the main environmental nuisances

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between VECs and the MOE Screening Criteria Questions that they address is provided in Table 7.4-2.

Table 7.4-2: MOE Screening Criteria Questions and VEC for the Atmospheric Environment

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Have negative effects on air quality due to emissions of nitrogen dioxide, sulphur dioxide, suspended particulates or other pollutants? (3.1)	Air quality
Cause negative effects from the emission of greenhouse gases (CO_2, methane)? (3.2)	Air quality
Cause negative effects from the emission of dust or odour? (3.3)	Air quality

A description of the existing conditions will include discussions on the climate of the Site Study Area (SSA), which is an important parameter in assessing the Atmospheric Environment. The assessment of effects of the Project on the Atmospheric Environment will consider the SSA (see Figure 4.3-1), the Local Study Area (LSA) which encompasses an area extending approximately 1 km around the SSA and the Regional Study Area (RSA) which includes the regional airshed.

To assess the extent, duration and irreversibility of the Project on the Atmospheric Environment, the general criteria in Section 5.3.2 are used. To more accurately assess the magnitude of effects, specific criteria for the Atmospheric Environment Key Indicators are defined in Table 7.4-3 below.

Table 7.4-3: Impact Assessment Criteria for the Atmospheric Environment

Key Indicator	Levels of Magnitude			
	Negligible	**Low**	**Moderate**	**High**
Greenhouse gases, Indicator compounds, Odour, Fugitive dust	No nominal change from baseline where the effects are fully reversible	Nominal change from baseline where more than 50% of the baseline can be regained	Measurable change from baseline where less than 50% of the baseline condition can be regained	Measurable change from baseline where the effects are irreversible

The following sections describe the existing conditions within the Atmospheric Environment at the SSA, as well as the assessment of effects of the Project on the Atmospheric Environment VEC.

7.4.2 Existing Conditions

7.4.2.1 Climate

The Project is to be located within the Township of Adelaide Metcalfe, Ontario, near the Village of Adelaide. Therefore the SSA will experience climatic conditions typical of southwestern Ontario. Environment Canada operates a climate station in the town of Strathroy (to the southeast of the Village of Adelaide). Data from this station can be considered representative of the climate of the SSA and LSA. Climate normals for this station are available for temperature and precipitation. Tables 7.4-4 and 7.4-5 present the representative temperature and precipitation normals for the SSA (Environment Canada 2008a).

Table 7.4-4: Temperature Normals for Strathroy, Ontario

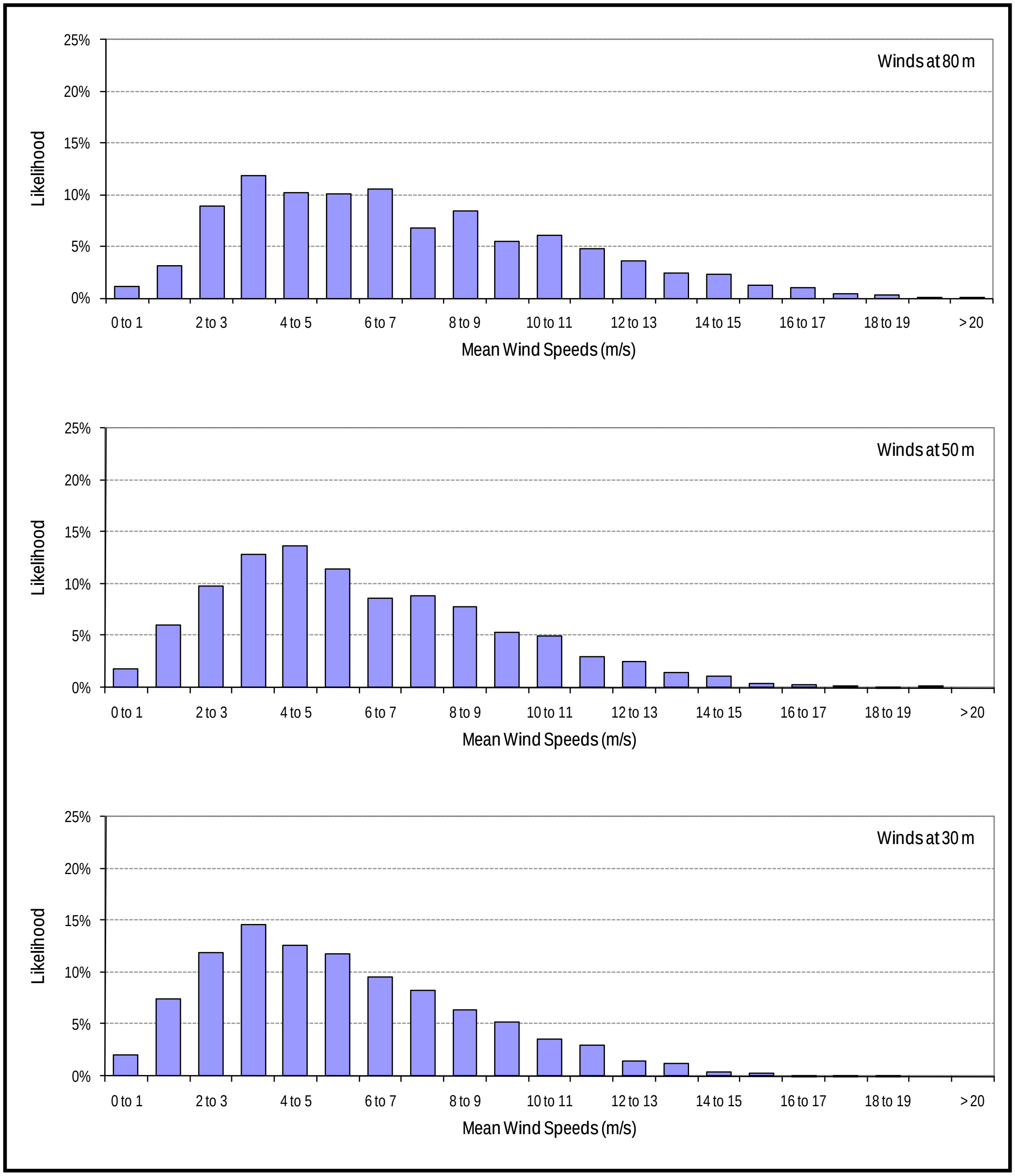
Strathroy	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Daily Average (°C)	-5.8	-5.2	0.5	7	13.6	18.6	21.2	20.2	16	9.8	3.8	-2.5
Standard Deviation (°C)	2.9	2.7	2.3	1.8	1.9	1.5	1.1	1.3	1.1	1.8	1.7	2.7
Daily Maximum (°C)	-2.2	-1.2	4.7	12	19.4	24.3	27	25.8	21.4	14.5	7.3	0.7
Daily Minimum (°C)	-9.4	-9.2	-3.7	1.9	7.7	12.8	15.3	14.5	10.5	5.2	0.3	-5.7
Extreme Maximum (°C)	15.5	15.5	24.5	30	34	39	38	35.5	34.4	29.4	22.8	19.5
Extreme Minimum (°C)	-30.6	-34.4	-30.6	-14.5	-5.6	-2.8	3.3	1	-2.8	-7.5	-18.9	-26.1

Table 7.4-5: Precipitation Normals for Strathroy, Ontario

Strathroy	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly Rainfall (mm)	27.2	26.9	51.2	75.2	73.9	74.5	71.7	82.1	89.8	67.4	77.6	45.9
Monthly Snowfall (cm)	48.1	34.2	23.8	8.8	0.1	0	0	0	0	3.4	16.9	46.5
Monthly Precipitation (mm)	75.3	61.1	74.9	84	74	74.5	71.7	82.1	89.8	70.8	94.5	92.4
Extreme Daily Precipitation (mm)	57.9	45.4	37.3	71.4	50.7	70.6	90.4	57.9	59.7	69	53.3	50.8

The wind normals for the Adelaide area are available through Environment Canada from the Canadian Wind Energy Atlas. The wind data for the SSA at 30, 50 and 80 m, is shown below in Figure 7.4-1 (Environment Canada, 2008b).

Figure 7.4-1: Mean Wind Speeds for Adelaide, Ontario



7.4.2.2 Air Quality

The nearest air quality monitors stations to the SSA are two Ministry of the Environment air quality monitors, located in the towns of London and Grand Bend, Ontario. Based on the data from these two stations, the existing air quality in the SSA is characterised by periodic exceedances of the Canada-Wide Standard for $PM_{2.5}$ and NO_X, respectively, like during smog-events. The available data shows no exceedances of SO_2 air quality criteria (MOE, 2008).

7.4.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on the Atmospheric Environment is provided in Table 7-1, and is summarized as follows:

- Use of construction and maintenance equipment could result in the emissions of pollutants, dust and carbon dioxide (CO_2); and
- By temporarily exposing soil and soil stockpiles, there could be an increase in air-borne dust.

An assessment of the interactions defined above to determine where there is a potential for measurable changes to the Atmospheric Environment as a result of the Project is identified in Table 7.4-6 below.

The assessment of the effects of the Project on the Atmospheric Environment is based on the description of the Project provided in Sections 4.2 to 4.5.

Table 7.4-6: Identification and Assessment of Potential Interactions with the VEC of the Atmospheric Environment

Relevant Project Activity	Air Quality (Indicator compounds, greenhouse gases and dust or odours)
Site Preparation and Construction	
Surveying and siting operations	**(no)**
Land clearing	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment • Dust from land clearing activities
Road construction/modification	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment • Dust from land clearing activities
Delivery of equipment	**(yes)** • GHG emissions from delivery vehicles
Temporary storage facilities	**(no)**

Table 7.4-6: Identification and Assessment of Potential Interactions with the VEC of the Atmospheric Environment (continued)

Relevant Project Activity	Air Quality (Indicator compounds, greenhouse gases and dust or odours)
Foundation construction	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment • Dust from land clearing activities
Tower and turbine assembly and installation	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment
Interconnection from turbines to substation	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment • Dust from trench excavation
Transmission line to power line	**(no)**
Fencing/gates	**(no)**
Parking lots	**(no)**
Operation and Maintenance	
Wind turbine operation	**(no)**
Maintenance activities	**(yes)** • Indicator compound emissions from equipment • GHG emissions from maintenance vehicles
Decommissioning	
Removal of turbines and ancillary equipment	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment
Removal of buildings and waste	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment • Dust from land clearing activities
Removal of power line	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment

Table 7.4-6: Identification and Assessment of Potential Interactions with the VEC of the Atmospheric Environment (continued)

Relevant Project Activity	Air Quality (Indicator compounds, greenhouse gases and dust or odours)
Site remediation	**(yes)** • Indicator compound emissions from equipment • GHG emissions from equipment • Re-vegetation and planting, which will increase the available carbon sinks • Dust from land clearing activities

7.4.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which the Atmospheric Environment may be affected by the various Project activities include:

- Greenhouse gas emissions from equipment; and
- Dust from land clearing activities.

During the initial assessment, specific provincial screening questions are asked to identify potential interactions with the environment. The topics that were identified as having a potential interaction with the Atmospheric Environment are as follows:

- Potential for adverse effects on air quality due to emissions of nitrogen dioxide, sulphur dioxide, suspended particulates or other pollutants;
- Potential for adverse effects from the emission of greenhouse gases (CO_2, CH_4); and
- Potential for adverse effects from the emission of dust or odour.

The following assessment of effects focuses on the above topics, as all other interactions were determined to have no effect on the Atmospheric Environment. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and if applicable, the need for further mitigation is evaluated. Also, residual effects remaining after mitigation are identified and advanced to Section 7.4.6 for an analysis of significance.

As determined through the secondary screening (Table 7.4-6), potential interactions were identified for Project activities during each of three phases and the VEC of Air Quality. These are described further below.

Site Preparation and Construction

The Land Clearing, Road Construction/Modification, Delivery of Equipment, Foundation Construction, Tower and Turbine Assembly and Installation, and Interconnection from Turbines to Substation Project works are activities from the Site Preparation and Construction Phase that have the potential to affect air quality through the increased presence of construction and delivery vehicles and equipment, through the loss of vegetation, and through the generation of air-borne dust.

Construction activities will lead to the emission of Greenhouse Gases (GHG) and indicator compounds, from vehicles and machinery operating on site. These emissions will fluctuate through the various construction phases, with land clearing, road construction and maintenance and foundation construction having the highest potential for GHG and indicator compound emissions, because of increased construction equipment activities during this time. In general these emissions will be minor and localized.

The construction phase of the Project also has the potential to generate fugitive dust emissions, which act as an environmental nuisance. These emissions will be highest during land clearing and other activities that involve significant levels of material handling (e.g., aggregate laydown in road construction, preparation for the installation of buried cables). Fugitive dust emissions will be managed by the implementation of Best Management Practices (BMP), which will help reduce the potential for dust generation and also mitigate emissions. This will help limit the transport of dust off-site.

The site preparation and construction activities will not involve the management or handling of odorous material. Therefore, there will not be any odour emissions from the construction phase.

Operation and Maintenance

During the Operation and Maintenance Phase of the Project, maintenance activities have the potential to cause infrequent and short-term emissions of low levels of GHGs and indicator compounds from maintenance equipment and vehicles on site. These emissions are expected to be considerably lower in magnitude than those from construction activities. Fugitive dust emissions will be managed by the implementation of BMPs, which will help reduce the potential for dust generation and also mitigate emissions. This will help limit the transport of dust off the site.

Operation and maintenance activities are not anticipated to generate any odour emissions.

The operation and maintenance phase of the Project will have significantly lower impacts on Air Quality than construction phase. Therefore no mitigation measures or follow-up are required, and no residual effects are expected.

Decommissioning

The Removal of Turbines and Ancillary Equipment, Removal of Buildings and Waste, Removal of Power Lines, and Site Remediation Project works are activities from the Decommissioning Phase that have the potential to affect air quality through the increased presence of construction and delivery vehicles and equipment, and through the generation of air-borne dust.

Similar to construction activities, decommissioning of the Project will involve the use of heavy equipment. This equipment will emit GHGs and indicator compounds for the duration of decommissioning activities, with highest levels of emissions during the periods with the most vehicular and equipment activity. These emissions will be of low levels and will be localized.

There is a potential for decommissioning activities to generate fugitive dust emissions, but these emissions should be lower than levels generated during construction. Fugitive dust emissions will be managed by the implementation of BMP, which will help reduce the potential for dust generation and also mitigate emissions. This will help limit the transport of dust off-site.

The Site Remediation activity will include re-vegetation and planting of the areas affected by the Project, thereby increasing the number of trees/vegetation that act as carbon sinks and will be a positive effect of this phase.

It is not anticipated that there will be any odour emissions during the decommissioning of the Project.

7.4.5 Mitigation, Residual Effect and Follow-up

7.4.5.1 Air Quality

The mitigation measures, residual effects and recommended follow-up for each of the potential interactions between Project activities during each of the three Project phases and this VEC are described below.

Site Preparation and Construction, Decommissioning

A BMP plan for fugitive dust will be implemented at the site during Site Preparation and Construction and Decommissioning. This will help reduce the potential for dust generation and also mitigate emissions. The main items included in the BMP plan are as follows:

- Implementation of a speed limit on access roads within the SSA, which will lead to reduced disturbance of dust on paved and un-paved surfaces.
- Application of dust suppressants to unpaved areas (i.e., unpaved roads, storage piles), which may include the use of water or chemical dust suppressants. The frequency of application will be determined based on site conditions during the construction process, and will be adjusted to increase suppression in drier periods.
- Staging of land clearing and heavy construction activities to reduce the number of activities with high potential for dust generation occurring simultaneously. This will be done to the extent that is feasible, based on the Project schedule.
- Re-vegetation of cleared areas, as soon as is possible, and maintenance of the vegetation to ensure growth.
- The installation of wind fences in areas where they may be required.
- The implementation of a complaint response program, whereby complaints received from the public are recorded and investigated. The investigations should be focused on determining the cause of the complaint and, if necessary, mitigative measures should be implemented.

Emissions of GHGs and indicator compounds will be managed as best as possible by implementing specific measures, as follows:

- Ensure proper maintenance of all vehicles, to reduce the potential for abnormal operation and increases in emissions;
- Implementation of a speed limit on access roads within the SSA; and
- Implementation of rules regarding idling of engines, to limit idling of vehicles as much as possible.

With the incorporation of these mitigation measures into the Project, the extent of the effects of the Project on Air Quality is anticipated to be restricted to the LSA; the duration of the effects will be short-term; the frequency of these effects may be once a week or less and the effects will be fully reversible. Therefore, based on the assessment measure levels provided in Table 5.3-2 and the level of importance criteria provided in Table 5.3-3, the site preparation and construction and decommissioning phases are anticipated to have a minimal impact on Air Quality.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

7.5 Environmental Noise

This section pertains to the following question from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- Cause negative effects from the emission of noise? (3.4)

Because this question has not been "screened out" in the initial screening (Table 7-1), it has been carried forward into this assessment. The following sections provide a summary of the methods and results for the noise assessment that was completed for the Adelaide Wind Farm Project. Appendix C provides the Noise Impact Assessment that was prepared in accordance with Ministry of the Environment (MOE) guidelines (MOE, 2008).

7.5.1 Existing Conditions

The SSA can be best defined as Class 3 rural as per MOE Publications NPC-232 and NPC-233 (MOE, 1995a and 1995b). The performance limits for Class 3 areas are listed in MOE Publication NPC-232 (MOE 1995b). The noise level limits are also provided in reference to wind induced background sound level in MOE Publication PIBS 4709e "*Noise Guidelines for Wind Turbines: Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities (October 2008)"*(MOE 2008).

As defined in these MOE documents, the sound level limit for the residential receptors in a Class 3 area can be described as follows:

- For wind speeds at or below 6 m/s

  The sound level limit at a Point of Reception, expressed in terms of the hourly equivalent energy sound level (L_{eq}) is 40.0 dBA or the minimum hourly background sound level established in accordance with requirements un Publication NPC-232/NPC-233, whichever is higher.

- For wind speeds above 6m/s

  The sound level limit at a Point of Reception in a Class 3 Area (Rural), under conditions of average wind speed above 6 m/s respectively, expressed in terms of the hourly equivalent energy sound level (L_{eq}), is the wind induced background sound level, expressed in terms of ninetieth percentile sound level (L_{A90}) plus 7 dB, or the minimum hourly background sound level established in accordance with requirements in Publications NPC-232/NPC-233, whichever is higher.

These limits are summarized in Table 7.5-1.

Table 7.5-1: Summary of Class 3 Noise Level Limits Based on Average Wind Speed

Wind Speed at 10 m Height (m/s)	≤ 6	7	8	9	10
Class 3 Criteria (dBA)	40.0	43.0	45.0	49.0	51.0

7.5.2 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VEC) for Environmental Noise. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project. The VECs can be individual valued species or environmental components.

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on the Environmental Noise have been assessed by evaluating the noise levels from the project at Points of Reception. Table 7.5-2 presents the VEC for the Environmental Noise along with the basis for its selection and the specific indicators used in the assessment.

Table 7.5-2: Valued Ecosystem Component and Key Indicator Selected for Environmental Noise

VEC Selection	Key Indicator(s)	Selection Basis
Noise Environment	Noise Level (1-hour L_{eq}[1])	Compliance with MOE noise guidelines is based on predictable worst-case 1-hour L_{eq} noise levels

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between the VEC and the MOE Screening Criteria Question that it addresses is provided in Table 7.5-3.

1 Leq is defined as the hourly equivalent energy sound level

Table 7.5-3: MOE Screening Criteria Questions and VEC for Environmental Noise

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Cause negative effects from the emission of noise? (3.4)	Noise levels (1-hour L_{eq})

7.5.2.1 Receptors

For the purposes of the Environmental Noise assessment, the Site Study Area (herein referred to as the SSA) is defined by the Site boundaries shown on Figure 4.3-1, and the Local Study Area (LSA) extends approximately 2.0 km in all directions from the Site boundary. The receptors within the SSA were assessed primarily based on field studies (described in the next section), but also as a desktop exercise which involved gathering existing information from aerial photo interpretation. The receptors within the LSA were assessed primarily based on desktop studies and incidental observations during field surveys.

Points of Reception

219 residential receptors have been identified as Points of Reception (PORs) in accordance with MOE guidelines. These PORs have been modelled at a height of 4.5m and located at the centre of the dwelling. 82 Vacant lots have also been modelled with PORs located within a building envelope typical to the area. More specifically, the PORs have been placed at the point within the building envelope closest to the nearest turbine. These receptors have also been modelled at a height of 4.5m above grade. Appendix C provides a detailed summary of all identified PORs.

To assess the extent, duration and reversibility of the Project on Environmental Noise, the general criteria in Section 5.3.2 are used. To more accurately assess the magnitude of effects, specific criteria for Environmental Noise Key Indicators are defined in Table 7.5-4 below.

Table 7.5-4: Effects Assessment Criteria for Environmental Noise in Class 3 Areas

Key Indicator	Wind Speed at 10 m Height (m/s)	Levels of Magnitude			
		Negligible[a]	Low[b]	Moderate[c]	High[d]
1-hour L_{eq}	≤ 6	≤ 33.0 dBA	≤ 40.0 dBA	N/A	> 40.0 dBA
1-hour L_{eq}	7	≤ 36.0 dBA	≤ 43.0 dBA	N/A	> 43.0 dBA
1-hour L_{eq}	8	≤ 38.0 dBA	≤ 45.0 dBA	N/A	> 45.0 dBA
1-hour L_{eq}	9	≤ 42.0 dBA	≤ 49.0 dBA	N/A	> 49.0 dBA
1-hour L_{eq}	10	≤ 44.0 dBA	≤ 51.0 dBA	N/A	> 51.0 dBA

[a] Negligible magnitudes were assigned when operation noise levels were predicted to be at or below the MOE recommended L_{90} for wind speeds ranging from 6 m/s to 10 m/s.

[b] A low magnitude was assigned when operation noise levels were predicted to be greater than the MOE recommended L_{90} but less than or equal to the MOE recommended L_{eq} for wind speeds ranging from 6 m/s to 10 m/s.

[c] A moderate magnitude was not assigned.

[d] High magnitudes were assigned when the noise levels from operations were predicted to be greater than the respective MOE noise limits for wind speed ranging from 6 m/s to 10 m/s.

Participating Receptors

In accordance with MOE guidelines, a receptor is a Participating Receptor (PR) and is not considered as a POR if the property of the receptor is associated with the Project. Therefore, the sound level limits recommended by the MOE do not apply at these locations.

Noise predictions have been carried out at these locations, however an assessment of the extent, duration and reversibility of the Project on Environmental Noise, as described in Section 5.3.2, will not be carried out for PRs.

45 existing receptors on signed lots have been identified as PRs in accordance with MOE guidelines. These receptors have been modelled at a height of 4.5 m and located at the centre of the dwelling. There are an additional 29 signed vacant lots that may have dwellings in the future. These have also been modelled with PRs located within a building envelope typical to the area. These PRs have been placed at the point within the building envelope closest to the nearest turbine. These receptors have also been modelled at a height of 4.5m above grade. These PR locations are summarized in Appendix C.

The following sections describe the existing conditions as they relate to Environmental Noise within the SSA and LSA, and an assessment of the potential effects of the Project on the VECs.

7.5.2.2 Determining Noise Emissions from the Project

The next step in the noise assessment involved estimating the noise emissions from significant noise sources from the Project (e.g., wind turbines and substation transformer). These emissions were then used as inputs for the noise models that provided estimates of noise levels due to Project emissions at PORs. Finally, the modelling results were compared to the MOE's established standards for baseline noise levels in Class 3 areas.

Various data sources were used when determining the noise emissions from the Project, including noise data from the wind turbine manufacturer and transformer noise specifications in accordance with CSA-C88-M90. Noise data for the wind turbines were acquired by Vestas in accordance with IEC 61400-11 procedures as identified in the manufacturer's noise data provided in Appendix C.

7.5.2.3 Wind Turbine Noise Data

The Project consists of 40 Vestas V90 – 1.8MW 60 Hz Wind Turbines with a total project rated capacity of 72MW. Tables 7.5-5 and 7.5-6 summarize wind turbine overall sound power level data provided by Vestas. The overall sound power levels were provided for both the 50 Hz model and 60 Hz models. However, at this time octave band data was available only for the 50 Hz model. Since the overall sound power level for the 50 Hz model is higher than that for the 60 Hz model, the sound power spectrum for the 50 Hz model was used in the assessment of the potential effects of the Project on the noise environment.

Table 7.5-5: Overall Sound Power Levels for Vestas V90 – 1.8 MW 50Hz Wind Turbines[a]

Wind Speed (m/s) at 10m height	6	7	8	9	10
Standard Operating Mode[b]	102.5	103.6	104.0	104.0	104.0

[a] Manufacturers test data based on a wind shear of 0.1592.
[b] Maximum sound power level of 104.0 dBA.

Table 7.5-6: Overall Sound Power Levels for Vestas V90 – 1.8 MW 60Hz Wind Turbines[a]

Wind Speed (m/s) at 10m height	6	7	8	9	10
Standard Operating Mode[b]	102.3	103.1	103.5	103.5	103.5

[a] Manufacturers test data based on a wind shear of 0.16.
[b] Maximum sound power level of 103.5 dBA.

The sample octave band spectra for the Vestas V90-1.8 are summarized in Table 7.5-7.

Table 7.5-7: Sample Octave Band Spectra for various Wind Speed at 10 m Height (50 Hz)

	Octave Band Sound Power Level (dB)				
	Manufacturer's Emission Levels[a]				
Wind Speed (m/s) at 10m height	**≤ 6**	**7**	**8**	**9**	**10**
Frequency (Hz)					
63	110.7	112.4	112.3	111.3	112.0

Table 7.5-7: Sample Octave Band Spectra for various Wind Speed at 10 m Height (50 Hz) (continued)

	Octave Band Sound Power Level (dB)				
	Manufacturer's Emission Levels [a]				
Wind Speed (m/s) at 10m height	**≤ 6**	**7**	**8**	**9**	**10**
125	105.1	106.9	106.8	106.8	106.6
250	100.9	102.1	101.9	101.0	101.4
500	97.9	98.4	98.9	98.3	98.4
1000	97.4	98.3	98.6	97.3	98.3
2000	94.6	95.6	96.3	95.3	96.3
4000	92.8	94.3	95.0	97.8	95.5
8000	86.0	89.7	90.4	91.2	93.0
A-Weighted	**102.5**	**103.6**	**104.0**	**104.0**	**104.0**

[a] Tested based on Measurement standard IEC 61400-11 ed. 2 2002.

7.5.2.4 Transformer Noise Data

The Project substation will include a step-up power transformer located south of highway 402 just east of Kerwood Road. Table 7.5-8 provides the transformer noise specification that will be used to procure the substation transformer. The specification is based on a sound pressure level of 74 dBA at a distance of 2 m from any surface on the transformer. This results in an overall sound power level of 100 dBA for the transformer.

Table 7.5-8: Substation Transformer Sound Power Noise Specification

Octave Band Centre Frequency (Hz)								
Source	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Transformer[a]	103.4	106.9	105.0	97.8	90.9	87.7	79.4	70.5

[a] Transformers will be designed in accordance with all applicable standards including CSA-C88-M90 and the above octave band sound power levels.

7.5.2.5 Predictive Noise Modelling

There are a number of factors that can affect noise levels in the environment. Typically, these factors result in attenuated noise levels at a point of reception. The most important of these is the distance between the source and the receiver. As distance increases, noise levels decrease. Other environmental factors that can result in noticeable changes to the noise levels include the following:

- Absorption of acoustic energy by the atmosphere;
- Loss of acoustic energy as it travels around or over hills; and
- Loss of acoustic energy as it passes over the ground (i.e., ground impedance).

The Computer Aided Noise Attenuation (CadnaA) prediction model developed by DataKustik GmbH is widely accepted for evaluating environmental noise. The model algorithms are based on ISO 9613 *Acoustics: Attenuation of Sound During Propagation Outdoors* (International Standard Organization, 1993 and 1996).

The model has the ability to simulate emission sources such as wind turbines, substations, roads, vessels and industrial facilities. Noise sources are characterized by entering the sound power and/or sound pressure frequency spectrum associated with each source. Other parameters such as building dimensions, frequency of use, hours of operation and enclosure attenuation ratings also define the nature of sound emissions. The ISO 9613 model assumes that all receptors are downwind from the noise source or that a moderate temperature inversion exists. In addition, ground cover, physical barriers, either natural (terrain based) or man-made and atmospheric absorption are included as determined by the Project. Predictions were carried out for all identified receptors (i.e., PORs and PRs) within the SSA and the LSA. Appendix C provides a complete summary of the modelling methods.

7.5.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on Environmental Noise is provided in Table 7.5-1 and is summarized as follows:

- Increased noise levels have the potential to occur during operation and construction of the Adelaide Wind Power Project.

The assessment of the effects of the Project on Environmental Noise is based on the description of the Project provided in Section 4.5.

A summary of the identification and assessment of potential interactions between the Project and Environmental Noise, according to the MOE screening criteria are found in Table 7.5-9.

Table 7.5-9: Identification and Assessment of Potential Interactions with a VEC of Environmental Noise

Relevant Project Activity	Noise levels
Site Preparation and Construction	
Surveying and siting operations	**(yes)** • Surveying and siting operations may result in a slight increase in noise levels.
Land clearing	**(yes)** • Increased noise levels due to operation of construction equipment.
Road construction/modification	**(yes)** • Increased noise levels due to operation of construction equipment.
Delivery of equipment	**(yes)** • Increased noise levels due to truck delivery of equipment.
Temporary storage facilities	**(yes)** • Increased noise levels due to construction of storage facilities.
Foundation construction	**(yes)** • Increased noise levels due to operation of construction equipment.
Tower and turbine assembly and installation	**(yes)** • Increased noise levels due to operation of construction equipment.
Interconnection from turbines to substation	**(yes)** • Increased noise levels due to operation of construction equipment.
Transmission line to power line	**(yes)** • Increased noise levels due to operation of construction equipment.
Fencing/gates	**(yes)** • Increased noise levels due to operation of construction equipment.
Parking lots	**(yes)** • Increased noise levels due to operation of construction equipment during parking lot construction.

Table 7.5-9: Identification and Assessment of Potential Interactions with a VEC of Environmental Noise (continued)

Relevant Project Activity	Noise levels
Operation and Maintenance	
Wind turbine operation	**(yes)** • Operations of wind turbines will result in increased noise levels.
Maintenance activities	**(yes)** • Increased noise levels due to maintenance operations.
Decommissioning	
Removal of turbines and ancillary equipment	**(yes)** • Increased noise levels due to operation of construction equipment.
Removal of buildings and waste	**(yes)** • Increased noise levels due to operation of construction equipment.
Removal of power line	**(yes)** • Increased noise levels due to operation of construction equipment.
Site remediation	**(yes)** • Increased noise levels due to operation of construction equipment.

7.5.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which Environmental Noise may be affected by the various Project activities include the following:

- Increased noise levels may result during the Site Preparation and Construction Phase;
- Increased noise levels may result during the Operation and Maintenance Phase of the Project; and
- Increased noise levels may result during the Decommissioning Phase.

The following assessment of effects focuses on these topic(s), as no other interactions were determined to have an effect on Environmental Noise. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and if applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are advanced to Section 7.5.5 for an analysis of significance.

7.5.4.1 Noise Levels

As determined through the secondary screening (Table 7.5-9), potential interactions were identified for Project activities during 3 Phase(s). The interactions are described in further detail below.

Site Preparation and Construction

During the Site Preparation and Construction Phase, land clearing, road construction/modification, delivery of equipment and the interconnection from turbines to the substation have the potential to affect noise levels due to the operation of heavy equipment. To minimize the potential increase in noise levels, these activities have been limited to daytime periods (i.e., 0700 – 1900). All construction equipment will be kept in good repair and will not exceed the noise emissions as specified in MOE Publication NPC-115 (MOE 1978). Also, all construction must abide by any local bylaws.

Operation and Maintenance

Based on the results of the Noise Impact Assessment, the operations of the wind turbines and substation transformer will result in noise levels that are below the most restrictive noise limit of 40 dBA set by the MOE for wind farms (i.e., the noise limit attributed to a wind speed of 6m/s at a height of 10m). The full details of the Noise Impact Assessment are provided in Appendix C.

Decommissioning

Activities associated with the Decommissioning Phase have the potential to affect noise levels due to the operation of heavy equipment. In order to minimize the potential increase in noise levels, these activities have been limited to daytime periods (i.e., 0700 – 1900). All construction equipment will be kept in good repair and will not exceed the noise emissions as specified in MOE Publication NPC-115 (MOE 1978). Also, all construction must abide by any local bylaws.

7.5.5 Residual Effects, Determination of Significance and Follow-up

7.5.5.1 Noise Levels

The residual effects, after mitigation measures have been implemented, were assessed to determine their overall importance using the methods described in Section 5.3. The mitigation measures, residual effects and recommended follow-up for each of the potential interactions during all Project Phase(s) are described below.

Site Preparation and Construction

During the Site Preparation and Construction Phase, land clearing, road construction/modification, delivery of equipment, and the interconnection from turbines to the substation have the potential to affect noise levels due to the operation of heavy equipment. In order to minimize the potential increase in noise levels, these activities have been limited to daytime periods (i.e., 0700 – 1900). All construction equipment will be kept in good repair and will not exceed the noise emissions as specified in MOE Publication NPC-115 (MOE 1978). Also, all construction must abide by any local bylaws. The residual effects on noise levels will be minimal, as they will be primarily limited to the SSA, only occur during the Site Preparation and Construction Phase and are completely reversible. Therefore, no follow-up is required.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Operation and Maintenance

One of the criteria used during the design stages of the Project was to minimize noise effects due to the operation of the Adelaide Wind Power Project at PORs. Predictive noise modelling was carried out to ensure compliance with MOE noise guidelines at the identified PORs. Although the predicted noise levels from Project Operations will be below the MOE noise level limits for wind turbines, the noise levels within the SSA and the LSA will be elevated when compared to the existing conditions.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Decommissioning

The construction-type activities during the Decommissioning Phase of the Project will be similar to those in the Site Preparation and Construction Phase. Therefore, the same mitigation measures will be implemented to minimize any increase in noise levels. The residual effects on noise levels will be minimal, as they will be primarily limited to the SSA, only occur during the Decommissioning Phase and are completely reversible. Therefore, no follow-up is required.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

7.6 Visual Landscape

This section pertains to the following questions from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Have negative effects on scenic or aesthetically pleasing landscapes or views*? (7.2)

As this question has not been “screened out” in the initial screening (Table 7-1), it has been carried forward into this assessment.

7.6.1 Assessment Methods

The first step of the assessment process is to identify VECs for the Visual Landscape. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project. The VECs can be individual valued species or environmental components.

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on the Visual Landscape have been assessed by evaluating changes to the viewscape. Table 7.6-1 presents the VEC for the Visual Landscape along with the rationale for the VEC selection and the specific indicators used in the assessment.

Table 7.6-1: Valued Ecosystem Component and Key Indicators Selected for the Visual Landscape

VEC Selection	Key Indicator(s)	Selection Basis
Views and landscapes	Wind turbine visibility	Wind turbine has the potential to affect rural views and vistas.
	Construction activity	Reduction in the aesthetic of rural views and vistas due to the presence of project related construction.

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between the VEC and the MOE Screening Criteria Question that it addresses is provided in Table 7.6-2.

Table 7.6-2: MOE Screening Criteria Question and VEC for the Visual Landscape

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Have negative effects on scenic or aesthetically pleasing landscapes or views? (7.2)	Views and landscapes

A description of the existing conditions and an assessment of the effects of the Project on the Visual Landscape will consider the Visual Study Area (VSA). The VSA is defined as a 30 km radius from the centre of the project Site Study Area (see Zone of Theoretical Visibility (ZTV) Figure in Appendix E). 30 km is the recommended size of the ZTV for turbines with a hub height of approximately 95m, according to the Sinclair-Thomas Matrix, a study on visibility of wind turbines (CPRW, 1999).

The data sources used in the visual assessment are:

- NTDB (National Topographic Data Base) and NRVIS (National Resources and Values Information System) base data;
- NRVIS Digital Elevation Model (DEM) having a 10 m resolution;
- Site photos, to represent the vantage of an average adult, and taken during several site visits; and
- Turbine locations and turbine size specifications provided by AET.

To assess the extent, duration and irreversibility of effects of the Project on the Visual Landscape within the VSA the general criteria in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for the Visual Landscape Key Indicators are defined in Table 7.6-3.

Table 7.6-3: Effects Assessment Criteria for the Visual Landscape

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Wind turbine visibility Construction equipment visibility	No effect	Minor feature(s) appearing in the background of the landscape (17 km to horizon from vantage point) (CPRW, 1999)	Prominent feature(s) in the middle-ground of the landscape (7.5 km to 17 km from vantage point) (CPRW, 1999)	Visually dominant feature(s) in the immediate foreground or foreground of the landscape (0 to 7.5 km from vantage point) (CPRW, 1999)

Table 7.6-3: Effects Assessment Criteria for the Visual Landscape (continued)

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
		Feature(s) seen by residents and tourists from a limited number of vantage points. Feature(s) generally consistent with existing landscape (i.e., exhibits high degree of visual unity).	Feature(s) seen by residents and tourists from several vantage points. Feature(s) somewhat consistent with existing landscape (i.e., exhibits moderate degree of visual unity).	Feature(s) seen by residents and tourists from numerous vantage points. Feature(s) inconsistent with existing landscape (i.e., exhibits low degree of visual unity).

The following sections describe the existing conditions of the Visual Landscape within the VSA, and an assessment of the potential effects of the Project on Visual Landscape VECs.

7.6.2 Existing Conditions

Within the VSA, the landscape can be described as dominantly flat rural and agricultural land dotted by rural communities and small woodlots (average woodlot size is 8.4 ha). The VSA contains the communities of Adelaide, Arkona, Dejong, Forest, Glencoe, Kerwood, Keyser, Mount Brydges, Mullifarry, Napperton, Parkhill, Strathroy and Watford. Highway 402, a four lane divided highway, crosses the VSA from east to west. Within the VSA there are two highway interchanges along the 402 at Kerwood Road and Centre Road, respectively. The area along the 402 is a major infrastructure/utility corridor for oil, gas and electricity industries. The southern part of the VSA has two large existing transmission lines running right through the VSA from Sarnia in the west towards London in the east. There are also a number of existing large telecommunication towers in the VSA. The transmission lines and telecommunication towers constitute the highest, most visible structures in the VSA. These structures can be seen in Figures 7.6-1 to 7.6-3.

