Legend
Wind Energy Centre Study Area
Transmission Line Study Area
120 m Area of Investigation
Municipal Division
Roads
Expressway / Highway
Major Road
Local Road
Watercourse (ABCA, UTRCA)
Non-REA Waterbody
REA Waterbody
Unknown Waterbody
Waterbody
Cartographic Wetland
Project Location
GE Turbine
Permanent Meterological Tower
Access Road
Collection Line
Transmission Line
Temporary Laydown Area
Substation
Disturbance Area
Bluewater
South Huron
Sararas Road
Pepper Road
Hendrick Road
MacDonald Road
Shadeview Road
Dashwood Road
Dashwood Main Street
Rogerville
Hurondale Road
Blackbush Line
Bronson Line
Goshen Line
Babylon Line
Parr Line
Ausable Line
Bell's Line
Shipka Line
Centre Street
Basemapping from Ontario Ministry of Natural Resources
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Metres
0 100 200 400 600 800
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UTM Zone 17N, NAD 83
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Goshen Wind Energy Centre
Water Assessment and Water Body Report
Identified REA and
Non-REA Water Bodies
December 2012
Project 60155032
AECOM
Figure 4.2a

Legend

- Wind Energy Centre Study Area
- Transmission Line Study Area
- 120 m Area of Investigation
- Municipal Division

Roads

- Expressway / Highway
- Major Road
- Local Road

- Watercourse (ABCA, UTRCA)
- Non-REA Waterbody
- REA Waterbody
- Unknown Waterbody
- Waterbody
- Cartographic Wetland

Project Location

- GE Turbine
- Permanent Meterological Tower
- Access Road
- Collection Line
- Transmission Line
- Temporary Laydown Area
- Substation
- Disturbance Area

Basemapping from Ontario Ministry of Natural Resources

Metres

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UTM Zone 17N, NAD 83

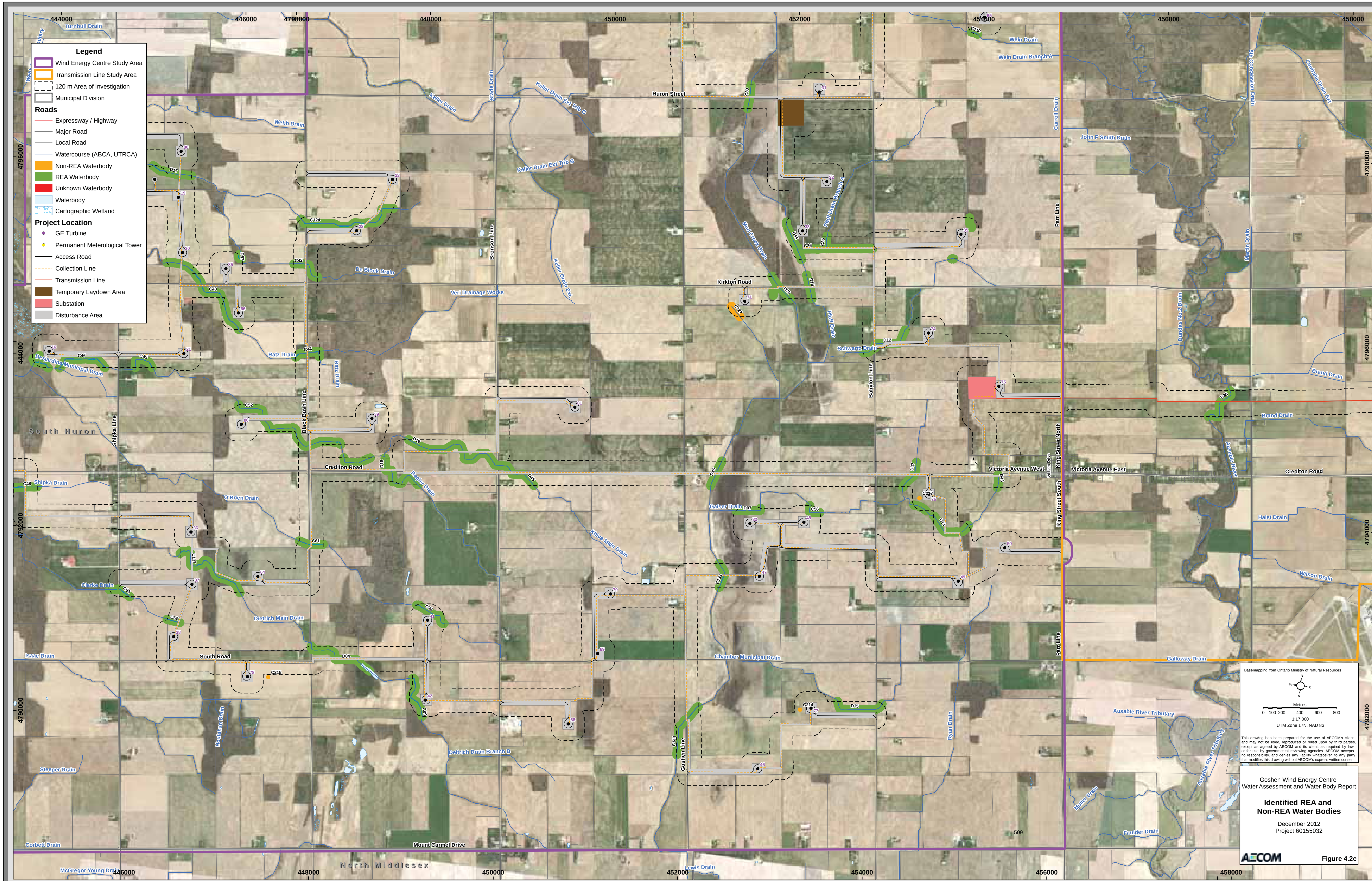
Goshen Wind Energy Centre
Water Assessment and Water Body Report

Identified REA and Non-REA Water Bodies

December 2012
Project 60155032

AECOM

Figure 4.2b


Legend
Wind Energy Centre Study Area
Transmission Line Study Area
120 m Area of Investigation
Municipal Division
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Expressway / Highway
Major Road
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Watercourse (ABCA, UTRCA)
Non-REA Waterbody
REA Waterbody
Unknown Waterbody
Waterbody
Cartographic Wetland
Project Location
GE Turbine
Permanent Meterological Tower
Access Road
Collection Line
Transmission Line
Temporary Laydown Area
Substation
Disturbance Area
Huron Street
Kirkton Road
Crediton Road
Victoria Avenue West
Victoria Avenue East
South Road
Mount Carmel Drive
Bronson Line
Black Bush Line
Shipka Line
Babylon Line
Parr Line
King Street North
King Street South
Goshen Line
South Huron
North Middlesex
Turnbull Drain
Keller Drain
Webb Drain
De Block Drain
Ratz Drain
Veri Drainage Works
Desjardine Municipal Drain
Shipka Drain
O'Brien Drain
Clarke Drain
Dietrich Main Drain
Isaac Drain
Dietrich Drain Branch B
Steeper Drain
Corbett Drain
McGregor Young Drain
Khiva Main Drain
Geiser Drain
Chamber Municipal Drain
Mud Creek Drain
Pfaff Drain
Schwartz Drain
Wein Drain
Wein Drain Branch A
Carroll Drain
John F Smith Drain
Brand Drain
Haist Drain
Wilson Drain
Galloway Drain
Ausable River
Ausable River Tributary
Faulder Drain
Ryan Drain
Lewis Drain
Basemapping from Ontario Ministry of Natural Resources
Metres
0 100 200 400 600 800
1:17,000
UTM Zone 17N, NAD 83
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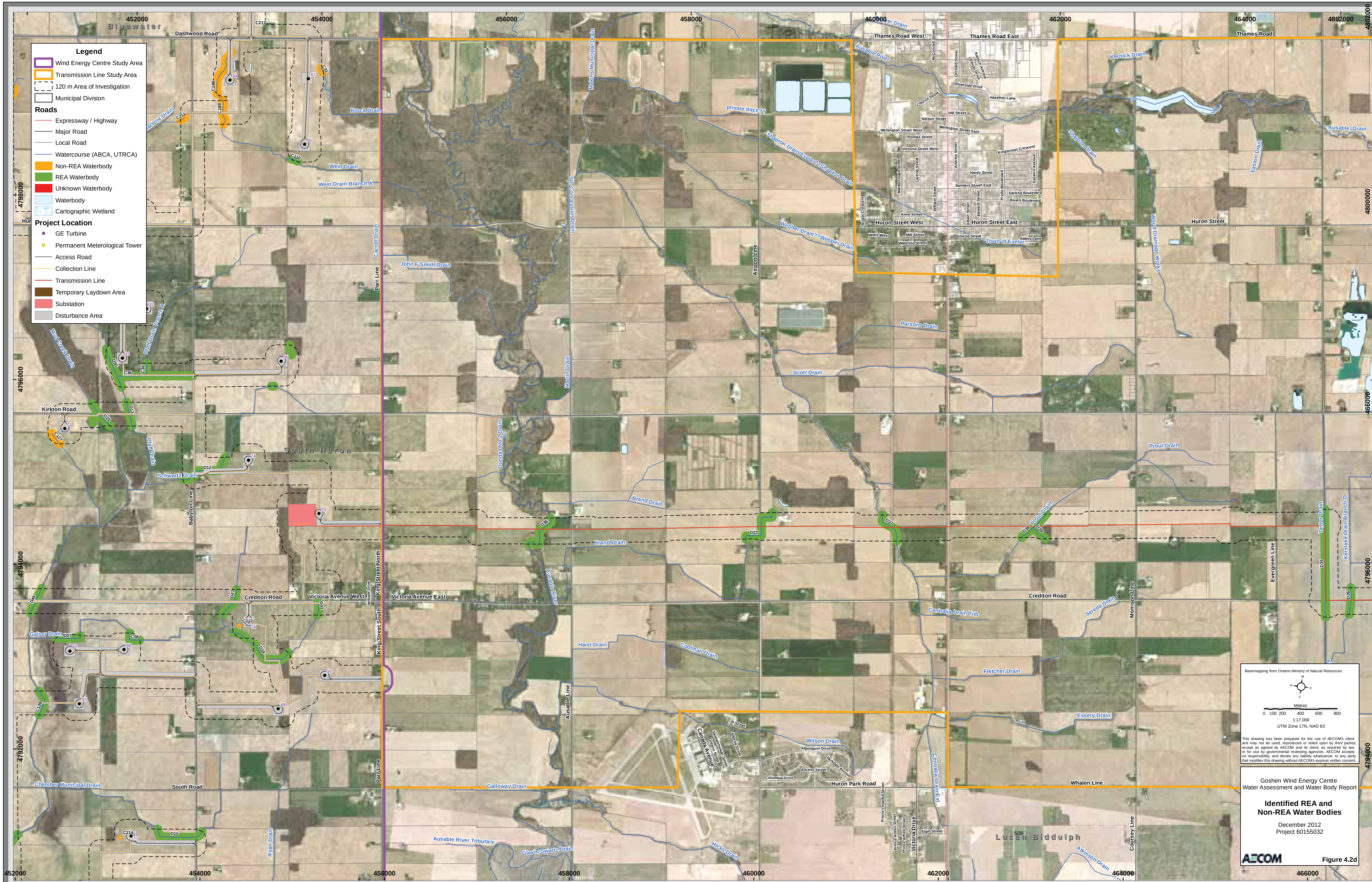
Goshen Wind Energy Centre
Water Assessment and Water Body Report
Identified REA and Non-REA Water Bodies
December 2012
Project 60155032
Figure 4.2c


Legend
Wind Energy Centre Study Area
Transmission Line Study Area
120 m Area of Investigation
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GE Turbine
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Access Road
Collection Line
Transmission Line
Temporary Laydown Area
Substation
Disturbance Area
Bluewater
South Huron
Lucan Biddulph
Thames Road West
Thames Road East
Huron Street West
Huron Street East
Crediton Road
Victoria Avenue West
Victoria Avenue East
Kirkton Road
South Road
Whalen Line
Huron Park Road
Dashwood Road
Ausable River
Town of Exeter
Basemapping from Ontario Ministry of Natural Resources
Metres
0 100 200 400 600 800
1:17,000
UTM Zone 17N, NAD 83
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Goshen Wind Energy Centre
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Identified REA and Non-REA Water Bodies
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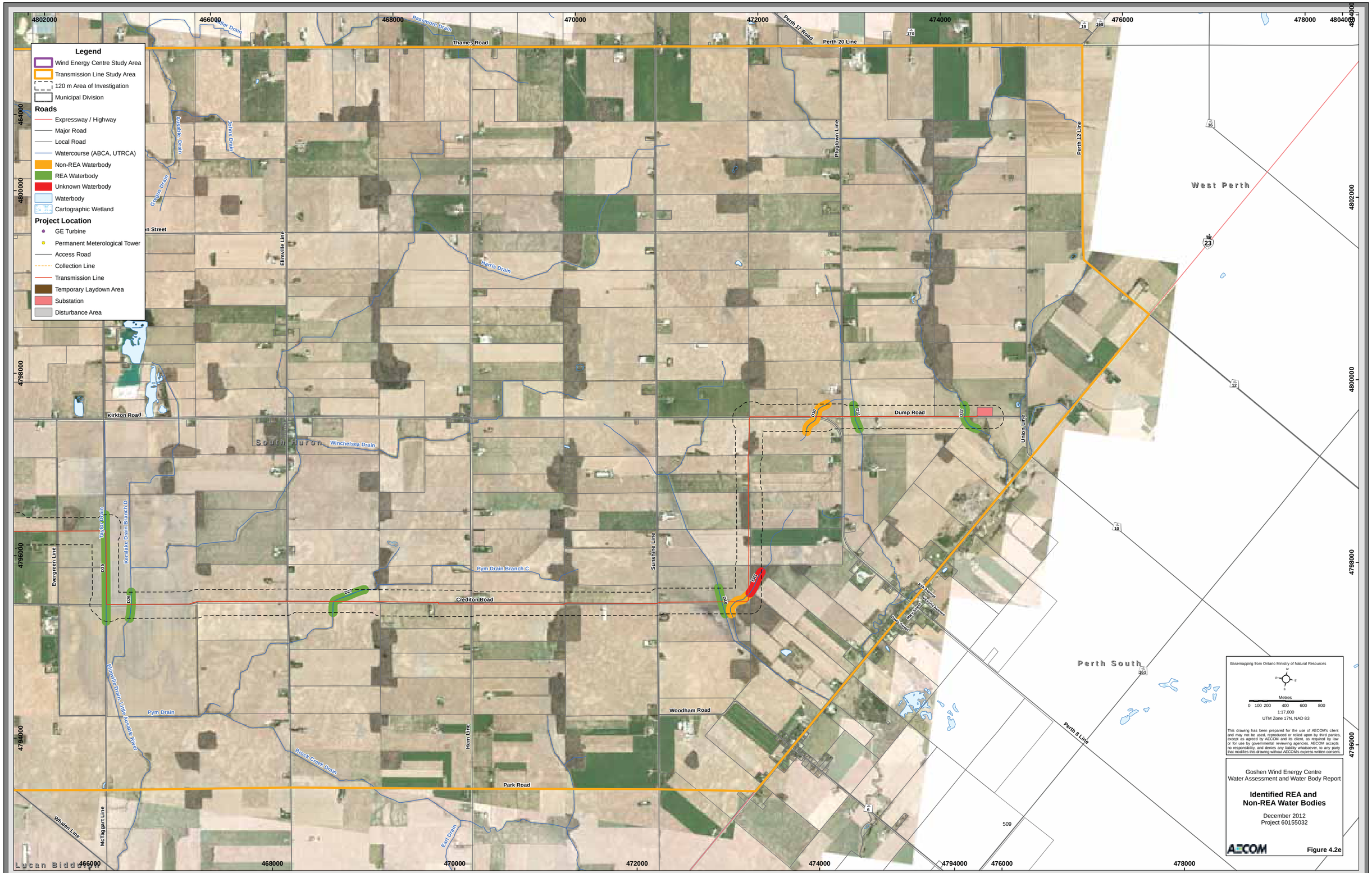
Project 60155032
Figure 4.2d