Calculated with the NRVIS DEM, elevations within the VSA range between 176 meters above sea level (masl) at the north end of VSA where the Ausable River discharges to Lake Huron and 302 masl on the east edge of the VSA just north of London. 90% of the land in the VSA is between 188 and 290 masl. The average slope is 1.8 degrees. The land within the SCRCA slopes south and the land with the ABCA slopes north.

7.6.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on the Visual Environment is provided in Table 7-1, and is summarized as follows:

- Activities during the Site Preparation and Construction, and Decommissioning Phases, in addition to the Operation of the Project have the potential to cause negative effects on scenic or aesthetically pleasing landscapes or views.

The assessment of effects to the Visual Landscape was based on the description of the Project provided in Section 4.0, and the following assumptions have been made:

- Wind turbines for the Project have a hub height of 95 m and a blade diameter of 90 m for a total height of 140 m;
- The only obstructing features other than topography are major woodlots (leaf on) and settlement areas; and
- The air does not contain haze or fog that hinders sight.

A summary of the identification and assessment of potential interactions between the Project and the Visual Landscape, according to the MOE screening criteria are found in Table 7.6-4.

Table 7.6-4: Identification and Assessment of Potential Interactions with a VEC of the Visual Landscape

Relevant Project Activity	Views and landscapes
Site Preparation and Construction	
Surveying and siting operations	**(no)**
Land clearing	**(yes)** • Construction vehicles and machinery • Loss of vegetation
Road construction/modification	**(yes)** • Construction vehicles and machinery
Delivery of equipment	**(yes)** • Delivery trucks travelling along all roads within the study area
Temporary storage facilities	**(no)**
Foundation construction	**(yes)** • Construction vehicles and machinery
Tower and turbine assembly and installation	**(yes)** • Cranes and towers

Table 7.6-4: Identification and Assessment of Potential Interactions with a VEC of the Visual Landscape (continued)

Relevant Project Activity	Views and landscapes
Interconnection from turbines to substation	**(yes)** • Construction vehicles and machinery
Transmission line to power line	**(yes)** • Construction vehicles and machinery
Fencing/gates	**(no)**
Parking lots	**(no)**
Operation and Maintenance	
Wind turbine operation	**(yes)** • Turbine towers and rotating blades • Substation • Aeronautical warning lights
Maintenance activities	**(no)**
Decommissioning	
Removal of turbines and ancillary equipment	**(yes)** • Cranes, delivery vehicles, construction vehicles and machinery
Removal of buildings and waste	**(yes)** • Delivery vehicles, construction vehicles and machinery
Removal of power line	**(yes)** • Construction vehicles and machinery
Site remediation	**(yes)** • Construction vehicles and machinery

7.6.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which rural views and vistas may be affected by the various Project activities include:

- Reduction in scenic or aesthetically pleasing views and landscapes due to project related construction; and
- Reduction in scenic or aesthetically pleasing views and landscapes due to the presence of the wind turbines and related infrastructure.

The assessment of effects that follows only addresses these topics as no other interactions were determined to have an effect on the Visual Landscape. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and if applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are advanced to Section 7.6.5 for an analysis of significance.

7.6.4.1 Views and Landscapes

As determined through the secondary screening (Table 7.6-4), potential interactions were identified between Project activities during each of the three phases and the VEC of Views and Landscapes. The interactions by phase are described further below.

Site Preparation and Construction

The Project requires large vehicles and machinery for landscaping, removal of vegetation as well as transport of equipment, parts and labour. Cranes used for assembly and extending up to 120 m high will be present at each turbine location during the Turbine Assembly and Erection Stage within the Site Preparation and Construction Phase. Due to the sheer size of the machinery and the flat landscape, site preparation and construction activities will be visible from many locations within the VSA for the duration of this phase while turbines are being constructed (approximately 8-10 months). Of the construction equipment used, the cranes are the largest and most visible.

There are no additional steps taken to mitigate the visual effects of the Project during the Site Preparation and Construction Phase on views and landscapes.

Operation and Maintenance

To assess the effects of the existence of the turbines on the landscapes and views within the VSA, a 2-dimensional viewshed analysis to identify the Zones of Theoretical Visibility (ZTV) was employed. The viewshed analysis was run using the NRVIS DEM and a height of 1.7 m for the average adult in standing position. The DEM was then supplemented by 8 m for forested areas identified by the NRVIS woodlot dataset and for the urban boundary of Strathroy as they provided visual barriers to the turbines. Small woodlots, hedgerows, individual trees and other upstanding features including buildings, silos, elevators, etc. were not considered in the analysis although these would also offer shielding effects. The viewshed analysis was processed on the entire VSA, covering 30 km from the project centre.

The results of the viewshed analysis, as seen in the ZTV figure in Appendix E, show that due to the flat nature of the landscape the potential for some visual effect of the wind farm can be experienced throughout the majority of the VSA. The yellow areas have potential sight lines to 31 to 40 turbines with the assumptions that the air does not contain haze or fog that hinders sight and that there are no other obstructing features other than the woodlots and the urban area of Strathroy included in the model. The areas in red have potential site lines to 21 to 30 turbines, the blue areas have potential sight lines to 11 to 20 turbines, while the green areas have potential sight lines to 1 to 10 turbines. Areas within the VSA that are without shading will have no turbines visible.

The existence of a sight line to the wind farm combined with a count of potentially visible turbines is not sufficient information to determine impact. As distance from a viewpoint to a turbine increases, the visual impact of the turbine becomes less dominant. The Sinclair-Thomas Matrix was developed to qualify the impact of turbines of a specific height as distance changes. At a distance of 17 km or greater, a turbine with a 95 m hub height can be considered to have a low visual impact. From 7.5 km to 17 km, that same turbine can be considered to have a moderate visual impact, while from less than 7.5 km the turbine can be considered to have a major or dominant visual impact. (CPRW, 1999)

To supplement the ZTV analysis, photomontages (Appendix E V1-V27) representing the viewpoints from 27 locations within the VSA were prepared. The viewpoints (V) from which the photos comprising the photomontages were taken are:

- V1 - Egremont Drive and Seed Road facing northeast;
- V2 - Adelaide Creek I (at Egremont Drive) facing northwest;
- V3 - Adelaide Creek II (at Egremont Drive) facing south;
- V4 - Egremont Drive and School Road facing southwest;
- V5 - Shooting Star Motel facing west;
- V6 - Cuddy Drive and Morse Road facing southeast;
- V7 - School Road and Egremont Drive facing northeast;
- V8 - Community of Hickory Corner facing west;
- V9 - Community of Wrightman's Corner facing west;
- V10 - Centre Road and Petty Street facing southwest;
- V11 - Centre Road and School Road facing south;
- V12 - Knox Church facing south;
- V13 - Community of Keyser facing south;
- V14 - Community of Rock Glen facing southeast;
- V15 - Egremont Drive and Arkona Road facing east;
- V16 - Egremont Drive and Kerwood Road facing east;
- V17 - Municipal Offices facing east;
- V18 - Kerwood Road and Napperton Drive facing north;
- V19 - Community of Napperton facing north;

- V20 - Centre Road (just north of the Town of Strathroy) facing northwest;
- V21 - Confederation Line and Donnelly Road facing northeast;
- V22 - Napperton Drive and School Road facing north;
- V23 - Highway 402 overpass at School Road facing northeast;
- V24 - Sexton Road and Napperton Drive Line facing northeast;
- V25 - Strathroy CA facing northwest;
- V26 - Strathroy Tourist Office facing northwest; and
- V27 - Zion Line and Donnelly Road facing east.

AET reviewed a map of the study area and drove the site area to select viewpoints that, when combined, would not only provide balanced cover of the entire site area but would also be representative of popular or frequently visited areas. The viewpoints provide an external and internal perspective and surround the highest density of wind turbines or turbine clusters to provide viewpoints of passersby and from the local community. There are four main residential areas in or on the edge of the study area (Adelaide Village, Arkona, Kerwood and Strathroy) and a number of viewpoints have been selected to represent these more populated locations.

The remaining viewpoints selected were either at easily recognizable main road intersections or taken from other strategic locations in the area, which would be known to and frequented by the public:

- Knox Church;
- Rock Glen Conservation Area;
- Strathroy Business Area;
- Township of Adelaide Metcalfe Municipal Offices;
- Shooting Star Motel;
- Strathroy Tourist Information Office;
- 402 overpass at School Road; and
- Strathroy Conservation Area.

To ensure that frequently visited places were accounted for, AET staff met with a representative from the Strathroy Tourist Information Office and agreed that the most significant outdoor Viewpoint in the area was the nearby “Strathroy Conservation Area” within the Town of Strathroy. Given the topography and built-up nature of the surrounding area within the Town it was not expected that the wind farm would be visible from this location however AET has prepared a Viewpoint from the car park area at this location to demonstrate this.

Viewpoints were also taken in Spring, Summer and Winter months so that there was a balanced view of the seasonal variations and how this may affect the view of the Adelaide Wind Farm.

All photos were taken using a Nikon D40 digital camera. PTGUI PanoTools was used to stitch multiple images together to create the panoramic views. Using the location specifications from each viewpoint, the wind farm analysis, design and optimization software package WindFarm© from ReSoft Limited was used to create a virtual layout of the proposed turbines from each of the viewpoints. Adobe® Photoshop© was then used to overlay this virtual layout onto the panoramic photos.

Mitigation measures built into the design of the towers will assist in reducing the adverse effects on visual landscapes. Towers, nacelles and blades will be painted white/light grey and the tower will be constructed of rolled steel (not steel lattice, which is more highly visible). Only those turbines that require lighting by Transport Canada for air navigational purposes will be lit.

Decommissioning

The Decommissioning Phase requires large vehicles and machinery for disassembly as well as transport of equipment, parts and labour. Cranes used for assembly and extending up to 120 m high will be present at each turbine location during the Turbine Assembly and Erection Stage within the Site Preparation and Construction Phase. Due to the sheer size of the machinery and the flat landscape, site preparation and construction activities will be visible from many locations within the VSA for the duration of this phase while turbines are being constructed. Of the construction equipment used, the cranes are the largest and most visible.

There will be no additional steps taken to mitigate the visual effects on views and landscapes during the Decommissioning Phase.

7.6.5 Residual Effects, Determination of Significance and Follow-up

The residual effects, after mitigation measures have been implemented, were assessed to determine their overall importance using the methods described in Section 5.3, and are summarized in Section 7.13.

7.6.5.1 Views and Landscapes

Site Preparation and Construction; Decommissioning

Equipment and vehicles associated with the Site Preparation and Construction Phase and the Decommissioning Phase of the Project will be clearly visible within the VSA for the duration of the Site Preparation and Construction Phase and Decommissioning Phase (approximately

8-10 months for Site Preparation and Construction, and 3 to 6 months for Decommissioning). The overall magnitude of the effect of the Project on rural views and vistas during this phase is considered high (Tables 7.6-2 and 7.6-4). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on rural views and vistas during this phase is restricted to the VSA; the duration is short-term (limited to the Construction and Site Preparation Phase and Decommissioning Phase); the frequency is moderate in that they will occur daily, and the irreversibility is negligible in that the effects are fully reversible. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Operation and Maintenance

Turbines will be visible from most areas within the VSA for the operational life of the Project. The overall magnitude of the effect of the Project on rural views and vistas during this phase is considered high (Table 7.6-2 and 7.6-4). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on rural views and vistas during this phase is restricted to the VSA; the duration is medium-term (limited to the Operation and Maintenance Phase); the frequency is high in that they will occur on a continuous basis, and the irreversibility is negligible in that the effects are fully reversible. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MEDIUM

7.7 Socio-Economic Resources

This section pertains to the following questions from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Have negative effects on neighbourhood or community character?* (6.1)
- *Have negative effects on local businesses, institutions or public facilities?* (6.2)
- *Have negative effects on recreation, cottaging or tourism?* (6.3)
- *Have negative effects related to increases in the demands on community services and infrastructure?* (6.4)
- *Have negative effects on the economic base of a municipality or community?* (6.5)
- *Have negative effects on local employment and labour supply*? (6.6)
- *Result in the creation of waste materials requiring disposal?* (9.1)

Any of the above questions that have been addressed, or "screened out" in the initial screening (Table 7-1) have not been carried forward into this assessment. For Socio-Economic Resources all questions have been carried forward.

7.7.1 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VECs) for Socio-Economic Resources. VECs are features of the environment selected to be a focus of the Environmental Assessment (EA) because of their ecological, social or economic value, and their potential vulnerability to effects of the Project.

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on Socio-Economic Resources have been assessed by evaluating various socio-economic changes. Table 7.7-1 presents the VECs for Socio-Economic Resources along with their rationale for selection and the specific indicators used in the assessment.

Table 7.7-1: Valued Ecosystem Components Selected for Socio-Economic Resources

VEC Selection	Key Indicator(s)	Selection Basis
Neighbourhood and Community character	Change in residents' perceptions of their neighbourhood and community Effects due to changes in: • Property values • Land use • Visual aesthetics • Public health and safety • Traffic	Regulatory guidance, professional experience, consultation records
Population and Demographics	Change in population or demographics	Regulatory guidance, professional experience
Employment, Business and the Economy (including fiscal benefits such as municipal taxes)	Change in capital investment, jobs created, quality of jobs, local spending and municipal tax base	Regulatory guidance, professional experience
Tourism and Recreation	Changes in: • Number of tourist visits • Recreational resources	Regulatory guidance, professional experience
Community Services and Infrastructure (including, institutions and public facilities; water supply, wastewater and solid waste management; fire, emergency and police services; healthcare; education; and transportation)	Changes in: • Remaining capacity of, or access to, services and infrastructure • Anticipated population growth	Regulatory guidance, professional experience

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between VECs and the MOE Screening Criteria Questions that they address is provided in Table 7.7-2.

Table 7.7-2: MOE Screening Criteria Questions and VECs for Socio-Economic Resources

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Have negative effects on neighbourhood or community character? (6.1)	Neighbourhood and Community Character
	Population and Demographics
Have negative effects on local businesses, institutions or public facilities? (6.2)	Employment, Business and the Economy
	Community Services and Infrastructure
	Population and Demographics
Have negative effects on recreation, cottaging or tourism? (6.3)	Tourism and Recreation
Have negative effects related to increases in the demands on Community Services and Infrastructure? (6.4)	Community Services and Infrastructure
	Population and Demographics
Have negative effects on the economic base of a municipality or community? (6.5)	Employment, Business and the Economy
	Population and Demographics
Have negative effects on local employment and labour supply? (6.6)	Employment, Business and the Economy
	Population and Demographics
Result in the creation of waste materials requiring disposal? (9.1)	Community Services and Infrastructure

A description of the existing conditions and an assessment of the effects of the Project on Socio-Economic Resources consider the Site Study Area (SSA) which includes all optioned parcels, turbines and cabling and the substation. The assessment also considers the Local Study Area (LSA) which, for Socio-Economic Resources, is defined by the geographic boundaries of the Township of Adelaide Metcalfe (referred to hereafter as Adelaide Metcalfe), the Township of Strathroy-Caradoc (referred to hereafter as Strathroy-Caradoc) and the Municipality of North Middlesex (referred to hereafter as North Middlesex), all located in the County of Middlesex. The LSA also includes and the Township of Warwick (referred to hereafter as Warwick) in Lambton County. Figure 7.7-1 shows the boundaries of the SSA and the LSA.

Existing conditions are identified to describe aspects of socio-economic conditions in the LSA that are relevant to the assessment of the effects of the Project. Data are compiled from the following sources:

- Official Plans for the County of Middlesex (2006), Adelaide Metcalfe (2005), Strathroy-Caradoc (2008), North Middlesex (2003), Lambton County (1997) and Warwick (1998);
- Ontario Provincial Policy Statement (2005);
- Statistics Canada Community Profiles (2006);
- Ministry of Finance Ontario Population Projections Update (2008);
- Trend, Opportunities and Priorities Report: Elgin, Middlesex, Oxford Local Training Board (2008); and
- Regional and municipal economic, employment and agricultural reports and studies.

To assess the magnitude, extent, duration and irreversibility of effects of the Project on Socio-Economic Resources within the Local Study Area, the general criteria described in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for Socio-Economic Resources Key Indicators are defined in Table 7.7-3.

Table 7.7-3: Effects Assessment Criteria for Socio-Economic Resources

Magnitude: Adverse Effects	
Low (L)	No effect on cultural, social or economic functions or processes beyond that of a minor nuisance.
Moderate (M)	Cultural, social and economic functions or processes continue, but in a somewhat modified way.
High (H)	Cultural, social or economic functions or processes are altered to the extent that they temporarily or permanently cease, resulting in deterioration of the impacted communities.
Magnitude: Beneficial Effects	
Low (L)	Slight positive effect on cultural, social or economic functions or processes.
Moderate (M)	Cultural, social or economic functions or processes continue in a noticeably enhanced way. The opportunities for livelihoods and the enhancement of socio-economic conditions are noticeably increased.
High (H)	Cultural, social or economic functions or processes, opportunities for livelihoods and socio-economic development are considerably promoted.

Table 7.7-3: Effects Assessment Criteria for Socio-Economic Resources (continued)

Duration: Life-Time of the Effect	
Short term (S)	0-5 years, the effects can be reversed in a short time.
Medium term (M)	5-15 years, the effects could be reversed over a medium time period, possibly coinciding with the life of the Project.
Long term (L)	The effect will only cease after the operational life of the Project.
Permanent (P)	The effect on the receiving environment will effectively be irreversible.
Extent: The Geographical Extent of the Effect	
Site (S)	Will affect the immediate Site Study Area.
Local (L)	Will affect one or more of the communities within the Local Study Area.
Regional (R)	Will affect the region (Southwestern Ontario).
Provincial (P)	Will affect Ontario.
National (N)	Will affect Canada.
Significance (Level of Importance)	
High (H)	Adverse consequences of the effect exceed the accepted parameters for changes in Socio-Economic Resources and residual effects are likely to persist in spite of mitigation measures; or Socio-Economic benefits accrue to large sectors of the economy and/ or population.
Medium (M)	Adverse effect does not breach the acceptable limits for changes in Socio-Economic Resources, as long as mitigation that is proposed is employed; or The effect has some minor benefits to Socio-Economic Resources within the environment.
Low (L)	The effect is so minor that Socio-Economic Resources within the environment are capable of being sustained without any noticeable adverse or beneficial effects.
Negligible (N)	The Socio-Economic Resources within the environment will not undergo an adverse or beneficial change as a result of the effect.

The following sections describe the existing conditions within Socio-Economic Resources on the Site and the LSA, and an assessment of the potential effects of the Project on the Socio-Economic Resources VECs.

7.7.2 Existing Conditions

7.7.2.1 Overview of the Local Study Area

The Site Study Area (SSA) is situated in the north-eastern corner of Adelaide Metcalfe and straddles Provincial Highway 402. The SSA is adjacent to North Middlesex to the north, Strathroy-Caradoc to the southeast, and Warwick to the west. Due to the proximity of the SSA to these municipalities, the Local Study Area (LSA) for this Project comprises all of Adelaide Metcalfe, North Middlesex and Strathroy-Caradoc in the County of Middlesex and Warwick in Lambton County (Figure 7.7-1).

The County of Middlesex and the second tier municipalities within it underwent significant restructuring in 2001 to create the current amalgamated municipalities within the LSA. Adelaide Metcalfe was formed by amalgamating the former Townships of Adelaide and Metcalfe (Adelaide Metcalfe 2004). Strathroy-Caradoc was formed by amalgamating the former Town of Strathroy and the former Township of Caradoc (Strathroy-Caradoc 2008). North Middlesex was formed by amalgamating the former Townships of East Williams, McGillivray and West Williams, the Town of Parkhill and the Village of Ailsa Craig (North Middlesex 2003). Warwick in Lambton County was formed in 1998 when the Village of Watford and the Township of Warwick were amalgamated (Warwick 1998).

Table 7.7-4 presents selected Statistics Canada Community Profiles (2006) census data for the townships and municipalities within the LSA. The LSA column is based on weighted calculations of Statistics Canada data (2006) for the municipalities that comprise the LSA, calculated by Golder.

Table 7.7-4: Local Study Area Size and Population Statistics

	Adelaide Metcalfe	North Middlesex	Strathroy-Caradoc	Warwick	LSA	Ontario
Land Area (km^2)	331.3	597.9	274.2	290.2	1,493.5	907,573.8
Population	3,117	6,740	19,977	3,945	33,779	12,160,285
Population Density (Persons/ km^2)	9.4	11.3	72.9	13.6	22.6	13.4

Source: Statistics Canada Community Profiles 2006

7.7.2.2 Neighbourhood and Community Character

Two two-tiered municipal systems are found within the LSA. The County of Middlesex makes up the upper tier of the region, while Adelaide Metcalfe, North Middlesex and Strathroy-Caradoc, along with five additional townships and municipalities, have lower tier municipal status. The western portion of the LSA includes Warwick, which is a lower tier municipality within the upper tier municipality of Lambton County. Agriculture is the predominant economic activity and land use throughout the County of Middlesex; however the municipalities that comprise the LSA each have features that create distinct community character (County of Middlesex 2006; Warwick 1998).

Adelaide Metcalfe has the smallest population of the communities within the LSA and has a primarily agricultural economic base (Adelaide Metcalfe Township 2004). Of the Adelaide Metcalfe land area (331.1 km^2), 261.7 km^2 (79.0%) of the area is farmland with 267 operating farms (Statistics Canada 2006). The most common crops are soybeans, corn (for grain and/or silage), winter wheat and alfalfa. Cattle and pig farming are the predominant livestock operation in the Adelaide Metcalfe (Statistics Canada 2006). Within Adelaide Metcalfe, planning policies do not encourage urban settlement as municipal water and sewage systems cannot sustain high density housing and the soil characteristics are poor for the construction of individual septic systems (Adelaide Metcalfe 2004). Industrial and highway commercial development is possible due to Adelaide Metcalfe's position along provincial Highway 402 (County of Middlesex 2006).

North Middlesex has a larger population than Adelaide Metcalfe and is slightly more diverse in its municipal structure and activities. In addition to farming, three urban communities are located in North Middlesex (Ailsa Craig, Nairn and Parkhill) and provide a foundation for manufacturing, business and tourism development (County of Middlesex 2006).

Strathroy-Caradoc is an urban-rural municipality and has the largest population of the municipalities within the LSA. It houses a relatively large urban settlement area, the former town of Strathroy, which accounts for approximately 68% of the Township's population. The majority of the Township's business and administrative activities are based in Strathroy (Strathroy-Caradoc 2008). Although agriculture is considered a long-established tradition in Strathroy-Caradoc, Strathroy's position on major transportation corridors (Highway 402 and the CN and CP railway lines with service between Toronto and Chicago) also allows the Township to sustain tourism, manufacturing and industrial businesses (County of Middlesex 2006).

Warwick is a relatively small township within Lambton County. Agriculture, industrial development and commerce are the economic base for the municipality. The majority of Warwick's residents live in the rural community of Watford where the majority of manufacturing and commercial activity is concentrated. Watford also functions as a trade and service centre for outlying rural areas of the Township (Warwick 2009).

7.7.2.3 Population and Demographics

Demographics

Statistics Canada (2006) demographic data from the following census divisions are used to characterize the population within the LSA:

- Township of Adelaide Metcalfe;
- Municipality of North Middlesex;
- Township of Strathroy-Caradoc; and
- Township of Warwick.

Table 7.7-5 below shows the most current Statistics Canada population data for the municipalities within the LSA (Statistics Canada 2006). Golder calculated these same statistics for the LSA as whole. The population within the listed municipalities within the LSA increased between 2001 and 2006 by 1.7%. Adelaide Metcalfe grew by 0.3% and Strathroy-Caradoc grew by 4.3%; however, North Middlesex and Warwick decreased by 2.3% and 2.0 %, respectively. The population growth and the population change for the individual municipalities within the LSA are low compared to Ontario's population growth of 6.6% over the same period. This is primarily due to the LSA's dependence on agriculture and manufacturing which are both declining sectors in Ontario and planning policies of these areas that encourage the maintenance of agricultural activities.

Middlesex County population data (Middlesex 2004; Middlesex 2006) for the period of 1991 to 2006 shows similar increasing/decreasing trends. Overall, the LSA has experienced population growth of 8.7%. Adelaide Metcalfe and Strathroy-Caradoc populations have increased by 1.7% and 14.5%, respectively. The population in North Middlesex has been steadily decreasing since 1991 (-2.8%).

Table 7.7-5: Local Study Area Population Demographics

	Adelaide Metcalfe	North Middlesex	Strathroy-Caradoc	Warwick	LSA	Ontario
2006	3,117	6,740	19,977	3,945	33,779	12,160,282
2001	3,109	6,901	19,154	4,025	33,189	11,410,046
2001 – 2006 % change	0.3	-2.3	4.3	-2.0	1.8	6.6
% change per year	0.06	-0.46	0.86	-0.4	0.36	1.32

Source: Statistics Canada Community Profiles 2006

Population growth for each of the municipalities within the LSA is projected in the County of Middlesex Official Plan (2006) and the Ministry of Finance's Ontario Population Projections Update (2008). Population projections for Warwick are estimated as a percentage of the population projections for Lambton County. Growth is expected to continue with the largest percent-increase over 20 years in Adelaide Metcalfe (32.8%), followed by Strathroy-Caradoc (18.2%), North Middlesex (9.3%) and Warwick (3.1%). Overall the population within the municipalities within the LSA is expected to increase by 18.5% over the next 20 years. Table 7.7-6 provides population projections compiled from the County of Middlesex Official Plan (2006), Statistics Canada Community Profiles (2006) and the Ontario Ministry of Finance Ontario Population Projections Update (2008).

Table 7.7-6: Local Study Area Population Projections 2006-2026

	Adelaide Metcalfe	North Middlesex	Strathroy-Caradoc	Warwick	LSA	Ontario
2026	4,138	7,370	23,764	4,067	39,339	15,688,100
2006	3,117	6,740	19,977	3,945	33,189	12,160,282
2006 – 2026 % change	32.8	9.3	19.0	3.1	18.5	29.0
% change per year	1.64	0.47	0.95	0.155	0.91	1.45

Source: Statistics Canada Community Profiles 2006
Source: Ministry of Finance Population Projections Update (2008)
Source: County of Middlesex Official Plan (2006)

Each municipality outlines strategies for growth and development over the upcoming years in recent planning documents. Strathroy-Caradoc is one of the fastest growing municipalities within the County of Middlesex because of its ability to attract development through existing urban and industrial amenities and services. Strathroy-Caradoc will continue to focus its growth and new business development efforts on the former town of Strathroy to maintain prime agricultural land and natural heritage sites (Strathroy-Caradoc 2008). Adelaide Metcalfe is planning for modest growth; however, it will not promote urban uses of land because it does not have the water and sewage systems in place to support large settlement areas (Adelaide Metcalfe 2004). North Middlesex will concentrate on developing existing settlement/urban areas in order to attract new businesses and industry while maintaining agricultural lands (North Middlesex 2003). Warwick will focus on stabilizing residential levels and attracting and retaining new residents and commercial activity (Warwick 1998).

7.7.2.4 Employment, Business and Economy

Economic Base

Manufacturing, construction and agriculture are the predominant economic sectors in the LSA (County of Middlesex 2006 and Warwick 2009). Agriculture is considered the traditional economic mainstay for the County of Middlesex. Gross farm receipts in the County of Middlesex totalled $594 million in 2006 (StatsCan 2006). The manufacturing and construction industries provide the highest number of jobs for the County of Middlesex (20% and 17% of County jobs, respectively). Across the LSA, the manufacturing sector provides the highest percentage of jobs (17.0%) followed by the agricultural sector (12.8%). The largest employers in the LSA are also in the manufacturing and agriculture sectors, and include the following (County of Middlesex 2009):

- Meridian Technologies (magnesium products): 370 full time jobs
- Wescast Industries (automotive engines): 286 full time jobs
- Cuddy Farms Partnership (poultry): 279 full time jobs

The Elgin, Middlesex, Oxford Local Training Board's Trends Opportunities and Priorities Report (2008) highlights four key trends in the community that are affecting the workforce and economic base. Similar trends are discussed in the Sarnia Lambton TOP report (2008). In these reports, an aging workforce is predicted to create retention and recruitment issues in the near future. This trend affects the farming sector in particular. Farmers under the age of 35 dropped by 19% between 1996 and 2001, while the overall number of farmers only dropped by 1%. Rising skill requirements could affect retention of skilled workers. The Elgin, Middlesex, Oxford Local Training Board area has a greater percentage of workers with lower levels of education when compared to Ontario overall. The London Economic Development Corporation indicates that 62% of businesses cite perceived lack of candidates as an issue when hiring or retaining employees (Elgin, Middlesex, Oxford Local Training Board 2008). In recent years, diversity in the workforce has been increasing. The region has seen increased intergenerational and equity group participation in the workforce. Regionally, a structural economic change is occurring which is resulting in increasing economic diversity. While jobs losses are mounting in the processing, manufacturing and utilities sectors, industries such as the food and beverage, plastics and paper and new small business developments are growing.

Municipalities within the LSA are working to combat the negative impacts of these trends by identifying key areas for development. These include enhancing the business environment by investing in small businesses and developing business retention strategies; addressing a declining manufacturing sector by targeting manufacturers that are well suited to the area; developing agricultural processes and the bio-economy; and developing an enhanced tourist industry (County of Middlesex 2006 and Warwick 2009).

Employment and Income

Table 7.7-7 provides labour force and income indicators for the municipalities within the LSA, Ontario (Statistics Canada 2006). Golder calculated these same statistics for the LSA as whole. Province-wide averages are provided in the table for comparative purposes. The 2006 participation rate (71.9%) in the LSA is higher than the provincial participation rate (67.1). The 2006 employment rate in the LSA (4.8%) was 1.6% less than Ontario's unemployment rate (6.4%). Each municipality reported unemployment rates lower than the Ontario average. The higher than average participation rate and lower than average unemployment rate in the LSA indicate a generally strong economy in this geographic region as of the 2006 census. Large urban centres tend to attract unemployed members of the workforce because they offer more employment opportunities and social programs (Anam 2008). Strathroy-Caradoc houses the largest urban centre (former town of Strathroy) and therefore has lower participation and higher unemployment rates than the other municipalities in the LSA.

Median income for individuals 15 years or older in the municipalities within the LSA is $26,886, slightly lower than the provincial average of $27,258. As identified in Table 7.7-7, individual municipalities within the LSA fall on either side of the provincial average.

Table 7.7-7: Labour Force Indicators

	Adelaide Metcalfe	North Middlesex	Strathroy-Caradoc	Warwick	LSA	Ontario
Population (15 years +)	2,325	5,155	15,830	3.040	26,350	9,819,420
Labour force[a]	1,785	3,870	11,075	2,195	18,925	6,587,580
Participation rate (%)[b]	76.8	75.1	70.0	72.2	71.9	67.1
Unemployment rate (%)[c]	3.9	3.1	5.4	5	4.8	6.4
Median Income ($)[d]	28,227	27,834	26,854	24,359	26,886	27,258

[a] Labour force refers to persons who were either employed or unemployed prior to Census Day (May 16, 2006) and are over the age of 15
[b] Participation rate refers to the labour force, expressed as a percentage of the population 15 years and older excluding institutional residents
[c] Unemployment rate refers to the unemployed expressed as a percentage of the labour force
[d] Median income refers to the median income of persons 15 years and older that have an income

Source: Statistics Canada Community Profiles 2006

Table 7.7-8 identifies industries according to the proportion of the total experienced workforce employed in the LSA. The total experienced workforce is concentrated in the manufacturing and agricultural sectors.

Manufacturing (17.0%) is the predominant industry, followed by other services (14.0%) and agriculture (12.8%). The percentage of people employed by the manufacturing and agriculture sectors fall above the provincial percentages of 13.0% and 2.9%, respectively. In the individual municipalities of Adelaide Metcalfe, North Middlesex and Warwick, agriculture is the predominant industry. In each of these municipalities the agricultural industry provides jobs for more of the labour force than manufacturing. However, Strathroy-Caradoc has a much larger population and a large proportion of that labour force is employed in the manufacturing sector.

Table 7.7-8: % Employment by Sector

Industry Sector	Adelaide Metcalfe	North Middlesex	Strathroy-Caradoc	Warwick	LSA	Ontario
Agriculture and other resource-based industries	22.0	20.3	8.0	16.5	12.8	2.9
Construction	7.9	10.7	7.7	10.3	8.6	5.9
Manufacturing	13.2	10.3	20.3	15.8	17.0	13.9
Wholesale trade	5.9	4.9	4.7	3.9	4.7	4.7
Retail trade	11.3	9.0	11.0	9.2	10.4	11.1
Finance and real estate	2.3	3.0	6.3	4.3	5.0	6.8
Health care and social services	13.2	11.8	10.3	9.2	10.8	9.4
Educational services	3.1	3.9	4.7	3.4	4.3	6.7
Business services	11.0	12.0	12.2	14.9	12.3	19.7
Other services	9.9	13.9	14.9	12.6	14.0	18.7

Source: Statistics Canada Community Profiles 2006

In summary, the majority of jobs in the LSA are based in the manufacturing and agricultural sectors. Given the current economic situation, which has resulted in further declines in manufacturing jobs and potential cross-border trade issues, the municipalities in the LSA may be faced with a weakening economic base in the approaching years. Attracting new and diverse businesses while limiting any potential reductions in the agricultural and manufacturing job base is crucial to the local long term economy. The municipalities within the LSA are aware of the situation and have developed policies accordingly. Planning and development policies focus on strengthening existing jobs in the manufacturing and agricultural sectors, increasing employment diversity and attracting and retaining a skilled labour force.

7.7.2.5 Tourism and Recreation

Middlesex County's regional tourism profile was used to describe the LSA's existing tourism and recreation condition. The Middlesex County profile does not include the Township of Warwick and does include other municipalities that are not in the LSA; however, for the purposes of this assessment and in absence of more current information it is assumed to be representative of the tourism profile across the LSA.

As identified in Table 7.7-9, direct and indirect tourism spending in the County of Middlesex provides approximately $268 million to the gross domestic product (GDP) of the County and

$341 million to Ontario's GDP (Ministry of Tourism 2007). By comparison, gross farm receipts in the County of Middlesex in 2006 totalled approximately $594 million (Statistics Canada 2006). Visitor spending provides approximately $163 million in wages and salaries, 5,000 jobs and $155,000 in property taxes to the County (Ministry of Tourism 2007).

Table 7.7-9: Employment by Sector

	Visitor Spending Retained within Middlesex County	Effect of Middlesex County's Visitor Spending in Ontario
Gross Domestic Product	267,649,000	340,837,000
Wages and Salaries	162,613,000	210,343,000
Number of Jobs	4,970	5,999
Taxes	155,407,000	186,850,000

In their economic development plans and strategies, the municipalities within the LSA consider tourism as a desirable means of economic growth (Adelaide Metcalfe 2004, North Middlesex 2003, Strathroy-Caradoc 2008, Warwick 1998). Three Community Economic Development projects in the County of Middlesex are tourism driven and include (Community Futures Development Corporation of Middlesex County 2007):

- **Middlesex…..We're on the Way** – an annual tourism magazine;
- **Middlesex Heritage Trail Signs** – signs erected in 8 municipalities that identify buildings/events from the past and give a brief history; and
- **Main Street Middlesex** – downtown revitalization for urban areas within the County.

The communities within the LSA are keenly aware of local heritage features. Important heritage locations within Adelaide Metcalfe include Crathie Hall, Ionic Lodge, Napier House, St. Andrews Presbyterian Church, St. Ann's Anglican Church and Wood's General Store. All of these attractions provide tourists and residents with historical information about events and buildings, each of which contribute to Adelaide Metcalfe's local heritage profile (Adelaide Metcalfe Township 2009).

Three Conservation Authorities are responsible for lands in the LSA. Ausable Bayfield Conservation Authority (ABCA) owns 1,880 ha acquired with the development of the Parkhill dam and reservoir in North Middlesex. Several campgrounds and an outdoor education centre are planned for the Parkhill Conservation Area; however, currently the lands are being rented for agricultural purposes for revenue with strict management requirements. The ABCA also owns the Lucan Conservation Area (3.2 ha) in North Middlesex. Half of the property is floodplain and the remainder is rolling upland hardwood forest. This area is used for hiking and fishing (Conservation Ontario 2005).

The St. Clair Conservation Authority owns fifteen Conservation Areas and six Habitat Management Areas including Cold Stream, Strathroy, Clark Wright Conservation Area and Watford Conservation Areas in the LSA. The Sydenham River in Strathroy-Caradoc is the only watershed which lies completely in the Carolinian Life Zone. These areas are wetlands, forests and urban parks used for outdoor excursions such as camping, hiking and sightseeing (Conservation Ontario 2005).

The Lower Thames Valley Conservation Authority owns two Conservation Areas in the LSA. The Mill Stream Conservation Area is a Carolinian Forest, stream and ravine system and is used as a nature trail for fishing, hiking and bird-watching. Longwoods Road Conservation Area is 63 ha of parkland that provides conservation education and native studies programs for school aged children (Conservation Ontario 2005).

7.7.2.6 Community Services and Infrastructure

The information provided in this section is a compilation of information predominantly from the four municipal official plans applicable to the LSA and the County of Middlesex Official Plan (2006). The LSA services, infrastructure, facilities and institutions are identified in Figure 7.7-2.

The County of Middlesex is the upper tier of a two-tiered municipality. The County is responsible for regional transportation networks (county roads), waste management, alternative and renewable energy systems development and groundwater management and protection. Individual lower tier municipalities in the County of Middlesex are responsible for local transportation networks (local roads), waste management, water and waste water management and emergency response. Warwick Township is the lower tier municipality within Lambton County. Warwick Township is responsible for local transportation networks (local roads), waste management and emergency response. Lambton County is responsible for water and waste water management and regional transportation networks (county roads).

Adelaide Metcalfe and other rural areas in the LSA rely on well water and in-ground septic tanks. The former town of Strathroy, Watford and urban areas within North Middlesex rely on water supply systems provided by the individual municipalities. Urban areas within North Middlesex and Strathroy-Caradoc are now serviced by the Lake Huron Primary Water Supply. The urban area of Watford in Warwick is serviced by the Lambton Area Water System.

Solid waste management is overseen by each municipality. There are five landfills in the LSA located in Adelaide Metcalfe (two active), Strathroy-Caradoc (one active, one closed) and Warwick (one active).

Fire and ambulatory services are overseen by the County and coordinated by each of the municipalities within the LSA. Most of the fire services rely on volunteer firefighters. Adelaide Metcalfe operates the Kerwood Adelaide Metcalfe Fire Department. North Middlesex has two fire stations; one is located in Ailsa Craig and the other is located in Parkhill. Strathroy-Caradoc has three fire stations located in Strathroy, Mount Brydges and Melbourne. Warwick has two fire departments that operate out of the hamlet of Warwick and Watford. Each municipality has at least one ambulance station. One Ontario Provincial Police (OPP) detachment is located in the LSA in Strathroy. Strathroy-Caradoc, North Middlesex and Warwick also support community policing services.

Health care centres are distributed throughout the LSA. The LSA is serviced by both the Middlesex Health Alliance and Four Counties Health Services. The Middlesex Health Alliance provides family centered patient care for rural communities. The Four Counties Health Services provides primary care to community members in Middlesex, Elgin, Chatham-Kent and Lambton Counties. Their services include outpatient care, access to visiting specialists, physicians on call, adult day centre, Rural Woman's Resource Centre, Palliative Care Volunteer Program, continuing care and minor surgical services. The nearest hospital in relation to the SSA is located in the town of Strathroy on 395 Carrie Street, approximately 2 km south-east of the SSA.

Schools in the LSA are operated by the Thames Valley District School Board (County of Middlesex), Lambton Kent District School Board (Warwick), London District Catholic School Board (County of Middlesex) and St. Clair Catholic District School Board (Warwick). The LSA contains a total of ten Catholic and public schools. Adelaide WG MacDonald Public School is located on 29059 School Road in the SSA.

The SSA spans the Provincial 400-series Highway 402, which is a primary road transportation corridor between London, Ontario and the border to the United States at Sarnia, Ontario. County Road 22, also called Egremont Road, traverses the SSA and portions of the LSA. Other important north-south County roads near the SSA include County Road 6 (Kerwood Road) and County Road 19 (Petty Street and Adelaide Road). Effects of the project on traffic are assessed in Section 7.11. The Canadian National (CN) and Canadian Pacific (CP) railways between Toronto and Chicago services Strathroy-Caradoc in the LSA.

7.7.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on Socio-Economic Resources is provided in Table 7-1, and is summarized below:

- Presence of commercial-scale wind turbines, the loss of arable land and the use of construction equipment on-site may have an effect on the predominantly rural/agricultural character of the area;
- Indirect effects on residents' perceptions of their neighbourhood and community could occur through changes in property values, use of land, visual aesthetics, public health and safety and traffic; and
- Equipment delivery and disposal of turbines and ancillary equipment could affect existing capacity of services and infrastructure

The assessment of effects to Socio-Economic Resources was based on the following assumptions and limitations:

- Construction effects are generally considered temporary and persist for a short period of 9 months or less;
- Operations and maintenance effects are described as they are expected to occur, on average, annually over the life of the Project;
- The workforce requirements for the Project are limited; at peak times the construction workforce is not expected to exceed 200 workers;
- The relatively modest labour requirements, limited duration, and nature of the construction and operation activities is not anticipated to induce any permanent workforce relocations (or migration) which could have potential negative impacts on the social and community services in the area; and
- There will be no need for a temporary construction camp; workers can be housed in existing accommodations if they are not residents from nearby communities.

A summary of the identification and assessment of potential interactions between the Project and Socio-Economic Resources, according to the MOE screening criteria are found in Table 7.7-10.

Table 7.7-10: Identification and Assessment of Potential Interactions with VECs of Socio-Economic Resources

Relevant Project Activity	Neighbourhood and Community Character	Population and Demographics	Employment, Business and Economy	Tourism and Recreation	Community Services and Infrastructure
Site Preparation and Construction					
Surveying and siting operations	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**
Land clearing	**(yes)** • Construction vehicles, machinery and delivery of equipment may affect perception of neighbourhood and community, visual aesthetics and traffic • Loss of vegetation may affect use of land	**(no)**	**(no)**	**(no)**	**(no)**
Road construction/modification	**(yes)** • Construction vehicles and machinery may affect perception of neighbourhood and community, visual aesthetics and traffic	**(no)**	**(no)**	**(no)**	**(no)**

Table 7.7-10: Identification and Assessment of Potential Interactions with VECs of Socio-Economic Resources (continued)

Relevant Project Activity	Neighbourhood and Community Character	Population and Demographics	Employment, Business and Economy	Tourism and Recreation	Community Services and Infrastructure
Delivery of equipment	**(yes)** • Delivery trucks may affect perception of neighbourhood and community, visual aesthetics and traffic	**(no)**	**(no)**	**(no)**	**(yes)** • Delivery of equipment along local roads could cause road conditions to deteriorate
Temporary storage facilities	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**
Foundation construction	**(yes)** • Construction vehicles and machinery may affect perception of neighbourhood and community, visual aesthetics and traffic	**(no)**	**(no)**	**(no)**	**(no)**
Tower and turbine assembly and installation	**(yes)** • Cranes, towers and operation of associated heavy machinery may affect perception of neighbourhood and community and visual aesthetics	**(no)**	**(no)**	**(no)**	**(no)**

Table 7.7-10: Identification and Assessment of Potential Interactions with VECs of Socio-Economic Resources (continued)

Relevant Project Activity	Neighbourhood and Community Character	Population and Demographics	Employment, Business and Economy	Tourism and Recreation	Community Services and Infrastructure
Interconnection from turbines to substation	**(yes)** • Construction vehicles and machinery may affect perception of neighbourhood and community, visual aesthetics and traffic • Works across or alongside existing roads will temporarily disrupt traffic	**(no)**	**(no)**	**(no)**	**(no)**
Transmission line to power line	**(yes)** • Construction vehicles and machinery may affect perception of neighbourhood and community, visual aesthetics and traffic	**(no)**	**(no)**	**(no)**	**(no)**
Fencing/gates	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**
Parking lots	**(no)**	**(no)**	**(no)**	**(no)**	**(no)**

Table 7.7-10: Identification and Assessment of Potential Interactions with VECs of Socio-Economic Resources (continued)

Relevant Project Activity	Neighbourhood and Community Character	Population and Demographics	Employment, Business and Economy	Tourism and Recreation	Community Services and Infrastructure
Operation and Maintenance					
Wind turbine operation	**(yes)** • May affect both residents' and visitors' perceptions of community • Property values may be affected • Turbine towers and rotating blades may affect public health and safety	**(no)**	**(yes)** • The loss of agricultural land will have beneficial effects (financial) on selected landowners that are hosting turbines • Skilled workers may be hired from within the LSA • The Project will pay annual property taxes to Adelaide Metcalfe • Local spending on accommodations, meals, procurement of materials	**(no)**	**(yes)** • Development of access roads that could help farmers access land • Improvements to roads through agreement with municipality could result in better road conditions than currently exist

Table 7.7-10: Identification and Assessment of Potential Interactions with VECs of Socio-Economic Resources (continued)

Relevant Project Activity	Neighbourhood and Community Character	Population and Demographics	Employment, Business and Economy	Tourism and Recreation	Community Services and Infrastructure
Maintenance activities	**(yes)** • Working at high elevations may effect public health and safety	**(no)**	**(no)**	**(no)**	**(no)**
Decommissioning					
Removal of turbines and ancillary equipment	**(yes)** • Delivery vehicles, construction vehicles and machinery may affect perception of neighbourhood and community, visual aesthetics and traffic	**(no)**	**(no)**	**(no)**	**(yes)** • Disposal of turbines and equipment may place strain on existing local waste facilities
Removal of buildings and waste	**(yes)** • Delivery vehicles, construction vehicles and machinery may affect perception of neighbourhood and community, visual aesthetics and traffic	**(no)**	**(no)**	**(no)**	**(no)**

Table 7.7-10: Identification and Assessment of Potential Interactions with VECs of Socio-Economic Resources (continued)

Relevant Project Activity	Neighbourhood and Community Character	Population and Demographics	Employment, Business and Economy	Tourism and Recreation	Community Services and Infrastructure
Removal of power line	**(yes)** • Construction vehicles and machinery may affect perception of neighbourhood and community, visual aesthetics and traffic • Working at high elevations may affect public health and safety	**(no)**	**(no)**	**(no)**	**(no)**
Site remediation	**(yes)** • Construction vehicles and machinery may affect perception of neighbourhood and community, visual aesthetics and traffic	**(no)**	**(no)**	**(no)**	**(no)**

In relation to the VECs of Socio-Economic Resources, the full effect of activities will not be realized until the Operation and Maintenance Phase of the Project, due to the short timeframe of the Site Preparation and Construction Phase. Accordingly, the assessment for the purposes of the evaluation of these Socio-Economic Resources, the Site Preparation and Construction Phase and the Operation and Maintenance Phase of the Project are discussed together below. Decommissioning will be similar in nature to the Site Preparation and Construction phase, although the duration is expected to be less. Therefore by assessing the combined Site Preparation and Construction and Operation and Maintenance Phases, the effects of the Decommissioning Phase will be thoroughly assessed. It should also be noted that an effect may be positive (beneficial) or negative (adverse). Some effects may have both positive and negative dimensions.

7.7.3.1 Neighbourhood and Community Character

As noted in Table 7.7-10, Neighbourhood and Community is carried forward to Section 7.7.5 for assessment of adverse effects based on effects of the Project on residents perceptions of their community, property values, land use, visual aesthetics, public health and safety and traffic.

7.7.3.2 Population and Demographics

The Project will result in a very small, but temporary, influx of workers from outside the LSA, with a focus on employment opportunities for local skilled labourers. In the event that skilled labour is not available in the LSA, the Project labour force would come from outside LSA and temporary population increases would be very small (less than 200 people over the construction period of approximately 9 months) compared to the population of the LSA, which has a population of 33,779. Therefore, no population effects are anticipated and no further assessment of adverse effects is required.

7.7.3.3 Employment, Business and the Economy

The scale of capital investment, labour requirements (crew of approximately 10 workers per turbine, moving between turbines), and salaries forecast for the project are relatively modest. Most employment opportunities on this project will require specialized skills and training. The limited number of employees and short duration of employment requirements for the Project can most likely be met within the three LSA municipality workforces and economies with negligible effects.

The positive effects of the project will include a potential modest input of wages/salaries to the LSA economy if labour requirements are available locally, as well as expenditures for accommodation, meals and minor expenses. Opportunities for local procurement include for example; site preparation services, gravel, aggregate, concrete and sewage disposal services.

There are also opportunities for longer term contracts for snow removal and access track, fence maintenance, etc.

The Project will pay annual property taxes to the Municipality of Adelaide Metcalfe and this will be shared with the County and local school board, which is also a beneficial effect of the Project. AET also has option agreements with landowners that will pay each landowner significant annual amounts based on the output of the project. AET is also in discussions with the local Municipality regarding a “Development Agreement” which would ensure increased payments above the standard tax rate to the Municipality on an annual basis.

The net effect of the Project on employment, business and the economy would be beneficial and therefore no further assessment is required.

7.7.3.4 Tourism and Recreation

The construction, operation and presence of turbines in the LSA are not expected to have significant adverse effects on tourism or recreation. The construction of access roads and the presence of turbines are not expected to negatively affect any of the natural heritage sites, Conservation Areas or parks in the LSA. The closest Conservation Area (CA) is located in the former town of Strathroy, discussions with the local tourism officer concluded that this was the areas main tourist attraction. AET prepared a photomontage from the car park of this CA and the Adelaide Wind Farm would not be visible from this location. The closest heritage site is Wood’s General store, which is located at the north-east corner of the SSA. Construction activities will not affect either of these sites and the presence of turbines is not expected to affect community or tourist enjoyment of these areas. In many cases, the novelty of wind parks in Ontario and their perceived aesthetic appeal actually attracts tourists. The British Wind Energy Association (2006) has found that wind farm sites often correlate with popular tourist area. The North Cape Wind Farm in Prince Edward Island attracts up to 60,000 visitors a year (CanWEA, 2006).

7.7.3.5 Community Services and Infrastructure

As noted in Table 7.7-10, Community Services and Infrastructure is carried forward to Section 7.7.5 for assessment of adverse effects based on Project effects on road conditions and waste disposal capacity.

7.7.4 Summary of Beneficial and Adverse Effects

The purpose of an Environmental Assessment is to assess the significance of adverse effects of the Project on the environment. However, in the case of the Socio-Economic Resources assessment several beneficial effects have been identified. These will not be carried forward for assessment in Section 7.7.5 but they should be identified. Table 7.7-11 identifies the adverse effects to be carried forward for assessment as well as the beneficial effects that will not be carried forward.

Table 7.7-11: Summary of Potential Adverse and Beneficial Interactions with VECs of Socio-Economic Resources

VEC	Indicator	Description of Effect	Beneficial or Adverse
Neighbourhood and Community Character	Perceptions of neighbourhood and community	Views and activities associated with the construction, operation and decommissioning of the turbines may affect perceptions of neighbourhood and community	Adverse
	Property values	Presence of the turbines have the potential to decrease property values	Adverse
	Land use	Construction and operation of the turbines will decrease agricultural capabilities	Adverse
	Visual Aesthetics	Views and vistas will alter people's perceptions of their neighbourhood and community	Adverse
	Public Health and Safety	Risks associated with operation of turbines will affect perceptions of safety and well being within the community	Adverse
	Traffic	Increased traffic during construction will affect how people feel about their neighbourhood and community	Adverse
Employment, Business and Economy	Jobs created	Labour requirements for skilled workers in the LSA	Beneficial

Table 7.7-11: Summary of Potential Adverse and Beneficial Interactions with VECs of Socio-Economic Resources (continued)

VEC	Indicator	Description of Effect	Beneficial or Adverse
Employment, Business and Economy (continued)	Municipal tax base	The Project will pay annual property taxes to Adelaide Metcalfe and the local school board	Beneficial
	Local spending	Expenditures for accommodation, meals and minor expenses Opportunities for local procurement (e.g., purchasing food, gravel, aggregate and concrete and sewage disposal services)	Beneficial
Community Services and Infrastructure	Remaining capacity of, or access to, services and infrastructure	Development of access roads that could help farmers access land	Beneficial
		Deteriorating road conditions due to equipment delivery	Adverse
		Disposal of turbines and ancillary equipment during decommissioning could strain local or regional waste facilities	Adverse

7.7.5 Assessment of Effects and Mitigation

On the basis of consultation with Project stakeholders, understanding of the local social and economic context, and concerns raised about wind park projects in other areas of Canada and elsewhere, plausible mechanisms or pathways through which Neighbourhood and Community Character may be affected (and can include both positive or negative effects) by the various Project activities include:

- Effects on residents perceptions of their neighbourhood and community;
- Effects on property values;
- Effects on land use;
- Effects on visual aesthetics;

- Effects on public health and safety; and
- Effects on traffic.

While the determination of socio-economic effects broadly shares the methods used for assessing environmental effects, there are some differences. Some socio-economic effects are inherently difficult to predict. For example, people have different perceptions on the visual aesthetics of wind farms. Socio-economic effects assessment thus relies more on people's perceptions, as articulated during consultation, as well as on lessons learned from similar projects and on professional judgment. Although there are exceptions, socio-economic effects assessments are generally more qualitative than other disciplines.

As part of the assessment of effects, this section identifies mitigation measures to reduce potential adverse effects of the Project. If applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are advanced to Section 7.7.6 for an analysis of significance.

7.7.5.1 Neighbourhood and Community Character

Perceptions of Neighbourhood and Community

Public consultation and issue scoping is used to determine public opinion and whether or not the community believes that the Project fits within the existing community character. Details of public consultation conducted as part of this Project are found in Section 6.0. AET initiated consultation activities with Adelaide Metcalfe and the County of Middlesex councils in October 2007. Feedback from the councils was positive towards development of renewable energy and AET subsequently issued a Notice of Commencement and Project Description in January 2008. Since January 2008, AET has met with Adelaide Metcalfe and the County of Middlesex Councils, land owners, and held two public Open Houses. Comment forms filled out by members of the public at these open houses indicate that the community is generally receptive to wind power generation in their community. At the most recent Open House (54 attendees) 17 people filled out comment forms. Of those attendees that filled out comment forms, 88% indicated that they support the Project, 12% indicated that they were neutral about the Project and 0% indicated their opposition.

The assessment of the effects of the Project on neighbourhood and community character must use the precautionary principle in determining how community members living within the viewshed of the wind farm will perceive the aesthetics of the turbines. Therefore, assuming that at least some community members will find them aesthetically unappealing, the presence of turbines is expected to have adverse effects on some residents' perceptions of neighbourhood and community, as a result of effects on visual aesthetics (see below). The effect of the visual presence of the wind turbines on Neighbourhood and Community Character is advanced to Section 7.7.6.

Property Values

Community apprehension about reduction in property values as a result of the wind farms has been a predominant concern and the subject of recent wind power research. To date, research conducted on the effects of wind farms on property values has provided no evidence that wind farms decrease property values (Sterzinger 2003; Grover 2002; Blake, Matlock and Marshal Ltd. 2006). The Renewable Energy Policy Project (Sterzinger 2003), sponsored by the United States government, based their research on three case scenarios for ten wind power projects evaluated:

- Case 1: how prices changed over the entire period of study for the view shed and comparable region;
- Case 2: how prices changed in the view shed before and after the projects came on-line; and
- Case 3: how prices changed for both the view shed and the comparable region after the projects came on-line.

The results of the Renewable Energy Policy Project study indicate that property values within the view shed of wind developments do not suffer or perform poorer than in a comparable region (Sterzinger 2003). Additional research conducted in the United States by Grover (2002) found no evidence for reductions in property values and supports Sterzinger’s findings. A more recent study conducted by Blake, Matlock and Marshal Ltd. (2006) in Ontario found that property values increased after the development of three wind farms located in the Township of Melancthon, the Township of East Luther Grand Valley, and the County of Dufferin. Accordingly, adverse effects on property values are not advanced for further assessment.

Land Use

Land use is assessed in Section 7.9. This section determines that the Project would not have significant adverse effects on land use and therefore there will be no effect on land use that would alter the Neighbourhood and Community Character in the study areas.

Visual Aesthetics

The visual landscape is assessed in Section 7.6. This section determines that the importance of residual effects of the Project on rural views and vistas will be minimal during the Site Preparation and Construction and minimal during the Operation and Maintenance Phase of the Project. Based on the effects assessment criteria outlined in Table 7.7-2, changes to visual aesthetics of the area could have moderately significant effects on Neighbourhood and

Community Character because these could affect perceptions of community and neighbourhood. Therefore this VEC is advanced to Section 7.7.5 for assessment of significance.

Effects on Public Health and Safety

Public health and safety is assessed in Section 7.12. This section determines that the importance of residual effects of the Project on public health would be minimal. Therefore there will be no effect on Neighbourhood and Community Character.

Traffic

Traffic is assessed in Section 7.11. This section determines that the importance of residual effects of the Project on traffic volume would be minimal. Therefore there will be no effect on Neighbourhood and Community Character.

7.7.5.2 Community Services and Infrastructure

Remaining Capacity of, or Access to, Services and Infrastructure

Two potential adverse effects exist for this indicator in the Community Services and Infrastructure VEC. The indicator pathways include:

- Effects of delivery of equipment on road conditions.
- Effects of turbines and ancillary equipment disposal during the Decommissioning Phase on waste facility capacity; and

Equipment delivery to and from the site have the potential to adversely affect road conditions given that large vehicles will be transporting heavy loads along the same transport route for up to nine months. As part of the planning and permitting process with the County of Middlesex and Adelaide Metcalfe, AET will select transport routes and schedules that will have minimal effects on roads. Additionally AET will develop mitigation measure and follow-up activities as part of the municipal permitting process. These mitigation measures and follow-up activities will be agreed upon by the County and Adelaide Metcalfe. AET have met with the County of Middlesex Engineer to discuss potential effects and mitigation and are currently in detailed discussions with the Township of Adelaide Metcalfe to enter into a Development Agreement; to ensure impacts on local infrastructure is minimised and existing services corridors, rights of ways are utilised. The agreement will also include details on pre and post condition surveys and mitigation and repairs. Therefore, there will be no significant adverse effect from delivery of equipment on Community Services and Infrastructure.

Disposal of turbines and ancillary equipment is expected to occur in 30 years and will take approximately 6 months. AET or its successors will be responsible for the decommissioning of the turbines. AET will remove the turbine structures and cover the base of the foundations with earth to a depth that can be utilized for farm land. Access road removal will depend on the requirements of the landowner. AET or its successors will remove and sell all recyclable material that has value in their respective scrap metal markets; therefore, disposal of the remaining materials is not expected to place undue strain on existing waste infrastructure. However, given the lack of information about the status of waste infrastructure 30 years from now, Community Services and Infrastructure will be advanced to Section 7.7.6 for recommended follow-up activities.

7.7.6 Residual Effects, Determination of Significance and Follow-up

7.7.6.1 Neighbourhood and Community Character

Visual aesthetics are an important indicator for Neighbourhood and Community Character. The visual aesthetics of wind turbines can be seen to have either beneficial or adverse effects on Neighbourhood and Community Character depending on individual perceptions. As a precautionary approach an EA is meant to assess the adverse effects of a Project on the environment; therefore adverse criteria from Table 7.7-3 is used to assess significance. Based on the environmental interaction criteria in Table 7.7-3, the magnitude of the effects on Neighbourhood and Community Character is moderate because social and economic processes will only be slightly modified by the visual aesthetics of the turbines. The geographical extent of the Project on the visual aesthetics will be confined to the LSA and therefore the effects are considered local (low). The duration of the effects on Neighbourhood and Community Character (through visual aesthetics) will continue through to the decommissioning phase of the Project and therefore are considered to be long-term. Overall, the significance (level of importance) of the effects on Neighbourhood and Community Character are medium, because the visual aesthetics of the LSA will not breach acceptable limits of change.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MEDIUM

7.7.6.2 Community Services and Infrastructure

Waste disposal capacity is an important component of Community Services and Infrastructure and will have adverse effects on this VEC if there is limited capacity for waste disposal at the time of decommissioning. As a precautionary approach an EA is meant to assess the adverse effects of a Project on the environment; therefore adverse criteria from Table 7.7-3 is used to assess significance. Based on the environmental interaction criteria in Table 7.7-3, the magnitude of this effect is moderate because waste disposal would continue, but may need to be slightly modified to accommodate the needs of the Project (i.e., waste may have to be transported a further distance to reach a facility that has capacity). The geographical extent of Project effects on Community Services and Infrastructure could affect the region depending on where remaining turbine components are disposed (moderate). The duration of the effects on Community Services and Infrastructure are considered permanent because the waste will remain at the disposal facility for many years. The overall significance (level of importance) of the effects on Community Services and Infrastructure are medium because waste disposal will continue in a slightly modified way and the effect will not breach acceptable limits of change.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MEDIUM

Follow up activities should include monitoring the status of waste disposal capacity over the course of the Project. A recommended strategy would be to identify local and regional waste disposal facilities, monitor capacity of these facilities and monitor the extent to which turbine parts and equipment can be recycled. This should be done every five years.

7.8 Heritage Resources

This section pertains to the following questions from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Be inconsistent with the Provincial Policy Statement, provincial land use or resource management plans?* (2.2)
- *Have negative effects on heritage buildings, structures or sites, archaeological resources, or cultural heritage landscapes?* (7.1)

Any of the above questions that have been addressed, or "screened out" in the initial screening (Table 7-1) have not been carried forward into this assessment. For Heritage Resources all questions have been carried forward.

7.8.1 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VECs) for Heritage Resources. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project.

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on Heritage Resources have been assessed by evaluating changes in archaeological and built cultural heritage. Table 7.8-1 presents the VECs for Heritage Resources along with the rationale for selection and the specific indicators used in the assessment.

Table 7.8-1: Valued Ecosystem Components and Key Indicators Selected for Heritage Resources

VEC Selection	Key Indicator(s)	Selection Basis
Archaeological Heritage	Archaeological Resources/Potential	A change to archaeological resources or potential can affect the archaeological heritage of the area
Built Cultural Heritage	Heritage Buildings/Structures/Sites/Landscapes	A change to heritage buildings can affect the cultural heritage of the area

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between the VECs and the MOE Screening Criteria Questions that they address is provided in Table 7.8-2.

Table 7.8-2: MOE Screening Criteria Question and VECs for Heritage Resources

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Be inconsistent with the Provincial Policy Statement, provincial land use or resource management plans? (2.2)	Archaeological Heritage
	Built Cultural Heritage
Have negative effects on heritage buildings, structures or sites, archaeological resources, or cultural heritage landscapes? (7.1)	Archaeological Heritage
	Built Cultural Heritage

A description of the existing conditions and an assessment of the effects of the Project on Heritage Resources will consider the Site Study Area (herein referred to as the SSA) shown on Figure 4.3-1. This includes all optioned lands, the turbines and substations.

A Stage 1 Archaeological Assessment of the SSA was conducted by Archaeologix Inc. (2008), now part of Golder Associates Ltd. The findings of the assessment are summarized in this section and the report is located in Appendix D. In compliance with the provincial regulations and standards set out in the "Archaeological Assessment Technical Guidelines" (MCL, 1993), the Stage 1 Archaeological Assessment included the following:

- Review of the land use history, including pertinent historical, environmental, and archaeological data, to determine areas of archaeological potential within the SSA;
- An examination of the National Site Registration Database to determine the presence of known archaeological sites in the SSA; and
- A visual evaluation of the SSA.

To assess the extent, duration, and irreversibility of effects of the Project on Heritage Resources within the SSA, the general criteria described in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for the Heritage Resources Key Indicators are defined in Table 7.8-3.

Table 7.8-3: Effects Assessment Criteria for Heritage Resources

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Archaeological Resources/ Potential	No archaeological potential determined to exist within SSA.	Archaeological potential determined to exist within SSA with little to no risk of disruption	Archaeological potential determined to exist within SSA with moderate risk of disruption	Significant archaeological potential within SSA with considerable risk of damage or disruption.
Heritage Buildings/Structures/Sites/ Landscapes	Not present in SSA.	Present with little to no risk of disruption	Present with moderate risk of disruption	Significant resources present with considerable risk of damage or disruption.

The following sections describe the existing conditions of Heritage Resources within the SSA and an assessment of the potential effects of the Project on Heritage Resources VECs.

7.8.2 Existing Conditions

The SSA has silty clay loams that range from moderately well drained to imperfectly drained. The SSA's topography is mostly level with only some areas of gentle sloping which can contribute to the soils' drainage characteristics (Hagerty and Kingston, 1992). Most of these soils would have been suitable for pre-contact Aboriginal agriculture. As described in previous sections, there are a number of watercourses in the SSA, including Adelaide Creek, Mud Creek and their tributaries.

7.8.2.1 Prehistoric and Historic Overview

Pre-Contact Occupation

Previous archaeological assessments and research surveys in Middlesex County have demonstrated that the area was inhabited by pre-contact Aboriginal peoples. Table 7.8-4 summarizes the culture history of Middlesex County, based on Ellis and Ferris (1990). Currently one site has been discovered within the SSA, in the southeast corner (MCL, n.d.a.). The Armbro site (AfHj-107) was a 10 m by 15 m lithic scatter found by Jacqueline Fisher in 2000. It contained a drill and a lithic debitage scatter but no diagnostic artifacts and therefore can only be interpreted as an undateable precontact Aboriginal site. To date, only one site has been recorded, likely due to the lack of archaeological assessments within the SSA, hence, this is not necessarily reflective of low archaeological potential.

Table 7.8-4: Cultural Chronology for the County of Middlesex

Period	Characteristics	Time Period	Comments
Early Palaeo-Indian	Fluted Projectiles	9000 - 8400 B.C.	spruce parkland/caribou hunters
Late Palaeo-Indian	Hi-Lo Projectiles	8400 - 8000B.C.	smaller but more numerous sites
Early Archaic	Kirk and Bifurcate Base Points	8000 - 6000 B.C.	slow population growth
Middle Archaic	Brewerton-like points	6000 - 2500 B.C.	environment similar to present
Late Archaic	Lamoka (narrow points)	2000 - 1800 B.C.	increasing site size
	Broadpoints	1800 - 1500 B.C.	large chipped lithic tools
	Small Points	1500 - 1100B.C.	introduction of bow hunting
Terminal Archaic	Hind Points	1100 - 950 B.C.	emergence of true cemeteries
Early Woodland	Meadowood Points	950 - 400 B.C.	introduction of pottery
Middle Woodland	Dentate/Pseudo-Scallop Pottery	400 B.C. - A.D.500	increased sedentism
	Princess Point	A.D. 550 - 900	introduction of corn
Late Woodland	Early Ontario Iroquoian	A.D. 900 - 1300	emergence of agricultural villages
	Middle Ontario Iroquoian	A.D. 1300 - 1400	long longhouses (100m +)
	Late Ontario Iroquoian	A.D. 1400 - 1650	tribal warfare and displacement
Contact Aboriginal	Various Algonkian Groups	A.D. 1700 - 1875	early written records and treaties
Late Historic	Euro-Canadian	A.D. 1796 - present	European settlement

Post-Contact Occupation

The SSA first enters the Euro-Canadian historic record as part of Treaty Numbers 21 and 27½ made between the First Nation inhabitants of the area and the British. Treaty Number 21 was further modified in Treaty Number 280½ and finally confirmed in Treaty Number 25 which modified the method of quantity of payment to the First Nation Groups concerned and some minor variation in the description of the land surrender. A small portion of the northwest corner of the Geographic Township of Adelaide (within the SSA) was subsequently surrendered in Treaty Number 27½ and confirmed on July 10, 1827 as Treaty Number 29 with only a minor change in the legal description of the boundaries of the land surrender (Morris, 1943: 24-25).

Township of Adelaide

The initial survey of the Geographic Township of Adelaide centred on Egremont Road was made in 1831. The remainder of the survey of the township was finished in 1832. The first Euro-Canadian settlement of the Township began in the 1830's after Egremont Road was laid through the SSA (Nielsen, 1993: 6-8).

The original township map of the SSA with later additions is preserved for the Geographic Township of Adelaide. An examination of the SSA as depicted on the original township map and described in the original surveyor's notes does not reveal any Euro-Canadian squatters recorded from before 1831 or any notable First Nations activity in the area (Caroll, 1831a; Caroll, 1831b).

Two later maps from the 19th century record the Euro-Canadian settlers and illustrate the growth in the SSA: the 1862 Tremaine Map (Tremaine, 1862) and the 1878 H.R. Page and Company Historical Atlas Map (Page, 1878). The Tremaine Map provides the names of all of the landowners but only illustrates a select number of structures on the properties. However, the later Historical Atlas Map not only provides the names of the landowners but also the structures on the majority of the properties. Besides houses, the structures noted include brickyards, cemeteries, churches, hotels, manufactories, mills and schools. Table 7.8-5 lists those lots that hold a structure other than a house, along with the name of the occupant. While locations are only approximate on the historical atlas maps, they do give an idea of potential for significant archaeological historic remains that could be impacted within the SSA. Typically these locations no longer exhibit any visible evidence of their former structures. There is also documentation that the township road grid was laid out in the early 19th century and it still survives today.

Table 7.8-5: Historic Properties with Potentially Significant Structures According to the 1878 *Illustrated Historical Atlas of the County of Middlesex*

Lot	Concession	Owner	Structure
11	1 N.E.R.	Village of Adelaide	Town Plot
19	1 N.E.R.	James Walker	Schoolhouse
8	2 N.E.R.	John Crummer	Schoolhouse
Part of 13	2 N.E.R.	Thomas Seed	Church
Part of 19	2 N.E.R.	Robert Ayre	Schoolhouse
Part of 7	4 N.E.R.	John Keyser Senior	Post Office, Brickyard
Part of 3	1 S.E.R.	John Wiley Senior	Church, Cemetery
2	2 S.E.R.	Lawrence Cleverdon	Factory
Part of 7	2 S.E.R.	James and Robert Thomas	Schoolhouse
Part of 7	3 S.E.R.	George Early	Church

Table 7.8-5: Historic Properties with Potentially Significant Structures According to the 1878 *Illustrated Historical Atlas of the County of Middlesex* (continued)

Lot	Concession	Owner	Structure
Part of 12	3 S.E.R.	Anne Rogers	Church
Part of 18	3 S.E.R.	Edwin Morrow	Schoolhouse
13	4 S.E.R.	Jonas Jury	Lime Kiln
Part of 14	4 S.E.R.	David Rapley	Schoolhouse

Source: H.R. Page and Company 1878

Two notable structures, recorded on the 1878 Historical Atlas map within the SSA but outside of any of the communities discussed below, are:

- **The West Adelaide Presbyterian Cairn** is located on the east half of Lot 3, Concession1 S.E.R. The original cemetery was used from 1853 to 1881 and subsequently abandoned. It was not until the 1950's that the present cairn was constructed from the remaining tombstones. Although some of the bodies might have been moved, documentation for this cemetery is insufficient to be able to determine this (Adelaide Township Heritage Group, 2001: 466-467) and the only information known about the burials is recorded on the cairn itself (Robb and McLeod, 1982).
- **The Victoria Cheese Company** was established in 1871 in a large wooden frame building by Lawrence Cleverdon and his business partner John Carrothers on Lot 2, Concession 2 S.E.R. The cheese factory was sold to John Clark in 1882. The building was sold again in 1925 and was used as a drive shed until it was blown down and demolished by a tornado in 1953 (Adelaide Township Heritage Group, 2001: 95-97; Grainger, 2002: 15).

Concerning the other structures in Table 7.8-5, documentary records do exist for the former schools and churches (which are summarized in Adelaide Township Heritage Group, 2001) and if those former structures are to be impacted by turbine construction additional historical research can be undertaken in conjunction with any further Stage 2 or Stage 3 archaeological assessment. However, not all significant structures survived long enough to be depicted on the surviving maps of Adelaide Township; two examples will suffice. On the west half of Lot 10, Concession 2 S.E.R. the Humphries' Wesleyan Methodist Church existed from 1855 to 1861. The land was purchased from William Humphries on September 28, 1855. The small log house built there was also used as a schoolhouse. Few records exist and there is no further trace of the church after 1861 (Adelaide Township Heritage Group, 2001: 453). Then, on Lot 5, Concession 1 S.E.R., the first log schoolhouse for S.S. #6 Adelaide was built in 1865 and was used until a new frame schoolhouse was built across the road on Lot 5, Concession 1 N.E.R around 1878 (Adelaide Township Heritage Group, 2001: 477).

Other Communities

There are four existing and former communities, established in the 19th century, within the SSA:

- the village of Adelaide;
- the former post office of Keyser;
- the former post office of Mullifarry; and
- the former post office of Napperton.

Adelaide's town plot was laid out in 1833 and had reached a maximum population of 200 in 1857 but ceased to grow when the Grand Trunk Railway Line bypassed the community (Adelaide Township Heritage Group, 2001: 505-506). Today, the surveyed road grid no longer survives although some of the road allowances still exist legally. Two former church sites, a historic cemetery, an active cemetery and a former schoolhouse site all dated to the 19th century.

Keyser was a former post office named after the Keyser family who held the property. The Keyser family occupied Lot 7, Concession 4 N.E.R. at the intersection of present day Langan Drive and Kerwood Road (County Road 8) from the 1830's onwards. The intersection was known locally from that time as "Keyser Corner" or "Keyser's Corner" (Adelaide Township Heritage Group, 2001: 226, 514).

The Keyser Post Office opened in 1864 and closed in 1891 and then reopened from 1901 to 1913. By 1913 when the post office closed the village had dwindled and now only the name remains on maps. The local brick and tile yard operated by John Philip Keyser from the 1860's onwards was located behind his house on part of Lot 7, Concession 4 N.E.R. (Adelaide Township Heritage Group, 2001: 515; Grainger, 2002: 9-10). Another significant building on the same lot was the S.S. #1 and #2 – Adelaide and West Williams, Keyser School, which was in use from 1858 until the school was abandoned for the new schoolhouse in 1877 (Adelaide Township Heritage Group, 2001: 469). Other poorly documented structures associated with Keyser might have existed in the SSA at one time. Just outside of the SSA in the northwest corner of Lot 7, Concession 5 N.E.R. stood a church and the schoolhouse replacing the S.S. #1 and #2.

The community of Mullifarry is still noted on maps although it was only a post office from 1880 until 1913 (Grainger, 2002: 12). A farm in the area retains the name "Mullifarry Landing" but is a later construction named in honour of the post office. The post office had been moved in 1900; the original building housing the post office no longer stands.

Another late 19th century post office was the Napperton Post Office. The community is well known for one of its turn of the century inhabitants, Arthur Currie, who later led the Canadian

Armed Forces in France during World War I (Grainger, 2002: 13). However, his family actually lived south of Napperton Drive just outside of the SSA. Besides various farmsteads, most special use structures associated with this community were also located south of Napperton Drive outside of the study (for example, a church, a log schoolhouse, and the post office after which the community was named). The last frame schoolhouse in the community, S.S. #5 Napperton, was located on the east half of Lot 14, Concession 4 N.E.R. and no longer stands today, having closed down in 1960 (Grainger, 2002: 13-14).

The Napperton Post Office opened in 1870 and closed in 1915, located outside of the SSA on Lot 14 Concession 5 S.E.R. until 1905 when it moved across the street into the SSA in a still existing house on Lot 12, Concession 4 S.E.R. (Adelaide Township Heritage Group, 2001: 539). At its height, Napperton spanned the intersection both inside and outside of the SSA but eventually the local church closed down and for indeterminate reasons the community did not respond to economic opportunities such as the nearby placement of the Sarnia Branch of the Great Western Railway (Grainger, 2002: 14). By 1915 when the post office closed, the village had declined and now only the name remains on maps.