Legend
Wind Energy Centre Study Area
Transmission Line Study Area
120 m Area of Investigation
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Waterbody
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Project Location
GE Turbine
Permanent Meterological Tower
Access Road
Collection Line
Transmission Line
Temporary Laydown Area
Substation
Disturbance Area
4802000
466000
468000
470000
472000
474000
476000
478000
4804000
4800000
4798000
4796000
4794000
Thames Road
Perth 17 Road
Perth 20 Line
Perth 12 Line
Plugdown Line
Miller Drain
Passmore Drain
Ansable Drain
Johns Drain
Geddes Drain
Elimville Line
Harris Drain
West Perth
Kirkton Road
South Huron
Winchelsea Drain
Dump Road
Union Line
Taylor Drain
Kirkhake Drain Branch D
Evergreen Line
Pym Drain Branch C
Sunshine Line
Crediton Road
Elimville Drain, Little Ausable River
Pym Drain
Brock Creek Drain
Hem Line
Woodham Road
Park Road
Perth South
Perth 8 Line
Whalen Line
McTaggart Line
Earl Drain
Lucan Biddulph
509
Basemapping from Ontario Ministry of Natural Resources
Metres
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UTM Zone 17N, NAD 83
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Project 60155032
AECOM
Figure 4.2e

5. Description of Environmental Effects

5.1 REA Requirements

This section presents potential negative effects of the Project on the identified water bodies and the area within 30 m of the water body as outlined in Renewable Energy Approval Act Section 40(2)(c). Mitigation measures and a summary of residual effects associated with the project components and the environment are outlined for the construction/decommissioning and operation phases. The potential effects described below are also presented in Section 3 of the Project Description Report (PDR) (AECOM, 2012).

5.2 Potential Effects of Project Components

Potential effects from the construction/decommissioning and operation of the project components are summarized below.

5.2.1 Turbines

With a total nameplate capacity of 102 MW, the Project is categorized as a Class 4 facility under *O. Reg. 359/09*. Although NextEra is seeking an REA for up to 72 wind turbines, only 63 are proposed to be constructed for the Project.

The wind turbine technology proposed for this Project is the GE 1.6-100 Wind Turbine and GE 1.56-100 Wind Turbine (one turbine only). The turbines are 3-bladed, upwind, horizontal-axis wind turbines that are state of the art technology. The turbines have a 100 m rotor diameter with a swept area of 7,854 m; each blade is connected to the main shaft via the hub. The turbine is mounted on an 80 m tubular steel tower which contains an internal ladder provided for maintenance access. The turbine will be constructed on a foundation that is approximately 400 m^2. The foundation consists of poured concrete and steel rebar to provide added strength.

The nacelle houses the main components of the wind turbine such as the rotor shaft, gear box, couplings, control panel, bearing brackets and the generator. The nacelle is equipped with sound-proofing, is ventilated and the interior is illuminated with electric lights. Some of the wind turbines will have external lighting in accordance with the requirements of Transport Canada (TC).

An approximately 122 m by 122 m square around each wind turbine will be established for the laydown and assembly of the wind turbine components. The construction trailers will receive electrical power through a temporary electrical service line connected to the local distribution line.

A minimum 30 m setback from the water bodies has been implemented and measured from the tip of the turbine blade.

There are 31 water bodies located within 120 m of the Project Location for turbines. Site preparation, grading and construction activities within 120 m of water bodies may result in a variety of potential negative effects including, but not limited to, increased erosion, sedimentation and turbidity in watercourses, windblown dust, reduced stability of sensitive landforms, and/or minor changes in natural drainage patterns and flow volume. The general landscape is quite flat and therefore not highly susceptible to erosion except where small valley features are present. If the facility is decommissioned and the turbine is to be removed at the end of its life, the procedures will be similar to the construction phase.

Potential effects associated with the construction and decommissioning of the turbines (including the laydown area) are as follows:

- Reduced groundwater upwelling areas (and hence stream baseflows) from groundwater dewatering activities (if required) for excavation of foundation area, resulting in increased surface water temperatures and reduced baseflows from reduced groundwater contributions.
- Increase to streamflows in watercourses that receive temporary groundwater dewatering discharge (if required). Groundwater discharge has potential to cause streambed and/or bank erosion and downstream sedimentation if not managed properly.
- Increased erosion, sedimentation and turbidity in watercourse from clearing and grubbing on adjacent lands for construction of turbines, pads and turnaround areas.
- Increase in impervious surfaces from presence of turbine foundation and access roads, resulting in increased water temperatures, increased surface runoff and stream peak flows, and reduced infiltration, base flows and upwelling.
- Soil compaction, which may result in hardening of surfaces and increased runoff into watercourses.
- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from equipment.
- Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.
- Soil compaction, which may result in hardening of surfaces and increased runoff into watercourses.

Potential effects associated with the operation of turbines are as follows:

- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from maintenance equipment.

5.2.2 Access Roads and Culverts

On-site access roads to each turbine will be constructed to provide an access point to the properties for equipment transport during the construction phase and for maintenance activities during operation. Typically the access roads will be between 10 m and 20 m wide during the construction phase to accommodate the large cranes.

The effects associated with access roads are related primarily to the 60 m wide footprint during the construction/ decommissioning and the 11 m wide footprint during the operations phases. In addition, there will be effects associated with the construction of roads and the installation of culverts at watercourse and drainage crossings, which are needed to transport construction equipment.

Access roads can be constructed within the water body or within the 30 m setbacks as outlined in Section 39(2) of O.Reg. 359/09. In the Project Location, there are 8 water bodies that will require a watercourse crossing through installation of a culvert. There are 15 water bodies located within the 120 m buffer of an access road.

Site preparation, grading and construction activities within 120 m of water bodies may result in a variety of negative effects including, but not limited to, increased erosion, sedimentation and turbidity, mobilization of dust, reduced stability of sensitive landforms, and/or changes in natural drainage patterns and flow volume. The exact culvert details, installation details and erosion control measures will be determined in conjunction with the ABCA and UTRCA as part of their permitting process. Consequently, water bodies may be affected through changes in hydrology, temporary disruption to fish habitat and minor riparian vegetation removal.

Decommissioning of the access roads includes removing the granular base and distributing to landowners, if desired, or removing from the site and disposing of in an approved and appropriate manner. The disturbed area will have the topsoil replaced from stockpiled material and will be reseeded in consultation with the landowner. It is proposed to leave culverts in place following the operations phase.

Potential effects associated with the construction and decommissioning of access roads are as follows:

- Temporary disruption of substrates/habitat and water quality at locations where in-water work is required (i.e., culvert installation).
- Obstruction of lateral flows in watercourses from water crossings.
- Increased erosion, sedimentation and turbidity from clearing and grubbing for construction of access roads.
- Degradation and loss of fish habitat through installation of culverts.
- Reduction to streamflow can result in the alteration of aquatic conditions which may negatively affect the local and downstream habitat and biota for the period of withdrawal. The withdrawal of surface water for construction activities such as dust suppression, equipment washing and land reclamation (e.g., hydroseeding) has the potential to reduce streamflow in watercourses. The magnitude and duration of these effects depend on the amount of water being removed and the duration of the taking.
- Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.
- Increase in impervious surfaces from presence of turbine foundation and access roads, resulting in increased water temperatures, increased surface runoff and stream peak flows, and reduced infiltration, base flows and upwelling; and
- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from equipment.

Potential effects associated with the operation of access roads are as follows:

- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from equipment.
- Obstruction of lateral flows in watercourses and other waterbodies due to design of culverts and debris build-up at water crossings.

5.2.3 Collection Lines

The system that connects each turbine to the transformer substation will consist of 34.5 kV electrical collection lines that will be buried 1 m below grade on private property or within the municipal road right of way. There may be occasional locations where the collection lines are placed above ground on wood, concrete or steel poles for technical reasons. Above ground electrical junction boxes will be used to connect sections of underground collection lines.

Most of the effects associated with collection lines are related to instances where the collection lines must pass under a water body. In these instances horizontal directional drilling under watercourses and other water bodies is required to clear the feature. Entrance and exit pits area will be excavated on either side of the feature to be bored under. The directional drilling equipment will be set up at the entrance pit and a drill bit attached to rod segments is advanced until it reaches the exit pit. A slurry of bentonite and/or polymer mixed with water will be injected into the hole while drilling to help stabilize the bore hole and reduce friction.

Collection lines can be constructed under the water body or within the 30 m setbacks as outlined in Section 39(2) of O.Reg. 359/09. There are 42 locations where collection lines will be installed via horizontal directional drilling underneath water bodies. There are 14 water bodies located within the 120 m of collection lines. No direct effects to water bodies or loss of fish habitat are expected as a result of collection line construction.

Site preparation and construction activities (including excavation of entry and exit pits) within 120 m of water bodies may result in a variety of potential negative effects, as follows:

- Release of pressurized drilling fluids into watercourses from fractures in substrate (also known as 'frac-out'). Release of pressurized drilling fluids into a water body could affect both water quality and aquatic habitat. The drilling fluids could increase turbidity in the water column and once it settles to the streambed it could cover substrates, fish spawning locations, benthics and aquatic vegetation.
- Change to groundwater flow patterns, which may affect groundwater discharge to watercourses.
- Increase in erosion and sedimentation from the entry and exit drill holes required for the directional drilling activities. This will require clearing and grubbing of the land and removal of substrates from the drill hole.
- Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.
- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from equipment.

The collection lines will require periodic preventative maintenance activities during the operations phase. There are no effects associated with the collection lines during decommissioning as the collection lines will be cut, the ends buried to 1 m below grade, and the lines left in place.

5.2.4 Transmission Line

A 115 kV electrical transmission line from the step-up transformer substation to the connection point with the Provincial electricity grid is proposed to be located on private property, or within existing road right-of-ways. It is anticipated that the transmission line will be mounted on new transmission line poles. The poles are proposed to be constructed of wood, concrete or steel and will be between 18 and 30 m tall.

The interconnection plan for any wind energy centre is subject to study, design and engineering by the Independent Electricity System Operator which manages the province's electricity grid, Hydro One and the Ontario Energy Board, which regulates the industry through the Transmission System Code and the Distribution System Code.

The transmission line may need to be directionally drilled in one location to avoid affecting a Provincially Significant Wetland. Construction will follow the same process described in Section 5.2.3 for directionally drilling the collection lines.

Transmission lines can be installed within the water body or within the 30 m setbacks as outlined in Section 39(2) of O.Reg. 359/09. There are 10 water body crossings associated with the installation of the overhead transmission line and 2 water bodies located within 120 m of the transmission line.

While no direct effects to water bodies are expected as a result of overhead transmission line construction/ decommissioning as there are no in-water works proposed, site preparation, grading and construction activities within 120 m of water bodies may result in a variety of potential negative effects as follows:

- Loss of riparian habitat adjacent to watercourses for installation of transmission line poles.
- Increased erosion, sedimentation and turbidity from clearing and grubbing for construction of the transmission line.

- Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.
- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from equipment.
- Damage to stream banks from the use of heavy machinery to install hydro poles

During operation, vegetation control will be required around the transmission line to prevent any damage to the line and ensure safe operation. Any vegetation that has the potential to grow to more than 4.3 m above grade is cleared. The vegetation is typically cleared by mechanized equipment (e.g., chain saw / hydro axe).

One site requires directional drilling to install the transmission line. Potential effects associated with this activity include site preparation and construction activities (including excavation of entry and exit pits) within 120 m of water bodies may result in a variety of potential negative effects, as follows:

- Release of pressurized drilling fluids into watercourses from fractures in substrate ("frac-out"). Release of pressurized drilling fluids into a water body could affect both water quality and aquatic habitat. The drilling fluids could increase turbidity in the water column and once it settles to the streambed it could cover substrates, fish spawning locations, benthics and aquatic vegetation.
- Change to groundwater flow patterns, which may affect groundwater discharge to watercourses.
- Increase in erosion and sedimentation from the entry and exit drill holes required for the directional drilling activities. This will require clearing and grubbing of the land and removal of substrates from the drill hole.
- Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.
- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from equipment.

5.2.5 Substation / Breaker Switch Station and Laydown Area

Approximately 2 to 3 hectares (ha) in size, the transformer substation will either be located on privately held lands through a lease agreement or on land purchased by Goshen Wind, Inc. The electricity collected via the 34.5 kV underground collection lines will converge at the transformer substation where the electricity will be "stepped-up" to 115 kV for transmission and then routed to a breaker switch station. The breaker switch station will occupy less than 0.4 ha (1 acre) of land and is the connection point with the existing Hydro One 115 kV transmission line. The substation equipment will include an isolation switch, a circuit breaker, a step-up transformer, transmission switch gear, instrument transformers, grounding and metering equipment. All substation grounding equipment will meet the Ontario Electrical Safety Code. The substation will be connected to the existing electrical distribution line to supply power for the control housing lighting and equipment.

Site preparation, grading and construction activities within 120 m of significant natural features may result in a variety of potential negative effects including, but not limited to, increased erosion, sedimentation and turbidity, reduced stability of sensitive landforms, and/or changes in natural drainage patterns and flow volume. During construction of the substation, topsoil and subsoils will be stripped and stockpiled separately. Stripped topsoil and subsoil will be replaced in the temporary storage facility area and topsoil stripped from the substation area will be distributed on other Project properties. An electrical service line of approximately 9 m and associated poles will be connected to the existing distribution line adjacent to the substation for the purpose of providing house service power to the substation control building. The temporary electrical service line and pole will be removed during the decommissioning phase. Construction equipment will include small trenchers, a small crane, a backhoe, forklifts, concrete trucks and a bulldozer.