7.8.2.2 Cultural Heritage Landscapes

In many areas of Ontario, built heritage extends beyond the individual buildings to consider the spaces in between and beyond that contribute to a community's unique character. These are known as cultural heritage landscapes. The Province of Ontario's *Provincial Policy Statement* (MMAH 2005) defines a cultural heritage landscape as:

> *a defined geographical area of heritage significance which has been modified by human activities and is valued by a community. It involves a grouping(s) of individual heritage features such as structures, spaces, archaeological sites and natural elements, which together form a significant type of heritage form, distinctive from that of its constituent elements or parts.*

Further to that definition, the Ontario Ministry of Culture (MCL, 2002) also divides cultural landscapes into the following three categories based upon criteria established by UNESCO's World Heritage Centre (UNESCO, 2008):

- Defined landscapes: those which have been intentionally designed (e.g., a formal garden or, in a more urban setting).
- Evolved landscapes: those which have grown organically including those which continue to evolve (continuing landscape); (relict landscape) where an evolutionary process has come to an end (e.g., an abandoned mine site).

- Associative landscapes**:** those with powerful religious, artistic or cultural associations of the natural element rather than material cultural evidence, which may be insignificant or even absent (e.g., Algonquin Park because of its association with the Group of Seven paintings).

According to a prior desktop assessment of the cultural heritage landscape conducted by the client (TCI Renewables, 2007), the landscape is largely a rural setting without any specific cultural associations. However, the developed area around the village of Adelaide would be considered an evolved landscape, having been originally surveyed for Euro-Canadian settlement in 1833 and subsequently growing, albeit not as much as was expected (as briefly discussed in Section 7.8.2.1 above). The desktop assessment also identifies a number of existing heritage sites (TCI Renewables, 2007), but only one of these, St. Ann's Anglican Church, falls within the SSA. The Adelaide Township Heritage Group has identified four individual built structures with notable late 19th century architecture (Adelaide Township Heritage Group, 2001: 543-548) but none of these structures are on properties where turbines are to be sited (Table 7.8-6). Otherwise an examination of the Ontario Heritage Properties Database yields no designated properties within the SSA (MCL, n.d.b.).

Table 7.8-6: Architecturally Notable Homes Within the SSA

Lot	Concession	Historic Occupant	Architectural Style
West half of 10	2 N.E.R.	Hodgson Family	Ontario Farm House
West half of 7	1 S.E.R.	Ball Family	Gothic Revival House
East half of 7	1 S.E.R.	McCarthy Family	Ontario Cottage
South half of 15	3 S.E.R.	McNiece Family	Ontario Farm House

Source: Adelaide Township Heritage Group, 2001

7.8.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on Heritage Resources is provided in Table 7.1 (and recapitulated in Table 7.8-2) and is summarized as follows:

- There is sufficient indication that the SSA possesses archaeological potential for pre-contact Aboriginal sites and historic Euro-Canadian middle to late 19th century structures. Therefore the Project has the potential to have negative effects on heritage buildings, structures or sites, archaeological resources, or cultural heritage landscapes.

A summary of the identification and assessment of potential interactions between the Project and Heritage Resources, according to the MOE screening criteria are found in Table 7.8-7.

Table 7.8-7: Identification and Assessment of Potential Interactions with VECs of Heritage Resources

Relevant Project Activity	Archaeological Heritage	Built Cultural Heritage
Site Preparation and Construction		
Surveying and siting operations	**(no)**	**(no)**
Land clearing	**(yes)** • Land clearing activities have the potential to disrupt archaeological resources.	**(yes)** • Land clearing activities could potentially disrupt the cultural heritage landscape.
Road construction/modification	**(yes)** • Road construction activities have the potential to disrupt archaeological resources.	**(yes)** • Road construction activities could potentially disrupt the cultural heritage landscape.
Delivery of equipment	**(no)** • Equipment delivery uses existing roads and will be stored in temporary storage facilities discussed below.	**(yes)** • Traffic associated with the project could temporarily disrupt the cultural heritage landscape.
Temporary storage facilities	**(no)** • Temporary storage facilities will be in a commercial area with existing buildings and existing access roads.	**(no)** • Temporary storage facilities will be in a commercial area with existing buildings and existing access roads.
Foundation construction	**(yes)** • Foundation construction has the potential to disrupt archaeological resources.	**(yes)** • Foundation construction could potentially disrupt the cultural heritage landscape.
Tower and turbine assembly and installation	**(no)** • No further ground disturbance or clearance is necessary once the foundation construction has been undertaken.	**(yes)** • Tower and turbine assembly and installation could potentially disrupt the cultural heritage landscape.
Interconnection from turbines to substation	**(yes)** • Reworking of overburden during trenching has the potential to disrupt archaeological resources.	**(yes)** • Reworking of overburden during trenching could potentially disrupt the cultural heritage landscape.
Transmission line to power line	**(yes)** • Reworking of overburden during trenching has the potential to disrupt archaeological resources.	**(yes)** • Reworking of overburden during trenching could potentially disrupt the cultural heritage landscape.

Table 7.8-7: Identification and Assessment of Potential Interactions with VECs of Heritage Resources (continued)

Relevant Project Activity	Archaeological Heritage	Built Cultural Heritage
Fencing/gates	**(yes)** • Installing fencing and gates has the potential to disrupt archaeological resources.	**(yes)** • Fencing and gates could potentially disrupt the cultural heritage landscape.
Parking lots	**(no)** • No ground disturbance will occur as only existing parking lot areas will be used.	**(yes)** • Parking lots could potentially disrupt the cultural heritage landscape.
Operation and Maintenance		
Wind turbine operation	**(no)**	**(no)**
Maintenance activities	**(no)**	**(no)**
Decommissioning		
Removal of turbines and ancillary equipment	**(no)** • Any area in which turbines and ancillary equipment are located will already have been disturbed during the Site Preparation and Construction Phase.	**(yes)** • Removal of the wind turbines and ancillary equipment could potentially alter the cultural heritage landscape of the area, given that the turbines will have become a part of that landscape.
Removal of buildings and waste	**(no)** • Any area in which buildings are removed will already have been disturbed during the Site Preparation and Construction Phase.	**(yes)** • Removal of buildings could potentially alter the cultural heritage landscape of the area, given that the buildings will have become a part of that landscape.
Removal of power line	**(no)** • Any area in which power lines are located will already have been disturbed during the Site Preparation and Construction Phase.	**(yes)** • Removal of power lines could potentially alter the cultural heritage landscape of the area, given that the power lines will have become a part of that landscape.
Site remediation	**(no)** • Any land to be remediated will already have been disturbed during the Site Preparation and Construction Phase.	**(yes)** • Any land to be remediated could potentially alter the cultural heritage landscape of the area.

7.8.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which archaeological heritage and cultural heritage landscapes may be affected by the various Project activities include:

- Use of construction equipment and construction activities that change ground surface cover (e.g., land clearing, construction of turbine pads) could disrupt archaeological resources; and
- Activities and equipment used during the Site Preparation and Construction, and Decommissioning Phases have the potential to alter existing cultural heritage landscapes.

The assessment of effects that follows only addresses these topics as all other interactions were determined to have no effect on Heritage Resources. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and if applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are advanced to Section 7.8.5 for an analysis of significance.

As determined through the secondary screening (Table 7.8-7), potential interactions were identified between Project activities during each of three phases and the VECs of archaeological resources and heritage buildings/structures/sites/landscapes. These are described further below.

7.8.4.1 Archaeological Heritage

Archaeological Resources/Potential

Site Preparation and Construction

Activities associated with the Site Preparation and Construction Phase have the potential to affect archaeological resources/potential through redistribution of existing soils. The Stage 1 Archaeological Assessment identified one registered archaeological site within the SSA, and determined that the presence of water sources, the level land (no areas of steep slope) and soils suitable for agricultural use suggest there is archaeological potential in the SSA for pre-contact Aboriginal sites. In addition, the assessment determined the evidence of cemeteries dating back to at least the middle 19^{th} century, Euro-Canadian settlement extending back to the early 19^{th} century, the 19^{th} century road grid still in use, and three small communities that might have left behind significant archaeological remains, and there is potential for historical archaeological sites in the SSA.

A Stage 2 Archaeological Assessment will be conducted as further mitigation prior to the Site Preparation and Construction Phase of the Project. The Stage 2 Assessment evaluates whether the turbines, substation and associated infrastructure, including access roads and distribution lines, will affect archaeological resources in the SSA. The Stage 2 Assessment was commenced in the summer of 2008 and will continue during the spring and summer of 2009. Upon completion of the Stage 2 Archaeological Assessment, a Stage 2 Archaeological Assessment report will be submitted for review to the Ontario Ministry of Culture. If the Stage 2 assessment finds any significant archaeological resources - significance being determined using the criteria in the 1993 *Archaeological Assessment Technical Guidelines* (MCL, 1993) - a determination will be made whether to proceed with further archaeological work as recommended by the archaeologist (subject to Ontario Ministry of Culture review). If further archaeological work is recommended, after consultation between the Proponent, the archaeologist and the Ontario Ministry of Culture, it will be decided whether this archaeological work will constitute a Stage 3 archaeological assessment, avoidance of the archaeological resources, or a combination of the two options. If avoidance of archaeological resources results in changes to the Project's access road and/or turbine layout, and significant modifications to the Project are required as a consequence, it is conceivable that the Addendum Provision of the MOE's "Guide to Environmental Assessment Requirements for Electricity Projects" (MOE, 2001) may apply.

Furthermore if any archaeological resources are found during the Site Preparation and Construction Phase after the Stage 2 Archaeologist Assessment has been conducted, the archaeologist and the Ontario Ministry of Culture will be notified immediately, at which time an appropriate course of action will be determined.

Operation and Maintenance

Once turbines and other infrastructure related to the Project have been located to areas that will not affect archaeological sites, there is no interaction between archaeological resources/potential and the Operation and Maintenance Phase of the Project, therefore it has not been carried further into the assessment.

Decommissioning

The Site Remediation activity of the Decommissioning Phase could affect archaeological resources/potential through redistribution of soils. As the soils would likely have been previously disturbed during the Site Preparation and Construction Phase, it is highly unlikely that a measurable change on archaeology resources/potential would occur and that Site Preparation and Construction is bounding. This interaction is therefore not carried further in the assessment.

7.8.4.2 Cultural Heritage Landscapes

Heritage Buildings/Structures/Sites/Landscapes

Site Preparation and Construction

No buildings within the SSA are slated to be demolished or altered when placing the turbines and their related equipment. The only identified heritage building and heritage landscape identified are in the village of Adelaide and no turbines will be placed within 600 m of the village as per Municipal Bylaw. However, given the turbines will be visible in Adelaide as determined by the visual landscape assessment in Section 7.6, similar visual effects will be experienced in the cultural heritage landscape as in the visual landscape.

The Project requires large vehicles and machinery for soil excavations, removal of vegetation, and transport of equipment, parts and labour. Cranes used for assembly up to approximately 120 m in height will be present at each turbine location at some point during the Site Preparation and Construction Phase. Due to the sheer size of the machinery and the flat landscape, site preparation and construction activities will be visible from many locations within the SSA, including Adelaide, for the duration of this phase.

There are no steps taken to mitigate the visual effects of the Project during the Site Preparation and Construction Phase on the cultural heritage landscape.

Operation and Maintenance

As the turbines will be visible throughout the SSA, as discussed in Section 7.6, the cultural heritage landscape will be visually altered. However, as discussed for the Site Preparation and Construction phase, none of the existing physical elements will be altered.

Mitigation measures built into the design of the towers will assist in reducing the adverse effects to the visual landscape and existing cultural heritage landscape. Such measures include towers, nacelles and blades being painted white or light grey and the tower being constructed of rolled steel (not steel lattice, which is more highly visible).

Decommissioning

The Project requires large vehicles and machinery for disassembly as well as transport of equipment, parts and labour. Cranes used for disassembling the turbines up to approximately 120 m in height will be present at each turbine location. Due to the sheer size of the machinery and the flat landscape, site preparation and construction activities will be visible from many locations within the SSA for the duration of this phase.

7.8.5 Residual Effects, Determination of Significance and Follow-up

The residual effects, after mitigation measures have been implemented, were assessed to determine their overall importance using the methods described in Section 5.3, and are summarized in Section 7.14.

7.8.5.1 Archaeological Heritage

Archaeological Resources/Potential

Site Preparation and Construction

The SSA has been identified as an area of archaeological potential and a Stage 2 Archaeological Assessment will be conducted to address the concerns as identified in the Stage 1 Assessment (Appendix D). Mitigation to reduce adverse effects to significant archaeological resources encountered will include either avoidance of these resources, Stage 3 Archaeological Assessment or a combination of these two options. In addition, mitigation and protocols have been outlined which would recognize the importance of archaeological resources that could be encountered during the Site Preparation and Construction Phase.

The overall magnitude of the effect of the Project on archaeological resources during this phase is considered to be low assuming that archaeological resources are to be avoided after the Stage 2 assessment (Table 7.8-3). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on archaeological resources during this phase is restricted to the SSA; the duration is limited to a few days or weeks; the frequency is occasional; and the irreversibility will be negligible if significant sites, or any site, that could potentially require Stage 3 mitigation are avoided. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

However, if the archaeological resources cannot be avoided and further archaeological assessment is required, the overall magnitude of the effect of the Project on archaeological resources during this phase is considered to be medium (Table 7.8-3). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on archaeological resources during this phase is restricted to the SSA; the duration is high in that they are removed from their natural setting permanently; the frequency is low in that it is likely that most archaeological resources will be avoided, and the irreversibility is high (irreversible). All archaeological resources are non-renewable and as such any operation where they are impacted by Project development will constitute an irreversible and permanent effect. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

IF ARCHAEOLOGICAL RESOURCES ARE AVOIDED, LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

IF ARCHAEOLOGICAL RESOURCES ARE SUBJECT TO FURTHER ASSESSMENT, LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MEDIUM

As discussed above, any archaeological resources recommended for Stage 3 Archaeological Assessment would require further follow-up. These resources might also be subject to a Stage 4 Archaeological Assessment if recommended by the archaeologist (subject to Ontario Ministry of Culture review). Following the 1993 *Archaeological Assessment Guidelines* (MCL, 1993) and the best practices reflected by the 2006 *Standards and Guidelines for Consulting Archaeologists (Final Draft)* (MCL, 2006), these archaeological resources will be excavated, recorded and reported upon prior to the Site Preparation and Construction Phase.

7.8.5.2 Cultural Heritage Landscapes

Site Preparation and Construction

Equipment and vehicles associated with the Site Preparation and Construction Phase of the Project will be clearly visible within the SSA for the duration of this phase. The overall magnitude of the effect of the Project on the cultural heritage landscape during this phase is considered moderate (Tables 7.8-3 and 7.8-7). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on the cultural heritage landscape during this phase is restricted to the SSA; the duration is short-term (limited to the Construction and Site Preparation Phase); the frequency is daily, and the irreversibility is negligible in that the effects are fully reversible – the construction equipment and vehicles will be removed from the area upon completion. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Operation and Maintenance

Turbines will be visible from most areas within the SSA for the life of the Project. The overall magnitude of the effect of the Project on the cultural heritage landscape during this phase is considered moderate (Table 7.8-3 and 7.8-7). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on cultural heritage landscape during this phase is restricted to the SSA; the duration is medium-term (limited to the Operation and Maintenance Phase); the frequency is continuous, and the irreversibility is negligible in that the effects are fully reversible – the turbines will be removed during the Decommissioning Phase. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Decommissioning

Disassembling equipment and vehicles will be clearly visible within the SSA for the duration of this phase. The overall magnitude of the effect of the Project on the cultural heritage landscape during this phase is considered high (Tables 7.8-3 and 7.8-7). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on the cultural heritage landscape during this phase is restricted to the SSA; the duration is short-term (limited to the Decommissioning Phase); the frequency is daily; and the irreversibility is negligible in that the effects are fully reversible. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

7.9 Land Use

This section pertains to the following questions from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Have negative effects on residential, commercial or institutional land uses within 500 metres of the site?* (2.1)
- *Have negative effects on the use of Canada Land Inventory Class 1-3, specialty crop or locally significant agricultural lands?* (5.2)
- *Have negative effects on existing agricultural production?* (5.3)
- *Have negative effects on the availability of mineral, aggregate or petroleum resources?* (5.4)
- *Have negative effects on the availability of forest resources?* (5.5)
- *Have negative effects on game and fishery resources, including negative effects caused by creating access to previously inaccessible areas?* (5.6)

Questions that have been addressed, or “screened out” in the initial screening (Table 7-1) for Land Use have not been carried forward into this assessment. For Land Use the following questions have been screened out in Section 7.1 above. Specifically, will the Project

- *Be inconsistent with the Provincial Policy Statement, provincial land use or resource management plans?* (2.2)
- *Be inconsistent with municipal land use policies, plans and zoning by-laws?* (2.3)
- *Have potential negative effects related to the remediation of contaminated land?* (2.5)

It should be noted that land clearing and turbine operation have the potential to affect significant natural heritage features, such as archaeological resources and cultural landscapes. Therefore this is considered in Section 7.8 of this report.

7.9.1 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VECs) for Land Use. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project. VECs can be individual valued species or environmental components.

A VEC is considered the receptor for both Project-specific effects and cumulative effects. The effects of the Project on Land Use have been assessed by evaluating changes in land use (specifically agricultural use) and recreational activities. Table 7.9.1-1 presents the VECs for

Land Use along with the basis for their selection and the specific indicators used in the assessment.

Table 7.9.1-1: Valued Ecosystem Components and Key Indicators Selected for Land Use

VEC Selection	Key Indicator(s)	Selection Basis
Land Use	• Change in residential, commercial or institutional land uses within 500 metres of the site • Consistency with Provincial Policy Statement, provincial land use or resource management plans • Consistency with municipal land use policies, plans and zoning by-laws • Change in the remediation of contaminated land	• Important to community character and perception • Policies and plans, including Ontario's Provincial Policy Statement (PPS) (MMAH, 2005) and municipal official plans and zoning by-laws, consider wind power development
Agriculture	• Change in Canada Land Inventory Class 1-3, specialty crop or locally significant agricultural lands • Change in agricultural production	• Important to community character and perception • Protected under Ontario's Provincial Policy Statement (PPS) (MMAH, 2005)
Resources	• Change in availability of mineral, aggregate or petroleum resources • Change in availability of forest resources • Change in game and fishery resources • Access to previously inaccessible areas	• Changes in availability or access to these resources could diminish the sustainable use of these resources • Protected under Ontario's Provincial Policy Statement (PPS) (MMAH, 2005) •

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between VECs and the MOE Screening Criteria Questions that they address is provided in Table 7.9.1-2.

Table 7.9.1-2: MOE Screening Criteria Questions and VECs for Land Use

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Have negative effects on residential, commercial or institutional land uses within 500 metres of the site? (2.1)	Land Use
Be inconsistent with the Provincial Policy Statement, provincial land use or resource management plans? (2.2)	Land Use Agriculture Resources
Be inconsistent with municipal land use policies, plans and zoning by-laws? (2.3)	Land Use
Have potential negative effects related to the remediation of contaminated land? (2.5)	Land Use
Have negative effects on the use of Canada Land Inventory Class 1-3, specialty crop or locally significant agricultural lands? (5.2)	Agriculture
Have negative effects on existing agricultural production? (5.3)	Agriculture
Have negative effects on the availability of mineral, aggregate or petroleum resources? (5.4)	Resources
Have negative effects on the availability of forest resources? (5.5)	Resources
Have negative effects on game and fishery resources, including negative effects caused by creating access to previously inaccessible areas? (5.6)	Resources

A description of the existing conditions and an assessment of the effects of the Project on Land Use will consider the Site Study Area (herein referred to as the SSA) and the Local Study Area (LSA) use for the Socio-Economic effects assessment, as shown on Figure 7.7-1. The LSA comprises the townships of Adelaide Metcalfe, Strathroy-Caradoc and North Middlesex, which are located in Middlesex County; and Warwick in Lambton County.

Data were collected from the Canada Land Inventory (NRCan, 2000), municipal planning documents and by-laws, including the following relevant Official Plans:

- County of Middlesex Official Plan (2006);

- Lambton County Official Plan (1998);
- Official Plan for the Township of Adelaide Metcalfe (2005);
- Township of Strathroy-Caradoc Official Plan (2008);
- Township of Warwick Official Plan (1998); and
- Municipality of North Middlesex Official Plan (2008).

Data were also collected directly from the above municipalities. Statistics Canada (2006) data from the 2006 census and 2006 census of agriculture were also used.

To assess the extent, duration and irreversibility of effects of the Project on Land Use within the Site, the general criteria in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for the Land Use Key Indicators are defined in Table 7.9.1-3 below.

Table 7.9.1-3: Effects Assessment Criteria for Land Use

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Change in residential, commercial or institutional land uses within 500 metres of the site	No change from baseline/existing conditions	Change in less than 1 ha of these land uses	Change in 1 to 5 ha of these land uses	Change in > 5 ha of these land uses
Consistency with Provincial Policy Statement, provincial land use or resource management plans	Consistent	Minor degree of inconsistency	Moderate degree of inconsistency	High degree of inconsistency
Consistency with municipal land use policies, plans and zoning by-laws	Consistent	Minor degree of inconsistency	Moderate degree of inconsistency	High degree of inconsistency
Change in the remediation of contaminated land	No change from baseline/existing conditions	Change in remediation of less than 1 ha of contaminated land	Change in remediation of 1 to 5 ha of contaminated land	Change in remediation of > 5 ha of contaminated land

Table 7.9.1-3: Effects Assessment Criteria for Land Use (continued)

Key Indicator	Levels of Magnitude			
	Negligible	**Low**	**Moderate**	**High**
Change in Canada Land Inventory Class 1-3, specialty crop or locally significant agricultural lands	No change from baseline/existing conditions	Loss of less than 10 ha of Class 1-3, specialty crop or locally significant agricultural lands	Loss of 10 to 50 ha of Class 1-3, specialty crop or locally significant agricultural lands	Loss of >50 ha of Class 1-3, specialty crop or locally significant agricultural lands
Change in agricultural production	No change from baseline/existing conditions	Loss of less than 1% of production in LSA	Loss of 1 to 5% of production in LSA	Loss of >5% of production in LSA
Change in availability of mineral, aggregate or petroleum resources	No change from baseline/existing conditions	Loss of less than 1% of resource availability in LSA	Loss of 1 to 5% of resource availability in LSA	Loss of >5% of resource availability in LSA
Loss of forestry resources	No change from baseline/existing conditions	Loss of less than 1% of resource availability in LSA	Loss of 1 to 5% of resource availability in LSA	Loss of >5% of resource availability in LSA
Reduction in quality of game and fishery resources	No change from baseline/existing conditions	Loss of less than 1% of resource availability in LSA	Loss of 1 to 5% of resource availability in LSA	Loss of >5% of resource availability in LSA
Access to previously inaccessible areas	No change from baseline/existing conditions	Temporary loss (one season) of game and fishery resources due to an episodic increase in the use of previously inaccessible areas	Temporary longer-term (two to four seasons) loss of game and fishery resources due to an episodic increase in the use of previously inaccessible areas	Permanent loss of game and fishery resources, due to the creation of permanent access to previously inaccessible areas

The following sections describe the existing conditions of Land Use with the Site and Local Area(s), and an assessment of the potential effects of the Project on Land Use VECs.

7.9.2 Existing Conditions

7.9.2.1 Existing Land Use

Municipal land use designations within 500 m of the SSA are shown on Figure 7.9-1. The SSA and adjacent properties (within 500 m) are almost entirely agricultural, with very small residential and institutional areas (Adelaide WG MacDonald Public School is located on 29059 School Road in the SSA, see Section 7.7) associated with the Hamlet of Adelaide. None of the proposed turbine locations are within 600 m of residential, commercial or institutional land use designations.

Because the SSA is located in Adelaide Metcalfe, Middlesex County, the most comprehensive sets of plans and policies relevant to the Project are the Local Official Plan for Adelaide Metcalfe and the Middlesex County Official Plan. Agriculture is the predominant land use and economic mainstay in the LSA and, consequently, the protection of the farming community and agricultural land are emphasized in the Local and County Official Plan.

In their OP, the County also indicates that integral to the preservation of agricultural land is the protection of the natural environment including natural features including wetlands, Areas of Natural and Scientific Interest, woodlots and stream corridors and their underlying environmental functions. The County OP recognizes that an ecosystem approach to planning will be used to achieve a balance between the economic and the natural environments (County of Middlesex. 2006).

The County Strategic Plan establishes a broad, long term vision for the County and includes specific objectives for land use planning at the County level. The objectives for land use planning established in the Strategic Plan emphasize key components that will contribute to a healthy community which include the protection of the agricultural community; the management of growth; and a vibrant economy (County of Middlesex. 2006).

Section 2.4.6 of the County of Middlesex Official Plan (County of Middlesex. 2006) states that:

> *"The County shall encourage the development of alternative and renewable energy systems, as a source of energy for the economic and environmental benefit of Middlesex County and the Province of Ontario. These systems significantly reduce the amount of harmful emissions to the environment when compared to conventional energy systems. The County encourages the use of wind, water, biomass, methane, solar and geothermal energy."*

Because the proposed Project comprises more than one generating unit and is intended to be connected to the provincial electrical transmission grid the Project is expected to be defined as a Commercial Wind Energy Generation Systems (CWEGS). The establishment of a CWEGS will not require an amendment to the County OP.

The Government of Ontario's proposed *Green Energy and Green Economy Act* was tabled as a bill on February 23, 2009. This Act, as tabled, prevents municipalities from restricting the development of renewable energy projects, including through planning by-laws. However, in the absence of specific setbacks requirements, discussions with local township planners and Council indicate that they prefer the use of the County OP as guidance. After several meetings and discussions with local planners and the Township of Adelaide Metcalfe Council, the Township of Adelaide Metcalfe passed By-Law # 17-2008, on May 5, 2008. This By-Law (Adelaide Metcalfe, 2008) was developed specifically for wind generating projects and establishes that:

"Commercial Wind Energy generation Systems shall be in conformity with the policies outlined in Section 2.4.6.1 of the County of Middlesex Official Plan and the following:

a) Minimum setback to urban area: 600 m
b) Minimum setback to dwelling units located off-site: 400 m
c) Minimum setback to lot lines: 20 m + blade length
d) Minimum setback to municipal road: 1.2 x Total Height (tower + blade at highest point)
e) Minimum setback to lot lines of adjacent properties within same wind farm development: 0 m

AET has designed the Adelaide wind project to comply with the requirements as identified in both the County and Local Official Plan.

The Ontario Provincial Policy Statement (PPS) (MMAH, 2005) states that planning authorities shall support energy efficiency and improved air quality through land use and development patterns, which, among other goals, promote design and orientation which maximize the use of alternative or renewable energy, such as solar and wind energy and the mitigating effects of vegetation.

According to the PPS (MMAH, 2005), increased energy supply should be promoted by providing opportunities for energy generation facilities to accommodate current and projected needs, and the use of renewable energy systems and alternative energy systems, where feasible. Alternative energy systems and renewable energy systems shall be permitted in settlement areas, rural areas and prime agricultural areas in accordance with provincial and federal requirements. In rural areas and prime agricultural areas, these systems should be designed and constructed to minimize impacts on agricultural operations.

The Site is a mix of agricultural land and woodlots with limited potential for contamination of the Project site (i.e., the area is primarily rural). To the best of AET and the land grantors' knowledge and belief, the SSA does not contain any pollutant, contaminant, hazardous materials or dangerous or toxic substances.

7.9.2.2 Agriculture

As shown on Figure 7.9-2, The SSA has predominantly Class 1 soils (no significant limitations in use for crops), with some areas of Class 2 soils (moderate limitations that restrict the range of crops or require moderate conservation practices) in the northern, southeastern and southwestern portions of the SSA. The LSA has a mix of Class 1 and Class 2, as well as relatively small areas in the northern and southeastern portions of the LSA with severely limited soils.

Table 7.9.2-1: Agriculture Profiles[1]

	Strathroy-Caradoc	Adelaide Metcalfe	Warwick	LSA	Middlesex County	Ontario
Total population in 2006	20,891	3,117	3,945	27,953	422,333	12,160,282
Total number of operators	400	380	360	1,140	3,660	82,410
Average age of operators	52.7	50.2	49.3	50.7	52.8	52.6
Total male operators	280	265	250	795	2,640	58,875
Total female operators	125	120	115	360	1,020	23,530
Total number of farms	272	267	246	785	2,525	57,211
Land area (km2)	347	331	290	968	3,317	907,574

Table 7.9.2-1: Agriculture Profiles[1] (continued)

	Strathroy-Caradoc	Adelaide Metcalfe	Warwick	LSA	Middlesex County	Ontario
Total area of farms (ha)	24,061	26,167	27,961	78,189	249,795	5,386,453
Average area of farms (ha)	88	98	114	100	99	94
Total gross farm receipts (excluding forest products) (million $)	98.4	61	68.3	228	594	10,342
Total farm capital (market value in million $)	351.5	354.3	408	1,114	3,675	65,337
Land in crops (ha)	19,394	21,704	24,264	65,362	209,158	3,660,941
Total cattle and calves	4,987	7,231	5,097	17,315	95,749	1,982,651
Total pigs	14,364	92,554	93,309	200,227	370,624	3,950,592
[1]North Middlesex not included due to insufficient data						

Source: Statistics Canada (2006) Agriculture Community Profiles

The importance of agriculture to the economy of the Local Study Area is apparent from the gross farm receipts presented in Table 7.9.2-1. The per capita value of these receipts is approximately $8,000 in the LSA, and approximately $850 per capita in Ontario as a whole. Middlesex and Lambton Counties boast diverse agricultural bases including horticulture, dairy, livestock and cash crops. Table 7.9.2-2 displays the four most important crops in Strathroy-Caradoc, Adelaide Metcalfe and Warwick. Feed and grain crops are the predominate crops in terms of areal coverage in these communities.

Table 7.9.2-2: Top Crops (hectares)[1]

	Strathroy-Caradoc	Adelaide Metcalfe	Warwick
Soybeans	6,399	7,340	9,925
Corn for grain	5,764	5,919	5,339
Winter wheat	2,538	4,180	4,915
Alfalfa and alfalfa mixtures	934	1697	1152
[1]North Middlesex not included due to insufficient data			

Source: Statistics Canada (2006) Agriculture Community Profiles

7.9.2.3 Resources

Based on a Granular Resources Map (OGS, 1977) of the northern section of the SSA and knowledge of the surficial geology, the SSA is located within an area with an overall low potential for aggregate resources. Drift thickness and surficial geology restricts the ability to quarry the bedrock formations and limits the availability of sand and gravel for most of the site. The Parkhill Granular Resource Map reports a small area of stratified drift containing local masses of usable granular material in the northwest section of the SSA. While not identified by the Ministry of Northern Development and Mines (MNDM), satellite images of this area indicate a minor, but active, surface aggregate mine. This total area, approximately 0.8 km by 1.8 km, is located approximately 3.5 km northwest of the closest planned turbine. MNDM base data shows there was a former limestone quarry within the SSA. MNDM records indicate it is a past producing mine with no reserves.

The MNDM database also reports discretionary occurrences of salt deposits with the SSA. The salt deposits are identified as two stratigraphic layers. The first unit is located quite deep, approximately 500 mbgs, and relatively thin, approximately 12 m. A shallower layer at approximately 390 mbgs is approximately 80 m thick. Neither deposit is considered economically viable.

Numerous oil and gas wells have been drilled within the SSA and vicinity from the early 1900s to the present. The locations of oil and gas wells, and pipelines, obtained from the Ontario Petroleum Institute (OPI) database, are presented on Figure 7.1-2. Based on the available data from the OPI database, there are 35 active oil/gas wells out of 222 wells that have been drilled within the SSA for which there is a record.

Forestry is not a major resource sector in the local economy, due primarily to the extent of land used for agriculture. Nonetheless, it is important to consider forestry resources with respect to existing and future land use development. Canadian Land Inventory Classifications for Forestry indicate that the Local Study Area is predominantly Class 2 (lands have very slight limitations to the growth of commercial forests), with some areas of Class 1 (lands having no important limitations to the growth of commercial forests) in the southern portions of the LSA and Class 3 (lands having slight limitations to the growth of commercial forests) in northern and southern portions. The SSA is almost entirely Class 2, with a small area of Class 3 in the northern portion.

Although the lands in the LSA are predominantly agricultural, some resources for fishing and game hunting exist. Canadian Land Inventory Classifications for ungulate wildlife for the LSA indicate that they are predominantly Class 1 (Lands in this class have no significant limitations to the production of ungulates) and Class 2 (lands in this class have very slight limitations to the production of ungulates) (NRCan, 2000). Classifications for waterfowl wildlife are predominantly Class 7 (lands in this class have such severe limitations that almost no waterfowl are produced), with minor areas of Class 6 (Lands in this class have severe limitations to the production of waterfowl).

7.9.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on Land Use is provided in Table 7.1 [also above], and is summarized as follows:

- Land clearing for turbine site construction and foundation installation, temporary storage facilities, collector system and substation could affect residential, commercial and institutional land use, and could remove land from agricultural production and resource extraction;
- Road construction/modification could affect residential, commercial and institutional land use, remove land from agricultural production and resource extraction, and could create access to previously inaccessible areas; and
- Wind turbine operation could affect residential, commercial and institutional land use, remove land from agricultural production and resource extraction, and could create access to previously inaccessible areas.

The assessment of the Project activities on Land Use is based on the description of the Project provided in Section 4.5. Assumptions used in the assessment of effects on Land Use include the following:

- Effects on Land Use, Agriculture and Resources are most likely to result from those activities that potentially change land use, agricultural practices and resource extraction; and therefore land clearing, road construction/modification and wind turbine operation are likely to bound the effects of other works and activities that may require land clearing (e.g., temporary storage facilities, foundation construction, tower and turbine assembly and installation and interconnection from turbines to substation) on these VECs and are the focus of the following assessment; and

- Likely adverse effects from the Decommissioning Phase are bounded by effects predicted during the Site Preparation and Construction, and Operation and Maintenance Phases; and are therefore not assessed further.

The identification and assessment of potential interactions between the Project and Land Use, according to the MOE screening criteria are described in Table 7.9.3-1.

Table 7.9.3-1: Identification and Assessment of Potential Interactions with Land Use VECs

Relevant Project Activity	Land Use	Agriculture	Resources
Site Preparation and Construction			
Surveying and siting operations	**(no)**	**(no)**	**(no)**
Land clearing	**(yes)** • Land clearing could affect residential, commercial and institutional land use	**(yes)** • Land clearing could remove land from agricultural production	**(yes)** • Land clearing could remove land from resource extraction
Road construction/modification	**(yes)** • Road construction/ modification could affect residential, commercial and institutional land use	**(yes)** • Road construction modification could remove land from agricultural production	**(yes)** • Road construction/modification could remove land from resource extraction and create access to previously inaccessible areas
Delivery of equipment	**(no)**	**(no)**	**(no)**
Temporary storage facilities	**(no)**	**(no)**	**(no)**
Foundation construction	**(no)**	**(no)**	**(no)**
Tower and turbine assembly and installation	**(no)**	**(no)**	**(no)**
Interconnection from turbines to substation	**(no)**	**(no)**	**(no)**
Transmission line to power line	**(no)**	**(no)**	**(no)**
Fencing/gates	**(no)**	**(no)**	**(no)**
Parking lots	**(no)**	**(no)**	**(no)**

Table 7.9.3-1: Identification and Assessment of Potential Interactions with Land Use VECs (continued)

Relevant Project Activity	Land Use	Agriculture	Resources
Operation and Maintenance			
Wind turbine operation	**(yes)** • Wind turbine operation could affect residential, commercial and institutional land use	**(yes)** • Wind turbine operation could remove land from agricultural production	**(yes)** • Wind turbine operation could remove land from resource extraction and create access to previously inaccessible areas
Maintenance activities	**(no)**	**(no)**	**(no)**
Decommissioning			
Removal of turbines and ancillary equipment	**(no)**	**(no)**	**(no)**
Removal of buildings and waste	**(no)**	**(no)**	**(no)**
Removal of power line	**(no)**	**(no)**	**(no)**
Site remediation	**(no)**	**(no)**	**(no)**

7.9.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which land use may be affected by the various Project activities include:

- Removal of land used for residential, commercial or institutional purposes, or for agriculture or resource extraction, as a result of land clearing, road construction/modification and wind turbine operation; and
- Road construction and wind turbine operation creating access to previously inaccessible areas.

During the initial assessment, specific MOE screening questions were asked to identify potential interactions with the environment. The works and activities that were identified as having a potential interaction with Land Use are as follows:

- Land clearing;
- Road construction/modification; and
- Wind turbine operation.

The assessment of effects that follows only addresses these interactions, as none other were predicted to interact with Land Use. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and if applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are advanced to Section 7.9.5 for an analysis of significance.

As determined through the secondary screening (Table 7.9-3), potential interactions were identified between Project activities during Site Preparation and Construction, and Operation and Maintenance, and the land use, agriculture and resources VECs These are described further below.

7.9.4.1 Land Use

Site Preparation and Construction

Land clearing will occur at selected locations within the Project site for the purpose of turbine site construction and foundation installation, temporary storage facilities, the collector system and the substation. Although the Hamlet of Adelaide is located within the Project site, no wind turbines will be located within 600 m of residential, commercial or institutional land uses and therefore no effects are identified on these land uses. Accordingly, this interaction is not advanced for further assessment.

Likewise, road construction/modification will not occur within 600 m of residential, commercial or institutional land uses and this interaction is not advanced for further assessment.

Mitigation measures inherent in the project design, including the 600 m minimum set-backs as determined through consultation with the municipalities, serve to mitigate any likely adverse effects of land clearing on these land uses. Additionally, the use of pre-existing rights-of-way and other corridors, where available, for new roads further mitigates any effects of this activity on land use.

Operation and Maintenance

The operation of the wind turbines has the potential to affect residential, commercial and institutional land uses within 500 m of the Project site. However, because no turbines will be located within 600 m of any of these land uses, no adverse effect as a result of turbine operation on land use are likely.

Mitigation measures inherent in the project design, including the 600 m minimum set-backs as determined through consultation with the municipalities, serve to mitigate any likely adverse effects of project operation on these land uses.