A minimum 30 m setback from water bodies has been implemented and measured from the outer limit of the Area of Disturbance. There is one water body located within 120 m of the substation and laydown area. Site preparation, grading and construction/decommissioning activities within 120 m of a water body may result in a variety of potential negative effects as follows:

- Increased erosion, sedimentation and turbidity from clearing and grubbing for construction of the substation.
- Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.
- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from equipment.

Potential effects associated with the operation of the substation and laydown areas are as follows:

- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from maintenance vehicles.

5.2.6 Operations & Maintenance Building

An operations building, approximately 30 m by 15 m in size, will be constructed on privately held lands (on or near the same parcel as the substation for the Project) for the purpose of monitoring the day-to-day operations of the wind energy centre and supporting maintenance efforts. A small parking lot will be constructed to accommodate staff vehicles. Prior to the construction phase, a Stormwater Pollution Prevention Study will be conducted to address any potential effects associated with stormwater runoff.

Potable water will be supplied by a well or through the municipal water system and a septic bed will be constructed for the disposal of sewage. The septic bed will be constructed to the minimum size required for the size of the operation and maintenance building. It is the Project owner's responsibility to ensure proper maintenance of the septic system. The operations and maintenance building, septic system and water supply will be constructed in accordance with applicable municipal and provincial standards.

5.2.7 Permanent Meteorological Towers

Permanent meteorological towers are an operational requirement of the Independent Electricity System Operator (IESO) as an electricity market participant (this includes all generators of electricity) and allow the IESO to operate the system reliably and safely.

Three permanent meteorological towers will be installed at the Project. The towers are typically up to 80 m in height. No significant soil or vegetation disturbance is anticipated. The use of meteorological data are key to the safe and efficient operation of a wind energy centre. Some operational decisions made using meteorological data include:

- Cut-in wind speed;
- Cut-out wind speed;
- Turbine shut down during potential icing conditions; and, Turbine shut down during extreme weather events.

Three permanent meteorological towers will be installed at the Goshen Wind Energy Centre. These towers are typically up to 80 m in height. No significant soil or vegetation disturbance is anticipated for the construction and operation of the towers.

A minimum 30 m setback from any water bodies has been implemented. There are three water bodies located within 120 m of the meteorological towers. The construction and decommissioning activities within 120 m of a water body may result in a variety of potential negative effects as follows:

- Increased erosion, sedimentation and turbidity in watercourse from clearing and grubbing on adjacent lands for construction.
- Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.
- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from equipment.

Potential effects associated with the operation of the meteorological towers are as follows:

- Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from maintenance vehicles.

5.3 Mitigation Measures

Mitigation techniques are proposed to offset possible effects of the construction, decommissioning and operation activities of the Goshen Wind Energy Centre. Mitigation measures recommended to minimize risk associated with potential impacts to the water bodies include the implementation of standard Best Management Practices (BMPs), as described below.

BMPs are work practices that outline acceptable practices to follow when carrying out certain activities. DFO has developed a series of operational statements (BMPs) as guidelines to avoid conditions that may harmfully alter aquatic habitat. The following are applicable to this Project:

Work Area

- Stabilize banks where necessary, minimizing the area and duration of soil exposure.
- Operate machinery on land and in a manner that minimizes disturbance to stream banks.
- Erect sediment fencing around water bodies and areas to be avoided (i.e., near unstable banks, vegetation communities).
- Locate staging areas away from watercourses to limit risk of impacts to aquatic habitat.

Equipment Use

- Ensure machinery arrives on site in a clean, washed condition and is maintained free of fluid leaks.
- Minimize vehicle traffic on exposed soils, avoid compacting or other hardening of natural ground surface, and avoid the movement of heavy machinery on areas with sensitive slopes.
- Locate site maintenance, vehicle washing and refuelling stations where contaminants are handled at least 30 m away from water bodies.
- Implement vehicle and equipment cleaning procedures and practices to minimize or eliminate the discharge of pollutants from vehicle/ equipment cleaning operations to watercourses.
- Limit speed of vehicles near watercourse crossings.

Erosion and Sediment Control

- Develop and implement an erosion and sediment control plan before commencement of construction.
- Utilize erosion blankets, erosion control fencing, straw bales, etc., where necessary to mitigate potential excessive erosion and sedimentation. Ensure any materials placed in floodline are free from silt and other such particles. Keep extra erosion and sediment control materials on site (*e.g.*, heavy duty silt fencing, strawbales).
- Keep sediment and erosion control measures in place until disturbed areas have been stabilized (i.e., re-vegetated).
- Schedule grading to avoid times of high runoff volumes where possible. Temporarily suspend work during storm events to avoid excessive flows of sediment discharges.
- Direct discharged water to an appropriately sized energy dissipating outlet device to prevent erosion at the point of discharge.

Maintenance

- Maintain and repair permanent and temporary erosion and sediment control measures as needed to ensure continued performance of their intended function for the duration of the works.
- Remove temporary erosion and sediment control measures after the final site stabilization is achieved.
- Permanently stabilize disturbed soil resulting from removal of BMPs or vegetation.

Material Stockpiling and Handling

- Store any stockpiled materials away from water bodies to prevent deleterious substances from inadvertently discharging to the environment.
- Dispose of any waste material from construction activities by authorized and approved off-site vendors.

Grading and Excavation

- Minimize changes in land contours and natural drainage to maintain timing and quantity of flows.

Construction Timing Windows

- Time construction within 30 m of watercourses to avoid periods of habitat use to the extent possible. These timing windows are applied to protect fish from any works in and around water during spawning, migration and other critical life history stages. Construction timing windows are based on site specific criteria such as type of fish species present, thermal regime and fish spawning times (spring or fall). The generic restricted in-water work timing windows established by DFO are
  - Fall Spawning Period – October 1st to May 31st
  - Spring Spawning Period – May 1st to July 15th
- Specific fisheries timing windows will be developed in co-operation with ABCA and UTRCA.

Isolated Crossing

- In-water works for permanent water bodies must occur in the dry via dry conditions and dam and pump method to maintain fish passage during in-water works. For intermittent water bodies, work is preferred to be completed in the dry and carried out during seasonally dry times or when the water body is frozen to the bottom.

- Develop and implement a fish rescue plan for dewatering areas. This will include appropriate sized end-of-pipe fish screen to prevent potential losses of fish due to entrainment or impingement as outlined in the DFO – Freshwater Intake End-of-Pipe Fish Screen Guideline.

Stream Flow

- Design and install culverts to prevent creation of barriers to fish movement and maintain bankfull channel functions.
- Design culverts to accommodate high flows of the watercourse.
- Embed the culvert below the streambed to maintain lateral flow.
- Install adequate gravel base to maintain flow of shallow groundwater.
- Locate crossings within straight sections of the stream, perpendicular to the bank. Avoid crossings on meander bends, braided streams and any other unstable areas.
- Use only clean material (i.e., rock or coarse gravel) for approaches to culverts.
- Regularly maintain culverts to ensure no debris build-up is impeding stream flow.

Water Quality

- Develop a spill response plan and train staff on associated procedures.
- Maintain emergency spill kits on site.
- Pass groundwater from dewatering activities (if required) through a sediment filtration system prior to being discharged to a watercourse.
- Control soil / water contamination through best management practices.
- Install a temporary storage basin to allow water to infiltrate, or use permanent stormwater management facilities as necessary for dewatering discharge

Water Management

- Control rate and timing of water pumping; pump from deep wells to infiltration galleries adjacent to water bodies or wetlands.
- Control rate and timing of water pumping from surface water features.
- Control quantity and quality of surface water runoff using best management practices, and implement infiltration techniques to the extent possible.
- Restrict taking groundwater and surface water during drought conditions.
- Regulate the discharge of water-taking to ensure that there is no flooding in the downstream area and no soil erosion, or stream channel scouring is caused at the point of discharge. The water taker will use a discharge diffuser or other energy dissipation device, if necessary, to mitigate flows which physically alter the stream channel or banks.
- Install siltation control measures that are sufficient for the volumes pumped at both the taking location upstream of the construction site and (if necessary) the discharge site. All measures will be taken to properly maintain these control devices throughout the construction period.

Directional Drilling

- Conduct all drilling by licensed drillers in accordance with Regulation 903 under *Ontario Water Resources Act*, R.S.O. 1990.
- Locate drill entry and exit pits at least 30 m from water bodies.
- Collect drill cuttings as they are generated, and place in a soil bin or bag for off-site disposal.

- Ensure drill depth is at an appropriate depth below the water body to reduce the risk of a 'frac-out'.
- Monitor water bodies for signs of surface disturbance.
- Develop a 'frac-out' contingency plan prior to the start of construction outlining protocols to monitor, contain and clean up a 'frac-out'.

Rehabilitation

- Re-vegetate and restore the turbine staging area following turbine installation with tiling (if desired by the owner).
- Restore and maintain vegetative buffers around water bodies including within the foundation footprint where possible.
- Restore & maintain vegetative buffers around water bodies including within the temporary construction areas.
- Keep vegetation removal to a minimum.
- Add suitable stream substrates (e.g., gravel or rip rap) to stabilize sediment and provide cover.

Specific contingency plans will be developed for spill emergencies and in the unlikely event of a 'frac-out' release. This will include sediment and erosion controls to reduce impacts on water quality and aquatic habitat.

5.4 Description of Residual Effects

Residual effects, which are those effects that remain following the application of mitigation measures, are summarized using the descriptors outlined in Table 5-1. The residual effects were assessed based on professional judgment and related project experience.

Table 5-1: Residual Effects Criteria

Variable	Definition
Spatial Extent	The direct footprint of the development as well as the areas indirectly affected.
Frequency	The likelihood that the negative effects will occur on more than one occasion
Duration	The expected length of construction and the amount of time a residual effect will persist.
Magnitude	The degree and extent of change from the baseline condition. This usually varies according to the project phase.

The assessment of environmental effects characterizes and evaluates the nature of any anticipated negative effects within the Area of Investigation. The evaluation of the negative effects includes the spatial extent, magnitude, frequency and duration of the likely adverse effects.

The potential negative effects are presented in Tables 5.2 to 5.6 and are arranged in relation to the sensitivity of the water body determined in the site investigations table (Section 4.4) and degree of impact from proposed project component.

5.4.1 Effects Associated with Turbines (including turbine staging area)

Table 5-2 describes the water body location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with the construction and decommissioning, and operation of turbines as they relate to water bodies and the 30 m area surrounding the water body.

Effects during the construction phase are primarily related to uncontrolled sediment release or hardening of the soils. No laydown areas are within 30 m of water bodies, and with adherence to timing windows to protect critical fish spawning habitat periods, and effective sediment and erosion control measures, no residual effects are anticipated to the water body in the medium (months) or long term (years).

There are no anticipated residual effects on water bodies from the operation of turbines provided that BMPs are adhered to with regard to equipment storage and handling.

5.4.2 Effects Associated with Access Roads

Table 5-3 describes the water body location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with access roads as they relate to water bodies and the 30 m area surrounding the water body.

There are limited residual effects associated with construction of access roads. Potential effects of lateral flows will be mitigated by properly designing and installing an appropriate sized culvert, embedded in the stream bed. Installation of a road crossing will result in a temporary disturbance of fish habitat such as substrates, instream cover and riparian habitat from the construction works. These potential effects can be reduced by conducting works within the specified fisheries timing windows, completing the crossing works appropriately and in a timely manner and rehabilitating stream banks following construction.

Degradation of fish habitat may occur as a result of a permanent culvert feature that may reduce the aquatic habitat quality. However, if fish passage is maintained through the culvert then the water body will continue to provide suitable habitat and in some cases may improve local connectivity and habitat availability to the fish.

Routine and unplanned turbine maintenance will be required which will include the use of maintenance vehicles using the watercourse crossing. There is a risk for sediment laden water to enter the watercourse from vehicles using the culvert. There is a risk of spills during maintenance, however, all appropriate mitigation measures will be adhered to. There may be some reduction in the available fish habitat due to the presence of culverts, however, design principles will ensure maintenance of fish passage by consideration of low flow channels. The habitat will still provide the same function to the resident fish populations and there may be opportunities for compensation of fish habitat, such as native riparian plantings upstream or downstream of the culvert or the addition of natural stone substrate.

5.4.3 Effects Associated with Collection Lines

Table 5-4 describes the water body location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with collection lines as they relate to water bodies and the 30 m area surrounding the water body.

Effects from construction can be mitigated through adherence to best management practices. There are anticipated to be minimal residual effects associated with the changes in groundwater flow patterns and water levels that should be monitored before, during and after construction. There are anticipated moderate residual effects associated with the potential release of pressurized drilling fluids (‘frac-out’) during the horizontal directional drilling for the collection lines. A contingency plan will be developed for water bodies where installation of a collection line results in significant changes in baseflow, as described in the Environmental Monitoring Plan in Table 5-8.