7.9.4.2 Agriculture

Site Preparation and Construction

Land clearing for turbine site construction and foundation installation, temporary storage facilities, the collector system and the substation, as well as for road construction/modification involves the use of bulldozers and excavators to strip topsoil and subsoil, as required. Much of this soil is left on site near the turbine foundations for possible re-use at the end of the Project life-cycle.

The area of land to be removed from agricultural use is estimated in Table 7.9.4-1 below. These estimates are conservative to consider the likely maximum extent of effects to agriculture and using temporary overwidened road widths. The collector system is included with roads because it is often constructed along the same rights-of-way (and is a temporary disturbance during construction). The total length of access roads is estimated as 24.5 km, assuming that during Site Preparation and Construction the roads are 10 m wide. Additionally, not all of the Project will be constructed at the same time resulting in a much smaller area being unavailable for agriculture at any one time. Finally, participating landowners will be compensated for the loss of agricultural productivity consistent with their lease agreements with AET.

Table 7.9.4-1: Land Area Unavailable to Agriculture and Resources Extraction during Site Preparation and Construction Phase

Component	Area (m^2)	#	Total Area (ha)
Turbine excavation area	625	40	2.5
Turbine laydown area	3,600	40	14.4
Substation	6,400	1	0.64
Laydown/Temporary Storage	3,600	2	0.72
Access Roads	245,000	N/A	24.5
Total			**42.8 ha**

The Site Preparation and Construction Phase of the Project is predicted to temporarily remove approximately 43 ha of agricultural land from production. By comparison, the total area of farms in the LSA is approximately 78,000 ha. Therefore, the area removed from agriculture during the Site Preparation and Construction Phase represents 0.055% of the total area of farms in the LSA. Nonetheless, the effect of land clearing and road construction/modification on agriculture is advanced for further assessment.

Mitigation measures inherent in the Project design are intended to minimize the area of land made unavailable to farming. This is achieved by limiting excavation, workspace areas and new road construction and orienting roads such that they minimize existing agricultural practices (i.e., orienting the longest portion of roads parallel to the long axis of the farm). Wherever possible, existing rights-of-way are used.

Operation and Maintenance

The operation of the wind turbines will make land occupied by the turbine foundations, the substation, and roads and collector system unavailable to agriculture, as shown in Table 7.9.4-2. It is assumed that roads will be 5 m wide for this phase.

Table 7.9.4-2: Land Area Unavailable to Agriculture and Resource Extraction during Operations and Maintenance Phase

Component	Area (m^2)	#	Total Area (ha)
Turbine foundation	289	40	1.16
Substation	6,400	1	0.64
Access Roads	122,500	N/A	12.3
Total			**14.1 ha**

Fourteen hectares represents approximately 0.018% of the total land area used for farming currently in the LSA. Due to the importance of agriculture to the local economy and community character, the effect of wind turbine operation on agriculture is advanced for further assessment.

Mitigation measures inherent in the Project design are intended to minimize the area of land made unavailable to farming. This is achieved by limiting excavation, workspace areas and new road construction and orienting roads such that they minimize existing agricultural practices (i.e., orienting the longest portion of roads parallel to the long axis of the farm). When possible, existing rights-of-way and access roads are used.

7.9.4.3 Resources

Site Preparation and Construction

Project works and activities for all Phases could potentially result in an effect on the availability of resources, through preventing or restricting access to these resources. As described above, land removed from resource extraction during the Site Preparation and Construction Phase is approximately 43 ha. It is unlikely that access to, forest resources, or game and fishery resources will be reduced by this land use activity because of the relative unimportance of these resources to the local economy and community character.

Overall from maps of surficial and bedrock geology there is little potential for sand and gravel resources within the SSA and the overburden thickness throughout the SSA limits the potential for quarrying bedrock resources. Prior to the onset of construction activities, the locations of the turbines with respect to oil and/or gas wells and pipeline locations will be confirmed though known locations of existing wells and pipelines were considered and avoided in the Project layout. The Petroleum Resources Centre in London will be contacted if it is suspected that a petroleum well has been located. Upon discovery of any un-mapped oil or gas wells, a 50 m setback between Project infrastructure (wind turbines, permanent met mast and power lines) and all petroleum wells will be implemented.

The construction/modification of roads is likely to create access to previously inaccessible areas and therefore this effect is advanced for further assessment.

Mitigation measures inherent in the Project design are intended to minimize the area of land made unavailable to resource extraction. This is achieved by limiting excavation, workspace areas and new road construction. When possible, existing rights-of-way are used for project access roads.

Operation and Maintenance

As described above, land made unavailable to resource extraction during the Operations and Maintenance Phase is approximately 14 ha. However, this is not likely to change significantly the availability of resources in the LSA. Nonetheless, access to previously inaccessible areas is likely to increase as a result of wind turbine operation and therefore this effect is advanced for further assessment.

Mitigation measures inherent in the Project design are intended to minimize the area of land made unavailable to farming. This is achieved by limiting excavation, workspace areas and new road construction. When possible, existing rights-of-way are used.

7.9.5 Residual Effects, Determination of Significance and Follow-up

The residual effects, after mitigation measures have been implemented, were assessed to determine their overall importance using the methods described in Section 5.3, and are summarized in Section 7.14.

7.9.5.1 Agriculture

Site Preparation and Construction

A residual adverse effect on Agriculture (specifically the loss of prime agricultural land) is identified as a result of land clearing and road construction/modification during the Site Preparation and Construction Phase. The following levels are assigned, based on Tables 5.3-2 and 7.9.1-3, to the significance of this residual adverse effect:

- Extent – I (effect restricted to SSA);
- Duration – II (effect predicted to last for Site Preparation and Construction Phase);
- Frequency – I (effect predicted to occur once);
- Irreversibility – I (effect is fully reversible); and
- Magnitude – Moderate (22 ha of prime agricultural land to be lost).

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL (NOT SIGNIFICANT)

Operation and Maintenance

A residual adverse effect on Agriculture (specifically the loss of prime agricultural land) is identified as a result of wind turbine operation during the Operations and Maintenance Phases.

The following levels are assigned, based on Tables 5.3-2 and 7.9.1-3, to the significance of this residual adverse effect:

- Extent – I (effect restricted to SSA);
- Duration – III (effect predicted to last through Operation and Maintenance Phase);
- Frequency – I (effect predicted to occur once);
- Irreversibility – I (effect is fully reversible); and
- Magnitude – Moderate (9 ha of prime agricultural land to be lost).

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

7.9.5.2 Resources

Site Preparation and Construction

A residual adverse effect on Resources (specifically creating access to previously inaccessible areas) is identified as a result of road construction/modification during the Site Preparation and Construction Phase. The following levels are assigned, based on Tables 5.3-2 and 7.9.1-3, to the significance of this residual adverse effect:

- Extent – I (effect restricted to SSA);
- Duration – II (effect predicted to last for Site Preparation and Construction Phase);
- Frequency – I (effect predicted to occur once);
- Irreversibility – II (effect is almost completely reversible); and
- Magnitude – Low (Temporary loss of game or fishery resource).

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Operation and Maintenance

A residual adverse effect on Resources (specifically creating access to previously inaccessible areas) is identified as a result of wind turbine operation during the Site Preparation and Construction Phase. The following levels are assigned, based on Tables 5.3-2 and 7.9.1-3, to the significance of this residual adverse effect:

- Extent – I (effect restricted to SSA);
- Duration – II (effect predicted to last for Site Preparation and Construction Phase);
- Frequency – I (effect predicted to occur once);
- Irreversibility – II (effect is almost completely reversible); and

- Magnitude – Low (Temporary loss of game or fishery resource).

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

7.10 Aboriginal Communities

This section pertains to the following question from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Cause negative effects on First Nations or other Aboriginal communities? (8.1)*

Because this question has not been "screened out" in the initial screening (Table 7-1), it has been carried forward into this assessment.

7.10.1 Assessment Methods

The first step of the assessment process is to identify VECs for Aboriginal communities. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project. VECs can be individual valued species or environmental components.

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on Aboriginal communities have been assessed by evaluating changes in Aboriginal Traditional Land Use. Specifically, this includes subsistence-based hunting (including trapping and gathering) and fishing. Aboriginal title and treaty rights are an important part of the following discussion; however, with respect to potential effects of the Project, Aboriginal Traditional Land Use was selected as the most appropriate VEC.

Table 7.10-1 presents the VEC for Aboriginal communities along with the basis for its selection and the specific indicators used in the assessment.

Table 7.10-1: Valued Ecosystem Component and Key Indicators Selected for Aboriginal Communities

VEC Selection	Key Indicator(s)	Selection Basis
Aboriginal Traditional Land Use	Changes in access to areas for hunting, gathering and trapping	Previous experience and correspondence with Aboriginal communities
	Changes in access to fishing areas	Previous experience and correspondence with Aboriginal communities

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between the VEC and the MOE Screening Criteria Question that it addresses is provided in Table 7.10-2.

Table 7.10-2: MOE Screening Criteria Questions and VECs for Aboriginal Traditional Land Use

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Cause negative effects on First Nations or other Aboriginal communities? (8.1)	Aboriginal Traditional Land Use

A description of the existing conditions and an assessment of the effects of the Project on Aboriginal communities will consider the Site Study Area (herein referred to as the SSA), the Local Study Area (LSA) and Regional Study Area (RSA) shown on Figure 7.10-1. The Regional Study Area is defined as the area of southwestern Ontario that encompasses those First Nations identified by Indian and Northern Affairs Canada as having submitted a specific land claim related to Lambton or Middlesex Counties. The Local Study Area includes those First Nations located within 30 km of the centre of the SSA (Figure 7.10-1).

AET is implementing a First Nations engagement strategy which aligns with the guidance developed by the OPA specifically for the RES III-RFP – Appendix T: Best Practices, Good Business: Consulting with First Nation and Métis Communities. This includes identifying and engaging with appropriate Aboriginal groups in a meaningful process. AET is also utilizing the advice provided in the Draft Guidelines for Ministries on Consultation with Aboriginal Peoples Related to Aboriginal Rights and Treaty Rights (Government of Ontario, 2006).

Following guidance provided by Indian and Northern Affairs Canada (INAC) and the Ontario Ministry of Aboriginal Affairs (MAA), AET compiled a First Nations consultation list and provided consultation materials to identified Aboriginal communities. AET will liaise with the various groups as the Project develops. Further details of the Aboriginal engagement program are provided in Section 6 and Appendix A.6.

To assess the extent, duration and irreversibility of effects of the Project on Aboriginal communities the general criteria in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for Traditional Land Use Key Indicators are defined in Table 7.10-3 below.

Table 7.10-3: Effects Assessment Criteria for Aboriginal Traditional Land Use

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Traditional land use (hunting and fishing)	No change from baseline/existing conditions	Some change is likely from baseline/existing conditions, but traditional land use is not expected to change appreciably in the RSA.	Traditional land use for some Aboriginal community members is altered or modified somewhat.	Traditional land use for some or all Aboriginal community members is severely altered or halted entirely.

The following sections describe the existing aboriginal communities within the study areas, with respect to land use and title and treaty rights, and an assessment of the potential effects of the Project on the Traditional Land Use VEC.

7.10.2 Existing Conditions

No lands within the SSA are federally-owned or designated First Nations reserve lands. Indian and Northern Affairs Canada (INAC) has also indicated that there are no comprehensive land claims in the Regional Study Area. The following First Nations were identified by INAC as having a land claim in the Regional Study Area:

- Chippewas of the Thames;
- Chippewas of Kettle & Stony Point;
- Munsee-Delaware Nation;
- Caldwell First Nation;
- Bkwejwanong Territory (Walpole Island); and
- Oneida Nation of the Thames.

Based on their proximity to the communities identified above, the following First Nations are also considered within the Regional Study Area:

- Chippewas of Aamjiwnaang (Sarnia); and
- Delaware Nation (Moravian of the Thames).

The Métis Nation of Ontario indicates (MNO, 2008) that they have no traditional harvesting territory in the Regional Study Area.

7.10.2.1 Aboriginal Identity

Statistics Canada (2006) reports 12,375 persons of Aboriginal-identity residing in Lambton and Middlesex Counties, combined. These data are presented in Table 7.10-3.

Table 7.10-4: Aboriginal Identity Population[a] in the RSA and Province in Ontario (2006)

Census Division	Total Population	Aboriginal Identity Population[a]	Percent Population Aboriginal Identity (%)
Lambton and Middlesex Counties	544,210	12,375	2.2%
Province of Ontario	12,028,900	242,490	2.0%

[a] Included in the Aboriginal population are those persons who reported identifying with at least one Aboriginal group, that is, "North American Indian", "Métis" or "Inuit (Eskimo)", and/or who reported being a Treaty Indian or a Registered Indian, as defined by the Indian Act of Canada, and/or who reported they were members of an Indian Band or First Nation.

Source: (StatsCan 2006).

Table 7.10-5 provides the population statistics for the Aboriginal communities identified above. Data for the Province of Ontario are provided for reference.

Table 7.10-5: Population Statistics for Aboriginal Communities in the RSA

Census Division	Population (2006)	Population (2001)	% Change (2001-2006)	Total Private Dwellings	Population Density (per km2)	Area (km2)	Off-Reserve Population
Aamjiwnaang (Sarnia 45)	706	695	1.6	253	56.2	12.6	1,207[a]
Bkejwanong (Walpole Island 46)	1,878	1,843	1.9	753	13.7	137.3	1,831[a]
Caldwell First Nation	0[a]	0[a]	0[a]	0[a]	N/A	0[a]	261[a]
Chippewas of Kettle and Stony Point (Kettle Point 44)	1,020	822	24.1	774	110.8	9.2	826[a]
Chippewas of the Thames 42	747	N/A	N/A	288	19.1	39.1	1474[a]
Delaware (Moravian 47)	412	368	12.0	173	32.7	12.6	539[a]

Table 7.10-5: Population Statistics for Aboriginal Communities in the RSA (continued)

Census Division	Population (2006)	Population (2001)	% Change (2001-2006)	Total Private Dwellings	Population Density (per km2)	Area (km2)	Off-Reserve Population
Munsee-Delaware Nation 1	167	N/A	N/A	72	14.9	11.2	398[a]
Oneida Nation of the Thames (Oneida 41)	2,000[b]	N/A	N/A	N/A	90.25	22.2[b]	3,000[b]
Province of Ontario	12,160,282	11,410,046	6.6	4,972,869	13.4	907,573.8	N/A

Sources: Data are from Statistics Canada [2006] unless otherwise stated.
[a] Source: (INAC, 2008).
[b] Source: (Oneida, 2001).
N/A = data not available.

7.10.2.2 Land Claims and Treaty Issues

In considering the potential effects of the Project on Aboriginal traditional land use, determination of whether there are any specific or comprehensive land claims, title or treaty rights or litigation involving Aboriginal communities in the Regional Study Area was made by contacting the Ontario Ministry for Aboriginal Affairs (OMAA) and Indian and Northern Affairs Canada (INAC). Further details of the Aboriginal engagement program are provided in Section 6 and Appendix A.6 of this report. Treaties and land claims were also identified using mapping, chronology and other available data.

Chief Joseph Gilbert of the Walpole Island First Nation indicated in correspondence with AET that his people have an assertion of Aboriginal Title on much of the Regional Study Area, including a large portion of the southeast corner of the SSA. No other outstanding land claims or treaty rights directly involving the SSA were identified; however, the study areas are located in the traditional lands of the Ojibwa, Potawatomi, Ottawa and Haudenosaunee Peoples and therefore their traditional land uses must be considered. Section 7.8 of this report also provides details about pre-contact Aboriginal occupation of the Project area.

In 1701, twenty Chiefs from the Five (Iroquois) Nations comprising the Iroquois Confederacy (Seneca, Mohawk, Cayuga, Onondaga and Oneida) signed the Nanfan Treaty, surrendering to a representative of the British Crown a large tract of land from the Niagara region to Chicago, including what is now Southwestern Ontario, on condition they be able to hunt on these lands forever. By then, Ojibwa Peoples had taken up residency on lands identified within the RSA for this assessment. The next major Act of the Crown was the Royal Proclamation of 1763[2], the oral promises of which are respected to this day (Jacobs, 1996). Between 1764 and 1862 there were many treaties and possession of the land covering most of southern Ontario was surrendered by the Aboriginal population.

Aboriginals of Iroquois, Ojibwa, Potawatomi, Ottawa and Haudenosaunee ancestry have a holistic earth view that includes all the elements of the earth and the living creatures that inhabit its land, water and air (Jacobs, 1996; McNab, 1999). These Aboriginal peoples believe that environmental stewardship is everyone's responsibility. Such concepts as the 'seven generations' (Bkejwanong, 2003), whereby the present generation must consider past and future generation in decision-making; and the 'circle of life' (Jacobs, 1996), which considers the interconnectedness of all things, explicitly recognize the responsibility that current generations have in protecting and ensuring the sustainability of the environment.

The Oneida Nation of the Thames and Six Nations of the Grand River recognize their rights documented by the Nanfan Treaty to hunt in the Regional Study Area. The Walpole Island First Nation maintains strong hunting, fishing and trapping traditions in the Regional Study Area (McNab, 1999). Commonly hunted animals include deer, turkey, rabbits, ducks and geese. Traditional hunting areas include areas of suitable habitat throughout the LSA; however, no specific hunting, fishing or trapping events in the LSA by members of local Aboriginal communities have been reported.

7.10.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on Aboriginal communities is provided in Table 7.1, and is summarized as follows:

- Land clearing, road construction/modification, and wind turbine operation may affect traditional land uses through direct effects on aquatic and terrestrial species or effects on access to traditional lands.

Generally, Site Preparation and Construction Phase activities that are likely to affect traditional land uses are short-term, and their effects may not be realized until into the Operations and Maintenance Phase of the Project. Therefore, the Site Preparation and Construction Phase are discussed together below. Likewise, Site Preparation and Construction Phase activities would tend to have similar effects on traditional land use and are therefore generally discussed together.

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[2] Following the Seven Years' War (1756-1763), the British Crown issued the Royal Proclamation of 1763 to reorganize British possessions taken from the French in North America. The Proclamation recognized Aboriginal land claims, and established how the Crown could attempt to acquire these lands. Aboriginal land interests could only be sold or ceded to the Crown, and not to private individuals.

Effects of decommissioning activities on traditional land use would be similar in nature, but of less duration and magnitude, than Site Preparation and Construction Phase Activities are therefore considered to be bounded by them.

A summary of the identification and assessment of potential interactions between the Project and Aboriginal communities, according to the MOE screening criteria are found in Table 7.10-6.

Table 7.10-6: Identification and Assessment of Potential Interactions with the VEC of Aboriginal Traditional Land Use

Relevant Project Activity	Aboriginal Traditional Land Use
Site Preparation and Construction	
Surveying and siting operations	**(no)** • Effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification
Land clearing	**(yes)** • Land clearing may affect traditional land use if access to traditional harvesting territory is affected or if resources for hunting or fishing are identified as residual adverse effects on aquatic and terrestrial biology
Road construction/modification	**(yes)** • Road construction/modification may affect traditional land use if access to traditional harvesting territory is affected or if resources for hunting or fishing are identified as residual adverse effects on aquatic and terrestrial biology
Delivery of equipment	**(no)** • Effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification
Temporary storage facilities	**(no)** • Effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification
Foundation construction	**(no)** • Effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification
Tower and turbine assembly and installation	**(no)** • Effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification

Table 7.10-6: Identification and Assessment of Potential Interactions with the VEC of Aboriginal Traditional Land Use (continued)

Relevant Project Activity	Aboriginal Traditional Land Use
Interconnection from turbines to substation	**(no)** • Effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification
Transmission line to power line	**(no)** • Effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification
Fencing/gates	**(no)** • Effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification
Parking lots	**(no)** • Any effect would be bounded by effect on traditional land use caused by land clearing and road construction/ modification
Operation and Maintenance	
Wind turbine operation	**(yes)** • Wind turbine operation may affect traditional land use if access to traditional harvesting territory is affected or if resources for hunting or fishing are identified as residual adverse effects on aquatic and terrestrial biology.
Maintenance activities	**(no)** • Effect would be bounded by effect on traditional land use caused by wind turbine operation
Decommissioning	
Removal of turbines and ancillary equipment	**(no)** • Effects bounded by any effects identified during the Site Preparation and Construction Phase as effects would be similar in nature, but of shorter duration and less magnitude.
Removal of buildings and waste	
Removal of power line	
Site remediation	

7.10.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which Aboriginal communities may be affected by the various Project activities include:

- Effects on access to lands traditionally used for hunting or fishing; and
- Effects to species traditionally harvested from the land, water and air in the Study Areas as identified in the Aquatic and Terrestrial Biology sections (7.2 and 7.3).

During the initial assessment, specific MOE screening questions were asked to identify potential interactions with the environment. The topics that were identified as having a potential interaction with Aboriginal communities are as follows:

- Land clearing
- Road construction/modification; and
- Wind turbine operation.

The assessment of effects that follows only addresses these topics as no other interactions were determined to have an effect on Aboriginal communities. As part of the assessment of effects, this section identifies any necessary mitigation measures (if required) and the potential need for further mitigation is evaluated. Any residual effects remaining after mitigation are advanced to Section 7.10.5 for an analysis of significance.

As determined through the secondary screening (Table 7.10-6), potential interactions were identified between Project activities and traditional land use. These are described further below.

7.10.4.1 Aboriginal Traditional Land Use

Hunting

Hunting considers the harvesting of species that are associated with the terrestrial environment. Access to lands currently used for traditional hunting purposes will not be affected by the Project because the project itself will occupy a relatively small portion of the RSA and fencing will only be used around the substation. Traditionally hunted species in the RSA include moose, deer, turkey and waterfowl (geese and ducks). Aboriginal leaders in the region have indicated an interest in potential effects on waterfowl and migratory birds, which may fly near, and be affected by, the wind turbines. However, as indicated in Section 7.3, those bird species traditionally harvested by Aboriginal people, such as geese and ducks, either fly above the wind turbine heights when they are migrating, or forage near the ground and are not affected by the operation of the turbines. As no residual adverse effects are identified on game wildlife or waterfowl species in the assessment of effects on the terrestrial environment (Section 7.3), no residual adverse effects on hunting are likely to result from the Project. Accordingly, no further assessment is warranted.

Fishing

As discussed in Section 7.2, no residual adverse effects on sport fish or other aquatic species are likely to result from the Project. Likewise, no effect on access to fishing areas in the study areas will be affected by the Project. Accordingly, no residual adverse effect is identified and no further assessment is warranted.

7.10.5 Residual Effects, Determination of Significance and Follow-up

No residual adverse effects on traditional land use are identified and no follow-up is therefore required.

7.11 Traffic

This section pertains to the following question from the MOE environmental screening criteria checklist (see Section 7.0). Specifically, will the Project:

- *Have negative effects related to traffic?* (6.7)

Because this question has not been "screened out" in the initial screening (Table 7-1), it has been carried forward into this assessment.

7.11.1 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VECs) for Traffic. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project.

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on Traffic have been assessed by evaluating changes in traffic volumes and traffic flow in the area. Table 7.11-1 presents the VEC for Traffic along with the rationale for its selection and the specific indicators used in the assessment.

Table 7.11-1: Valued Ecosystem Component and Key Indicator Selected for Traffic

VEC Selection	Key Indicator(s)	Selection Basis
Traffic volume/flow	Increase in traffic volume and disruption on the following roadways: Highway 402, Egremont Drive (County Road 22), Mullifarry Drive	Potential to be affected by construction/decommissioning activities; major traffic routes in Local and Site Study Area.

The VECs and their key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between the VEC and the MOE Screening Criteria Question that it addresses is provided in Table 7.11-2.

Table 7.11-2: MOE Screening Criteria Questions and VEC for Traffic

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Have negative effects related to traffic? (6.7)	Traffic volume/flow

A description of the existing conditions and an assessment of the effects of the Project on Traffic will consider the Site Study Area (herein referred to as the SSA) which is shown on Figure 4.3-1. In addition, the traffic assessment considers the Local Study Area (LSA) which is not shown on Figure 4.3-1, but encompasses an area approximately two kilometers outside of the SSA boundary, along Highway 402, and includes any other county or local roads that will be traveled during all phases of the Project.

To assess the extent, duration and irreversibility of effects of the Project on Traffic at the Site and within the LSA and SSA the general criteria described in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for the Traffic Key Indicators are defined in Table 7.11-3.

Table 7.11-3: Effects Assessment Criteria for Traffic

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Increase in traffic volume and disruption on Highway 402 and county and local roads, particularly Egremont Drive (County Road 22) and Mullifarry Drive	No change from baseline/existing conditions	Noticeable change in the composition of traffic but no noticeable change in volume or congestion	Noticeable change in composition and volume of traffic but no increase in congestion or delay	Noticeable increase in congestion or delay along with changes in composition and volume

The following sections describe the existing conditions for Traffic within the SSA and LSA study and an assessment of the potential effects of the Project on Traffic.

7.11.2 Existing Conditions

The LSA is located within the Township of Adelaide Metcalfe, which is largely rural, but contains a segment of a major highway (Highway 402) in addition to a number of smaller county and local roads. Highway 402 runs east-west through the middle of the SSA and is part of the 400-series King's Highway system. This highway is designated as a Provincial Highway on Schedule "C" of the Township of Adelaide Metcalfe OP (County of Middlesex Planning Department, 2004), and is under the jurisdiction of the Provincial Ministry of Transportation (Adelaide Metcalfe Township, 2004). Other major roads in the LSA include Egremont Drive (County Road 22) and Kerwood Road (County Road 6), both of which are designated as collector roads, and Centre Road (County Road 81), which is designated as an arterial road. These are under the jurisdiction of the County of Middlesex. Mullifarry Drive and all other roads within the LSA are designated as local roads and are under jurisdiction of the Township of Adelaide Metcalfe. Egremont Drive is the first road north of Highway 402 and runs east-west through the centre of the village of Adelaide, the only built-up area within the LSA. Most of the other north-south and east-west roads within the LSA (including Mullifarry Drive) are local roads which provide direct access to abutting properties and minimize through-traffic within the Township (Adelaide Metcalfe Township, 2004).

The speed limit on Highway 402 is 100 km/h. As of 2005, the Average Annual Daily Traffic (AADT)[3] volume along the 9.2 km section of Highway 402 from Middlesex Road 81 (interchange 65) to Middlesex Road 6 (interchange 56) was 18,300 (MTO, 2005). From 1994 to 2005, the traffic pattern along this section of the highway was classified as "intermediate recreation", which is an intermediate variation, or blend of all types of traffic (commuter and recreation/tourist). In 2005, there was an accident rate[4] of 0.6 for this section of the 402 (MTO, 2005).

The speed limit in open or low occupancy areas of the county roads in the LSA (i.e., Centre Road/County Road 81 and Egremont Drive/County Road 22) is typically 80 - 90 km/h; however this decreases to as slow as 50 km/h in residential areas with interim transitional speed zones between the 80-90km/h and 50km/h areas. Speed limits are set and enforced under the *Ontario Highway Traffic Act* (Ontario Legislative Assembly, 1990). The 50 km/h minimum speed limit would apply to most residentially-zoned areas within the LSA. Traffic volume on county roads is not monitored by the MTO; however according to the Township OP, the purpose of these roads is to move relatively large volumes of traffic at relatively high speeds through and within the Township boundary (Adelaide Metcalfe Township, 2004). The speed limit of the local roads within the LSA is typically 60 km/h and existing traffic volume is relatively light, as the population density is low. The local roads intersect private properties with primarily single unit dwellings and active agricultural activity.

7.11.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on Traffic is provided in Table 7.1 [also above] and is summarized as follows:

- Construction and/or decommissioning activities could have negative effects on traffic.

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[3] Average 24-hour, two-way traffic from January 1 to December 31

[4] Accident rate equals the number of accidents in a year divided by the million vehicle kilometres traveled on that section during the same period.

The assessment of the effects of the Project on Traffic is based on the description of the Project provided in Section 4.0.

A summary of the identification and assessment of potential interactions between the Project and Traffic are found in Table 7.11-4.

Table 7.11-4: Identification and Assessment of Potential Interactions with a VEC of Traffic

Relevant Project Activity	Traffic Volume/Flow
Site Preparation and Construction	
Surveying and siting operations	**(no)**
Land clearing	**(yes)** • Delivery of equipment • Disruption of traffic
Road construction/modification	**(yes)** • Disruption of traffic
Delivery of equipment	**(yes)** • Disruption of traffic • Increased traffic volume
Temporary storage facilities	**(no)**
Foundation construction	**(yes)** • Concrete truck traffic
Tower and turbine assembly and installation	**(yes)** • Movement of cranes and other equipment between turbine sites
Interconnection from turbines to substation	**(yes)** • Works across or alongside existing roads will cause temporary disruption of traffic
Transmission line to power line	**(no)**
Fencing/gates	**(no)**
Parking lots	**(no)**
Operation and Maintenance	
Wind turbine operation	**(no)**
Maintenance activities	**(no)** • Traffic associated with maintenance crew activity is negligible

Table 7.11-3: Identification and Assessment of Potential Interactions with a VEC of Traffic (continued)

Relevant Project Activity	Traffic Volume/Flow
Decommissioning	
Removal of turbines and ancillary equipment	**(yes)** • Temporary disruption of traffic on local/rural roads within the Project site and in the local study area • Increased traffic on local/rural roads within the Project site and in the local study area
Removal of buildings and waste	**(no)**
Removal of power line	**(yes)** • Works across or alongside existing roads will cause temporary disruption of traffic
Site remediation	**(no)**

7.11.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which traffic volume and flow may be affected by the various Project activities include:

- Delivery of construction equipment and infrastructure and construction of new access roads could result in a temporary increase in slower moving traffic volume on Highway 402, Egremont Drive, and Mullifarry Drive and some other local roads; and
- Construction and/or decommissioning activities, particularly next to, or in, road easements could result in a temporary disruption to the flow of traffic on some local roads.

The assessment of effects that follows addresses these topics only, as no other interactions were determined to have an effect on Traffic. The effect of delivery of equipment on road conditions is not included here in the assessment of the effects of increased traffic, but is considered under Socio-Economic Resources in Section 7.7.5.2 (Community Services and Infrastructure). As part of the assessment of effects of traffic, this section identifies mitigation measures that are inherent in the Project and, if applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are identified and advanced to Section 7.11.5 for an analysis of significance.

As determined through the secondary screening (Table 7.11-4), potential interactions were identified between Project activities during each of the three phases and the VEC of Traffic Volume. These are described further below.

7.11.4.1 Traffic Volume and Disruption of Traffic Patterns

Site Preparation and Construction

Land clearing, road construction/modification, equipment delivery, foundation construction, tower and turbine assembly and installation, and interconnection (i.e., between turbines and substation) activities associated with the Site Preparation and Construction Phase all have the potential to affect traffic volume/flow.

Delivery of turbine components will require an estimated 360 to 520 trips (9 to 13 per turbine) with additional (approximately 15) trips being required for substation equipment, electrical lines, and construction equipment delivery. The Site Preparation and Construction Phase of the Project will be spread over a period of 8-10 months, during which time all Project-related activities affecting traffic patterns will be episodic and largely localized. The major construction traffic route will include travel along Highway 402, then south on Kerwood Road as required to access the proposed staging/laydown area located southwest of the intersection of Mullifarry Drive and Kerwood Road and north Centre or Kerwood Road), and then west or east on Cuddy Drive to access the proposed staging/laydown area located east of the intersection of Cuddy Drive and School Road. If turbine components are delivered directly to each turbine location, travel will be west along Highway 402, and then from the closest interchange (i.e., either Centre Road or Kerwood Road) to the county or local roads with entrances to access roads. If components must be delivered to one of the staging areas, the major construction traffic routes from the staging areas will include travel along Mullifarry Drive, Egremont Drive (County Road 22) and Cuddy Drive to allow entrance to access roads located on private property. On higher-volume roads like Highway 402, Kerwood Road and Egremont Drive, construction traffic will not represent a measurable change from existing traffic volume. In addition there will be a smaller amount of traffic on local roads to access individual or smaller turbine clusters. Affected roadways will include Brown Road, School Road, Cuddy Drive and Seed Road. AET will liaise closely with the Township roads supervisor to ensure appropriate measures are put in place.

Within the LSA, for much of this overall period, drivers will experience no effects on traffic volumes or flow. Although construction traffic will be required to travel on county and local roads, it is only for short distances (likely < 5km) and speeds are not anticipated to be significantly different from local speed limits. In the event that construction traffic does result in slower traffic, the grid-like pattern of local roads allows frequent opportunity for residents to by-pass stretches of roads that are affected by slower-moving traffic.

There will be periodic interruptions in smaller areas of the SSA for road upgrades, work within the road easement or as delivery vehicles slow to enter the site. During the Site Preparation and Construction Phase, upgrades to the existing roads within the SSA may be required to accommodate the large trucks, cranes and other large equipment that will traverse the area during construction. Road work may also be required to install underground distribution cables across or alongside existing roads. Due to the availability of alternate routes that result in only very minor changes to travel distances (< 1 km), delays are anticipated to be minor and of short duration.

As described in Section 7.7.5.2 (Community Services and Infrastructure), transportation of heavy turbine components on local roads may result in minor damage to the roads. AET will consult with the County and Township to ensure that road damage resulting from equipment delivery is avoided were possible and suitable mitigation and repair measures are in place. A survey to determine the roads/travel routes within the LSA that are capable of accommodating the oversize vehicles and heavy loads associated with construction and decommissioning will be conducted in conjunction with the Township prior to these Project Phases. Given the availability of alternate routes, any required upgrading or other construction works are not likely to substantially affect traffic congestion or travel times.

The construction of new access roads and upgrading of existing local/rural roads (e.g., widening, installation of new culverts, and widening of turn radii between existing roads and new access roads) will require separate permit approvals outside of the ESR/EIS process. Appropriate permits will be obtained from provincial and municipal agencies, including (but not limited to) the Ministry of Transportation (MTO) and the County and/or Township.

If a road safety program is required by local governments (Township or County) the construction contractor and/or turbine manufacturer will oversee the implementation of a road safety program during the detailed design phase, which may include measures such as signage, road closures, speed restrictions, truck lighting, load restrictions and equipment inspections.

Operation and Maintenance

During the Operation and Maintenance Phase of the Project, it is not anticipated that traffic planning will be required as only periodic maintenance activities will be required and no affect on traffic is anticipated. There will be no effects on traffic as a result of this phase of the Project, and therefore, it has not been carried further in the assessment.

Decommissioning

The removal of turbines and ancillary equipment and removal of power lines during the Decommissioning Phase have the potential to affect traffic volume through the increased presence of construction and delivery vehicles, as was the case during the Site Preparation and Construction Phase. All effects on traffic in this Phase will be similar to those described in the Site Preparation and Construction Phase.

7.11.5 Residual Effects, Determination of Significance and Follow-up

The residual effects, after mitigation measures have been implemented, were assessed to determine their overall importance using the methods described in Section 5.3, and are summarized in Section 7.14.

Site Preparation and Construction; Decommissioning

The Site Preparation and Construction Phase and the Decommissioning Phases are of short and well-defined durations (approximately 8-10 months for Site Preparation and Construction, and 3 to 6 months for Decommissioning). Residual effects have been considered for the general periods of the Site Preparation and Construction and Decommissioning Phases, and for specific periods when construction activities are occurring on roads (minor road upgrades and equipment transport). During these phases, there will be a short-term change in the composition of traffic within the LSA, but due to the availability of alternate routes, increased traffic congestion or delays are not anticipated to be significant, and the magnitude of residual effects is predicted to be low. Similarly, road improvements, or work required in the road right-of-way will also be short-term in duration and will be easily avoided with no appreciable change to travel distance or travel time (low magnitude). All effects on traffic will be largely restricted to the SSA (as all staging/laydown areas will be located within the SSA), traffic interruptions will likely occur daily during construction and decommissioning (creating periodic traffic interruptions during these phases), and any change to traffic volume or flow will be fully reversible following completion of associated works. Based on this analysis of effects during the Site Preparation and Construction Phase and Decommissioning Phase, the level of importance of the residual effects (based on Table 5.3-3) is considered to be minimal as traffic will return to baseline levels after these Project Phases.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Upon completion of project decommissioning, AET will determine if removal of Project components has resulted in damage to local roads and will consult with the Township of Adelaide Metcalfe and County of Middlesex with regards to their repair if required.

7.12 Electromagnetic Interference (EMI)

Consideration of electromagnetic interference (EMI) is not specifically included in the MOE screening checklist; however, the potential for EMI is an important aspect in the siting of wind farm projects and is now a required consideration for proponents seeking federal funding from NRCan under the ecoENERGY for Renewable Power Program. The issue of EMI can be considered to apply to question 6.8 of the MOE environmental screening checklist (see Section 7.0). Will the Project:

- *Cause any other negative environmental effects not covered by the criteria outlined above? (9.2)*

Because this question has not been "screened out" in the initial screening (Table 7-1), it has been carried forward into this assessment.

EMI impact studies involve determination of the presence of broadcast, radiocommunication, radar and seismological systems near the wind farm location and evaluation of the potential for turbines to occur within the consultation and exclusion zones for each type of equipment, as outlined in the document: Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines on Radio Communication, Radar and Seismoacoustic Systems (RABC/CanWEA, 2007).

The effects of EMI are restricted to the Operation and Maintenance Phase of the Project, with wind turbine operation being the only Project activity that will create this effect. Wind turbines cause EMI by three pathways; 1) near-field effects; 2) diffraction; and 3) reflection/scattering (URS Pty Ltd., 2004). An example of a near-field effect is when the electromagnetic field emitted by the generator and switching components of a turbine nacelle causes interference to radio signals. Diffraction occurs when an object either reflects part of the signal and/or absorbs it. Reflection/scattering occurs when a turbine either reflects or obstructs signals between a transmitter and a receiver (URS Pty Ltd., 2004).

The types of signals that could be affected by the turbines include the following (RABC and CanWEA, 2007):

- Cable distribution off-air systems (head-ends);
- Satellite uplinks and receiver systems;
- Direct-to-home receiver systems (Star Choice, Bell Expressvu);
- Radar;

- Airport communications and guidance systems;
- Broadcasting (AM, FM, TV);
- Canadian Coast Guard communications and vessel traffic radar systems;
- Point-to-point radiocommunication links;
- Point-to-multipoint systems;
- Cellular type networks; and
- Seismological and infrasound monitoring systems.