Table 5-2: Effects Associated with Turbines (including turbine staging area)

Activity	Project Component	Water Body Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect
Construction and Decommissioning	**Turbine**	• **Moderate Sensitivity** –C5, C7, C15, C43, C46, C52, C67, C74, C80, C89, C124, D44, D57 • **Low Sensitivity**–C14, C36, C37, C48, C56, C62, C68, C73, C75, C76, C78, C86, C110, D07, D09, D51, D52, D55	• Reduced groundwater upwelling areas (and hence stream baseflows) from groundwater dewatering activities (if required) for excavation of foundation area, resulting in increased surface water temperatures and reduced baseflows from reduced groundwater contributions.	• Water management • Timing windows • Water quality	• Spatial Extent – isolated to area of disturbance (localized extent) • Frequency – During dewatering activities (if required) • Duration – short term (days) • Magnitude – small scale dewatering (if required) and no long-term change to the baseline flow	**No residual effects**
			• Increase to streamflows in watercourses that receive temporary groundwater dewatering discharge (if required). Groundwater discharge has potential to cause streambed and/or bank erosion and downstream sedimentation if not managed properly.	• Erosion and sediment control • Water management • Timing windows	• Spatial Extent – isolated to area of disturbance (localized extent) • Frequency – during dewatering activities (if required) • Duration – short term (days) • Magnitude – small scale dewatering (if required) and no long-term change to the baseline flow	**No residual effects**
			• Increased erosion, sedimentation and turbidity in watercourse from clearing and grubbing for on adjacent lands for construction of turbines, pads and turnaround areas.	• Erosion and sediment control • Grading and Excavation • Equipment use	• Spatial Extent – isolated to area of disturbance • Frequency – ongoing through construction period • Duration – short term (weeks) • Magnitude – with effective sediment and erosion control, no change expected from the baseline condition.	**No residual effects**
			• Soil compaction, which may result in hardening of surfaces and increased runoff into watercourses.	• Erosion and sediment control • Grading and Excavation • Water Quality	• Spatial Extent – isolated to area of disturbance • Frequency – ongoing through construction period • Duration – short term (weeks) • Magnitude – with effective sediment and erosion control, no change expected from the baseline condition.	**No residual effects**
			• Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.	• Water Quality • Erosion and sediment control • Timing windows	• Spatial Extent – localized area if mitigation is provided • Frequency – ongoing through construction period • Duration – short term (days to weeks) • Magnitude – with effective sediment and erosion control, no change expected from the baseline condition.	**No residual effects**
			• Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from construction equipment.	• Equipment Use • Material Stockpiling and Handling • Water Quality	• Spatial Extent – localized effect • Frequency – construction and decommissioning period • Duration – short term (hours) • Magnitude – no change expected to baseline conditions	**No residual effects**
			• Increase in impervious surfaces from presence of turbine foundation and access roads, resulting in increased water temperatures, increased surface runoff and stream peak flows, and reduced infiltration, base flows and upwelling	• Water Management	• Spatial Extent – localized effect • Frequency – during operation of turbine • Duration – during operation of turbine • Magnitude – no change expected to baseline conditions	**No residual effects**
Operations	**Turbine**	• **Moderate Sensitivity** –C5, C7, C15, C43, C46, C52, C67, C74, C80, C89, C124, D44, D57 • **Low Sensitivity**–C14, C36, C37, C48, C56, C62, C68, C73, C75, C76, C78, C86, C110, D07, D09, D51, D52, D55	• Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from maintenance vehicles.	• Equipment Use • Material Stockpiling and Handling • Water Quality	• Spatial Extent – localized effect • Frequency – ongoing throughout operation period • Duration – short term (hours) • Magnitude – no change expected to baseline conditions	**No residual effects**

Table 5-3: Effects Associated with Access Roads

Activity	Project Component	Water body Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect
Construction and Decommissioning	**Road Crossing**	• **Moderate Sensitivity** – C6, C52, C74, C208, D12 • **Low Sensitivity** – C73, C75, C76	• Obstruction of lateral flows in watercourses from water crossings.	• Stream Flow • Isolated crossing	• Spatial Extent – limited to localized crossing of watercourse. • Frequency – one-time installation • Duration – short term (days) • Magnitude – temporary reduction in habitat suitability	**Low residual effects**
			• Temporary disruption of substrates/habitat at locations where in-water work is required (culvert installations).	• Timing windows • Isolated Crossing • Erosion and sediment control • Rehabilitation	• Spatial Extent – limited to localized crossing of watercourse. • Frequency – one-time installation • Duration – short term (days) • Magnitude – temporary reduction in habitat suitability	**Low residual effects**
			• Degradation and loss of fish habitat through installation of culverts.	• Stream flow • Isolated crossing • Erosion and sediment control • Rehabilitation	• Spatial Extent – localized at area of culvert • Frequency – once • Duration – long term (years) • Magnitude – permanent culvert may reduce the aquatic habitat quality but overall insignificant relative to the marginal habitat and common species. Fish passage will be maintained and will continue to provide habitat.	**Low residual effects**
	Access Road and Associated Buffer	**<u>Road Crossing</u>** • **Moderate Sensitivity** – C6, C52, C74, C208, D12 • **Low Sensitivity** – C73, C75, C76 **<u>Buffer</u>** • **Moderate Sensitivity** – C15, C46, C66, C80, C89, C124 • **Low** – C37, C45, C48, C63, C68, C78, C14, D15, P19	• Increased erosion, sedimentation and turbidity from clearing and grubbing for construction of access roads.	• Erosion and sediment control • Grading and Excavation • Equipment Use	• Spatial Extent – isolated to area of disturbance • Frequency – one-time installation • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	**No residual effects**
			• Soil/water contamination by oils, grease and other materials from construction equipment.	• Equipment Use • Material Stockpiling and Handling • Water Quality • Timing windows	• Spatial Extent – isolated to area of disturbance although some potential for downstream effects • Frequency – one-time installation • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	**No residual effects**
			• Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.	• Water Quality • Erosion and sediment control • Time Crossings	• Spatial Extent – isolated to area of disturbance • Frequency – N/A • Duration – short term • Magnitude – N/A	**No residual effects**
			• Reduction of streamflow due to the withdrawal of surface water for construction activities such as dust suppression, equipment washing and land reclamation (e.g., hydroseeding)	• Erosion and sediment control • Water Management	• Spatial Extent – isolated to area of disturbance • Frequency – N/A • Duration – short term • Magnitude – N/A	**No residual effects**
			• Increase in impervious surfaces from presence of turbine foundation and access roads, resulting in increased water temperatures, increased surface runoff and stream peak flows, and reduced infiltration, base flows and upwelling.	• Water Management	• Spatial Extent – localized effect • Frequency – during operation of turbine • Duration – during operation of turbine • Magnitude – no change expected to baseline conditions	**No residual effects**
Operations	**Road Crossing**	• **Moderate Sensitivity** – C6, C52, C74, C208, D12 • **Low Sensitivity** – C73, C75, C76	• Soil/water contamination by oils, grease and other materials from maintenance activities.	• Equipment Use • Material Stockpiling and Handling • Water Quality	• Spatial Extent – isolated to area of disturbance • Frequency – ongoing • Duration – short term (hours) • Magnitude – no change expected to baseline conditions	**Low residual effects**
			• Obstruction of lateral flows in watercourses and other water bodies due to design of culverts and debris build-up at water crossings.	• Stream Flow	• Spatial Extent – isolated to area of disturbance • Frequency – ongoing • Duration – short term (hours) • Magnitude – N/A	**Low residual effects**

Table 5-4: Effects Associated with Collection Lines

Activity	Project Component	Water body Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.3 for further details)	Residual Effect Evaluation	Residual Effect
Construction	**Collection Line Crossing**	• **Moderate Sensitivity** – C6, C33, C42, C43, C52, C61, C64, C67, C74, C81, C82, C83, C124, C137, C139, C208, D11, D12, D17, D18, D19, D20, D43 • **Low Sensitivity** – C11, C14, C36, C44, C48, C62, C73, C75, C76, C144, C209, D04, D13, D14, D16, D45, D46, D47, D55	• Release of pressurized drilling fluids into watercourse due to fractures in the substrate resulting in a 'frac-out'	• Directional Drilling • Water Quality	• Spatial Extent – potential to impact channel reach or entire watercourse • Frequency – one-time installation • Duration – short term (days to weeks) • Magnitude – potential for change to baseline conditions	**Moderate residual effects**
			• Change to groundwater flow patterns which may affect groundwater discharge to watercourses.	• Water management	• Spatial Extent – Localized - isolated to area of disturbance • Frequency – during construction period • Duration – short term (days) • Magnitude – no change to baseline conditions	**No residual effects**
	Collection Line Crossing and Associated Buffer	**<u>Collection Line Crossing</u>** • **Moderate Sensitivity** – C6, C33, C42, C43, C52, C61, C64, C67, C74, C81, C82, C83, C124, C137, C139, C208, D11, D12, D17, D18, D19, D20, D43 • **Low Sensitivity** – C11, C14, C36, C44, C48, C62, C73, C75, C76, C144, C209, D04, D13, D14, D16, D45, D46, D47, D55 **<u>Collection Line Buffer</u>** • **Moderate Sensitivity** – C15, C46, C66, C89, C96, D44 • **Low Sensitivity** – C37, C45, C78, D01, D05, D53, P8	• Increase in erosion and sedimentation from the entry and exit drill holes required for the directional drilling activities. This will require clearing and grubbing of the land and removal of substrates from the drill hole.	• Erosion and sediment control • Water management	• Spatial Extent – Localized - isolated to area of disturbance • Frequency – during construction period • Duration – short term (days) • Magnitude – no change to baseline conditions	**No residual effects**
			• Soil / water contamination by oils, gasoline, grease and other materials from accidental spills and release of contaminants from equipment.	• Equipment Use • Water Quality	• Spatial Extent – isolated to area of disturbance • Frequency – during construction period • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	**No residual effects**
			• Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.	• Water Quality • Erosion and sediment control	• Spatial Extent – localized area if mitigation is provided • Frequency – during construction period • Duration – short term (days) • Magnitude – no change to baseline conditions	**No residual effects**
Operation / Decommissioning	**N/A**	• **N/A**	• **N/A**	• **N/A**	• **N/A**	**N/A**

5.4.4 Effects Associated with the Transmission Line

Table 5-5 describes the water body location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with the transmission line as they relate to water bodies and the 30 m area surrounding the water body.

There are limited residual effects associated with the construction of the transmission line. These residual effects would be a result of loss of riparian vegetation. Riparian vegetation occurs adjacent to the watercourse and directly contributes to fish habitat by providing shade, cover, and spawning and food production areas. Potential effects associated with the minor and temporary loss of riparian vegetation include erosion and sedimentation resulting from bank disturbance and loss of plant root systems. These potential effects can be reduced by stabilizing the work area, keeping heavy machinery away from stream banks and creating and implementing a restoration plan.

5.4.5 Effects Associated with Substation / Breaker Switch Station and Laydown areas

Table 5-6 describes the water body location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with the substation / breaker switch station and laydown area as they relate to water bodies and the 30 m land surrounding the water body.

There are no effects associated with the substation, as there are no water bodies nearby. There are limited residual effects associated with the construction and decommissioning of the breaker switch station and laydown area. These residual effects result from clearing and grubbing of the land for construction. Potential effects associated with the clearing and grubbing include streambed and bank erosion and downstream sedimentation. These potential effects can be reduced by stabilizing the work area, implementing erosion and sediment control measures and reducing any changes to land contours.

5.4.6 Effects Associated with Meteorological Towers

Table 5-7 describes the water body location and sensitivity, potential effects, mitigation measures, residual effect evaluation and residual effects associated with the permanent meteorological towers as they relate to water bodies and the 30 m land surrounding the water body.

There are limited residual effects associated with the construction, operation and decommissioning of the meteorological towers, which result from clearing and grubbing of the land. Potential effects associated with the clearing and grubbing include streambed and bank erosion and downstream sedimentation. These potential effects can be reduced by stabilizing the work area, erosion and sediment control measures and reducing any changes to land contours.

Table 5-5: Effects Associated with Overhead and Directionally Drilled Transmission Line

Activity	Project Component	Water body Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.4 for further details)	Residual Effect Evaluation	Residual Effect
Construction and Decommissioning	**Overhead Transmission Line**	• **Moderate Sensitivity** – D23, D27, D31, D32, D35, D37, D38, D39, D40 • **Low** – D26, P11	• Loss of riparian habitat adjacent to watercourses for installation of transmission line poles.	• Rehabilitation • Erosion and Sediment Control	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – one-time installation • Duration – medium term (months to one-year) • Magnitude – temporary minor reduction in riparian cover. Appropriate compensation measures to be discussed with ABCA.	**Low residual effects**
			• Damage to stream banks from the use of heavy machinery.	• Work Area • Erosion and sediment control • Rehabilitation	• Spatial Extent – Localized, isolated to area of disturbance • Frequency - one-time installation • Duration – short term (weeks) • Magnitude – no major change to baseline conditions	**No residual effects**
			• Increased erosion, sedimentation and turbidity from clearing and grubbing for pole installation.	• Erosion and sediment control	• Spatial Extent – Localized, isolated to area of disturbance • Frequency - one-time installation • Duration – short term (weeks) • Magnitude – no change to baseline conditions	**No residual effects**
			• Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.	• Water Quality • Erosion and sediment control	• Spatial Extent – Localized, isolated to area of disturbance • Frequency - one-time installation • Duration – short term (weeks) • Magnitude – no change to baseline conditions	**No residual effects**
Operations	**Overhead Transmission Line**	• **Moderate Sensitivity** – D23, D27, D31, D32, D35, D37, D38, D39, D40 • **Low** – D26, P11	• Soil/water contamination by oils, grease and other materials from maintenance activities.	• Equipment Use • Material Stockpiling and Handling • Water Quality	• Spatial Extent – Localized, isolated to area of disturbance • Frequency - ongoing • Duration – long term (years) • Magnitude – no change to baseline conditions	**No residual effects**
Construction and Decommissioning	**Directionally Drilled Transmission Line**	• **High Sensitivity** – D36	• Release of pressurized drilling fluids into watercourse due to fractures in the substrate resulting in a 'frac-out'	• Directional Drilling • Water Quality	• Spatial Extent – potential to impact channel reach or entire watercourse • Frequency – one-time installation • Duration – short term (days) • Magnitude – potential for minor change to baseline conditions	**Low residual effects**
			• Change to groundwater flow patterns which may affect groundwater discharge to watercourses.	• Water management	• Spatial Extent – Localized - isolated to area of disturbance • Frequency – during construction period • Duration – short term (days) • Magnitude – no change to baseline conditions	**No residual effects**
			• Increase in erosion, and sedimentation from directional drilling activities.	• Erosion and sediment control • Water management	• Spatial Extent – Localized - isolated to area of disturbance • Frequency – during construction period • Duration – short term (days) • Magnitude – no change to baseline conditions	**No residual effects**
			• Soil / water contamination by oils, gasoline, grease and other materials from construction equipment for construction and directional drilling.	• Equipment Use • Water Quality	• Spatial Extent – isolated to area of disturbance • Frequency – during construction period • Duration – short term (days to weeks) • Magnitude – no change to baseline conditions	**No residual effects**
			• Release / discharge of sediment laden runoff from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.	• Water Quality • Erosion and sediment control	• Spatial Extent – localized area if mitigation is provided • Frequency – during construction period • Duration – short term (days) • Magnitude – no change to baseline conditions	**No residual effects**
Operations	**Directionally Drilled Transmission Line**	• **High Sensitivity** – D36	• **N/A**	• **N/A**	• **N/A**	**N/A**

Table 5-6: Effects Associated with Substation / Breaker Switch Station and Laydown Areas

Activity	Project Component	Water body Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.4 for further details)	Residual Effect Evaluation	Residual Effect
Construction and Decommissioning	**Breaker Switch Station and Laydown Areas**	• **Moderate Sensitivity** – D32	• Increased erosion, sedimentation and turbidity from clearing and grubbing for construction of breaker switch station and laydown area.	• Erosion and sediment control • Grading and Excavation	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – one time period construction • Duration – short term (4 months) • Magnitude – minor changes to baseline conditions due to removal of vegetation.	**Low residual effects**
			• Soil / water contamination by oils, gasoline, grease and other materials from accidental spills and release of contaminants from construction equipment.	• Equipment Use • Water Quality	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – one time period construction • Duration – short term (4 months) • Magnitude – no changes to baseline conditions	**No residual effects**
			• Release or discharge of sediment laden surface water from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.	• Water Quality • Erosion and sediment control	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – one time period construction • Duration – short term (4 months) • Magnitude – no changes to baseline conditions	**No residual effects**
Operations	**Breaker Switch Station and Laydown Areas**	• **Moderate Sensitivity** – D32	• Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from maintenance activities.	• Equipment Use • Material Stockpiling and Handling • Water Quality	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – ongoing • Duration – long term • Magnitude – no changes to baseline conditions	**No residual effects**

Table 5-7: Effects Associated with Meteorological Towers

Activity	Project Component	Water body Location and Sensitivity	Potential Effects	Mitigation Measures (see Section 5.4 for further details)	Residual Effect Evaluation	Residual Effect
Construction and Decommissioning	**Meteorological Tower**	• **Moderate Sensitivity** – C74, D17 • **Low Sensitivity** – D48	• Increased erosion, sedimentation and turbidity from clearing and grubbing for construction of meteorological towers.	• Erosion and sediment control • Grading and Excavation	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – one time period construction • Duration – short term (4 months) • Magnitude – minor changes to baseline conditions due to removal of vegetation.	**Low residual effects**
			• Soil / water contamination by oils, gasoline, grease and other materials from accidental spills and release of contaminants from construction equipment.	• Equipment Use • Water Quality	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – one time period construction • Duration – short term (4 months) • Magnitude – no changes to baseline conditions	**No residual effects**
			• Release or discharge of sediment laden surface water from the construction area, which has the potential to transport nutrients and contaminants into the watercourse.	• Water Quality • Erosion and sediment control	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – one time period construction • Duration – short term (4 months) • Magnitude – no changes to baseline conditions	**No residual effects**
Operations	**Meteorological Tower**	• **Moderate Sensitivity** – C74, D17 • **Low Sensitivity –** D48	• Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from maintenance activities.	• Equipment Use • Material Stockpiling and Handling • Water Quality	• Spatial Extent – Localized, isolated to area of disturbance • Frequency – ongoing • Duration – long term • Magnitude – no changes to baseline conditions	**No residual effects**

5.5 Summary of Environmental Effects

With adherence to the outlined mitigation measures, there are no significant residual effects to water bodies anticipated from the construction, decommissioning and operation phases of the turbines, collection lines, meteorological towers, transmission line and substation.

There is potential for minor disruption to fish habitat, water quality and obstruction of lateral flows during construction of road crossings. Disruption of fish habitat has the potential to impair spawning, feeding or routine activities of the resident fish community. There is also potential for fish to display avoidance behaviour of the actively disturbed area, which can result in the temporary displacement of fish. Fish passage within the channel may also become temporarily (*i.e*., days) restricted as a result of construction activities, disrupting migration patterns. Adherence to timing windows will ensure that spawning behaviours are not affected and therefore no impacts to the long-term and at a population level. There is also potential for effects to water quality and aquatic habitat in the event of a 'frac-out' during the horizontal direction drilling for collection lines and the transmission line. This has the potential to increase turbidity in the water column and settle to the streambed covering fish habitat, benthic invertebrates and aquatic vegetation. Implementation of recommended mitigation measures and review of local soils will ensure that all appropriate mitigation measures are put in place, and there are expected to be no effects from the horizontal directional drilling.

Effective sediment and erosion control measures and BMPs related to construction and equipment usage are particularly important for all project components. Adherence to these mitigation measures however, will ensure no impact to water quality or downstream reaches and therefore no residual effects.

Features given a 'Not Sensitive' ranking are not considered water bodies as outlined in Section 1.1. These features were identified as dugout, off-line or agricultural ponds, swales or low lying areas within agricultural fields. Basic mitigation measures will be implemented to prevent any transport of sediments, as some of these features may act as surface water conveyance to downstream water bodies during the spring freshet and high rain events.

5.6 Description of Cumulative Effects

Cumulative effects are described as 'residual effects on the environment (*i.e*., that occur after mitigation measures have been put in place) combined with the environmental effects of past, present and future projects or activities. Cumulative effects can also result from the combination of different individual environmental effects of the project acting on the same environmental component' (CEAA, 2010).

Within the Goshen Project Study Area there are seven watercourses that have several project components located within close proximity to them. These water bodies are as follows:

- Water bodies C14 and C15 are part of the same watercourse (Datar Millers Drain Branch F). This watercourse is classified as moderate sensitivity given its permanent status, warmwater baitfish community and general moderate quality aquatic habitat. This watercourse will be crossed with a collection line on the west side of Bronson line, then run parallel along the watercourse for approximately 2 km. In addition, this water course is located within 120 m of two turbines (9 and 13). Effects from the construction and decommissioning of the turbines are minimal for this water body given the mitigation places that will be put in place during construction and decommissioning. It is further recommended that additional sediment and erosion control measures be employed at these sites and that machinery access the turbine areas at the point farthest from the watercourse, where feasible. No effects to the watercourse are anticipated during the operation of the turbines. The majority of potential effects to this water body are expected to be from the collection line crossing and construction (based on the distance the collection line runs parallel to the watercourse). Adherence to the above-outlined mitigation measures will ensure low to no residual effects

and additional sediment and erosion control measures will be put in place where necessary. Cumulative effects are not anticipated for this watercourse based on the type of proposed works, the sensitivity of the watercourse, adherence to mitigation measures, and appropriate timing and phasing of construction activities to ensure that construction does not occur during the same period.

- Water bodies C33, C139, C144, D20 and D26 are located within the same watercourse (Mud Creek Drain). This water course is classified as low to moderate sensitivity due to its permanent status, warmwater baitfish community and low to moderate habitat quality. There are a total of 5 collection line crossings spanning a 7 km distance over the Mud Creek Drain. The duration of works is short term and isolated to each individual collection line crossing. Given the moderate residual effects anticipated from the collection lines, minimal cumulative effects are expected if all appropriate mitigation measures are implemented.

- Water bodies C89, D04 and P8 are located within the same watercourse (Dietrich Main Drain). Both C89 and D04 are along the main channel and P8 is a pond where Dietrich Drain is dammed at South Road. Both C89 and D04 are classified as moderate sensitivity based on its permanent warm water system and moderate aquatic habitat. P8 likely acts as a fish barrier between D04 and C89. D04 is crossed by a collection line at South Road while, C89 is located in close proximity to turbine 42 and also runs parallel to the access road. Given the close proximity of C89 to the turbine there is an increased risk of potential negative effects including sediment runoff, increased spills from heavy equipment and from the construction around the water body. Adherence to the above outlined mitigation measures will decrease any potential effects, and no cumulative effects are expected.

- Water bodies C45, C46, C52 and D19 are located within the same watercourse (Khiva Main Drain). All the water bodies are classified as moderate sensitivity based on their permanent warm water system, and diversity of aquatic habitat. Both C52 and D19 are crossed by two collection lines each and C52 is also crossed by a road. C45 and C46 are located in close proximity to an access road and collection line. C52 is located within the 120 m buffer of turbine 86. It is expected that construction of each project component will be staged and occur at different times. There are no anticipated effects from the construction of the turbine to C52. Given the close proximity of the road to C45 and C46 there is the potential for sediment runoff and, increased spills from heavy equipment especially given the duration of works around the water body. An appropriate setback from the watercourse should be adhered to and mitigation measures outlined above should be implemented. Due to the close proximity of the water body to the road and the number of water body crossings on Khiva Main Drain, there is a higher risk of spills from the road; however, regular construction monitoring and implementation of Best Management Practices will help reduce any effects to the watercourse.

- Water bodies C44 and C43 are located within the same watercourse (Ratz Drain). C44 is classified as low as it is a channelized warm water feature and moderate quality aquatic habitat. C43 is classified as moderate as it is a permanent warm water system with moderate aquatic habitat and presence of groundwater indicators. C44 is crossed by a collection line along Blackbush Line. C43 is located within 120 m of the Area of Disturbance of two turbines and is crossed by two collection lines. It is expected that construction of each project component be staged and occur at different times. It is anticipated that due to the close proximity of the turbines to the water bodies there is the potential for sediment runoff and increased spills from heavy equipment during the construction period only. Minimal effects are expected from the collection line crossings as these span the width of any watercourses and do not require any in-water works. Adherence to the above mentioned mitigation measures will decrease any potential negative effects, however due to the close proximity to the two turbines and two collection line crossings, there is a higher risk of construction related spills during the construction period, but additional mitigation measures will be put in place at these sites. No cumulative impacts of the turbines and collection lines are expected during the operational and decommissioning phases.

- Water bodies C124 and D17 are located within the same watercourse (Adams Drain). Both C124 and D17 are classified as moderate as it is a permanent warm water system with moderate aquatic habitat and presence of groundwater indicators. D17 and C124 are crossed by collection lines and C124 is also located within 120 m of the Area of Disturbance of Turbine 22 and runs parallel to an access road and buried collection line for approximately 500 m. It is expected that construction of each project component will occur at varying times. It is anticipated that due to the close proximity of the turbine to the water body that there is the potential for sediment runoff and increased spills from heavy equipment during construction only. Minimal impacts are expected from the collection line crossings. Mitigation measures outlined above should be implemented and will decrease any potential negative effects, therefore no cumulative effects are likely to occur.

- Water bodies C66, C67, C81 and C82 are located within the same watercourse (Turner Drain). All four water bodies are classified as moderate as it is a permanent warm water system with moderate aquatic habitat. C67, C81 and C82 are crossed by a collection lines, C66 is located within close proximity to an access road and collection line and C67 is located within the 120 m Area of Disturbance of Turbine 57. It is expected that construction of each project component be staged and occur at different times. It is anticipated that due to the close proximity of the turbine to the water body that there is the potential for sediment runoff and increased spills from heavy equipment during construction only. Minimal impacts are expected from the collection line crossings. Mitigation measures outlined above should be implemented and will decrease any potential negative effects, therefore no cumulative effects are likely to occur.

5.7 Environmental Effects Monitoring Plan

An adaptive management approach to water body protection will be implemented in conjunction with the conditions of the REA approval. This requires regular site inspections and monitoring by a designated on-site Environmental Monitor(s) (EM). Understanding the condition of the natural ecosystem throughout all phases of the project will form the basis upon which to consider altering construction methods, environmental protection measures, and monitoring programs. Ultimately, any determination related to the application of mitigation and contingency measures not addressed through conditions of the REA approval will be informed by ongoing analyses of monitoring data, and rely on the experience and judgment of the on-site EM in consultation with regulatory agencies MOE, MNR, ABCA, UTRCA, and DFO as applicable.

Active construction monitoring will be required at all locations where water bodies are present. Pre-construction monitoring is recommended to ensure all BMP's are properly installed and located appropriately. Post-construction monitoring will also be required to ensure that proper restoration, stabilization, and overall quality of runoff is returned to pre-construction conditions as well as to satisfy regulatory permitting and/or authorizations. The following are the general proposed monitoring activities related to construction in or near surface water features:

- On-site conditions such as erosion and sediment control (ESC), spills, flooding etc.;
- Monitor weather conditions;
- Ensure all timing windows are adhered to;
- Water quality; and
- Fish habitat.

Monitoring activities specific to construction related groundwater dewatering include the following:

- Water quality (groundwater and surface water);
- Stream baseflow;
- Receiving stream temperature; and
- Stream erosion and sedimentation.

The potential effects associated with water takings during Construction and Decommissioning phases of the Project are described in Section 5.2. In order to monitor these effects, discharge water will be sampled each day that water is discharged and analyzed for total suspended solids (TSS). In the event that sampling results show that TSS in the discharge water exceeds 25 mg/L, the construction contractor will implement appropriate contingency measures, such as utilizing a settling tank, geosock or similar device, to mitigate these impacts.

5.7.1 Mitigation Measures, Residual Effects and Monitoring Plan

Table 5-8 provides mitigation measures, residual effects and the monitoring plan for each potential effect identified above.