In order to determine the potential for EMI from the Adelaide Wind Farm, AET retained Yves R Hamel & Associates Inc (YRH) to complete a detailed EMI impact study. Using the RABC published guidelines and their industry experience, YRH performed an impact analysis and studied the potential effects from the Adelaide wind farm on systems within 100 km of the SSA. The study specifically examined:

- Broadcast systems, TV, FM radio and AM radio;
- Cable TV operators cable head;
- Navigational aids systems, VOR;
- Mobile systems, VHF and UHF mobile, cellular and PCS;
- Point-to-point radio systems, UHF, microwave and satellite links;
- Point-to-multipoint systems, FWA, MMDS, LMCS;
- Navigational and meteorological radar systems; and
- Canadian National Seismograph Network.

The main conclusions of the EMI Impact study are summarized here, with the full EMI Impact Study included in Appendix F.

The quality of analog TV reception will not require further study as all analog stations are scheduled for closure prior to the Adelaide Wind Farm becoming fully operational in late 2010. Digital TV is known to be more robust and less likely to be affected by the development of a wind farm. There are no TV or AM transmitters in the vicinity of the Project, although there is one FM broadcast station. Because a 500 m exclusion area has been applied around the FM broadcast station, there is not expected to be any interference with their signal. There are no RCMP telecommunications or broadcast stations in the area and the Department of National Defence has no objections. Although there are three microwave links identified within SSA, all turbines have been located outside of consultation zones in order to avoid interference.

Of the service providers and government agencies considered, there were some potential EMI issues identified; there is one Environment Canada weather radar station within 60 km of the Project (within their consultation zone), and the final layout has been forwarded to the agency for clearance. There is one NAV CANADA air traffic control radar system within 80 km (within their consultation zone), and clearance from NAV CANADA will be achieved directly through their land use proposal process. In addition, an infrasound measurement station that is jointly operated by the University of Western Ontario Department of Physics and Astronomy and Geological Survey of Canada/NRCan is located approximately 32 km from the Project. Discussions are currently underway with the University of Western Ontario to determine the potential for interference with their sensitive monitoring equipment.

Throughout the Project design and EA process, AET engaged and consulted with the various licensed service providers and government agencies to determine potential EMI issues and how these could be mitigated through turbine and infrastructure siting. The results of the consultation conducted as part of the EMI impact study (based on the Project layout as shown in Appendix F) are summarized below in Table 7.12-1.

Table 7.12-1: Potential for Electromagnetic Interference (EMI) from the Adelaide Wind Farm

EMI Contact/System	Response
Department of National Defence (military air traffic control)	No objection
Department of National Defence (radiocommunications)	No objection
Department of National Defence (Navigational Aids)	No objection
Environment Canada - Meteorological Service of Canada (weather radars)	Interference is possible; further review is in progress
Royal Canadian Mounted Police (radiocommunications)	No objection
Canadian Coast Guard (vessel traffic)	No objection
Geological Survey of Canada Seismology and Geomagnetism/Natural Resources Canada (seismological monitoring)	No objection
University of Western Ontario - Department of Physics and Astronomy	Included in consultation because the Elginfield Observatory (containing sensitive microbarograph instrumentation) is jointly operated with the Geological Survey of Canada/NRCan. Consultations are on-going.

Table 7.12-1: Potential for Electromagnetic Interference (EMI) from the Adelaide Wind Farm

EMI Contact/System	Response
NAV CANADA (civilian air traffic control)	To be addressed under their Land Use Proposal process – submitted March 30, 2009
Ontario Government Mobile Communications Office (GMCO)	No objection as per email received March 30, 2009
CBC Technology	Consultation is on-going
Telus	No objection as per email received March 25, 2009
Rogers	Consultation is on-going
Bell Mobility	No objection as per email received March 18, 2009

By siting turbines outside of broadcast, radiocommunication, radar and seismological system signal pathways, the potential for EMI is predicted to be negligible. This has been confirmed by the comments on EMI received from the contacts listed in Table 7.12-1. A final layout has been sent to all contacts to confirm that there will be no issues, and given that AET has considered the respective exclusion zones etc. for each service provider and government agency, it is unlikely that previous responses with no objection are likely to change. Although there are still some confirmations of no objection outstanding, the conclusions from the EMI study and discussion with service providers and government agencies indicate there are unlikely to be any serious EMI interference issues.

Because potential effects of EMI will be fully addressed in the pre-construction/planning stage of the Project, no further mitigation is being proposed and no residual effects are predicted. It is noted, however, that proponents are held responsible for any complaints from local residents regarding TV signal interference caused by the installation and the operation of the proposed wind farm (Levert pers. comm., 2008). AET will create a TV interference complaints process prior to construction in late 2010, to allow all complaints to be addressed in a timely and appropriate manner. This process will include a 24 hour toll-free call-in number, a complaint logging and tracking system, use of independent EMI consultants where necessary and implementation of appropriate mitigation measures where appropriate.

It is also standard practice that wind farm developers will enter into discussions with service providers and government agencies if it is discovered that the construction and/or operation of the wind farm is directly causing interference with an existing system. AET will ensure that the service providers and government agencies operating systems identified in the area have appropriate contact details for post-construction liaison and will work closely with these operators to resolve interference issues.

7.13 Public Health and Safety

This section pertains to question 6.8 of the MOE environmental screening checklist (see Section 7.0). Will the Project:

- *Cause public concerns related to public health and safety?* (6.8)

Because this question has not been "screened out" in the initial screening (Table 7-1), it has been carried forward into this assessment.

7.13.1 Assessment Methods

The first step of the assessment process is to identify Valued Ecosystem Components (VECs) for Public Health and Safety. VECs are features of the environment selected to be a focus of the EA because of their ecological, social or economic value, and their potential vulnerability to effects of the Project.

A VEC is considered to be the receptor for both Project-specific effects and cumulative effects. The effects of the Project on Public Health and Safety have been assessed by evaluating the potential for injury or death as a result of the Project. Table 7.13-1 presents the VECs for Public Health and Safety along with their rationale for selection and the specific indicators used in the assessment.

Table 7.13-1: Valued Ecosystem Component and Key Indicator Selected for Public Health and Safety

VEC Selection	Key Indicator(s)	Selection Basis
Public Health	Personal injury or illness	Safety issues during construction, ice accumulation on tower and blades, shadow flicker, noise, catastrophic failure

The VEC and its key indicators are the assessment and measurement endpoints used to answer the MOE Screening Criteria Questions related to this environmental component. The relationship between the VEC and the MOE Screening Criteria Question that it addresses is provided in Table 7.13-2.

Table 7.13-2: MOE Screening Criteria Questions and VEC for Public Health and Safety

MOE Screening Criteria Question: *Will the Project...*	VEC(s) Used to Address the Question
Cause public concerns related to public health and safety? (6.8)	Public health

A description of the existing conditions and an assessment of the effects of the Project on Public Health and Safety will consider the Site Study Area (herein referred to as the SSA) shown on Figure 4.3-1. This includes all optioned and un-optioned lands and roads (both public and private), turbines and substation.

A literature review on the subjects of ice throw, shadow flicker and noise health effects was conducted to determine the effects of the Project on Public Health and Safety. Peer-reviewed articles on these topics were obtained through a search on the academic search indices Scholar's Portal and Scopus conducted in November 2008. A more general web-based search has also been conducted to obtain government reports, grey literature (including reports by consultants for government agencies), or publicly available peer-reviewed journal articles.

To assess the extent, duration, and irreversibility of effects of the Project on Public Health and Safety in the SSA, the general criteria described in Section 5.3 are used. To more accurately assess the magnitude of effects, specific criteria for the Public Health and Safety Key Indicator is defined in Table 7.13-3.

Table 7.13-3: Effects Assessment Criteria for Public Health and Safety

Key Indicator	Levels of Magnitude			
	Negligible	Low	Moderate	High
Personal Injury or Illnesses	No change from baseline.	Low risk and rare occurrence of minor injury or short-term minor health issues.	Low to moderate risk and/or occurrence of minor injuries or short-term minor health issues.	Any major injury or short-term major health issue or long-term minor health issue.

The following sections describe the existing conditions for Public Health and Safety within the SSA and an assessment of the potential effects of the Project on the Public Health and Safety VEC.

7.13.2 Existing Conditions

As described in Section 7.7 (Socio-Economic), the SSA is primarily under agricultural land use (79% of the Adelaide Metcalfe land area), with individual residences on large lots and a small built-up area consisting of the former Village of Adelaide. There are no other industrial scale wind turbine facilities operating in the SSA, although there are a number of new projects in the pre-planning and planning stages (see Section 7.16 Cumulative Effects). Based on the lack of industrial operations and other wind farms, there are no existing activities within the SSA that have been identified as having Public Health and Safety concerns.

7.13.3 Project-Environment Interactions

The initial screening to identify potential interactions of the Project on Public Health and Safety, with respect to the MOE screening criteria, is provided in Table 7.1 and is summarized as follows:

- The typical construction activities to be carried out during the Site Preparation and Construction and the Decommissioning Phases may cause concerns to public health and safety; and
- There are health and safety concerns associated with the Operation and Maintenance Phase (i.e., rotating blades throwing ice, shadow flicker, noise, and the emission of electromagnetic fields) that are either perceived or have been shown to exist.

The identification and assessment of potential interactions of the Project with Public Health and Safety is found in Table 7.13-4. An appropriate site health and safety plan will be created for the Project that will ensure compliance with all local, provincial and federal health and safety regulations.

Table 7.13-4: Identification and Assessment of Potential Interactions with a VEC of Public Health and Safety

Relevant Project Activity	Public health
Site Preparation and Construction	
Surveying and siting operations	**(no)**
Land clearing	**(yes)** • Proximity to heavy machinery
Road construction/modification	**(yes)** • Proximity to heavy machinery • Traffic

Table 7.13-4: Identification and Assessment of Potential Interactions with a VEC of Public Health and Safety (continued)

Relevant Project Activity	Public health
Delivery of equipment	**(yes)** • Proximity to heavy machinery
Temporary storage facilities	**(no)**
Foundation construction	**(yes)** • Proximity to heavy machinery • Presence of excavation pit
Tower and turbine assembly and installation	**(yes)** • Proximity to heavy machinery
Interconnection from turbines to substation	**(yes)** • Proximity to heavy machinery • Presence of trenches (for underground cables)
Transmission line to power line	**(yes)** • proximity to construction activities and lines
Fencing/gates	**(no)**
Parking lots	**(no)**
Operation and Maintenance	
Wind turbine operation	**(yes)** • Ice throw • Shadow flicker • Noise • Catastrophic failure • Electromagnetic fields associated with distribution lines and substation
Maintenance activities	**(no)**
Decommissioning	
Removal of turbines and ancillary equipment	**(yes)** • Proximity to heavy machinery and construction activity
Removal of buildings and waste	**(yes)** • Proximity to heavy machinery
Removal of power line	**(no)**
Site remediation	**(no)**

7.13.4 Assessment of Effects and Mitigation

Plausible mechanisms or pathways through which public health and safety may be affected by the various Project activities include:

- Personal injury or illnesses during the Site Preparation and Construction, and Decommissioning Phases of the Project, including construction equipment and general construction activities; and
- Personal injury or illnesses during the Operation and Maintenance Phase of the Project, including ice throw, shadow flicker, noise, catastrophic failure and electromagnetic fields.

The assessment of effects that follows only addresses this/these topic(s) as no other interactions were determined to have an effect on Public Health and Safety. As part of the assessment of effects, this section identifies mitigation measures that are inherent in the Project and if applicable, the need for further mitigation is evaluated. Residual effects remaining after mitigation are advanced to Section 7.13.5 for an analysis of significance.

As determined through the secondary screening (Table 7.13-4), potential interactions were identified between Project activities during each of the three phases and the VEC of Public Health. These are described further below.

7.13.4.1 Public Health

Site Preparation and Construction

Public safety hazards are present on any construction site and require the implementation of appropriate safety measures to prevent incidents from occurring. One such hazard that exists during construction is the proximity to operating heavy machinery. Typical construction equipment to be used for construction of the turbine and substation sites, roads and buried lines includes: tracked bulldozers, excavators, tippers and dumpers, two mobile cranes for general use and an 800-1000 tonne tracked crane for tower section, turbine and blade erection. Various large truck and trailer combinations will be used to transport the turbine and substation equipment to the site. Approximately 360-520 loads of turbine components are expected, with 1,000 additional trips required for concrete (delivered by truck). Concrete pumps will be used to construct the turbine foundations, and two cranes will be used to erect the turbine towers. Additional vehicles will be used for personnel and small equipment transport to and at the site. Installation of buried cable that connects turbines to the substation will require the excavation of trenches approximately 1 -1.5 m depth both on private and public property. Excavated trenches could pose a risk of injury to the public and once operational, buried cable could be a safety issue if accidentally encountered during digging or other excavation. Standard cable markers will be installed as appropriate to indicate the presence of underground cable on public lands.

In order to ensure public safety for the duration of the Site Preparation and Construction Phase, the turbine manufacturer, or the Balance of Plant (BOP) contractor will ensure that the following safety measures are implemented as appropriate:

- Appropriate warning signage (including locations of underground cable);
- Speed restrictions;
- Road closures;
- Vehicle lighting;
- Safety fencing surrounding trenches, or work space, as necessary; and
- Traffic direction.

Additional information relating to traffic safety is provided in Section 7.11. Further specific measures will be determined during the detailed design phase by either the turbine manufacturer or the BOP contractor.

Operation and Maintenance

Ice Throw

Under certain meteorological conditions, exposed structures, including wind turbines, can become covered with ice. There are two types of ice throw scenarios under these specific conditions: during operation, fragments of ice can be thrown off the blades due to aerodynamic and centrifugal forces or ice can fall from the turbine when it is shut down or idling without power production (Seifert *et al.,* 2003; Tammelin and Seifert, 2001). Anecdotal information from existing European operations suggests that falling ice is more common than ice throw (Morgan and Bossanyi, 1996). Although falling ice and ice throw both have the limited potential to cause personal injury or damage to property, ice throw has greater potential to affect persons or damage property, which are more likely to occur outside the immediate vicinity of a turbine.

Generally, it has been estimated that only very high winds would cause ice fragments of any significant mass to land beyond 50 m of the base of a modern 2 MW stationary turbine. The potential ice throw distance from a moving blade is dependent on several variables including the rotor azimuth, the rotor speed, the local radius, the wind speed, and the geometry and mass of the ice fragments.

A study of ice throw conducted in the Swiss Alps monitored an area around an Enercon E40 wind turbine during two winter seasons, and found that ice throw occurred during both winter seasons, and also during summer months, most ice was actually dropped directly under the blades, and that 95% of any ice thrown landed within 80 m of the turbine base, with 40% of all pieces found within 20 m of the turbine base (Cattin et al., 2007). It should be noted that the Enercon E40 model has smaller blades (20 m length versus the 45 m blade on a Vestas V90 turbine), and it is likely that the maximum distance of ice thrown from the larger Vestas V90 turbine would also be larger.

A predictive modelling study has also been conducted by Garrad Hassan Consultants in May 2007, at the request of the Canadian Wind Energy Association (CanWEA). They examined a generic turbine scenario – a 2 MW capacity turbine with 80 m hub height and 80 m blades (Garrad Hassan, 2007). The study concluded that ice was unlikely to fall more than 50 m from a stationary turbine. They also completed a Monte Carlo analysis where 100,000 theoretical ice fragments are shed from an operational wind turbine. Of the three scenarios tested, it was estimated that an average fixed dwelling of 100 m^2 size located 300 m away from a turbine would have an individual risk (IR) of 0.000002 strikes per year or 1 strike per 500,000 years. A moving car travelling on a rural road located 200 m from a wind turbine would have an IR of 0.0000038 strikes per year or one vehicle strike per 260,000 years. A person who never moved from a location 50 m away from the base of a turbine but within 300 m distance would have an IR of 0.000000007 strikes per year or 1 strike in 137,500,000 years.

Based on the studies conducted to date, it is extremely unlikely that ice throw would pose a significant risk beyond the minimum setback distances of 600 m for non-participating receptors, 500m for participating dwellings, 250 m from Highway 402, and 170 m (for minor municipal roads) applied at the Adelaide Wind Farm.

Although proper siting of wind turbines will largely minimize the potential for ice throw to affect public health and safety, most modern wind turbines also include systems that would enable shut down should icing pose an issue. All commercial wind turbines are equipped with vibration monitors which will deactivate the turbine when vibrations exceed a certain level, due to mass and/or aerodynamic imbalance which can be caused by the accretion of ice (Garrad Hassan, 2007). In addition, modern wind turbines, including the Vestas models, are equipped with an automatic shut-off feature that is activated if the nacelle-mounted sensors detect ice or if anemometer icing leads to a measured wind speed below the cut-in speed. Once a turbine has automatically shut down, it will only resume operation once the issue in question has been resolved. These measures limit the amount of time turbines would be in operation and potentially able to "throw" ice. Mitigation measures for preventing injury or damage due to ice throw or falling ice include the following (Wahl and Giguere, 2006; Morgan et al., 1998):

- Locating turbines a safe distance from any occupied structure, road or public area.
- Providing fencing and/or warning signs.
- Deactivating the turbines when ice accumulation is detected.

- Restricting access to the turbines by maintenance/operation personnel while there is ice on the structure. If site personnel require access to the turbine while iced, safety precautions, beyond remotely deactivating the turbines, may include the following:
  - Yawing to place the rotor on the opposite side of the tower door;
  - Parking vehicles at a distance of at least 100 m from the tower; and
  - Wearing standard personal protective equipment (PPE) such as hard hats.

Additionally, although ice build-up is a known occurrence on all types of tower structures, it can be considerably reduced through the use of a conical tower, as is typical for wind turbines, rather than the lattice structure, which is typically used for large hydro tower construction.

The wind turbines in this Project are located on private property therefore access by the general public would be restricted. Additionally, the turbines have been sited with a minimum setback from on-site residences of 500 m, off-site residences (i.e., residences of land owners that are not in an Option & Lease Agreement with AET) of 600 m and a setback of 168 m from roads, which considerably reduces the risk of injury from ice throw or falling ice to the general public.

Shadow Flicker

Wind turbines, like other tall structures, can cast a shadow on adjacent ground or object surfaces when the sun is visible. Shadow flicker caused by wind turbines is defined as alternating changes in light intensity created by the moving blade casting shadows on the ground and stationary objects (Wind Engineers, Inc., 2003). This shadow flicker can be not only irritating or annoying to nearby residents, but shadow flicker also has the potential to produce symptoms of motion sickness in susceptible people and the potential to trigger seizures in people with epilepsy. Shadow flicker frequency is related to the rotor speed and the number of blades; the typical blade pass frequencies associated with the Vestas V90 turbine is 0.15 to 0.24 Hz per blade (9 to 14.5 rpm; dynamic operation range). At frequencies this low, they are believed to be harmless (Wind Engineers, Inc., 2003). Research has shown that television monitors, which have a frequency of 60 Hz, can be associated with a photoconvulsive response in only 15% of people with epilepsy (Carmant and Seshia, 2008). In North America, the incidence of epilepsy is 50/100,000 per year or 0.05% of North Americans (Theodore 2006). Therefore, the proportion of the population that are at risk of a photoconvulsive response is 7.5/100,000, which is less than 1% of the population. The frequency of the shadow flicker caused by turbines is much lower, therefore should not be a concern to public health and safety. The American Epilepsy Foundation has also found that the typical range of frequencies at which epileptic seizures occur is between 5 to 30 Hz. They have determined that it is unlikely that there are any effects on the health of people with epilepsy or other individuals who are photosensitive (Erba, 2008). Although there is a very low risk of physiological health effects associated with shadow flicker, the risk of annoyance is still possible and must be assessed.

The amount and position of shadow flicker will vary on a monthly basis depending on the position of the sun. In the winter months, the sun remains to the south of the turbine, therefore more shadow flicker will occur to the north of the turbine. In the summer months, this pattern will be reversed. There is no shadow flicker when the sun is blocked by clouds or fog, or when the turbine is not rotating. Studies have also shown that at distances greater than approximately 305 m between the wind turbine and the receptor (i.e., a neighbour's house), shadow flicker usually only occurs at sunrise or sunset when the shadows are sufficiently long. Generally, the closer the receptor is to the wind turbine, the greater the effect of shadow flicker. Where the rotor plane is in-line with the sun and receptor (as seen from the receptor), the cast shadows will be very narrow (blade thickness), of low intensity, and will move quickly past the stationary receptor. When the rotor plane is perpendicular to the sun and receptor, the cast shadow of the blades will move within a circle equal to the turbine rotor diameter (Wind Engineers, Inc., 2003).

There are no accepted standards for shadow flicker, nor is shadow flicker regulated by any planning authorities at this time. Court cases in Europe have lead to currently accepted industry practices, in which no more than 30 hours of shadow flicker per year is tolerated. Additionally, according to the Danish Wind Industry Association, within that 30 hours, only the flicker occurring during the hours when the property is actively being used (i.e., by residents who are awake) was to be included in that tolerated limit (Danish Wind Industry Association, 2008).

AET conducted shadow flicker modelling in order to predict the frequency of shadow flicker occurrence as a result of the Adelaide Wind Farm. Using industry standard software (WindFarm by ReSoft Ltd.) a shadow model was created for dwellings within the SSA that were likely to be affected. It is generally accepted that shadow flicker is not an issue beyond a distance equivalent to 10 blade diameters (900 m from the turbine base in the case of the Vestas V90 model). For certainty, all dwellings within 1,000 m of a turbine were evaluated in the model. A residential layout map was built using baseline mapping, ortho-photography and on-site proofing. AET also adopted a worst-case "greenhouse" approach in terms of the modelled window layouts for each dwelling (i.e., each dwelling was assumed to have a single 1.0 m^2 window, lying horizontal to the ground, and 2.0 m above ground level, giving a 360-degree exposure). Once the turbine and dwelling location data were entered into the WindFarm software, the model determined the total predicted effect (i.e., hours per year of shadow flicker) occurring at each location. As mentioned previously, the Adelaide Metcalfe area is rural with a low population density and relatively limited residential housing. Through the residential layout map compilation process it was calculated that only 64 dwellings would potentially be affected by shadow flicker. Of these 64, the model predicted that only 12 would be actually be affected, and only for very short periods of time (most falling well below the 30 hour per year threshold). Detailed model output is provided in Appendix G (Table of Results).

Of the 12 dwellings affected, one dwelling (#16) was predicted to have just over 30 hours per year (30.64) of shadow flicker events. This is a dwelling that is owned by a landowner who is directly involved in the Project through an Option & Lease Agreement with AET. AET personnel met with the property owner to explain shadow flicker and provide information on the possible effects. The landowner agreed in writing that the effects were acceptable and AET agreed that if there was an issue with shadow flicker, a mutually agreeable consultant would be appointed to suggest mitigation measures, the costs of which would be covered by AET. The letter from the affected resident is contained in Appendix G.

In summary, shadow flicker can be readily predicted through modelling, and can be minimized by appropriate siting. Only 12 dwellings of the 64 within the SSA could experience shadow flicker, and of these, only one is predicted to experience shadow flicker at a level that is marginally higher than the internationally recognised 30 hour per year limit, and AET and this property owner have an agreement in place.

The following mitigation measures reduce the amount of shadow flicker experienced by receptors, and could be adopted by residents of the 12 dwellings predicted to experience shadow flicker at some point during the calendar year:

- Shadows are fainter in a lit room (i.e., keeping the room lit during shadow flicker events will minimize the visibility of shadows);
- Window coverings (i.e., curtains, blinds, shutters) prevent shadow flicker; and
- Exterior screening (e.g., trees) can reduce or prevent shadow flicker from reaching the windows of affected dwellings.

Noise

There have been recent anecdotal reports in Canadian national media (Cowan, 2008a and 2008b; Favaro and St. Philip, 2008) of residents near wind turbines being affected by what has been coined “Wind Turbine Syndrome” by Dr. Nina Pierpont, a medical doctor in New York State (Pierpont, 2006). Based on a literature review of peer-reviewed scientific journals, only three studies on the human health effects of wind turbines were found (one by Waye and Öhrström in 2002 was a laboratory study exposing people to pre-recorded turbine noise and has not been included in this discussion). All were from one primary group of researchers, with the two studies discussed in this report conducted in one area in Sweden having 16 wind turbines within a 22 km^2 flat, agricultural area (Pedersen et al., 2007; Pedersen and Waye, 2004). The primary findings indicated that there was a significant relationship between A-weighted sound pressure levels and the level of annoyance reported by residents (i.e., higher noise levels from turbines were associated with higher reported levels of annoyance). Also, the variation in responses among the 351 people was high, indicating other physical and/or subjective factors influenced people's responses.

Attitudes toward the visual impact of the turbines was related to the level of annoyance reported, which indicates that "annoyance" might not solely be caused by noise, but also the perception of a negative change to the landscape. The follow-up study (Pedersen et al., 2007) consisted of more in-depth interviews with people from the same area in Sweden and found that although all respondents agreed that they were exposed to sounds and visual impacts (shadow flicker), not all were annoyed. Those people that were annoyed had concerns ranging from a lack of influence and control over their home environment, being subjected to injustice and not being believed by friends and authorities. Those who were not annoyed felt the noise levels associated with the wind farms were so quiet it could be easily blocked out and that shadow flicker was not of concern. There were no other human health studies found from any other countries with operational wind farms. The studies found examined the occurrence of general "annoyance" to noise and shadow flicker and did not examine specific physiological conditions as described by Dr. Pierpont.

Dr. Pierpont believes that the presence of high levels of low frequency noise (LFN) and infra-sound may cause some or all of the following symptoms: sleep disruptions, headaches, dizziness, exhaustion, anxiety, anger, irritability, concentration and learning difficulties and tinnitus (ringing ears) (Pierpont, 2006). Consistent with the lack of wide-spread reports of these symptoms associated with wind farms, Dr. Pierpont acknowledges that not all residents near turbines will suffer from this syndrome, but that risk factors for susceptibility would mean a sensitive subpopulation would potentially be affected. There is currently debate over the presence of infrasound and LFN due to the operation of wind turbines (Ramakrishnan, 2007; Leventhall, 2006) and the association of these symptoms with the presence of a wind farm (CanWEA, 2009; Cowan, 2008a). An independent review report prepared for the Ontario Ministry of the Environment found the noise associated with wind farms does not contain significant LFN and/or infrasonic components; however, it stated that revisions to the MOE's noise assessment procedures may be necessary based on any future research that can provide scientifically consistent data linking human health to turbine noise source character (Ramakrishnan, 2007). In addition, a discussion paper by Dr. Geoff Leventhall (an audiologist) published in the journal Canadian Acoustics states that modern wind turbines are associated with insignificant levels of infrasound and low levels of LFN under normal conditions (turbulent air inflow conditions are associated with enhanced levels of LFN) (Leventhall, 2006). A Swedish Environmental Protection Agency Report on noise annoyance from wind turbines (written by the same Swedish researchers who conducted the two studies described above) concluded that: "*there is no scientific evidence that noise at levels created by wind turbines could cause health problems other than annoyance*." (Pedersen and Halmstad, 2003).

With regards to the potential for human health impacts relating to the aerodynamic noise emitted from turbines, annoyance, by nature, is difficult to assess as a human health impact, as it is subjective, there are no obvious physiological symptoms or signs associated with it, and it can be highly influenced by factors other than the noise level (i.e., a resident's negative opinion of the wind farm and the changes to their viewscape). High levels of LFN and/or infrasound may cause physiological health effects, but to-date, there has been no definitive proof presented in peer-reviewed journals or information provided by governments that indicates high levels of LFN and/or infrasound can be associated with wind farms. Epidemiological studies, in conjunction with acoustic studies, would be necessary to definitively confirm a link between these physiological effects and wind farms.

In Ontario, the MOE has set noise guidelines based on information on the effects of noise on people. These guidelines are in line with those in Europe where wind farms have been in operation for a longer time (Ramakrishnan, 2007). Predictive noise modelling and assessment (see Section 7.4 Environmental Noise) must be completed for all wind farms in Ontario, including the Adelaide Wind Farm, and noise levels must comply with MOE guidelines. These guidelines do not dictate minimum setback distances from residences, but rather provide a maximum level of noise that sensitive Points of Reception (POR(s)) can be exposed to (see Section 7.4 Environmental Noise). The benefit in this approach is that regardless of the model of wind turbines used, the allowable noise levels at the PORs are always the same. Alternatively, if the MOE had specified minimum setbacks, wind turbines with higher noise ratings would produce higher noise levels at the same PORs.

Because there are no conclusive links between wind turbine noise and human health impacts (other than annoyance), mitigation measures that will be undertaken at the Adelaide Wind Farm are largely precautionary and focused on avoidance of annoyance by local residents. These include:

- Minimum setbacks to individual residences – in addition to the confirmation provided by predictive noise modelling that there will be no exceedances of allowable noise levels at PORs, Air Energy TCI has adopted an operational best practice minimum turbine setback distance of 600 m to all off-site residences and 500 m to on-site residences. This exceeds the minimum setback distance adopted by the Township of Adelaide Metcalfe (as part of their Zoning By-law Amendment ZBA #01/2008) of 400 m to dwelling units located off-site. Minimum setbacks to urbanized areas – the minimum setback adopted by the Township of Adelaide Metcalfe as part of their Zoning By-law Amendment ZBA #01/2008 is 600 m to the urban area of the former Village of Adelaide.
- Open communication with local residents – a call-in number established by AET to allow local residents to report any health concerns relating to the turbines would alleviate many of the complaints described in the Swedish study (i.e., a lack of control and influence and not being listened to or believed when describing health concerns) (Pedersen et al., 2007).

Catastrophic Failure

Any tall structure has the potential to collapse. There is also a limited potential for blade detachment during severe weather conditions. Although both of these scenarios are highly unlikely, these types of failure could pose a hazard to public safety in the SSA.

The Vestas V90 wind turbine is designed to withstand extreme conditions and is designed to standard operating parameters as shown in Table 7.13-5 below:

Table 7.13-5: Extreme Design Parameters for the Vestas V90 1.8 MW Wind Turbine (Source: Vestas, 2008).

Wind Climate	IEC 2A	IEC 3A
Ambient temperature interval (normal temperature turbine)	-30 to 50˚C	
Extreme wind speed (10 minute average)	42.5 m/sec	37.5 m/sec
Survival wind speed (3 second gust)	59.5 m/sec	52.5 m/sec

If the turbine's processor determines that wind speeds are in excess of the figures above, the blades will feather out of the wind and the yaw system on the turbine nacelle will rotate the turbine out of the prevailing wind direction. The turbines are also equipped with a secondary safety braking mechanism, mounted on the high-speed shaft connecting the gearbox to the generator, in the event that there are operational difficulties with the blade pitching and yaw controls. These operational measures are also described in Section 7.13 (Effects of the Environment on the Project).

In the unlikely event of structural collapse or blade detachment, equipment will fall within a very small diameter due to the weight of the equipment (over six tonnes for the turbine blades). In addition, the turbines have been sited away from roads (150 m) and residences (approximately 500 m).

Electromagnetic Fields

Electric and magnetic fields (EMF) are invisible forces that surround any electrical device. On a daily basis, people are continually exposed to EMF at extremely low frequencies (ELF) (3 to 300 Hz). Natural lighting, appliances, fluorescent lighting, power cords, hair dryers or larger outdoor distribution or transmission lines, all represent sources of EMF.

Electrical fields are generated by voltage and are measured in volts per metre (V/m) or Newtons per Coulomb (N/C). Magnetic fields are a result of electrical current (i.e., movement of charge particles) running through a circuit or power line, and are measured in units of Teslas (T) or Gauss (G).

Guidelines for Electromagnetic Field Exposure

At present, there are no Canadian government guidelines for exposure to EMFs at extremely low frequencies. Health Canada considers that the scientific evidence is not strong enough to conclude that typical exposures cause health problems.

Ontario has a set voluntary electric field standard of 3 kV/m at the edge of a right-of-way (ROW) and presently has no standards regulating magnetic fields. Similarly Quebec and Manitoba have standards of 2 kV/m and 5kV/m respectively at the edge of the ROW and have no standards for magnetic fields (FPTRPC, 2005).

The International Commission on Non-Ionizing Radiation Protection has established a continuous, magnetic field exposure limit of 0.833 G, or 833 mG, and a continuous electric field exposure limit of 4.2 kV/m for members of the general public.

Electromagnetic Fields Associated with the Project

The electric fields that are generated by the underground transmission lines from the Project will be shielded by the soil as the lines are buried. Also, the associated magnetic fields will be similar to other buried transmission lines in Ontario. Magnetic fields directly above underground transmission lines typically range from 10 to 20 mG for main feeders (>115 kV in Ontario) and less than 10 mG for laterals (<115 kV in Ontario). Peak EMF levels, however, can vary considerably depending on the amount of current carried by the line. Peak magnetic field levels as high as 40 mG have been measured above underground lines. However, these levels are still much smaller than those produced naturally by a human brain, nerves and heart, and are not associated with any known health risks (Health Canada, 2004).

Both electric and magnetic fields will be generated by the Project switchyard. In general, the strongest EMF around the outside of a switchyard comes from the power lines entering and leaving the switchyard. The strength of the EMF from equipment within the switchyards, such as transformers, reactors and capacitor banks, decreases rapidly with increasing distance. Beyond the switchyard fence or wall, EMF levels are typically indistinguishable from background levels.

Health Risks

Research has shown that EMF from electrical devices and power lines can cause weak electric currents (induced currents) to flow through the human body. In order to better understand if there is an interaction between human health and EMF, several different types of studies have been conducted, including:

- Animal studies;
- Epidemiological studies;
- Clinical studies; and
- Cellular studies.

The following is a summary of some of the results of studies conducted to date.

Health Canada's position on the human health implications of EMF at ELF is that they present no known health risks. Although Health Canada continues to monitor ongoing studies on EMF, they do not feel guidelines for exposure are warranted. The evidence at this time is not strong enough to conclude that exposure can cause health problems (Health Canada, 2004).

The Federal Provincial Territorial Radiation Protection Committee (FPTRPC) serves as the primary government forum to develop standards and practices for radiation protection within Canada. In 2005, the FPTRPC released a review of all relevant scientific information reported in refereed journals in the time period between 1998-2002.

There have been increasing requests from concerned citizens that the precautionary principle (PP) be used in a number of areas, including exposure to EMFs. It should be noted that the extent of PP covers a variety of measures ranging from moderate methods such as monitoring scientific developments and providing information, through participation in the process of acquiring new knowledge by carrying out research, to stronger measures such as lowering exposure limits. Since there is no conclusive evidence that exposure to EMFs at levels normally found in Canadian living and working environments is harmful, FPTRPC is of the opinion that moderate measures and participation in the process of acquiring new knowledge are sufficient. These types of activity are consistent with the Canadian government framework on precaution (FPTRPC, 2005).

As part of its Charter to protect public health and in response to public concern, the World Health Organization (WHO) established the International EMF Project in 1996 to assess the scientific evidence of possible health effects of EMF in the frequency range from 0 to 300 Gigahertz [GHz] (WHO, 2009). October 2005, WHO convened a task group of scientific experts to assess any risks to health that might exist from exposure to ELF electric and magnetic fields in the frequency range from 0 to 100,000 Hz (100 kHz). The conclusions and recommendations of the Task Group are presented in a WHO Environmental Health Criteria (EHC) monograph (WHO, 2007). Following a standard health risk assessment process, the Task Group concluded that there are no substantive health issues related to ELF electric fields at levels generally encountered by members of the public. Thus the remainder of this fact sheet predominantly addresses the effects of exposure to ELF magnetic fields.

Electromagnetic Fields Summary

Components of the Project, including buried transmission circuits, the switchyard and the interconnection to the existing Hydro One transmission line will all result in EMF. Health Canada's position at this time is that health effects have not been sufficiently demonstrated to warrant guidelines for EMF. However, voluntary guidelines do exist for the province of Ontario. Levels of EMF from all Project components will be significantly below this voluntary provincial guideline as well as all existing United States standards (between 8 and 11.8 kV/m; NIEHS, 2008). As a result, this issue has not been carried forward for further assessment.

Decommissioning

The activities conducted during the Decommissioning Phase will be similar to those during the Site Preparation and Construction Phase. All appropriate mitigation measures, as outlined in the Site Preparation and Construction Phase will be utilized during this phase.

7.13.5 Residual Effects, Determination of Significance and Follow-up

The residual effects, after mitigation measures have been implemented, were assessed to determine their overall importance using the methods described in Section 5.3, and are summarized in Section 7.14.

7.13.5.1 Public Health

Site Preparation and Construction; Decommissioning

The issues with respect to public health during the Site Preparation and Construction and Decommissioning phases are limited to proximity to construction-type activities and the inherent dangers of heavy machinery, increased traffic and other construction equipment. Best management practices such as the mitigation measures that will be used during these phases are designed to reduce risk to the lowest possible level, however it is impossible to eliminate risk altogether. Assuming that any additional site-specific mitigation measures that are required as part of other permitting or municipal approval processes will be developed during the detailed design phase, there should be few, if any residual effects. The overall magnitude of the effect of the Project on public health during Site Preparation and Construction and Decommissioning is considered low (Table 7.13-3). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on public health during this phase is restricted to the SSA or slightly outside the SSA in the case of noise during construction; the duration is short-term (limited to these phases); the frequency will potentially occur daily, and the irreversibility is low, in that the effects are fully reversible. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

A regular inspection of the construction site would be conducted to ensure all mitigation measures have been implemented as required and are functioning as anticipated. No further follow-up is necessary.