Table 5-8: Mitigation Measures, Residual Effects and Monitoring Plan

Potential Effect	Performance Objectives	Mitigation Strategy	Residual Effects	Monitoring Plan and Contingency Measures
Reduced groundwater upwelling areas (and hence streamflows) from groundwater dewatering activities (if required) for excavation of foundation area, resulting in increased surface water temperatures and reduced baseflows from reduced groundwater contributions.	• Minimize reduction of stream baseflows and groundwater upwelling areas, and increase in water temperatures.	**Water Management** • Control rate and timing of water pumping; pump from deep wells to infiltration galleries adjacent to water bodies or wetlands. • Control quantity and quality of stormwater discharge using best management practices, and implement infiltration techniques to the extent possible. • Restrict taking groundwater and surface water during drought conditions. • The water taker will regulate the discharge at such a rate that there is no flooding in the downstream area and no soil erosion, or stream channel scouring is caused at the point of discharge. The water taker will use a discharge diffuser or other energy dissipation device, if necessary, to mitigate flows which physically alter the stream channel or banks. • Siltation control measures will be installed at both the taking location upstream of the construction site and (if necessary) the discharge site and will be sufficient for the volumes pumped. All measures will be taken to properly maintain these control devices throughout the construction period. **Timing Windows** • Time construction to avoid periods of habitat use to the extent possible, these timing windows are applied to protect fish from any works in and around water during spawning, migration and other critical life history stages. Construction timing windows are based on site specific criteria such as type of fish species present, thermal regime and fish spawning times (spring or fall). The generic restricted in-water work timing windows established by DFO are ▪ Fall Spawning Period – October 1st to May 31st ▪ Spring Spawning Period – May 1st to July 15th **Water Quality** • Develop a spill response plan and train staff on associated procedures. • Maintain emergency spill kits on site. • Pass groundwater from dewatering activities (if required) through a sediment filtration system prior to being discharged to a watercourse. • Control soil / water contamination through best management practices.	• Reduced stream baseflows, groundwater upwelling areas and increase in water temperatures minimized through application of mitigation measures. • Low likelihood and limited magnitude of effects as there will only be small scale dewatering (if required).	• Where known groundwater dewatering is required, install staff gauges to monitor stream levels • Monitor water level at these locations to monitor watercourse depth and estimated flow before, during and after dewatering activities. **Contingency Measures:** • Control rate and timing of water pumping. • In the event of a decrease in stream water levels, of which it can be attributed to the dewatering activities, stop all dewatering until appropriate site specific mitigation plan has been developed.
Increase to streamflows in watercourses that receive temporary groundwater dewatering discharge (if required). Groundwater discharge has potential to cause streambed and/or bank erosion and downstream sedimentation if not managed properly.	• Minimize increase in flows to watercourses and erosion and/or sedimentation.	**Erosion and Sediment Control** • Develop and implement an erosion and sediment control plan before commencement of construction. • Install erosion blankets, erosion control fencing, straw bales, etc., where necessary to mitigate potential excessive erosion and sedimentation. • Ensure any materials placed in floodline are free from silt and other such particles. • Maintain extra erosion and sediment control materials on site (e.g., heavy duty silt fencing, strawbales). • Maintain sediment and erosion control measures in place until disturbed areas have been stabilized (i.e., re-vegetated). • Schedule grading within 30 m of watercourses to avoid times of high runoff volumes. • Temporarily suspending work if excessive flows of sediment discharges occur until mitigation measures are in place. • Direct discharged water to an appropriately sized energy dissipating outlet device to prevent erosion at the point of discharge. **Water Management – See above** **Timing Windows – See above**	• Increased flows to watercourses and associated streambed and/or bank erosion minimized through application of mitigation measures. • Low likelihood and limited magnitude of effects as there will only be small scale dewatering (if required).	• Monitor erosion and sedimentation of receiving watercourse before and during dewatering events • Monitor water level and stream flow at these locations to test watercourse depth and flow speed before and during construction. • Collect surface water samples from discharge locations before and after construction. Analyze for general chemistry (e.g., temperature, pH, dissolved oxygen, and conductivity), suspended solids, turbidity, nutrients and total metals (e.g., copper, iron, zinc and aluminum). These data will be used to determine background watercourse water quality at discharge locations. In conjunction with the streamflow measurements, these data will allow for site-specific loading calculations to determine watercourse assimilation capacity. • The findings of the monitoring program will be reported back to MOE following the completion of dewatering activities. **Contingency Measures:** • Install a temporary storage basin adjacent to foundation area to allow water to infiltrate.
Increased erosion, sedimentation and turbidity from clearing and grubbing on adjacent lands for construction of turbines, pads/turnaround areas, and access roads and from directional drilling activities.	• Minimize erosion, sedimentation and turbidity.	**Erosion and Sediment Control – See above** **Grading and Excavation** • Minimize changes in land contours and natural drainage; maintain timing and quantity of flows. **Equipment Use** • Ensure machinery arrives on site in a clean, washed condition and is maintained free of fluid leaks. • Minimize vehicle traffic on exposed soils, avoid compacting or other hardening of natural ground surface, and avoid the movement of heavy machinery on areas with sensitive slopes. • Locate site maintenance, vehicle washing and refuelling stations where contaminants are handled at least 30 m away from natural features including water bodies and significant woodlands, wetlands, and wildlife habitat. • Implement vehicle and equipment cleaning procedures and practices to minimize or eliminate the discharge of pollutants from vehicle/ equipment cleaning operations to watercourses or natural areas. • Limit speed of vehicles near watercourse crossings.	• Increased erosion, sedimentation and turbidity from clearing and grubbing minimized through application of mitigation measures • Low likelihood and limited magnitude of effects as a result.	• Monitor on-site conditions (i.e., erosion and sediment control, spills, flooding, etc.) where construction occurs within 30 m of a water course on the following basis: ▪ Weekly during active construction periods. ▪ Prior to, during and post forecasted large rainfall events (>20 millimetres in 24 hours) or significant snowmelt events (i.e., spring freshet). ▪ Daily during extended rain or snowmelt periods. ▪ Monthly during inactive construction periods, where the site is left alone for 30 days or longer. • In the event that a spill / flooding occurs, the details of the event will be reported back to MOE, including a description of any assessment and remediation undertaken. **Contingency Measures:** • Suspend work if excessive flows of sediment discharges occur until mitigation measures are in place

Table 5-8: Mitigation Measures, Residual Effects and Monitoring Plan

Potential Effect	Performance Objectives	Mitigation Strategy	Residual Effects	Monitoring Plan and Contingency Measures
Soil compaction, which may result in hardening of surfaces and increased runoff into watercourses	• Minimize soil compaction and increased runoff into watercourses.	• **Erosion and sediment control – See above** • **Grading and Excavation – See above** • **Water Quality – See above**	• Soil compaction and associated increase in runoff into watercourses minimized through application of mitigation measures • Low likelihood and limited magnitude of effects as a result.	• Monitor on-site conditions (i.e., erosion and sediment control, spills, flooding, etc.) where construction occurs within 30 m of a water course on the following basis: ▪ Weekly during active construction periods. ▪ Prior to, during and post forecasted large rainfall events (>20 millimetres in 24 hours) or significant snowmelt events (i.e., spring freshet). ▪ Daily during extended rain or snowmelt periods. ▪ Monthly during inactive construction periods, where the site is left alone for 30 days or longer. **Contingency Measures:** • Suspend work if excessive flows of sediment discharges occur until mitigation measures are in place.
Release or discharge of sediment-laden runoff from the construction area, which has the potential to transport nutrients and contaminants from construction of turbines, access roads, collection lines, and water crossings	• Minimize release or discharge of sediment-laden surface water into adjacent watercourse or drainage features.	• **Water Quality – See above** • **Erosion and Sediment Control – See above** • **Timing Windows – See above**	• Release or discharge of sediment laden surface water into the adjacent watercourse or drainage features minimized through application of mitigation measures • Low likelihood and limited magnitude of effects as a result.	• Monitor on-site conditions (i.e., erosion and sediment control, spills, flooding, etc.) where construction occurs within 30 m of a water course on the following basis: ▪ Weekly during active construction periods. ▪ Prior to, during and post forecasted large rainfall events (>20 millimetres in 24 hours) or significant snowmelt events (i.e., spring freshet). ▪ Daily during extended rain or snowmelt periods. ▪ Monthly during inactive construction periods, where the site is left alone for 30 days or longer. • In the event that a spill / discharge of sediment occurs, the details of the event will be reported back to MOE, including a description of any assessment and remediation undertaken. **Contingency Measures:** • Suspend work if excessive flows of sediment discharges occur until mitigation measures are in place.
Obstruction of lateral flows in watercourses from water crossings	• Minimize obstruction of lateral flows in watercourses.	**Stream Flow** • Design and install culverts to prevent creation of barriers to fish movement and maintain bankfull channel functions. • Design culverts to accommodate high flows of the watercourse. • Embed the culvert below the streambed to maintain lateral flow. • Install adequate gravel base to maintain flow of shallow groundwater. • Locate crossings within straight sections of the stream, perpendicular to the bank. Avoid crossings on meander bends, braided streams and any other unstable areas. • Use only clean material (i.e., rock or coarse gravel) for approaches to culverts. **Isolated Crossing** • Install in-water works for permanent water bodies in the dry via dam and pump method or creation of a diversion channel to maintain flow around the work site. For intermittent water bodies, work is preferred to be completed in the dry and carried out during seasonally dry or when the water body is frozen to the bottom. • Develop and implement a fish rescue plan for dewatering areas. This will include appropriate sized end-of-pipe fish screen to prevent potential losses of fish due to entrainment or impingement as outlined in the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline. • Retain an adequate portion of channel with sufficient width and depth to allow for fish passage if construction requires that an instream work area be isolated from the primary channel. In the event that an area must be blocked from bank to bank, construct a temporary by-pass to allow fish passage around the construction area.	• Obstruction of lateral flows in watercourses avoided through application of mitigation measures. • No likelihood of effect occurring.	• Monitor on-site conditions at all water body crossings (i.e., culverts are installed properly and embedded below the streambed.): ▪ Prior to, during and after the installation of the culvert to ensure lateral flows have been maintained. **Contingency Measures:** • In the event the culvert creates issues relating to lateral flow and fish barriers, steps will be required to fix issues which may involve re-installing the culvert to ensure it is properly installed and embedded within the streambed.
Temporary disruption of substrates/habitat associated with in-water works	• Minimize temporary disruption of substrates/habitats.	**Timing Windows – See above** **Isolated Crossing – See above** **Erosion and Sediment Control – See above** **Rehabilitation** • Re-vegetate and restore the turbine staging area following turbine installation with tiling (if desired by the owner). • Restore and maintain vegetative buffers around water bodies including within the foundation footprint where possible. • Restore and maintain vegetative buffers around water bodies including within the temporary construction areas. • Keep vegetation removal to a minimum. • Add suitable stream substrates (e.g., gravel or rip rap) to stabilize sediment and provide cover.	• Temporary disruption of substrates/habitat associated with in-water works minimized through application of mitigation measures. • Moderate likelihood and magnitude of effect occurring due to number of watercourse crossings; however, effects are limited due to marginal habitat and common species; as such fish passage will be maintained and will continue to provide habitat.	• Monitor fish habitat once per week or as required throughout duration of in-water construction to identify any minor or major disturbances caused by construction activities by undertaking the following: ▪ Turbidity monitoring for sediment loading; ▪ Monitoring bank stability; ▪ Monitoring substrate composition; ▪ Monitoring stream flow and ensure fish passage is maintained at all times. • Document changes to aquatic habitat as a result of construction activities and obtain photographic documentation. • The findings of the monitoring program will be reported back to MOE following the completion of in-water construction activities. **Contingency Measures:** • Mitigate or compensate for any disturbance to fish habitat according to Department of Fisheries and Oceans Canada (DFO) authorization and in consultation with ABCA and UTRCA.

Table 5-8: Mitigation Measures, Residual Effects and Monitoring Plan

Potential Effect	Performance Objectives	Mitigation Strategy	Residual Effects	Monitoring Plan and Contingency Measures
Degradation of fish habitat.	• Minimize degradation of fish habitat.	**Stream Flow – See above**	• Degradation of fish habitat minimized through application of mitigation measures. • Moderate likelihood of effect occurring due to number of watercourse crossings; however, magnitude of effect limited due to marginal habitat and common species; as such fish passage will be maintained and will continue to provide habitat.	• Monitor fish habitat throughout duration of in-water construction to identify any minor or major disturbances caused by construction activities. • Document changes to aquatic habitat as a result of construction activities and obtain photographic documentation. **Contingency Measures:** • Mitigate or compensate for any disturbance to fish habitat according to Department of Fisheries and Oceans Canada (DFO) authorization and in consultation with ABCA and UTRCA.
Soil/water contamination by oils, grease and other materials from accidental spills and release of contaminants from construction equipment.	• Minimize soil/water contamination.	**Equipment Use – See above** **Material Stockpiling and Handling** • Store any stockpiled materials away from natural features to prevent deleterious substances from inadvertently discharging to the environment. • Dispose of any waste material from construction activities by authorized and approved off-site vendors. **Water Quality – See above** **Timing Windows – See above**	• Soil / water contamination minimized through application of mitigation measures. • Low likelihood and limited magnitude of effects on surface water and groundwater as a result.	• Conduct daily inspections of construction equipment for leaks / spills. • Implement Contingency Measures in the event of a spill: ▪ Install a spill collection pad for refuelling and maintenance. ▪ In the event of a spill, immediately stop all work until the spill is cleaned up. ▪ Notify MOE's Spills Action Centre of any leaks or spills. ▪ Assess and remediate affected soils and water by using spill kit kept on site. ▪ Analyze water samples for general chemistry (e.g., temperature, pH, dissolved oxygen, and conductivity), suspended solids, turbidity, nutrients and total metals (e.g., copper, iron, zinc and aluminum) during and after construction. ▪ Monitor daily to ensure proper cleanup is completed.
Fractures in substrate releasing pressurized drilling fluids into watercourse and causing potential change to groundwater flow patterns due to directional drilling.	• Minimize fractures in substrates and release of pressurized drilling fluids into watercourse.	**Directional Drilling** • Conduct all drilling by licensed drillers in accordance with Regulation 903 under Ontario Water Resources Act, R.S.O. 1990. • Locate drill entry and exit pits at least 30 m from water bodies. • Collect drill cuttings as they are generated and place in a soil bin or bag for off-site disposal. • Ensure drill depth is at an appropriate depth below the water body to reduce the risk of a 'frac-out'. **Water Quality – See above**	• Fractures in substrate releasing pressurized drilling fluids into watercourse and causing potential change to groundwater flow patterns minimized through application of mitigation measures**.** • Low likelihood of effects as a result of mitigation measures; however magnitude of effects could be high as benthic invertebrates, aquatic plants and fish and their eggs could be smothered by the fine particles if bentonite were discharged to waterways.	• Monitor directional drilling for the duration of such activities to ensure that "frac-out" does not occur, and if it does, to ensure that effects are minimized on surface or groundwater. **Contingency Measures:** • In the event of a "frac-out", immediately stop all work, including the recycling of drilling mud / lubricant. • Monitor frac-out for 4 hours to determine if the drilling mud congeals. If drilling mud congeals, take no other action that would potentially suspend sediments in the water column. If drilling mud does not congeal, erect isolation/containment environment (underwater boom and curtain). • If the fracture becomes excessively large, engage a spill response team to contain and clean up excess drilling mud in the water and bottom substrates. • If the spill affects an area that is vegetated, reseed and/or replant the area using species similar to those in the adjacent area, or allowed to re-grow from existing vegetation. Revegetated areas will be monitored twice per year for two years subsequent to frac-out to confirm revegetation is successful. • Document post-cleanup conditions with photographs and prepare frac-out incident report describing time, place, actions taken to remediate frac-out and measures implemented to prevent recurrence. Provide incident report to MNR and MOE within 30 days of the incident.
Reduction of streamflow due to the withdrawal of surface water for construction activities such as dust suppression, equipment washing and land reclamation (e.g., hydroseeding).	• Minimize effects to surface water and fish habitat	**Erosion and Sediment Control – see above** **Water Management** • Restrict taking groundwater and surface water during drought conditions • Control rate and timing of water pumping from surface water features • Regulate the discharge of water-taking to ensure there is no soil erosion, or stream channel scouring is caused by the point of discharge.	• Low likelihood and limited magnitude of effects on surface water as a result.	• Monitor all surface water-taking activities to ensure no damage to watercourse and fish habitat occurs, including drops in water levels and damage to stream banks and bed from discharge. **Contingency Measures:** • In the event of decreased water levels and damage to stream banks and bed, suspend work until mitigation measures are in place.
Loss of riparian habitat adjacent to watercourses for installation of hydro poles.	• Minimize loss of riparian habitat adjacent to watercourses	**Rehabilitation** • Keep vegetation removal to a minimum • Restore and maintain vegetative buffers around water bodies including within the temporary construction areas **Erosion and Sediment Control – see above**	• Loss of riparian habitat adjacent to watercourses minimized through application of mitigation measures. • Low likelihood and limited magnitude of effects riparian cover and adjacent watercourse.	• Monitor site during riparian vegetation removal. • Monitor on-site conditions (i.e., erosion and sediment control, etc.) where construction occurs within 30 m of a water course on the following basis: ▪ Weekly during active construction periods. ▪ Prior to, during and post forecasted large rainfall events (>20 millimetres in 24 hours) or significant snowmelt events (i.e., spring freshet). ▪ Daily during extended rain or snowmelt periods. ▪ Monthly during inactive construction periods, where the site is left alone for 30 days or longer. **Contingency Measures:** • Suspend work if excessive flows of sediment discharges occur until mitigation measures are in place. • Restabilize banks with plantings as soon as works are complete to ensure no further damage to stream banks.

Table 5-8: Mitigation Measures, Residual Effects and Monitoring Plan

Potential Effect	Performance Objectives	Mitigation Strategy	Residual Effects	Monitoring Plan and Contingency Measures
Damage to stream banks from the use of heavy machinery	• Minimize damage to stream banks	**Work Area** • Stabilize banks where necessary, minimizing area and duration of soil exposure. • Operate machinery on land and in a manner that minimizes disturbance to stream banks • Erect sediment fencing around water bodies and areas to be avoided **Erosion and Sediment Control – see above** **Rehabilitation** • Keep vegetation removal to a minimum • Restore and maintain vegetative buffers around water bodies including within the temporary construction areas	• Damage to stream banks minimized through application of mitigation measures. • Low likelihood and limited magnitude of effects on surface water and groundwater as a result.	• Monitor on-site conditions (i.e., erosion and sediment control, etc.) where construction occurs within 30 m of a water course on the following basis: ▪ Weekly during active construction periods. ▪ Prior to, during and post forecasted large rainfall events (>20 millimetres in 24 hours) or significant snowmelt events (i.e., spring freshet). ▪ Daily during extended rain or snowmelt periods. ▪ Monthly during inactive construction periods, where the site is left alone for 30 days or longer. **Contingency Measures:** • Suspend work if excessive flows of sediment discharges occur until mitigation measures are in place. • Restabilize banks with appropriate measures as soon as works are complete to ensure no further damage to stream banks.
Increase in impervious surfaces from presence of turbine foundation and access roads, resulting in increased water temperatures, increased surface runoff and stream peak flows, and reduced infiltration, base flows and upwelling.	• No changes to surface water quality or quantity.	• Adhere to all setback requirements from watercourses. • Control quantity and quality of stormwater discharge using best management practices, and implement infiltration techniques to the extent possible (e.g., use of a permeable surface for access roads).	• Increase in impervious surfaces and subsequent changes to surface water quality or quantity minimized due to setback requirements and through application of mitigation measures. • Low likelihood and limited magnitude of effect due to small increase in impervious surfaces within entire Project Study Area.	• No monitoring or contingency measures required.

6. Summary and Conclusions

This water assessment of the Goshen Project Study Area includes both Records Review and Site Investigations with the purpose of identifying and characterizing water bodies in the Area of Investigation. Through a combination of Records Review, aerial photography interpretation, reconnaissance site visits, and site investigations, a total of 83 REA water bodies were identified in the Goshen Project Study Area.

To aid in the assessment of water bodies and to focus mitigation measures, water quality, flow observations, aquatic habitat and riparian features information was collected during site investigations. This information was also used to provide an understanding of the system's resiliency. The majority of the water bodies were found to be fairly resilient to environmental perturbations. This is supported by background data collated from Conservation Authorities and other agencies. Generally, coldwater habitat is more sensitive to environmental change than warmwater habitat. Water bodies in the South Gullies, Lower Parkhill, and Upper Parkhill watersheds consist of warmwater baitfish communities, that are generally common, demonstrably secure on a global, national and local level and respond well to changing environmental conditions, and whose habitat preferences are wide-ranging. The fishery in Black Creek contains a warmwater fishery in the main channel and cold water tributaries that are more sensitive. In addition the Upper Ausable, Little Ausable and Ausable Headwaters are considered warmwater habitat but are known to contain a variety of Species at Risk that are listed both provincially under the ESA, 2007 and Federally protected under the Species at Risk Act (SARA, 2002). These are dealt with under separate cover, although it is important to note that no in-water works are proposed in these areas as transmission lines are to be installed overhead with the exception of one site (D36) where the transmission line will be directionally drilled to avoid impacts to a Provincially Significant Wetland.

In general, water quality throughout the Project Study Area is heavily influenced by agriculture, as evidenced by tile drain runoff, low water clarity and abundant algal growth in most of the watercourses. No effects to water quality are expected during construction or operation of the Project, as potential sediment release and accidental spills from machinery will be mitigated through the use of best management practices and sediment fencing. Although a large number of water bodies in the Project Study Area were classified as intermittent, these sites will be protected with the same recommended mitigation measures as for permanent streams, particularly as such sites may provide seasonal fish habitat, or provide important surface water conveyance to downstream reaches.

The potential cumulative impacts from the Project were also taken into consideration during the assessment of effects. There are seven locations where more than one project component is proposed in the vicinity of the same water courses, and where necessary, additional mitigation measures and monitoring will be applied to these sites to ensure residual effects remain low.

This Water Body Assessment provides details on individual water bodies within the Project Location in order to determine potential effects and mitigation for each site. The mitigation measures and Environmental Effects Monitoring Plan outline requirements for construction, operation and decommissioning of the Wind Energy Centre to ensure there are no residual effects from the Project. All of the potential effects from the construction and operation of this Project can be mitigated so that the effect on the water bodies are reduced to no residual effects, or low in the case of water body crossings.

6.1 Other Permitting Requirements

This report has been completed to meet the requirements of O. Reg. 359/09, although there may be other potential regulation requirements to consider. This will be particularly important when considering features classified as 'not sensitive' in this Report as they do not meet the REA requirements of a water body, yet may still provide important function and connectivity to downstream seasonal fish habitat, for example. These features will be assessed in accordance with regulations under the federal *Fisheries Act* and the *Conservation Authorities* Act.

The following is an outline of other legislation and policies relevant to water body features and functions as they relate to the REA application for the Goshen Wind Energy Centre.

6.1.1 *Conservation Authorities Act*

Any works to be completed within water bodies and floodplains will require review and input from the Ausable Bayfield Conservation Authority (ABCA) and Upper Thames River Conservation Authority (UTRCA) for any proposed plans involving these features.

The subject lands also contain features regulated by the *Conservation Authorities Act* Ontario Generic Regulation 97/04, with the implementation of it falling under ABCA (147/06) and UTRCA (157/06) local Ontario Regulation. The proposed development application will therefore, require review by the ABCA and UTRCA and will require the submission of an "Application for Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses".

The CA's role in this project would largely be related to fisheries, aquatic and floodplain requirements.

6.1.2 *Fisheries Act*

Any in-water work will require review under the Fisheries Act to determine any impacts on Fish and Fish Habitat. The *Fisheries Act* defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes". ABCA has a Level 2 agreement to review projects on behalf of the Department of Fisheries and Oceans (DFO) and can authorize a Letter of Advice if mitigation can be used to reduce the impacts to fish habitat. If the potential impacts cannot be mitigated, a Section 35(2) HADD authorization is required, and a project review will be conducted by DFO.

In the absence of fisheries data required to obtain approvals for in-water works, fish community surveys will be conducted at the request of the CA.

There are no proposed in-water works within the UTRCA jurisdiction.

6.1.3 *Endangered Species Act (ESA*, 2007) and *Species at Risk Act* (*SARA*,

A permit may be required from MNR or DFO in the event that a Species at Risk is encountered or the proposed works are located in protected habitat. A permit is required if the proposed works have an adverse effect on a protected species or its habitat. Endangered Species permitting will be completed in co-operation with MNR and DFO.

6.1.4 *Municipal Drainage Act*, 1990

Any work proposed on, through, over, under, or next to a municipal drain may need to be approved by the corresponding municipalities Drainage Engineer.

6.1.5 Navigable Waters Protection Act, 1985

The Navigable Waters Protection Act (NWPA) provides a legislative mechanism for the protection of the public right of marine navigation on all navigable waters in Canada. This is done through the permitting of works built or place over, through or across navigable waters. The NWPA is administered through Transport Canada. A permit may be required for any in-water works if the water bodies do not meet the criteria outlined in the *Minor Works and Waters Order,* available at http://www.tc.gc.ca/eng/marinesafety/oep-nwpp-minorworks-menu-1743.htm.

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Appendix A

Record of Agency Consultation

Appendix A. Record of Agency Consultation

Agency	Information Source/Method and Date of Consultation	Information Obtained
Ausable Bayfield Conservation Authority (ABCA)	• Geoff Cade (Supervisor of Water and Planning) and Andrew Bicknell (Regulations Co-ordinator/Officer) • Meeting (ABCA offices) • August 12, 2010	• ABCA provided constraints used to guide preliminary turbine layout, based on Land Information Ontario (LIO), Natural Heritage Information Centre (NHIC) and Natural Resources and Values Information System (NRVIS) databases. Request made to ABCA for aquatic data including water quality, benthic macroinvertebrates, fisheries, generic regulation mapping, stream flow, and any available relevant terrestrial information.
	• Geoff Cade, Andrew Bicknell and Tracy Boitson (GIS/CAD Information Systems Specialist) • Meeting (ABCA offices) • May 2, 2011	• Preliminary discussion regarding the permitting process and previous background data request.

	• Tracy Boitson
	• Email correspondence
	• May 15, 2011
		• Received fish survey data and locations and associated data from ABCA:
		  • ABCA Shape files (1999)
		  • Regulation Limit
		  • 1 m Contours
		  • Natural Features
		  • Watershed Boundary
		  • ABCA ESAs
		  • Waterflow with thermal regimes and names

	• Tracy Boitson • Email correspondence • July 20, 2011	• Requested average annual high water mark data from ABCA. Advised that ABCA does not have this information.
	• Geoff Cade • Phone conversation • November 16, 2011	• Conversation with ABCA regarding the CA regulation limits and required setbacks of infrastructure from watercourses. ABCA advised that setbacks required by REA may not be the same as watercourse setbacks determined by the CA.
	• Andrew Bicknell • Phone conversation • November 22, 2011	• Follow up discussion with A. Bicknell regarding CA setbacks from watercourses. Also discussed ideas to streamline the O. Reg 147/06 (Regulation of development, interference with wetlands and alterations to shorelines and watercourses) permitting process, such as issuing a blanket permit for the entire study.
	• Tracy Boitson • Email correspondence • November 30, 2011	• Email to ABCA requesting year of drain classifications.
	• Tracy Boitson • Email correspondence • December 1, 2011	• ABCA replied that drain classification data is from 1999.

	• Tracey McPherson
	• Email correspondence
	• March 12, 2012
		• Information request to ABCA for records for the updated Goshen Project Study Area:
		  • 1 m Contours
		  • Regulation limit
		  • Fish records
		  • Natural Features
		  • Watershed Boundary
		  • ABCA ESAs
		  • Waterflow with thermal regimes and names
		• Information received from ABCA on March 26, 2012

	• Andrew Bicknell • Meeting (ABCA office) • May 15, 2012	• Request made for the ABCA floodline mapping for the Goshen Project Study Area • Received floodline mapping from ABCA on June 8, 2012
	• Tracey McPherson • Email correspondence • June 5, 2012	• Email to ABCA asking for clarification with drain classifications provided in shapefiles. Specifically that: F is intermittent, U is unknown and T is tiled.
	• Tracey McPherson • Email correspondence • June 5, 2012	• ABCA confirmed data assumptions from June 5, 2012 email is correct.

Appendix A. Record of Agency Consultation

Agency	Information Source/Method and Date of Consultation	Information Obtained
Ministry of Natural Resources (MNR) – Clinton Office	• Tara Lessard (Acting Area Biologist) • Phone conversation/email correspondence • September 7, 2010	• Discussion regarding a blanket Scientific Collector's Permit (SCP) for each Project Study Area. MNR confirmed they would prefer a specific list of watercourses to be surveyed before a permit will be given. A SCP can be issued quickly, but Species-at-Risk (SAR) permits can take three (3) months to one (1) year to be developed and approved.
	• Tara Lessard (Acting Area Biologist) • Email correspondence • September 7, 2010	• T. Lessard followed up with an email documenting the phone conversation held on September 7, 2010.
	• Tara Lessard • Phone conversation • December 15, 2010	• MNR suggested that a specific list of water bodies/crossing locations be provided to MNR in order for them to provide fish records.
	• Tara Lessard • Email correspondence • December 20, 2010	• Further to the phone conversation on December 15th, 2010, MNR suggested that AECOM provide MNR with a spreadsheet identifying locations that require fish records.
	• Tara Lessard • Email correspondence • February 7, 2011	• Response to April Nix's email dated February 7th, 2011, indicating that Clinton office will be providing fish records not the Guelph District MNR office. MNR wanted to know if specific locations for fish records had been narrowed down instead of providing fish records for entire Goshen Project Study Area.
	• Tara Lessard • Email correspondence • March 11, 2011	• Follow-up to correspondence on February 7, 2011 regarding fish records. MNR indicated that they need to make modifications to the current fish database before facilitating a fish information request of this size.

	• Chris Godwin (Acting Area Biologist)
	• Phone conversation
	• May 18, 2011
		• Requested the following data from MNR for the entire Project Study Area:
		  • Fish records;
		  • Water temperature;
		  • Habitat mapping;
		  • Benthic macroinvertebrate data;
		  • SAR records – C. Godwin indicated that he could only release SAR records with permission from colleague Pud Hunter (SAR biologist Guelph); and,
		  • Mussel records
		• MNR provided may of stream classification on May 20, 2011 and confirmed data requested on May 18, 2011 will be compiled for the Project Study Area.
		• Received fisheries records, fish habitat and benthic macroinvertebrate data and water quality information on June 20, 2011 in response to May 18, 2011 request.