Operation and Maintenance

Ice Throw

Although the chance of ice throw can never be completely eliminated, the danger to public health and safety has been minimized through careful siting of the turbines and use of mitigation measures. The overall magnitude of the effects of ice throw on public health is considered low (Table 7.13-3). Based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on public health in this Phase (due to ice throw) is restricted to the SSA; the duration is medium-term (limited to the Operation and Maintenance Phase); the frequency is occasional, and the irreversibility is moderate in that the nature of effects (i.e., damage to property), should there be an incident of ice throw, will be of a severity that will allow less than 50% of the original value to be regained. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Shadow Flicker and Noise

Based on the result of shadow flicker and noise modelling and because the nearest residences of non-participating receptors (i.e., households of local residents that are not affiliated with the Project and do not have Option & Lease Agreements with AET) are located more than 600 m from the wind turbines in the SSA, there will likely be no human health (i.e., annoyance) issues related to shadow flicker or noise. No further mitigation will be required for shadow flicker or noise, and there are few residual effects anticipated. The overall magnitude of the effect is considered to be low (Table 7.13-3). Based on the environmental interaction criteria, the extent of the effects are restricted to localized areas within the SSA; the duration is medium-term (limited to the Operation and Maintenance Phase); the frequency occurs on a near-continuous basis for noise, but only occasionally for shadow flicker (i.e., less than 30 hours per year for most affected residents); and the irreversibility is low, in that the effects are fully reversible once the turbines are removed. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

Catastrophic Failure

As a result of the siting of turbines away from roads and residences, and the extremely low likelihood of a catastrophic failure, the associated risk to public safety is anticipated to be very low. The overall magnitude of the effects of a catastrophic failure on public health is considered high (Table 7.13-3); however, based on the environmental interaction criteria in Table 5.3-2, the extent of the effects of the Project on public health in this Phase (due to catastrophic failure) is restricted to smaller areas within the SSA and would likely occur with low probability and at a single tower location with no receptors within range; the duration is medium-term (limited to the Operation and Maintenance Phase); the frequency is occasional, and the irreversibility is moderate to high in that the effects (i.e., effects ranging from property damage to death, in the extreme), should there be a catastrophic failure, are irreversible. The level of importance, or significance, of the residual effects is based on Table 5.3-3.

LEVEL OF IMPORTANCE OF RESIDUAL EFFECTS: MINIMAL

7.13.6 Other Public Health and Safety Issues – Electrical System Supply Reliability

One other issue which could indirectly affect Public Health and Safety is electrical supply system reliability. Power surges could increase the risk of electrical fire which would also constitute an indirect Public Health and Safety issue. Wind is a variable form of energy generation as it only produces energy when the wind is blowing and it is not practical for energy to be stored. To offset the variable nature of wind energy, a secondary source of generation (spinning reserve) is required for times when the wind is not blowing. Many opponents of wind development state that because of this variable nature, wind development is not beneficial and that this variable nature can result in power surges in the transmission grid.

Electricity supply and demand are themselves inherently variable. Demand is constantly changing as a result of predictable and unforeseen changes in weather and decisions made by millions of consumers. Ontario’s supply mix is continually reacting to this variable demand, while itself managing variability including changing commodity prices, trees falling on transmission lines, retrofits of generation facilities and unforeseen generation facility closures.

The attitude of many grid operators towards wind power can best be illustrated by the following quote from Eltra Wind, the Transmission System Operators (TSO) in west Denmark, at the presentation of its annual report (Anderson, 2005).

> *"Since the end of 1999 - so in just three years - wind power capacity in the Jutland-Fyn system has increased from 1,110 MW to 2,400 MW. In installed capacity that is twice the capacity of the «Skydstrup» power Plant near Aarhus. Seven or eight years ago, we said that the electricity system could not function if wind power increased above 500 MW. Now we are handling almost five times as much. And I would like to tell the Government and the Parliament that we are ready to handle even more, but it requires that we are allowed to use the right tools to manage the system."*

As there is no way for one energy supplier to control or mitigate the variability in the reliability of the electrical supply system, this issue cannot be carried further into the ESR/EIS. As a result, there are no predicted residual effects of the Project on the reliability of the electrical supply system.

7.14 Summary of Environmental Effects

In summary, the assessment of environmental effects conducted in Sections 7.1 to 7.13 followed a three step process. The first step determined which Project activities have potential interactions with the VECs chosen for each environmental component (the initial screening is shown in Table 7-1, and the secondary screening is shown in the Identification and Assessment of Potential Interactions table in each of Sections 7.1 to 7.13). Where potential interactions were identified (any interactions with "yes" in the Identification and Assessment of Potential Interactions table in each of Sections 7.1 to 7.13), they were carried forward for effects assessment. In a few cases, negligible effects were carried forward to provide additional detail that could be used to support the ESR/EIS conclusions, or future permit applications. This second step determined the magnitude of measurable effects on the key indicators chosen as measurement endpoints for VECs. Where negligible effects on a key indicator were anticipated, mitigation measures are usually not required, and the interaction was not normally carried forward for further assessment of residual effects. If a measurable effect on a VEC's key indicator was predicted (i.e., effects with low to high magnitude, or effects with negligible magnitude that would still warrant mitigation measures), the third step in the effects assessment was to develop suitable mitigation measures to minimize, to the extent practical, the predicted effect on the VEC. Following application of mitigation measures, the significance of the residual effect on the VEC was then determined.

A summary of all necessary mitigation measures identified for each environmental component, and the report section where they are described in more detail, is provided in Table 7.14-1.

Table 7.14-1: Summary of Mitigation Measures

Environmental Component	Mitigation Measures	Report Section
Geophysical	Prior to construction, a geotechnical assessment with soil sampling will be conducted to ensure soil is handled appropriately and determine if contaminated soil removal or installation of groundwater wells is required. Prior to decommissioning, soil sampling will be conducted at all areas where infrastructure is to be removed to determine if soil contamination occurred during operation of the wind farm; During construction and decommissioning, implementation of a Soil Management Plan (SMP) to minimize soil erosion (detailed in Section 7.1) and Best Management Plans (BMPs) to minimize erosion impacts on water and sediment quality (as outlined below for the aquatic environment, and detailed in Section 7.2) will be required; During construction and decommissioning, implementation of an Emergency Management Plan (EMP) which includes a spill contingency plan will be required; If excavation requires dewatering at a rate over 50,000 L/day, an application for a Permit to Take Water (PTTW) from the MOE will be required. All dewatering will be conducted in a manner which manages potential sedimentation resulting from discharge to local watercourses and the EMP will include information on appropriate monitoring, treatment and discharge; If private water wells are identified as being within 100 m of turbine foundations during construction, landowners may request that monitoring of water quantity and quality be conducted, at AET's cost, to ensure no changes. If water quantity or quality is impaired, AET will provide a temporary potable water supply until corrective measures are taken; Conduct ongoing review and revision, as necessary, of the required BMPs and spill contingency plan; and Regular inspections of the site by AET or those retained by AET during construction.	7.1
Aquatic	During construction and decommissioning, implementation of erosion and sediment control BMPs to minimize erosion impacts on water and sediment quality (detailed in Section 7.2); Implementation of a spill contingency/response plan (detailed in Section 7.2); Avoidance of construction of new access road watercourse crossings (to avoid effects on aquatic habitat), which was inherent in the final Project design; Water crossings for underground cabling and some sections of access roads are along watercourses within Regulation boundaries (ABCA and SCRCA); permission and permitting will be required from the CA(s) prior to construction; Ensure construction and decommissioning activities in and around watercourses adhere to Fisheries and Oceans Canada (DFO) Operational Statements including: • Timing windows; and	7.2

Table 7.14-1: Summary of Mitigation Measures (continued)

Environmental Component	Mitigation Measures	Report Section
Aquatic (continued)	• Isolated or dry open cut stream crossings (for underground cable crossings); During works and activities within wetted watercourses (if using isolated stream crossings), monitoring of turbidity and TSS up- and down-stream of disturbed areas; Immediate backfilling of underground cable trenches to prevent soil loss and erosion; Delineation of vegetation clearing and retention zones and ensuring appropriate vegetation clearing techniques are used; Minimization of riparian vegetation removal and re-vegetation of any cleared areas immediately after disturbance; Ensure appropriate clearing and disposal of all construction or decommissioning related debris; and Conduct environmental inspections during construction to ensure all protection measures are implemented, maintained and repaired (if necessary), and remedial measures are initiated (where warranted).	
Terrestrial	Prior to site preparation and construction, the limits of vegetation clearing will be staked in the field to avoid disturbance to woodlots or any other sensitive areas; Restrict construction machinery movement to areas previously cleared and within staked areas; During construction, ensure access roads are periodically wetted to minimize dust deposition on surrounding vegetation; If construction activities occur within 50 m of woodlots during the avian and mammal breeding season, conduct site-specific surveys for bird nets and dens and establish setbacks, as necessary, to avoid sensory disturbance; Ensure turbines are equipped with appropriate lighting/marking to reduce potential for avian collisions; and Prior to construction and decommissioning activities, area searches of access roads, turbine work areas, and power lines will be conducted to identify the presence of threatened or endangered flora or fauna and appropriate species-specific setbacks will be implemented in consultation with MNR and CWS.	7.3

Table 7.14-1: Summary of Mitigation Measures (continued)

Environmental Component	Mitigation Measures	Report Section
Atmospheric	Implement a BMP for fugitive dust during construction including: • Establish on-site speed limits for access roads; • Apply dust suppressants to unpaved areas; • Stagger land clearing and heavy construction activities to reduce the number of simultaneously occurring activities; • Re-vegetate cleared areas as soon as possible; • Install wind fences where required; and • Implement a complaint response plan. Implement a BMP for greenhouse gases and indicator compounds including: • Proper maintenance of all vehicles; • Implement an on-site speed limit for access roads; and • Limiting vehicle idling.	7.4
Environmental Noise	Construction and decommissioning-related activities will be limited to daytime periods (i.e., 0700 to 1900); and Construction equipment will be kept in good repair and noise emissions will not exceed MOE guidance (MOE Publication NPC-115).	7.5
Visual	Establish limits of disturbance during the site preparation and construction phase; Ensure wind turbine towers, nacelles and blades are painted white/light grey and the towers are constructed of rolled steel (not steel lattice towers). Maintenance of a call-in number for local residents to report any visual disturbance concerns during the construction period.	7.6
Socio-Economic Resources	Should damage to local roads during equipment and component delivery occur, damages will be assessed and compensation for repairs to road surfaces will be made by AET in consultation with the Township of Adelaide Metcalfe. Maintenance of a call-in number for local residents to report any traffic or other concerns during the construction period.	7.7

Table 7.14-1: Summary of Mitigation Measures (continued)

Environmental Component	Mitigation Measures	Report Section
Heritage Resources	A Stage 2 Archaeological Assessment will be carried out prior to Site Preparation and Construction, and will determine the presence of any archaeological resources within areas to be disturbed. Should any additional archaeological resources be encountered during the Site Preparation and Construction Phase, work will be halted, the Ministry of Culture will be notified immediately and an appropriate course of action will be determined. As described for Visual, wind turbine towers, nacelles and blades will be painted white/light grey and the towers constructed of rolled steel to minimize the visual effect on the cultural heritage landscape during all phases of the Project.	7.8
Land Use	The Petroleum Resources Centre in London will be contacted if it is suspected that a petroleum well has been located; Upon discovery of any un-mapped oil or gas wells, implementation of a 50 m setback between Project infrastructure (wind turbines, permanent met mast and power lines) and all petroleum wells will be undertaken; The 600 m minimum setback to urban areas is required by the Township of Adelaide and is a mitigation measure for disturbances to residential, commercial or institutional land uses that is inherent in the Project design; Land owners are compensated for the loss of agricultural productivity according to their lease agreements with AET; Limits to the extent of turbine base excavation, workspace areas and new access road construction and orientation of access roads in a manner that minimizes effects on existing agricultural practices are all mitigation measures for the loss of agricultural land that are inherent in the Project design.	7.9
Aboriginal Communities	None required	7.10
Traffic	If required by the Township of Adelaide Metcalfe or County of Middlesex, the construction contractor under the direction of AET will implement a road safety program which will include signage, road closures, speed restrictions, truck lighting, load restrictions, and equipment inspections.	7.11

Table 7.14-1: Summary of Mitigation Measures (continued)

Environmental Component	Mitigation Measures	Report Section
EMI	Consultation with any licensed service providers and government agencies with operations that could be affected by wind turbine operation was conducted as part of the EMI Impact Study to ensure EMI was avoided, and would not impact their operations; Avoidance of the microwave links intersecting the Project site through wind turbine micrositing is a mitigation measure that is inherent in the Project design; A TV interference complaints process will be implemented prior to construction. This process will include a toll-free call-in number, a complaint logging and tracking system, use of independent EMI consultants where necessary and implementation of appropriate mitigation measures where appropriate; and If construction and/or operation of the Project is found to directly cause EMI with an existing system, AET will enter into discussions with the service providers and/or government agencies and will work closely with them to resolve interference issues.	7.12
Public Health and Safety	Implement public safety measures including warning signage, speed restrictions, road closures, truck lighting, safety fencing around trenches or work spaces (as necessary) and traffic direction; To avoid ice throw, a mitigation measure that is inherent in the Project design is ensuring turbines are equipped with standard shutdown mechanisms in the case of ice build-up; Use of minimum setbacks from roads and residences is a mitigation measure for avoidance of ice throw, shadow flicker, noise and catastrophic failure effects on human health that is inherent in the Project design; Mitigation measures to avoid shadow flicker include: keeping affected rooms lit during shadow flicker events and installation of window coverings and exterior screening (e.g., trees); and Maintenance of a call-in number for local residents to report any health concerns relating to wind turbine noise or shadow flicker.	7.13

Professional judgement was used to assess the magnitude, extent, duration, frequency and irreversibility of residual effects on VECs remaining after the application of these mitigation measures, and to determine their overall level of importance (as described for each individual environmental component in Sections 7.1 to 7.13 and in Section 5.3). A summary of these residual effects and the assessment of their overall significance is provided in Table 7.14-2 below. As with the analysis in Sections 7.1 to 7.13, only interactions with predicted residual effects were assessed and are shown in the table.

Table 7.14-2: Summary of Predicted Residual Environmental Effects

Residual Effects	Explanation	Assessment of Residual Effects[5]					
		Magnitude	Extent	Duration	Frequency	Irreversibility	Level of Importance of Residual Effect
Geophysical Environment (Section 7.1)							
Soil Quality							
Spills of fuels/lubricants during all three Project phases	• BMPs and spill contingency plan will be implemented; however there is always a minor chance that mitigation measures can fail under certain conditions.	Low	I	I	I	II	Minimal
Groundwater Quality							
Spills of fuels/lubricants during all three Project phases	• BMPs and spill contingency plan will be implemented; however there is always a minor chance that mitigation measures can fail under certain conditions.	Low	I	I	I	II	Minimal
Aquatic Environment (Section 7.2)							
Surface Water/Sediment Quality							
Increases in sedimentation during the Site Preparation and Construction, and Decommissioning Phases	• BMPs will be implemented (as described in Section 7.2); however extreme weather events could cause a reduction in the effectiveness of the mitigation measures.	Low	II	II	I	I	Minimal
Spills of fuels/lubricants during the Site Preparation and Construction, and Decommissioning Phases	• BMPs and spill contingency plan will be implemented (as described in Section 7.2); however there is always a minor chance that mitigation measures can fail under certain conditions.	Negligible	II	II	I	II	Minimal
Fish and Fish Habitat							
Increases in sedimentation and spills and works in and around watercourses could affect fish habitat during the Site Preparation and Construction, and Decommissioning Phases	• BMPs will be implemented and DFO Operational Statements will be followed for works in and around watercourses (as described in Section 7.2). Following DFO Operational Statements will ensure effects on fish or fish habitat are avoided.	Negligible	I	II	I	II	Minimal
Terrestrial Environment (Section 7.3)							
Birds							
Sensory disturbance during the Site Preparation and Construction, and Decommissioning Phases	• Woodlots and other sensitive habitat areas will be avoided; however, some sensory disturbance to birds will occur. • Nest surveys will be undertaken prior to commencement of construction activities (if they occur during the breeding season) and if required, species-specific setbacks and exclusion zones will be flagged for avoidance.	Low	I	II	III	II	Low

[5] Residual effects assessment measure levels (I to IV) are defined in Table 5.3-2. The magnitude levels (Negligible to High) for the VEC key indicators of each environmental component are provided in Sections 7.1 to 7.13. The levels of importance of residual effects (Minimal to High) are defined in Table 5.3-3.

Table 7.14-2: Summary of Predicted Residual Environmental Effects (continued)

Residual Effects	Explanation	Assessment of Residual Effects[5]					
		Magnitude	**Extent**	**Duration**	**Frequency**	**Irreversibility**	**Level of Importance of Residual Effect**
Direct mortality and sensory disturbance during the Operation and Maintenance Phase	• Low mortality predicted; however, a follow-up operational monitoring program will be developed in consultation with MNR and CWS.	Low	I	III	I (mortality)/IV (sensory disturbance)	II	Low
Bats							
Direct mortality and sensory disturbance during the Operation and Maintenance Phase	• Low mortality predicted; however, a follow-up operational monitoring program will be developed in consultation with MNR.	Low	I	III	I (mortality)/IV (sensory disturbance)	II	Low
Other Wildlife							
Adverse effects on wildlife due to deposition of dust and debris and habitat disturbance during the Site Preparation and Construction, and Decommissioning Phases	• Woodlots and other sensitive habitat areas will be avoided; however, some sensory disturbance to wildlife will occur. • Den surveys will be undertaken prior to commencement of construction activities (if they occur during the breeding season) and if required, species-specific setbacks and exclusion zones will be flagged for avoidance.	Low	I	II	III	II	Low
Atmospheric Environment (Section 7.4)							
Air Quality (Indicator Compounds, Greenhouse Gases, Dust and Odour)							
Emissions of greenhouse gases, indicator compounds and fugitive dust during the Site Preparation and Construction, and Decommissioning Phases	• BMPs will be implemented (as described in Section 7.4); however, heavy equipment will still create emissions while in operation and minor dust may be released.	Low	II	II	II	I	Minimal
Environmental Noise (Section 7.5)							
Noise Levels							
Noise emissions due to construction-type activities in the Site Preparation and Construction, and Decommissioning Phases	• Activities during these two Project phases will occur during daytime hours • Equipment will be maintained in good repair and will not exceed the noise emissions as specified in MOE publication NPC-115.	Negligible	II	II	III	I	Minimal
Noise emissions during the Operation and Maintenance Phase	• Noise emissions during this Project phase will meet or be below the MOE noise level limits for wind turbines; however the noise levels will be elevated compared to the existing baseline levels.	Low	II	III	III	I	Minimal
Visual Landscape (Section 7.6)							
Views and Landscapes							
Adverse effects on rural viewscape during the Site Preparation and Construction, and Decommissioning Phases	• Changes to the viewscape created due to an increase in construction vehicles and machinery on-site.	High	II	II	III	I	Minimal

Table 7.14-2: Summary of Predicted Residual Environmental Effects (continued)

Residual Effects	Explanation	Assessment of Residual Effects[5]					
		Magnitude	**Extent**	**Duration**	**Frequency**	**Irreversibility**	**Level of Importance of Residual Effect**
Adverse effects to rural viewscape during the Operation and Maintenance Phase	• Changes to the viewscape created due to the presence of the turbines and substation.	High	II	III	IV	I	Medium
Socio-Economic Resources (Section 7.7)							
Neighbourhood/Community Character							
Adverse effects on neighbourhood and community character during the Operation and Maintenance Phase	• The neighbourhood and community character is influenced by visual aesthetics which will be modified by the presence of turbines and the substation.	Moderate	II	IV	IV	I	Medium
Community Services and Infrastructure							
There is the potential for adverse effects on community services (waste management facilities) during the Decommissioning Phase	• There is the potential for local waste disposal facility capacity to be insufficient for the amount of waste material created during dismantling and disposal of Project-related infrastructure; however, recycling may be in place for some components. • Monitoring of the status of waste disposal capacity during the operational life of the Project will include identification of local or regional waste disposal facilities and capacity for turbine parts and equipment recycling.	Moderate	III	IV	IV	IV	Medium
Heritage Resources (Section 7.8)							
Archaeological Heritage							
Disruption of archaeological resources during the Site Preparation and Construction and Decommissioning Phases	• The Stage 2 Archaeological Assessment will ensure that archaeological resources are avoided, however a medium magnitude effect has also been considered; two scenarios have been assessed: o The first measure level applies to a future scenario where no archaeological resources are found during future Stage 2 field work or all can be avoided; o The second level applies to a future scenario where future Stage 2 field work finds significant archaeological resources that cannot be avoided and may require Stage 3 assessment.	Low/Medium	I/I	I/IV	I/II	I/IV	Minimal (If all archaeological resources avoided) / Medium (If any archaeological resources subject to further assessment)
Cultural Heritage Landscapes							
Adverse effects on the cultural heritage landscape during the Site Preparation and Construction Phase	• The cultural heritage landscape is influenced by visual aesthetics which will be modified by the presence of construction vehicles and machinery on-site.	Moderate	I	II	III	I	Minimal
Adverse effects on the cultural heritage landscape during the Operation and Maintenance Phase	• The cultural heritage landscape is influenced by visual aesthetics which will be modified by the presence of turbines and the substation.	Moderate	I	III	IV	I	Minimal

Table 7.14-2: Summary of Predicted Residual Environmental Effects (continued)

Residual Effects	Explanation	Assessment of Residual Effects[5]					
		Magnitude	Extent	Duration	Frequency	Irreversibility	Level of Importance of Residual Effect
Adverse effects on the cultural heritage landscape during the Decommissioning Phase	• The cultural heritage landscape is influenced by visual aesthetics which will be modified by the presence of construction vehicles and machinery on-site.	High	I	II	III	I	Minimal
Land Use (Section 7.9)							
Agriculture							
Loss of prime agricultural land (Class 1-3 agricultural land) and agricultural production during the Site Preparation and Construction Phase	• Some Class 1 or 2 agricultural lands will be taken out of production during construction; however, the amount of Class 1-3 agricultural land to be affected is low compared to the amount remaining in the area.	Moderate	I	II	I	I	Minimal
Loss of prime agricultural land (Class 1-3 agricultural land) and agricultural production during the Operation and Maintenance Phase	• Some Class 1 or 2 agricultural lands (and the related agricultural production) will be taken out of production for the operational life of the Project. The amount of Class 1-3 agricultural land to be affected is lower than during construction due to a smaller footprint during operations.	Moderate	I	III	I	I	Minimal
Resources							
Road construction and modification during the Site Preparation and Construction Phase will create access to previously inaccessible areas; effects will be carried through to the Operation and Maintenance Phase	• Game or fishery resources may be temporarily affected.	Low	I	II	I	II	Minimal
Traffic (Section 7.11)							
Traffic Volume							
Increased traffic volume and disturbance of traffic flows/patterns during the Site Preparation and Construction, and Decommissioning Phases	• Road upgrades or equipment delivery will temporarily disrupt traffic.	Low	I	II	III	I	Minimal
Public Health And Safety (Section 7.13)							
Public Health							
General construction-related public safety hazards during the Site Preparation and Construction, and Decommissioning Phases	• Public safety measures will be implemented, however in the unlikely event that they fail, safety risks may exist.	Low	I	II	III	I	Minimal
Public safety hazards due to ice throw during the Operation and Maintenance Phase	• BMPs will be implemented, however in the unlikely event that they fail, safety risks may exist	Low	I	III	I	III	Minimal

Table 7.14-2: Summary of Predicted Residual Environmental Effects (continued)

Residual Effects	Explanation	Assessment of Residual Effects[5]					
		Magnitude	Extent	Duration	Frequency	Irreversibility	Level of Importance of Residual Effect
Shadow flicker and noise annoyance during the Operation and Maintenance Phase	• Considering the location of the nearest receptors to the turbines and the research conducted to-date on shadow flicker and noise health effects, it is unlikely to be an issue for this Project, however particularly sensitive individuals may be affected and a call-in number will be maintained by AET to allow individuals to report concerns.	Low	I	III	IV (noise)/I (shadow flicker)	I	Minimal
Public safety hazards due to catastrophic failure during the Operation and Maintenance Phase	• BMPs will be implemented, however in the unlikely event that they fail, safety risks may exist	High	I	III	I	III to IV	Minimal

7.15 Effects of the Environment on the Project

Environmental factors including climatic fluctuations, extreme weather events and seismic activity have the potential to affect the normal operation of the Project. The environment will exert certain stressors on the Project as a whole and have the potential to affect all phases. These potential interactions were assessed holistically in all phases of the Project, rather than in each phase independently. The potential interactions of the environment on the Project are assessed further in the following sections. Mitigation has been discussed where appropriate.

7.15.1 Potential Interactions and Mitigation

7.15.1.1 Climatic Fluctuations

Weather is characterized as a non-linear dynamic system. Average climatic conditions tend to be relatively stable and predictable. On the scale of decades, climatic changes can result from interaction between the atmosphere and oceans. Many climatic changes are a result, in part, of the different ways that heat is stored in the oceans and moved between reservoirs. Ocean processes operate on longer time scales and can redistribute heat, dramatically affecting climate. It is generally accepted that global warming is occurring as a result of the emission of Greenhouse Gases (GHG) into the atmosphere. Global warming will not only increase the earth's temperatures, but also increase the number of extreme weather events.

The Project site was chosen because of favourable wind conditions, which are a function of climate. Long-term weather data were analyzed during the site selection process, as was the collection of site-specific meteorological data. While effects of climatic fluctuations cannot be precisely predicted, they are not anticipated to alter the wind resource beyond required levels during the operational life of the Project (30 years).

7.15.1.2 Extreme Weather Events

Potential extreme weather events were considered during development of the Project so that environmental stressors (i.e., high wind, heavy rain, hail, freezing rain or snow, lightning storms and flooding) that may result from changes in weather patterns or climate, will not compromise the safe operation of turbines.

Extreme Wind Events

Historically wind project sites have occasionally experienced extreme wind speeds caused by a severe weather situation, such as a hurricane or tornado. Extreme wind events can result in mechanical load levels that can lead to damage or failure of wind turbine components. Failures may not only prohibit the operation of the wind turbine, but could also lead to injury. Public health and safety issues associated with catastrophic failure of the turbine or blade detachment are addressed in Section 7.13.

In Ontario the potential risks associated with flooding are assessed primarily by local Conservation Authorities. Regulation Limits have been defined for watercourses with the ABCA and SCRCA under Regulation 147/06 and Ontario Regulation 171/06 respectively. The Regulation Limit includes flood limits and hazardous lands that may be susceptible to extreme storm events causing flooding or erosion. Construction within the Regulation Limit requires permission under the Regulation applicable for the CA having jurisdiction. Effects of changes in stream flow rates were assessed in Section 7.2 and it was determined that the effects are negligible to low. As a result, flood hazard is not further considered in this section.

As shown in Table 7.15-1, the Vestas V90 wind turbine has been designed to withstand a reasonably foreseeable level of mechanical loading caused by an extreme wind event:

Table 7.15-1: Extreme Design Parameters for the Vestas V90 1.8 MW Wind Turbine (Source: Vestas, 2008).

Wind Climate	IEC 2A	IEC 3A
Ambient temperature interval (normal temperature turbine)	-30 to 50˚C	
Extreme wind speed (10 minute average)	42.5 m/sec	37.5 m/sec
Survival wind speed (3 second gust)	59.5 m/sec	52.5 m/sec

Vestas wind turbines are also equipped with two ultrasonic wind sensors that continuously monitor wind conditions, and also have built-in heaters that allow the turbine to function at temperatures below freezing (Vestas, 2008). If wind speeds become elevated to levels above normal operational parameters, the multi-processor (VMP 5000) automatically feathers the turbine blades, which creates an aerodynamic braking effect. Hydraulic accumulators inside the hub ensure sufficient power to halt turbine function in the event of grid failure (Vestas, 2008). There is also a mechanical brake on the high-speed shaft of the gearbox which can be used as a parking brake or as an emergency stop.

Vestas wind turbines are also equipped with over-speed protection (Vestas, 2008). The VOG (Vestas Over-speed Guard) is an independent computer module which monitors the rotor RPM and in the case of an over-speed situation, will activate full feathering of all three blades (independently of the turbine processor for additional safety). The full General Specification document for the Vestas V90 turbine is provided as part of Appendix C (Noise Impact Assessment).

Lightning Strikes

Lightning strikes during storm events also have the potential to damage the turbines and associated infrastructure (such as the substation). Both the turbines and substation will be equipped with lightning protection systems designed to route lightning into the ground. The Vestas 1.8 MW turbines are specifically equipped with a lightning protection system, which contains three main elements: lightning receptors, a down conducting system and an earthing system (Vestas, 2008). Lightning protection design parameters for the Vestas turbine are provided in Table 7.15-2.

Table 7.15-2: Lightning Protection Design Parameters for the Vestas V90 1.8 MW Wind Turbine (Source: Vestas, 2008).

Lightning Protection Design Parameters	Protection Level I
Current peak value (i_{max})	200 kA
Total charge (Q_{total})	300 C
Specific energy (W/R)	10 MJ/Ω
Average steepness (di/dt)	200 kA/µs

The lightning protection system of Vestas wind turbines has been designed to meet the following international standards and guidelines (Vestas, 2008):

- IEC 62305-1 Ed. 1.0: Protection against lightning – Part 1: General principles.
- IEC 62305-3 Ed. 1.0: Protection against lightning – Part 3: Physical damage to structures and life hazard.
- IEC 62305-4 Ed. 1.0: Protection against lightning – Part 4: Electrical and electronic systems within structures.
- IEC/TR 61400-24. First edition. 2002-07. Wind turbine generator systems - Part 24: Lightning protection.
- IEC 60364-5-54. Second edition 2002-06. Electrical installations of buildings - Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors.
- IEC 61936-1. First edition. 2002-10. Power installations exceeding 1kV a.c.- Part 1: Common rules.

Icing

Icing events would occur in conditions where there is a period of snow thaw/melt followed by quick periods of sub-zero conditions (i.e., in the winter and spring), or when precipitation may quickly turn from rain to freezing rain or snow. Both of these weather scenarios would create conditions where ice could form on the surface of turbine blades and the nacelle. As described in Section 7.13, commercial wind turbines are equipped with vibration monitors that deactivate the turbine when vibrations exceed a certain level, due to mass and/or aerodynamic imbalance which can be caused by ice (Garrad Hassan, 2007). Vestas turbines are also equipped with an automatic shut-off feature that is activated if the nacelle-mounted sensors detect ice or if anemometer icing leads to a measured wind speed below the cut-in speed. Once a turbine has automatically shut down, it will only resume operation once the ice has been removed (either manually, or through melting or ice drop from the blades or nacelle). Based on the location of the Project, it is possible that climatic conditions will occasionally create icing events, and periodically cause turbine shut-down.

7.15.1.3 Seismicity

As indicated in Section 7.1.2.4, the Project is located in a zone of low seismic activity considered to be a low hazard zone (Figure 7.1-4). Turbine construction will comply with all requirements of the Ontario Building Code and will be subject to inspection from the Canadian Standards Association (CSA). As a result, seismicity is not anticipated to have any effect on the Project. Public health and safety considerations related to catastrophic failure of turbines (in the unlikely event that a severe earthquake causes catastrophic failure of a turbine) are discussed further in Section 7.13.

7.15.2 Residual Effects, Determination of Significance and Follow-up

Adherence to the Ontario Building Code and inclusion of Project mitigation measures that are inherent to the turbine and tower design result in no expected residual effects of the environment on the Project.

7.16 Assessment of Cumulative Effects

Cumulative Effects Assessment (CEA) examines the residual effects of the Project being assessed (i.e., the Adelaide Wind Farm) in combination with the anticipated or known effects of other historic, existing or reasonably foreseeable Projects in the area. The approach for this CEA has been completed with regard to the *Canadian Environmental Assessment Act* Cumulative Effects Assessment Practitioners Guide (Hegmann et al., 1999). According to the CEA Guide, cumulative effects are defined as:

> *"changes to the environment that are caused by an action in combination with other past, present and future human actions. A CEA is an assessment of those effects".*

The objective of the CEA is to identify and assess the cumulative effects, on a regional scale, of this Project in conjunction with other unrelated Projects during a period of time that extends into the past and future. The detailed methods used for the CEA are further defined in Section 5.4 and are summarized below.

There are a number of ways that a cumulative effect may occur (Hegmann et al., 1999), including:

- **Physical-chemical transport**: physical or chemical material is transported from a Project via a pathway, and then interacts with another action or Project component;
- **Nibbling loss**: several activities compound the loss of land or habitat;
- **Spatial and temporal crowding:** effects resulting from too much activity within too small an area or too short an amount of time. Temporal crowding occurs when a VEC is not allowed enough time to recover from an activity; and
- **Growth-inducing potential:** where each activity encourages subsequent activities that compound an effect. These actions are often called "spin-off actions" (e.g., improved access resulting in increased fishing in previously inaccessible areas) or relate to the "domino effect".

According to the CEA Guide, a Project-specific CEA needs to generally do the following:

1. Determine if the Project will have an effect on a VEC;
2. If such an effect can be demonstrated, determine if the incremental effect acts cumulatively with the effects of other actions, either past, existing, or future; and
3. Determine if the effect of the Project, in combination with the other effects, may cause a significant change now or in the future in the characteristics of the VEC after the application of mitigation for that Project.

7.16.1 Scoping

7.16.1.1 Determination of Project VECs

VECs have been determined for this Project in the previous sections (Sections 7.1-7.13). The potential effects of the Adelaide Wind Farm Project on these VECs were assessed and residual effects have been determined. Project-specific VECs that were predicted to have greater than minimal residual effect or those that were identified as having regional importance (e.g., environmental noise and traffic) have been carried forward for examination in this CEA.

7.16.1.2 Identification of Regional Issues of Concern

Through discussions with the county and municipal planners, it was determined that in general, land development is considered to be the activity with the greatest regional significance, and therefore, would be the activity that would have the greatest environmental and social effects in the Project area. The Planner for the County of Middlesex reported that residential growth is generally limited in the "bedroom" communities that are typical in the County (e.g., Adelaide), with London being the only large urban centre (Vanderwerff, pers. comm., 2009). Agriculture is the main land use within the CEA study area, and the protection of agriculture is strongly emphasized in the County OP, which minimizes lot severances and activities that are not consistent with agricultural land use. The promotion of alternative energy development has also been recently added to the County OP, with economic development focused along Highway 402. Although the above noted types of development are encouraged, natural heritage protection is also broadly endorsed in the Township and County Official Plans in a manner consistent with the Provincial Policy Statement. The County OP also contains goals for enhancement (Vanderwerff, pers. comm., 2009).

7.16.1.3 Selection of Regional Valued Ecosystem Components

Regional VECs used in this CEA have been selected based on professional judgement and input received through the Project consultation process. Regional VECs are listed in Table 7.16-1.

Table 7.16-1: Regional Valued Ecosystem Components

Ecosystem Component	Regional Issues of Concern	Regional Valued Ecosystem Component	Examples of Indicators
Visual Landscape	Alteration of viewscapes	Area Aesthetics	Complaints from local residents regarding the appearance of wind turbines and other types of infrastructure in their viewshed
Noise	Increase in sources of noise	Noise Levels	Complaints from local residents regarding annoyance induced by new sources of noise
Socio-Economic Resources	Alteration to the rural nature of the area	Neighbourhood and Community Character	Changes in residents' perceptions of their community, property values, land use, public health and safety and traffic.
Traffic	Increase in construction traffic volume	Traffic Volume/Flow	Increase in construction traffic volume and disruption on the provincial highway (Highway 402), county roads (e.g., Egremont Drive/County Road 22) and local roads
Terrestrial Environment	Avian and bat mortality, loss of terrestrial habitat	Birds and Bats	Number of species and their abundance and/or activity. Direct or indirect habitat loss.

7.16.1.4 Temporal Boundaries

The projected/future temporal boundary for this CEA was chosen to reflect the first two Project phases (Site Preparation and Construction, and Operation and Maintenance). It is very difficult to predict and forecast potential effects of Projects more than five to ten years in the future, since the likelihood and number of unforeseeable Projects or activities is greatly increased. The past temporal boundary for this CEA was chosen to reflect activities conducted during the pre-construction period (i.e., during surveys conducted in support of the ESR/EIS). This period was considered to be representative of existing conditions, as these Project activities did not result in any known environmental effects. The temporal boundaries identified for the CEA are summarized in Table 7.16-2.

Table 7.16-2: Temporal Boundaries for the CEA

Phase/Stage of Project	Temporal Boundary
Pre-construction (i.e., surveys)	June 2007 to April 2010
Site Preparation and Construction	April 2010 to December 2010
Operation and Maintenance	2010 to 2040

Although these temporal boundaries have been identified, it is not reasonable to expect that all current or future activities/development for these selected time periods are currently known. Other Projects were only considered in this CEA if there was a reasonable level of certainty that they would be constructed within the foreseeable future and if their inclusion would contribute to the meaningful assessment of regional effects in this CEA. For example, Projects within the area that were identified by local planners, but were considered to be too small to have a significant effect (e.g., expansions to buildings occurring on lands with existing agricultural operations), or were not likely to occur within the next five years were not included in this assessment. Projects that are being contemplated, but may not be able to proceed if the TCI Adelaide Wind Farm is constructed due to known constraints (i.e., current transmission line limitations) were also considered.

7.16.1.5 Spatial Boundaries

The spatial extents of many environmental effects associated with the Site Preparation and Construction Phase of this Project (i.e., noise, dust, etc.) will be largely limited to within one to two kilometres of the SSA boundary (i.e., elevated levels or concentrations of key indicator variables will return to background levels within one to two kilometres of the SSA). Visual effects of this Project could, however, extend to a further distance away based on topography, vegetation, viewing location and weather conditions within the viewshed (see Figure 7.6-1). Based on professional judgement, a distance that considered the spatial extent of these effects was chosen, and a spatial boundary of a 10 km buffer around the SSA has been applied for this CEA (Figure 7.16-1).

7.16.1.6 Identification of Other Projects

To assess potential Project-specific cumulative effects, all other foreseeable Projects and activities within the temporal and spatial boundaries (defined above) were considered. All reasonable attempts have been made to determine anticipated developments within the CEA boundary. The identification of other Projects was conducted through the consultation process (during open houses and other meetings with local government authorities) and through discussions with planners for the local municipal and regional governments. Information on new Projects was also obtained through geographic queries of the Canadian Environmental Assessment Agency Registry (CEAA, 2009), and the Government of Ontario Environmental Bill of Rights Environmental Registry (Government of Ontario, 2009). This information is summarized in Table 7.16-3, and where possible illustrated on Figure 7.16-1. In some cases, only the point location of a Project was available or known, and these are illustrated as points; for Projects that had defined study areas available, those defined study areas are shown.

Table 7.16-3: Other Activities/Projects within the CEA Boundaries

Jurisdiction	Summary of Activities/Projects Identified	Rationale for Inclusion/Exclusion in CEA
Township of Adelaide Metcalfe	• Part of the FPLE Canadian Wind - Bornish Wind Farm Project; • FPLE Canadian Wind – Strathroy A and B Wind Farm Projects; • Strathcore Developments - installation of sewer and water lines at potential location for commercial development (truck stop) at the intersection of Highway 81 (Townsend Line) and Highway 402; • Wastewater treatment facility (likely septic field) in Village of Kerwood; and • Various farm improvement projects (e.g., dairy barn additions).	• The FPLE Canadian Wind - Bornish Wind Farm is an 85 MW wind farm (56 turbines) planned in response to the OPA Renewable Energy Supply III Procurement program, subject to a harmonized provincial-federal EA process. The Project study area overlaps the northern section of the Adelaide Wind Farm SSA and is in direct competition for the same transmission line. There is currently the capacity to accommodate only the Adelaide Wind Farm or Bornish Wind Farm (or some other combination of Projects with a nameplate capacity up to the available line capacity which is presumed equal to Adelaide). As of the current date, if it is assumed that the Adelaide Wind Farm Project proceeds, the Bornish Wind Farm cannot, therefore, this Project will not be considered in this assessment. • The FPLE Canadian Wind – Strathroy A and B Wind Farms are two Projects making up a combined 18 MW wind farm (12 turbines) planned in response to the OPA Standard Offer Contract program. They are subject to a harmonized provincial-federal EA process, overlap the southeast corner of the Adelaide Wind Farm SSA and are in direct competition for the same transmission line capacity. As of the current date, if it is assumed that the Adelaide Wind Farm Project proceeds, the Strathroy A and B Wind Farms cannot, therefore, they will not be considered in this assessment. • The commercial development Project at Highway 81 and 402 is very preliminary (i.e., has zoning but no site plan approval), but likely to be developed within the next two years. Regional VECs that will be affected by the Project include traffic volume during construction, noise, and birds and bats. • The wastewater treatment facility is located in the Village of Kerwood which is ~ 3 km south of the SSA. The extent of likely effects is negligible and the interaction with the Adelaide Project is minimal. The regional VEC that will be affected by the Project is limited to traffic volume during construction.

Table7.16-3: Other Activities/Projects within the CEA Boundaries (continued)

Jurisdiction	Summary of Activities/Projects Identified	Rationale for Inclusion/Exclusion in CEA
Township of Adelaide Metcalfe (continued)		• The agricultural improvement projects are small in size and will be occurring on properties with existing on-going agricultural activity. The extent of likely effects and interaction with effects related to the Adelaide Project are negligible and therefore, considered cumulatively, with all other agricultural activities, in this CEA. Regional VECs that will be affected include noise, traffic volume during construction, and birds and bats.
Municipality of Strathroy-Caradoc	• FPLE Canadian Wind - Strathroy C Wind Farm Project; • Chartwell Group - retirement home complex at Napperton Drive and County Road 39; • Residential development; and • No new industrial development proposed.	• FPLE Canadian Wind – Strathroy C Wind Farm Project is a 9 MW wind farm (6 turbines) planned in response to the OPA Standard Offer Contract program, subject to a harmonized provincial-federal EA process. An open house was held February, 2008 and this Project is still assumed to be underway, as the wind energy zoning bylaws relating to the development of the Project were already approved; however, the municipal planner had not heard from the proponent over the last year. It is also concluded that this project is competing for a portion of the same 75 MW of available transmission line capacity and is unlikely to go ahead if Adelaide Wind Farm is constructed. • The Chartwell Group retirement home will consist of 165 units and 20 townhouse units, and is located less than one kilometre from the southeast corner of the SSA. The regional VECs that will be affected by the Project are limited to traffic volume during construction, noise and birds. • A number of subdivisions have been granted draft approval by Strathroy-Caradoc; however, these are not within the northwest area of Strathroy-Caradoc that is inside the 10 km CEA boundary. Based on the distance from the Adelaide Project and type of development (i.e., expansion of residential development within a relatively urbanized area), this would have negligible interaction with the Adelaide Project, therefore these residential development projects are not considered in this CEA.

Table7.16-3: Other Activities/Projects within the CEA Boundaries (continued)

Jurisdiction	Summary of Activities/Projects Identified	Rationale for Inclusion/Exclusion in CEA
Municipality of North Middlesex	• Canadian Hydro Developers - Parkhill Wind Project; • Part of the FPLE Canadian Wind - Bornish Wind Farm Project; • Dairy barn addition – Townsend Line between Highland and Centre Road; and • Ernald turkey operation doubling in size – located on Elginfield Road east of Brook Road	• The Canadian Hydro Developers Parkhill Wind Project includes a transmission line corridor as well as a 30-70 MW wind farm (number of turbines unknown), and will prepare an ESR document that will also meet CEAA requirements. The Project will likely connect to a different transmission line than is proposed for the FPLE Canadian Wind Bornish/Strathroy and AET Adelaide Projects, therefore, there will be no constraint on the capacity of the transmission line proposed for use by the Adelaide Wind Farm and the Parkhill Project could therefore co-exist with a combination of the other Projects. Regional VECs that will be affected by the Project include area aesthetics, noise, neighbourhood and community character, traffic volume during construction, and birds and bats. • See discussion above from the Township of Adelaide Metcalfe regarding the FPLE Canadian Wind Bornish Wind Farm Project. • The dairy barn addition has been discussed with council, but no application submitted yet. The turkey operation expansion will occur in 2009 or 2010. Both Projects are relatively small in size and will be occurring on properties with existing agricultural activities. The extent of likely effects are negligible and the Projects are located outside of the 10 km CEA boundary and therefore, they are not considered in this CEA.
Township of Middlesex Centre	• Lynn Cattle Company Inc. Lynn Cattle Turnkey Integrated Manure Processing Plant; and • Development limited within the jurisdiction; most projects are small-scale and primarily residential	• The Lynn Cattle Company Inc. Lynn Cattle Integrated Turnkey Manure Processing Plant has been subject to a CEAA-level screening initiated in March 2004, but is over 10 km outside of the CEA boundary, and would have negligible interaction with effects related to the Adelaide Project. This Project is not considered in this CEA. • No projects/activities were noted for this jurisdiction within the 10 km CEA boundary, therefore, nothing from Middlesex Centre has been included in this CEA.

Table7.16-3: Other Activities/Projects within the CEA Boundaries (continued)

Jurisdiction	Summary of Activities/Projects Identified	Rationale for Inclusion/Exclusion in CEA
County of Middlesex	• Highway 402 always under improvement, no other large-scale highway improvement projects planned for near future; • Unconfirmed anecdotal mention of solar farm proposals; • There are no major industrial commercial or industrial developments planned; • According to those consulted with, of the wind farms in the county, the Adelaide project is the furthest along in the EA process, followed by Parkhill and Bornish; and • Chippewas of the Thames First Nation Indian Reserve 42 - retail/recreational and commercial development and Munsee-Deleware First Nation Reserve 1 – water-main servicing.	• There are no known Highway 402 improvements planned for the section within the SSA or within the 10 km CEA boundary, therefore, it is not possible to consider regional effects or include highway improvement in this CEA. • Without more specific information regarding solar farms, they cannot be included in this CEA. • The two development Projects on the Chippewas of the Thames First Nation Indian Reserve 42 and Munsee-Deleware First Nation Reserve 1 are subject to CEAA screenings initiated in March 2008 and February 2007, respectively; however, both are well outside the 10 km buffer of the SSA, would have negligible interaction with the Adelaide Project and are therefore not included in this CEA.
Lambton County (on behalf of the Township of Brooke-Alvinston)	• Lambton County planner did not identify major Projects in this jurisdiction.	• No projects/activities were noted for this jurisdiction within the 10 km CEA boundary, therefore, nothing from Brooke-Alvinston has been included in this CEA.
Lambton County (on behalf of the Township of Warwick)	• A part of the M.K. Ince – Forest Wind Farm is located in Warwick; and • No new residential developments have occurred in the last two years, Watford area has growth planned, however, nothing has been confirmed yet.	• See discussion below from the Municipality of Lambton Shores regarding the M.K. Ince Forest Wind Farm Project. • No projects/activities were noted for this jurisdiction within the 10 km CEA boundary, therefore, nothing from Warwick has been included in this CEA.

Table7.16-3: Other Activities/Projects within the CEA Boundaries (continued)

Jurisdiction	Summary of Activities/Projects Identified	Rationale for Inclusion/Exclusion in CEA
Municipality of Lambton Shores	• M.K. Ince – Forest Wind Farm (majority of the lands are within Lambton Shores); • Aeolian Energy Inc. – Proof Line Wind Farm; • Sky Generation Inc. – Ravenswood Wind Farm; and • No other projects or activities were identified.	• The Sky Generation Inc. Ravenswood Wind Farm is 9.9 MW (6 turbines), and has been operational since January 2008. The Aeolian Energy Inc. Proof Line and M.K. Ince Forest Wind Farms are both 10 MW (6 turbine) Projects currently undergoing municipal planning approvals. All three of these Projects are outside of the 10 km CEA boundary, and therefore, have not been included in this CEA.

Through this CEA consultation process, it was determined that major public road development is not expected to occur within the Adelaide SSA or within the CEA boundaries. On-going agricultural activities is the major activity in the area (other than wind Power projects) that has been identified.

For the purpose of the CEA, it has been conservatively assumed that all other Projects/activities will proceed simultaneously with Project construction. A critical assumption used in this CEA relates to the current electrical grid capacity. At least four wind power Projects are in direct competition for the same transmission line, with a current capacity limit of 75 MW. If the AET Adelaide Wind Farm is approved, all other FPLE Canadian Wind Projects cannot be developed at this time and as a result, they are not included in this assessment.

7.16.1.7 Assessment of Potential Effects of the Other Projects on VECs

Potential effects of the Adelaide Wind Farm are discussed in Section 7. When considered individually, the residual environmental and social effects of the Project on each of the identified regional VECs (Table 7.16-1) are predicted to be minimal to medium.

The key potential effects of the other Projects that will interact with the effects of the Adelaide Wind Farm include the following:

- Alteration of existing viewscapes (area aesthetics);
- Increase in environmental noise;
- Alteration to the rural nature of the area (neighbourhood and community character);
- Increase in construction-related traffic; and
- Disruption to wildlife (birds and bats) and habitat fragmentation or nibbling loss.

7.16.2 Mitigation Measures

Mitigation of effects for individual Projects is the most efficient and effective way to reduce potential cumulative effects. To this end, it is anticipated that other Projects, at a minimum, will ensure the following:

- The Project will be located with a sufficient setback from wetlands, watercourses, hazard lands and other environmentally sensitive/significant areas;
- Projects will avoid the destruction of significant woodlands, and therefore, tree and vegetation removal, other than small portions of agricultural crops, will be highly limited (resulting in minimal habitat removal);

- Best Management Practices, including those to prevent accidental spills of fuels/lubricants and those to prevent erosion/sedimentation will be implemented and monitored during all construction and decommissioning activities;
- The Project will be located at appropriate distances from non-participating noise receptors (i.e., homes of neighbouring residents that are not in Option & Lease agreements with wind farm proponents), to ensure that environmental noise guidelines (for wind Projects) are met; and
- The Project will be sited, operated and maintained with regard for municipal, provincial and federal legislation, policies and standards.

7.16.3 Evaluation of Significance

When determining and defending the significance of the effects of a Project/activity, one method includes answering a series of questions (Hegmann et al., 1999). In addition, the CEA Guide suggests answering additional questions based on whether the VECs are biological or physical-chemical.

- Is there an increase in the action's direct effect in combination with effects of other actions?
- Is the resulting effect unacceptable?
- Is the effect permanent?
- If not permanent, how long before recovery from the effect?

Factors which influence the significance of cumulative effects include the following:

- The size of the study area;
- The effectiveness of mitigation;
- The incremental contribution of net effects from each Project; and
- The magnitude of change relative to the baseline.

7.16.4 Summary of Potential Environmental Impacts and Cumulative Effects

A summary of cumulative effects has been compiled in Table 7.16-4 using the assessment of the residual effects for this Project (Section 7.14) for the regional VECs that were identified in Table 7.16-1 and the anticipated residual effects of the other Projects defined in Section 7.16.1.6. The significance of the net cumulative effects of the Adelaide Wind Farm Project and all other Projects/activities has been determined using the criteria in Table 5.3-3.

Table 7.16-4: Summary and Significance of Net Cumulative Effects

Potential Project – Regional VEC Interaction	Significance of Residual Effects from the Adelaide Wind Farm	Significance of Anticipated Residual Effects from Other Projects/Activities					Significance of Net Cumulative Effect
		Agricultural Development Activities (numerous)	Canadian Hydro Devp. – Parkhill Wind	Chartwell Group - Retirement Residence	Strathcore Developers - Highway 402 and 81 Commercial Development	Village of Kerwood Septic Field Project	
Visual Landscape							
Adverse effects to landscape views during the Site Preparation and Construction, and Decommissioning Phases	Minimal	N/A	Minimal	Minimal	Minimal	N/A	Minimal
Adverse effects to landscape views during the Operation and Maintenance Phase	Medium	N/A	Medium	None	None	N/A	Medium
Noise							
Noise emissions due to construction-type activities in the Site Preparation and Construction and Decommissioning Phases	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal
Noise emissions during the Operation and Maintenance Phase	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal
Socio-Economic Resources							
Adverse effects to the neighbourhood and community character (alteration to the rural nature of the area)	Medium	N/A	Medium	Minimal	Minimal	N/A	Medium

Table 7.16-4: Summary and Significance of Net Cumulative Effects (continued)

Potential Project – Regional VEC Interaction	Significance of Residual Effects from the Adelaide Wind Farm	Significance of Anticipated Residual Effects from Other Projects/Activities					Significance of Net Cumulative Effect
		Agricultural Development Activities (numerous)	Canadian Hydro Devp. – Parkhill Wind	Chartwell Group - Retirement Residence	Strathcore Developers - Highway 402 and 81 Commercial Development	Village of Kerwood Septic Field Project	
Traffic							
Increased traffic volume/ disturbance of traffic flow during the Site Preparation and Construction, and Decommissioning Phases	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	Low
Increased traffic volume/ disturbance of traffic flow during the Operation and Maintenance Phase	None	Minimal	None	Minimal	Low	N/A	Minimal
Terrestrial Environment							
Birds							
Sensory and habitat displacement during the Site Preparation and Construction Phase	Low	Minimal	Low	Minimal	Minimal	N/A	Low
Direct mortality during the Operation and Maintenance Phase	Low	Minimal	Low	Minimal	Minimal	N/A	Low
Bats							
Direct mortality during the Operation and Maintenance Phase	Low	Minimal	Low	None	None	N/A	Low

7.16.5 Conclusion

This CEA predicts that the net cumulative effects of this Project and other Projects in the area will be minimal to medium. The majority of the cumulative effects noted during this assessment are related to other alternative energy projects, namely wind power.

As the majority of other Projects in the Cumulative Effects Study Area are wind farms, the likely cumulative effects will be due to spatial and temporal crowding, where there are effects created by a relatively higher level of activity within a small area and within a narrow period of time. Temporal crowding can occur when a VEC is not allowed enough time to recover from the effects of a Project work or activity. There is currently a relatively low level of development in the area, with a number of new wind farms either already approved, or in the planning stages within a 10 km area of the Adelaide Wind Farm. Habitat nibbling will be very low to negligible, as the region has already undergone extensive clearing of native vegetation for agriculture, leaving a relatively small amount of wildlife habitat in the way of woodlots or other natural stands of trees and it is assumed that the additional loss of significant woodland habitat will not be allowed by the county or township(s) consistent with their Official Plans and the Provincial Policy Statement.

The extent of residual effects on a number of regional VECs is restricted by regulatory requirements and characteristics of the local area. For Environmental Noise, it is assumed that all other wind farm Projects will be bound by the MOE guidelines, which will restrict the total noise level in the region. For traffic, the county (Middlesex and/or Lambton) and/or municipalities will ensure construction traffic is controlled and will not result in major changes to traffic volume and flow. Although it was assumed as a worst-case scenario, it is also highly unlikely that the construction periods of multiple wind farms would directly coincide, or that the same routes would be travelled at the same time. The area contains a grid-like pattern of local and county roads, which creates more opportunity for traffic egress, if certain sections of local or county roads are affected by slow-moving traffic.

The regional VECs predicted to be most affected by the cumulative effects of all Projects within the temporal and spatial CEA boundaries are primarily limited to:

- Area aesthetics and Neighbourhood and Community Character (due to the visibility of wind turbines from long distances in an area with flat topography and a primarily rural setting); and
- Birds, bats and habitat (due to the increased potential for bird and bat collisions or other trauma related to wind turbines, and changes to habitat due to the installation of wind turbines, buildings, new roads and other infrastructure).

7.16.6 Follow-Up

As described in Section 5.3.5, the follow-up program is meant to verify the accuracy of the environmental assessment and to determine the effectiveness of mitigation measures. For the CEA, it is typically the Responsible Authority (RA) that defines and implements the follow-up monitoring program (in this case, as most other major projects are wind power Projects, this would likely be Natural Resources Canada, if other proponents have applied for federal funding), whereas it would be the responsibility of AET and other proponents to monitor their own Project's contribution to the cumulative effects within the region.

There are no Project-specific follow-up programs proposed for cumulative visual effects within the viewshed of the Adelaide Wind Farm, although a complaints resolution process has been proposed by AET to resolve potential concerns by local residents.

Project-specific follow-up monitoring for other components of the environment, where deemed necessary, has also been outlined in Section 8.3 (Follow-up).

8.0 SUMMARY AND CONCLUSIONS

8.1 Summary of Residual Effects and Significance

This section is provided to summarize the Adelaide Wind Farm Project–environment interactions that were identified for each VEC, any residual effects that are predicted to remain after mitigation, and the significance of any identified residual effects.

Table 8.1-1 summarizes the assessment of the MOE screening criteria that were introduced in Section 7.0 using the VECs identified for each environmental component. Consistent with previous sections, each of these criteria questions are meant to be preceded with the phrase: "*Will the Project…*".

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
Surface and Ground Water					
1.1	Have negative effects on surface water quality, quantities or flow?	Surface hydrology Surface water quality Sediment quality	7.1	There are no predicted effects on surface water quantity or flow. There is the potential for effects on surface water or sediment quality only if mitigation measures fail or if there is a spill of hydrocarbons.	Minimal
1.2	Have negative effects on ground water quality, quantity or movement?	Soil quality Groundwater quality Groundwater recharge Groundwater flow	7.1	There are no predicted effects on groundwater quantity or flow. There is the potential for effects on groundwater quality in the event of a spill if mitigation measures for spill management and containment fail.	Minimal
1.3	Cause significant sedimentation, soil erosion or shoreline or riverbank erosion on or off site?	Surface water quality Sediment quality Erosion potential	7.2	There is no significant soil erosion or shoreline or river bank erosion predicted. There is the potential for minor localized sedimentation on site only if mitigation measures fail during extreme weather events.	Minimal

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
1.4	Cause potential negative effects on surface or ground water from accidental spills or releases to the environment?	Soil quality Groundwater quality Surface water quality Sediment quality	7.1/7.2	There is the potential for effects on surface or ground water only if mitigation measures, spill contingency plans and BMPs fail.	Minimal
Land					
2.1	Have negative effects on residential, commercial or institutional land uses within 500 metres of the site?	Land Use	7.9	A setback of 600 m from the urban area of Adelaide Metcalfe has been applied to ensure there will be no negative effects on residential, commercial or institutional land uses within 500 m of the site.	N/A
2.2	Be inconsistent with the Provincial Policy Statement, provincial land use or resource management plans?	Listed endangered and threatened species Designated areas Archaeological Heritage Built Cultural Heritage Land Use Agriculture Resources	7.3, 7.8, 7.9	The Project will be consistent with the Provincial Policy Statement with regards to energy and air quality, natural heritage, cultural heritage and archaeology and agriculture. The Project is not predicted to affect listed species (none observed on site) or designated areas. To minimize effects on agricultural land use some access roads are within the zone which could trigger a DAR under the County OP but no significant woodland will be removed. If archaeological resources are found during Stage 2 surveys, cultural heritage and archaeology will be preserved through removal and documentation. A relatively minor amount of Class 1 or 2 agricultural lands will be affected by the Project and access to game and fishery resources outside of private lands may be temporarily affected due to construction of new access roads.	7.3 – N/A 7.8 – N/A 7.9 – Minimal

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
2.3	Be inconsistent with municipal land use policies, plans and zoning by-laws?	Land Use	7.9	The Project will be consistent with municipal land use policies, plans and zoning by-laws and is subject to approvals from the Township of Adelaide Metcalfe. Zoning approval has been received for 12 turbines effective the date of this report.	N/A
2.4	Use hazard lands or unstable lands subject to erosion?	Surface hydrology Surface water quality Sediment quality Erosion potential	7.2	Although a minor amount of access road and underground cable crossings will be built within Generic Regulation boundaries defined by ABCA and SCRCA, proper grading, the use of mitigation measures and BMPs will avoid residual effects.	N/A
2.5	Have potential negative effects related to the remediation of contaminated land?	Land Use	7.9	Contaminated lands have not been identified on site.	N/A
Air and Noise					
3.1	Have negative effects on air quality due to emissions of nitrogen dioxide, sulphur dioxide, suspended particulates or other pollutants?	Air Quality	7.4	Minor and short-term emissions of nitrogen dioxide, sulphur dioxide, suspended particulates or other pollutants will be created by heavy equipment during construction. BMPs will be implemented.	Minimal
3.2	Cause negative effects from the emission of greenhouse gases (CO_2, methane)?	Air Quality	7.4	Minor and short-term emissions of greenhouse gases will be created by heavy equipment during construction. BMPs will be implemented.	Minimal
3.3	Cause negative effects from the emission of dust or odour?	Air Quality	7.4	Minor and short-term emissions of dust will be created by heavy equipment during construction. BMPs will be implemented. There will be no odour emissions.	Minimal

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
3.4	Cause negative effects from the emission of noise?	Noise Levels	7.5	There will be typical noise emissions from the construction and decommissioning of the Project (minimal). Although the predicted noise levels during the operation of the Project will be at or below the MOE noise level limits, they will be elevated compared to the existing baseline noise levels.	Minimal
Natural Environment					
4.1	Cause negative effects on rare, threatened or endangered species of flora or fauna or their habitat?	Flora and habitat types Listed endangered and threatened species Designated areas	7.3	No effects on rare, threatened or endangered species of flora or fauna or their habitat are predicted as none are known to exist on site.	N/A
4.2	Cause negative effects on protected natural areas such as ANSIs, ESAs or other significant natural areas?	Designated areas	7.3	There are no negative effects on protected natural areas such as ANSIs, ESAs or other significant natural areas predicted. Nest and den surveys will be undertaken in significant woodlands situated immediately adjacent to and prior to commencement of construction activities (if they occur during the breeding season) and if required, species-specific setbacks and exclusion zones will be flagged for avoidance.	N/A
4.3	Cause negative effects on wetlands?	Wetlands	7.3	There are no provincially or locally significant wetlands located on site, and the Project layout was designed to avoid the few wetlands that are present	N/A

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
4.4	Have negative effects on wildlife habitat, populations, corridors or movement?	Flora and habitat types Birds Bats Other wildlife	7.3	Deposition of dust or debris will have negligible effects on flora and habitat types. Mortality rates for bird and bat-turbine collisions are predicted to be low. The Project is not predicted to affect wildlife habitat or corridors.	Low
4.5	Have negative effects on fish or their habitat, spawning, movement or environmental conditions (e.g., water temperature, turbidity, etc.)?	Fish and fish habitat	7.2	Consultation with local Conservation Authorities (ABCA and SCRCA) during the detailed design phase will ensure that underground cable crossings are not located in sensitive habitats. Cable crossings will follow requirements of the DFO Operational Statements. There is the potential for negative effects on fish and fish habitat only if mitigation measures, spill contingency plans and BMPs fail.	Minimal
4.6	Have negative effects on migratory birds, including effects on their habitat or staging areas?	Birds Flora and habitat types	7.3	The overall potential for bird-turbine collisions is low. Turbines and access roads have been sited outside of any known migratory bird habitat or staging areas; however nest surveys will be undertaken in significant woodlands prior to commencement of construction activities (if they occur during the breeding season) and if required, species-specific setbacks and exclusion zones will be flagged for avoidance.	Low
4.7	Have negative effects on locally important or valued ecosystems or vegetation?	Flora and habitat types Designated areas	7.3	Nest and den surveys will be undertaken in significant woodlands prior to commencement of construction activities (if they occur during the breeding season) and if required, species-specific setbacks and exclusion zones will be flagged for avoidance.	N/A

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
Resources					
5.1	Result in inefficient (below 40%) use of a non-renewable resource (efficiency is defined as the ratio of output energy to input energy, where output energy includes electricity produced plus useful heat captured)?	N/A	N/A	The Project involves the potential production of energy from a renewable resource (wind power).	N/A
5.2	Have negative effects on the use of Canada Land Inventory Class 1-3, specialty crop or locally significant agricultural lands?	Agriculture	7.9	Approximately 14 ha of Class 1-3 agricultural land will be lost during the operational life of the Project; however this is a loss of 0.018% of the total land area currently used for farming in the Local Study Area. The effects are fully reversible after Project Decommissioning.	Minimal
5.3	Have negative effects on existing agricultural production?	Agriculture	7.9	Approximately 14 ha of Class 1-3 agricultural land will be lost during the operational life of the Project; however this is a loss of 0.018% of the total land area currently used for farming in the Local Study Area. The effects are fully reversible after Project Decommissioning.	Minimal
5.4	Have negative effects on the availability of mineral, aggregate or petroleum resources?	Resources	7.9	No effects on mineral, aggregate or petroleum resources are predicted.	N/A

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
5.5	Have negative effects on the availability of forest resources?	Resources	7.9	No effects on the availability of forest resources are predicted.	N/A
5.6	Have negative effects on game and fishery resources, including negative effects caused by creating access to previously inaccessible areas?	Resources	7.9	Access to game and fishery resources may be temporarily affected due to construction of new access roads. Much of the project is situated on private land or near roadways where hunting would not occur.	Minimal
Socio-economic					
6.1	Have negative effects on neighbourhood or community character?	Neighbourhood and Community Character Population and Demographics	7.7	Neighbourhood and community character is influenced by visual aesthetics which will be modified by the presence of turbines and the substation. Population and demographics will not be affected.	Medium
6.2	Have negative effects on local businesses, institutions or public facilities?	Employment, Business and the Economy Community Services and Infrastructure Population and Demographics	7.7	No negative effects on local businesses, institutions or public facilities are predicted.	N/A
6.3	Have negative effects on recreation, cottaging or tourism?	Tourism and Recreation	7.7	The Project is not expected to have negative effects on recreation, cottaging or tourism.	N/A

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
6.4	Have negative effects related to increases in the demands on community services and infrastructure?	Community Services and Infrastructure Population and Demographics	7.7	There is the potential for local waste disposal facility capacity to be insufficient for the amount of waste material created during dismantling and disposal of Project-related infrastructure; however, recycling is or may be in place for many of the infrastructure components.	Medium
6.5	Have negative effects on the economic base of a municipality or community?	Employment, Business and the Economy Population and Demographics	7.7	No negative effects on the economic base of the municipality or community are predicted.	N/A
6.6	Have negative effects on local employment and labour supply?	Employment, Business and the Economy Population and Demographics	7.7	No negative effects on local employment and labour supply are predicted.	N/A
6.7	Have negative effects related to traffic?	Traffic volume/ flow	7.11	Road upgrades or equipment delivery will temporarily disrupt traffic.	Minimal
6.8	Cause public concerns related to public health and safety?	Public health	7.13	Public safety measures and BMPs will be implemented, however in the unlikely event that they fail, safety risks may exist. Considering the location of the nearest receptors to the turbines and the research conducted to-date on shadow flicker and noise health effects, it is unlikely to be an issue for this Project, however particularly sensitive individuals may be affected and a call-in number will be maintained by AET to allow individuals to report concerns.	Minimal

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
Heritage and Culture					
7.1	Have negative effects on heritage buildings, structures or sites, archaeological resources, or cultural heritage landscapes?	Archaeological Heritage Built Cultural Heritage	7.8	No negative effects on heritage buildings, structures or sites, archaeological resources are predicted. A Stage 2 Archaeological Assessment will be completed before construction. If archaeological resources are found during Stage 2 surveys, cultural heritage and archaeology will be preserved through removal and documentation. Effects on the cultural heritage landscape are related to the change to the rural viewscape due to the short-term presence of construction vehicles and machinery and long-term presence of turbines.	Minimal (if archaeological resources avoided) or Medium (if archaeological resources subject to further assessment) Minimal
7.2	Have negative effects on scenic or aesthetically pleasing landscapes or views?	Views and landscapes	7.6	The presence of equipment and vehicles during construction and the presence of turbines and a substation during operations changes the rural viewscape and creates what certain individuals deem to be a negative effect on rural views and vistas; however, the effect is completely reversible upon decommissioning.	Minimal to Medium
Aboriginal					
8.1	Cause negative effects on First Nations or other Aboriginal communities?	Aboriginal Traditional Land Use	7.10	The rights and freedoms of First Nations or other Aboriginal communities to carry out traditional hunting or fishing will not be affected by the Project.	N/A

Table 8.1-1: Summary of Residual Effects of the Adelaide Wind Farm based on MOE Screening Criteria (Continued)

Number	MOE Screening Criterion	VECs	Report Section	Conclusion/Rationale	Level of Importance of Residual Effect
Other					
9.1	Result in the creation of waste materials requiring disposal?	Community Services and Infrastructure	7.7	There is the potential for local waste disposal facility capacity to be insufficient for the amount of waste material created during dismantling and disposal of Project-related infrastructure; however, recycling is or may be in place for many of the infrastructure components.	Medium
9.2	Cause any other negative environmental effects not covered by the criteria outlined above?	Electromagnetic Interference	7.13	Consultation with known licensed service providers and government agencies with operations that could be affected by wind turbine operation was conducted as part of the EMI Impact Study to ensure EMI was avoided, and would not impact their operations.	N/A

Following the application of mitigation measures, the only significant residual effects predicted for the Adelaide Wind Farm Project (i.e., residual effects with a magnitude of medium to high) are as follows:

- Disruption of archaeological resources during the Site Preparation and Construction and Decommissioning Phases (if future Stage 2 field work finds significant archaeological resources that cannot be avoided and may require Stage 3 assessment);
- Adverse effects on the rural viewscape and neighbourhood and community character during the Operation and Maintenance Phase; and
- There is the potential for residual effects on community services (waste management facilities) during the Decommissioning Phase, depending on the capacity of local waste management facilities to accept turbine components, and the status of re-sale markets for recycling of turbine components following the operational life of the Project (i.e., in 30 years).

8.2 Commitment to Mitigation and Effects Management

Mitigation measures and follow-up monitoring programs have been identified and recommended in sections 7.1 to 7.13 and mitigation measures were also summarized in Section 7.14. AET is committed to ensuring implementation of all mitigation measures and follow-up programs in order to negate or reduce any potentially adverse effects of the Adelaide Wind Farm Project.

AET has also made a number of commitments that will ensure the safe and community-friendly commissioning and operation of the Adelaide Wind Farm. These are summarized below:

- Compliance with all mitigation measures and follow-up programs identified in the ESR/EIS;
- Compliance with all applicable rules and regulations;
- Inspection of the construction by appropriate authoritative personnel;
- Development and appropriate updating of the environmental management plans (EMPs) for the Construction and Operations Phases, including best management practices, emergency response plans, extreme weather plans, and spill contingency plans;
- Safe use, storage, and disposal of all hazardous chemicals and equipment;
- Compliance with all applicable spills reporting regulations (the Ontario Ministry of Environment toll-free Spills Action Centre number is 1-800-268-6060);
- Maintenance of equipment in best working condition;
- To the extent possible, employ members of the local workforce for construction related activities;
- Maintenance of a toll-free 24-hour call in number by AET to allow local residents, businesses and government agencies to report concerns;
- Compliance with all applicable health and safety standards; and
- Health and safety and job training to be provided by either the turbine manufacturer, or the Balance of Plant (BOP) contractor.

8.3 Follow-Up

As part of the effects assessment process, it was determined that follow-up monitoring programs will be required for the following disciplines/environmental components as described in the subsections below.

8.3.1 Geophysical and Aquatic Environment

To minimize residual effects of the Project on the Geophysical Environment (i.e., groundwater) or the Aquatic Environment, these follow-up measures should be followed:

- Representative soil and groundwater quality samples will be taken across the SSA in conjunction with the detailed geotechnical assessment.
- Inspection of the construction site should be undertaken to ensure BMPs and other mitigation measures are being used consistently and in the correct manner.
- Regular inspection of vehicles and the construction site should be undertaken to ensure proper working conditions are maintained to reduce the likelihood of any spills. Regular review of the spill response plan should also be undertaken.
- Closer to construction, consultation necessary approvals from the two local Conservation Authorities (ABCA and SCRCA) will be attained for works inside of their Generic Regulation

boundaries. DFO Operational Statements for timing windows for dry open cut crossings will be followed and works can proceed without approval. A notification letter must be submitted in advance of commencing the works consistent with Operational Statement requirements

8.3.2 Terrestrial Environment

A post-construction monitoring study should be developed in consultation with Environment Canada (EC) Canadian Wildlife Service (CWS) and the MNR. Elements of the post-construction monitoring program should include:

- Mortality monitoring for birds at a subsample of turbines throughout the year for a period of one or more years. Searcher efficiency and scavenger trials should be conducted each year according to Environment Canada's protocols (See Section 7.3).
- Development of a point count-based breeding bird study to assess disturbance effects and changes in bird composition and distribution for a period of one to two years. The surveys should use the same protocols as the pre-construction surveys.
- Mortality monitoring for bats at a subsample of turbines throughout the year for a period of one or more years. Searcher efficiency and scavenger trials should be conducted each year according to Environment Canada's protocols (See Section 7.3).

The monitoring program results are to be provided to EC/CWS and MNR for review at the end of each monitoring year. Pending outcomes of their review, the program methodologies, frequencies and durations may be reasonably modified by the parties to better reflect the findings and goals of the monitoring programs.

8.3.3 Atmospheric Environment and Public Health and Safety

A call-in number will be established by AET to allow local residents to report complaints relating to dust or other emissions created by the Project, and any health concerns relating to the turbine noise or shadow flicker. AET will be responsible for following-up with any complaints received, and ensuring that all concerns are addressed in an appropriate manner in a complaint mitigation procedure.

8.3.4 Socio-Economic Resources

There is the potential for local waste disposal facility capacity to be insufficient for the amount of waste material created during dismantling and disposal of Project-related infrastructure. The potential for this to happen will be minimized by monitoring the status of waste disposal capacity over the course of the Project. The recommended program involves identification of suitable local and regional waste disposal facilities to accept Project-related waste and monitoring of the capacity of these facilities, and also the extent to which turbine parts and equipment can be recycled (based on re-sale market conditions). This should be done within five years of the project time of decommissioning.

8.3.5 Heritage Resources

The potential for archaeological sites was identified through the Stage 1 Archaeological Assessment. The site has been recommended for further assessment in a Stage 2 Archaeological Assessment work that will be completed prior to the Site Preparation and Construction Phase.

8.3.6 Electromagnetic Interference

AET will create a TV interference complaints process prior to construction, to allow all complaints to be addressed in a timely and appropriate manner. This process will include a toll-free call-in number, a complaint logging and tracking system, use of independent EMI consultants where necessary and implementation of appropriate mitigation measures where appropriate. In addition, AET will enter into discussions with service providers and government agencies if it is discovered that the construction and/or operation of the wind farm is directly causing interference with an existing system. AET will ensure that the service providers and government agencies operating systems identified in the area at the time of construction have appropriate contact details for post-construction liaison and will work closely with these operators to resolve interference issues.

8.4 Overall Benefits of the Project

The numerous benefits of generating electricity from wind energy are well documented. The Adelaide Wind Farm Project will create the following benefits:

- Uses renewable resources to generate electricity that is reliable, efficient, and sustainable;
- Help Ontario meet its renewable energy targets as laid out in the Integrated Power System Plan;
- Wind energy represents a predictable cost that, once built, incurs minimal future costs and is not susceptible to increases in commodity costs (unlike fossil fuels);
- Wind energy is a clean source of energy which does not emit greenhouse gases or produce toxic or hazardous wastes;
- Reduction in Ontario's contribution to global climate change, since wind energy assists in offsetting the emissions from other energy sources (i.e., coal and natural gas);
- Using wind energy in place of conventional carbon-based energy reduces the generation of smog and acid rain;
- The creation of a number of temporary construction jobs (approximately 200 over the construction period) and several permanent on-site jobs related to turbine maintenance;
- Local procurement for site preparation services, gravel, aggregate, concrete and sewage disposal services during construction, and potential for longer-term contracts for snow removal and access road or fence maintenance;
- Local spending by construction crew on accommodation, meals and minor expenses;

- Annual property taxes will be paid to the Municipality of Adelaide Metcalfe which will be shared with the County of Middlesex and local school board;
- Wind power allows farmers and landowners to stay on the land, in turn helping to keep agricultural lands in active production by providing landowners with Option & Lease Agreements with a reliable stream of additional income;
- Construction of turbine access roads will aid farmers in their ability to access areas of their land that may have been previously inaccessible;
- Increased demand for wind power infrastructure, such as wind turbines and tower sections, creates an opportunity for new manufacturing jobs in the Ontario;
- On-going local contracts for snow removal and maintenance of access roads, etc.; and
- Potential for increased tourism to the area and secondary economic benefits.

8.5 Conclusions

It is expected that the construction, operation, and subsequent decommissioning of the Adelaide Wind Farm Project will not have significant negative effects on the human and natural environments of the SSA, LSA or the RSA, assuming recommended mitigation measures and other commitments are implemented. Benefits from the Project have been identified for landowners with Option & Lease Agreements with AET, and for residents of Ontario who will benefit from this new source of clean and renewable energy.

It can be concluded that the overall advantages of the Adelaide Wind Farm Project outweigh any disadvantages, and that the Project will create an environmentally and socially safe energy source that will contribute a significant amount of clean electricity to the province of Ontario’s overall energy supply.

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