	• Chris Godwin
	• Email correspondence
	• October 24, 2011
		• Data request for Project Study Area.
		  • Fish records;
		  • Habitat mapping;
		  • Benthic macroinvertebrate data;
		  • Mussel records
		• Data received November 1, 2011

	• Chris Godwin • Email correspondence • November 1, 2011	• Request for MNR fish records for the entire Project Study Area. • Data received November 11, 2011
	• Chris Godwin • Email correspondence • November 30, 2011	• Email to MNR requesting source and date of drain classification information received from May 18th 2011 data request.
	• Chris Godwin • Email correspondence • December 1, 2011	• MNR indicated that the Huron/Perth watercourse layer was built in 1996 and is based on the current and historical records at that time. This layer is periodically updated and is maintained by the Clinton area office.
	• Chris Godwin • Email correspondence • December 20, 2011	• Fish record data request for updated Goshen Project Study Area • MNR advised that information from the December 20, 2011 data request from has been compiled and is in the mail. • Data received January 2012.
	• Chris Godwin • Email correspondence • April 5, 2012	• Data request for MNR stream classification for Goshen Transmission Study Area • Data received April 20th, 2012 from April 5, 2012 data request

Appendix A. Record of Agency Consultation

Agency	Information Source/Method and Date of Consultation	Information Obtained

	• Chris Godwin
	• Email correspondence
	• April 18, 2012
		• Data request for Goshen Transmission Study Area.
		  • Fish records;
		  • Habitat mapping;
		  • Benthic macroinvertebrate data;
		  • Mussel records

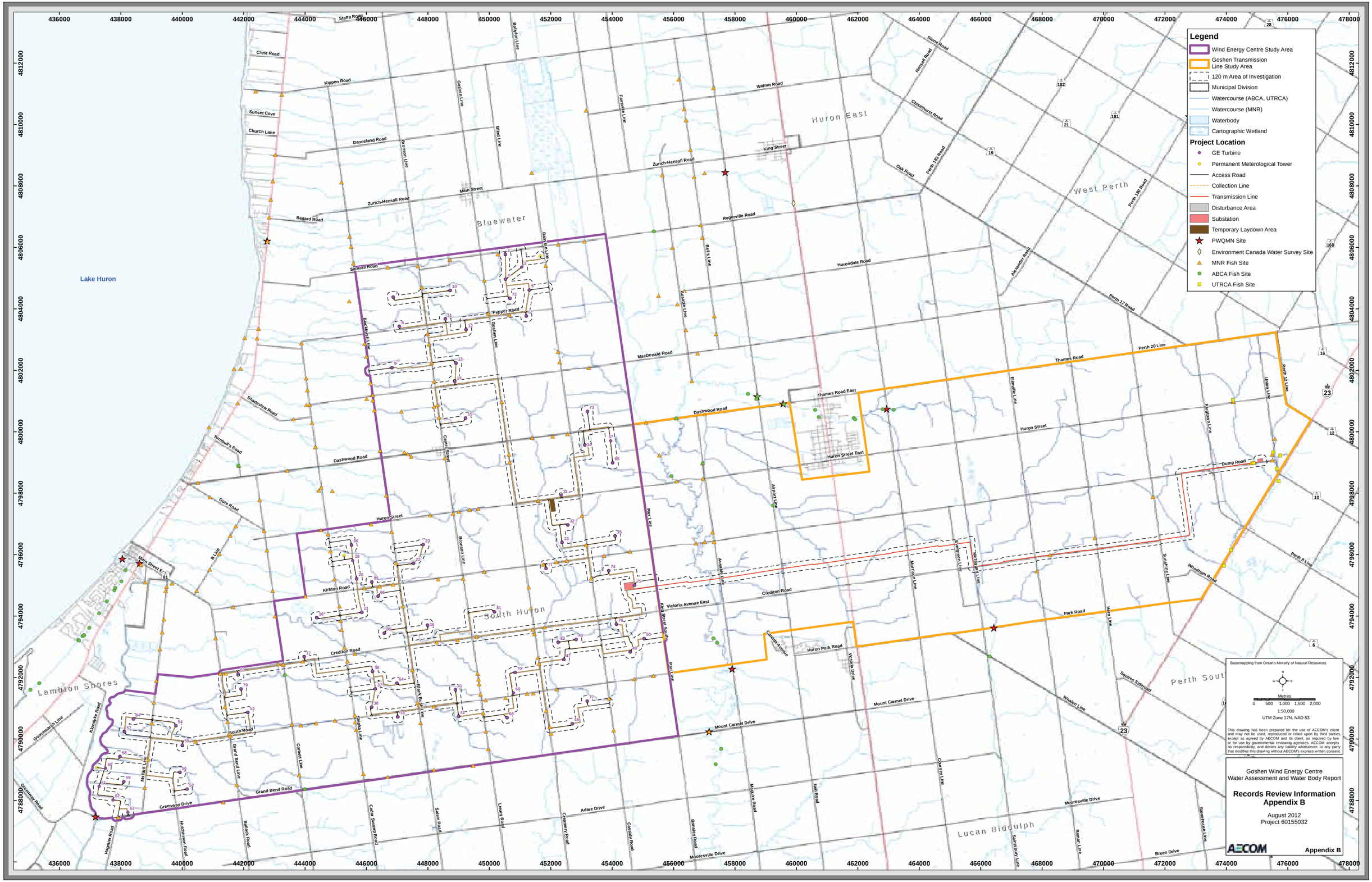
	• Chris Godwin • Email correspondence • May 1, 2012	• MNR advised that data has been compiled according to request from April 18 and is in the mail. Data received May 4, 2012.
MNR – Guelph Office	• April Nix (Renewable Energy Planning Ecologist) • Email correspondence • February 7, 2011	• Email to MNR requesting fish records for the Goshen Project Study Area.
	• April Nix (Renewable Energy Planning Ecologist) • Email correspondence • February 7, 2011	• Response to email from February 7, 2011, indicating that Tara Lessard will provide fish records.
	• April Nix (Renewable Energy Planning Ecologist) • Email correspondence • March 28, 2011	• MNR confirmed the Great Lakes are not considered Lake Trout Lakes for the purpose of REA regulation. Only lakes listed in the *Inland Ontario Lakes Designated for Lake Trout Management (May 2006)* are considered Lake Trout Lakes for the regulation.
Ministry of the Environment (MOE)	• Shannon McNeil (Senior Project Evaluator - REA) • Phone conversation • March 28, 2011	• Discussed the requirements for the water bodies field investigations, specifically regarding the need for water quality samples, stream flow surveys, fish community surveys and if MOE requires a field work plan. • MOE confirmed that lab analysis for water quality was not required. MOE does not require proponent to collect water velocity readings and that this can be done through records review.
	• Shannon McNeil • Email correspondence • March 31, 2011	• Sent a summary of information exchanged in the previous phone conversation (28/03/11).
	• Shannon McNeil • Email correspondence • May 11, 2011	• MOE confirmed that the Water Bodies work plan does not require MOE approval prior to conducting site investigations.
	• Shannon McNeil • Email correspondence • October 14, 2011	• Requested advice from MOE regarding the protocol for the MOE water bodies Alternative Site Investigation.
	• Shannon McNeil • Phone conversation • October 20, 2011	• Response from MOE regarding requirements for Alternative Site Investigations. MOE suggested that use of any records review data available, physical site investigations of sites upstream and downstream and studies from adjacent properties is acceptable to MOE.
	• Shannon McNeil • Email correspondence • November 3, 2011	• Submitted protocol to MOE for Alternative Site Investigations for feedback on the proposed methodology.
	• Shannon McNeil • Email correspondence • November 16, 2011	• Summary of discussions regarding Alternative Site Investigations from previous email correspondence (Oct 14th, 2011) and phone conversation (20th October 2011) was documented through email. MOE confirmed records were accurate representation of discussion.
	• Shannon McNeil • Phone conversation • November 29, 2011	• Discussion regarding classification of certain water features (i.e. ponds that are considered REA) and requirements for Water Bodies Report. MOE suggested that it is up to NextEra as to how the ponds should be classified. They recommended that on-line ponds should be treated as REA water bodies given that they are connected to watercourses.
Huron County	• Claire Dodds (Municipality of South Huron) • Email correspondence • November 1, 2011	• Email to the Municipality to request water bodies information relevant to the project. The Municipality suggested contacting ABCA for this information.

Appendix A. Record of Agency Consultation

Agency	Information Source/Method and Date of Consultation	Information Obtained
Municipality of Bluewater	• Arlene Parker (Municipality of Bluewater) • Email correspondence • November 1, 2011	• Email to the Municipality of Bluewater to request water bodies information relevant to the project. The Municipality suggested contacting the MNR and the ABCA for this information. Any information on natural environments, floodplains and wellhead protection areas can be found in the Municipality's Official Plan.
	• Arlene Parker • Email correspondence • November 24, 2011	• Data request from the Municipality for municipal drain information for the entire study area.
	• Arlene Parker • Phone conversation • November 28, 2011	• In response to email from November 24th, Municipality of Bluewater (Arlene Parker) provided a website where the municipal drain mapping could be obtained.
	• Arlene Parker • Email correspondence • March 12, 2012	• Email to the municipality for municipal drain information for the updated Goshen study area.
	• Arlene Parker • Email correspondence • April 24, 2012	• Municipality suggested consultation with MNR, ABCA to obtain natural heritage information and that the Municipality has previously provided municipal drainage information that will cover this study area.
Municipality of South Huron	• Trista Russel • Email correspondence • November 1, 2011	• Email to the Municipality of South Huron to request for water bodies information relevant to the project.
	• Trista Russel • Email correspondence • November 24, 2011	• Second email to the Municipality of South Huron to request for water bodies information relevant to the project.
	• Trista Russel • Email correspondence • November 29, 2011	• The Municipality indicates that there are several municipal drains within the Goshen study area and recommended contacting Huron County for their electronic information regarding these drains.
Upper Thames Conservation Authority (UTRCA)	• C Harrington and T Chapman • Email correspondence • March 13, 2012	• Information request for Natural Heritage information, regulation limit mapping and fish records for the entire study area.
	• Karen Winfield • Email correspondence • March 16, 2012	• UTRCA provided comments and Regulation limit (O. Reg 157/06) mapping for the Goshen Transmission study area. UTRCA said that given the broad study area they are unable to provide detailed technical comments at this time. They indicated that they can provide digital mapping with boundaries of natural heritage and natural hazard features. Outlined that permits may be required for works within their regulation limit under Ontario Regulation 157/06. Fish Creek is considered mainly warmwater and that fish and mussel records are available from their office.
	• Phil Simm • Email correspondence • April 16, 2012	• Data request to UTRCA for digital shapefiles including boundaries for natural heritage features and hazards • UTRCA provided digital shapefiles on April 20th, 2012 in response to data request from April 16th, 2012.
	• Cathy Reeves, • Email correspondence • May 2, 2012	• Data request for fish/mussel records and benthic data for the Project Study Area as outlined in email dated March 16, 2012. • Received information from May 2, 2012 data request, including fish and benthic invertebrate data, no mussel records were available.

Appendix B

Records Review Mapping



Map Document: (N:\projects\0-aecom\60155032\2010\Final\GIS\Spatial\MXDs\Report\MXDs\NHA_Mapping\60155032_Bluewater_NaturalFeatureRecReview.mxd)
09/20/2011 -- 1:32:17 PM

Appendix C

Estimated Zones of Potential Recharge and Discharge Areas

CANADA

U.S.A

Lake Huron

Lake St. Clair

Lake Erie

N

Wingham

Goderich

Listowel

Bayfield

Mitchell

Exeter

Grand Bend

Woodstock

Ingersoll

Sarnia

Strathroy

London

St. Thomas

Chatham

Windsor

Essex

402

401

Map Projection: UTM NAD83 Zone 17

Six Conservation Authorities Geological and Hydrogeological Model Project

Legend

- Conservation Area Boundaries
- County Boundaries
- Study Boundary
- Major Highways
- Major Rivers
- Lakes

Recharge — Discharge

-388.7 - -75
-74.9 - -65
-64.9 - -55
-54.9 - -45
-44.9 - -35
-34.9 - -25
-24.9 - -15
-14.9 - -10
-9.9 - 0
0 - 1
1 - 5
5 - 15
15 - 25
25 - 45
45.1 - 140.6

1:973,454

0 5 10 20 30
Kilometres

Index Map

Disclaimer: This map is intended for illustrative purposes only. Figure is to be read in conjunction with the Six Conservation Authorities FEFLOW model report.
Digital Mapping Sources: Base mapping features - Ministry of the Environment.
Water well information - Ministry of the Environment.

Date: December, 2004

Schlumberger WATER SERVICES

Figure 24: Recharge/Discharge

Appendix D

Field Notes

AECOM

C5

Field Crew: BG NL

General Information

Study Area: Jericho (Goshen) Bluewater Land Parcel# 1059 Turbine # ~~GE 11~~ / SMN-9

Date: July 13, 2011 Start time: 10:00 End Time: ~~10:00~~ 10:30

Weather Conditions: Sunny, light wind

Field Notes By: NL

Site Location

Parked btwn 2 houses off Zimmer, walk thru corn field.

UTM Co-ordinates

Easting	Northing	Descritpion
0448703	4804873?	Edge, site @ unsigned prop-boundary

Surrounding Landuse/Pollution Sources

- Residential ☐
- Agriculture ☒
- Forest ☐
- Meadow ☐
- Wetland ☐
- Livestock ☐

Other:

Type of Watercourse

- Intermittent ☐
- Permanent ☐
- Ephemeral ☐
- Channelized ☐
- Natural Channel ☒

Notes: (Include any inputs into the system i.e. tile drainage, seepages, overland flow)

No obvious signs of drainage from surrounding land

In-Situ Water Quality

WT (°C):	AT(°C):
pH:	Cond (s/cm):

Water Clarity: Clear ☒ Turbid ☐

Ground Water Indicators

- Watercress ☐
- Iron Staining ☐
- Bubbling ☐
- Bank Seepage ☐
- None ☐
- Other ☐

Notes: couldn't access water to take WQ. V. steep banks

Stream Morphology

Site Length (m):

Channel Dimenions

Mean Wetted Width (m):	1.5	Mean Bankfull Width (m):	2m
Mean Wetted Depth (m):	15cm	Mean Bankful Depth (m):	50cm

Bank Stability:

	Stable	Slightly unstable	Moderately unstable	Unstable
Left Bank	☒	☐	☐	☐
Right Bank	☐	☒	☐	☐

Flow Description: slow moving - almost no flow at all - standing water /stagnant

Notes:

EST. from top of bank

AECOM

Stream Morphology (continued)

Substrate (< = >)

Bo - Boulder
Co - Cobble
Gr - Gravel
Sa - Sand
Si - Silt
Cl - Clay
MK-Muck
DT-Detritus
Other

Description

Cl = Si > Co

Morphological Structure (%)			
Pool	Riffle	Run	Flat
			100

Notes:

Habitat

Instream Cover (%)

None	Woody Debris	Bouiders	Cobble	Aquatic Vegetation*	Undercut Bank	Other:
	30		10	5	10	

***Aquatic Vegetation Types Present (algea, submergent, emergent etc.)** Submergent

Canopy Cover (% closed cover):

100-90%	☐	30-1%	☐
90-60%	☐	0%	☐
60-30%	☒		

Types of Cover (% cover)

Trees 10 Shurbs 30 Man-made structures _____
Grasses _____ Herbaceous 20 Other _____

Notes:

Obsructions to Fish Passage

No Obstructions ☐ Man-Made ☐
Natural ☒

Description: Some low-flow barriers due to LWD

Drainage Features within Study Area

Observations of Land Topography within 120 m buffer area:

Probably some surface runoff from cash cropped, but area is generally flat + no obvious signs of drainage.

Terrestrial features Present Yes (No)

Terrestrial Recon Form Filled out Yes (No)

AECOM July 13/11 ~~SE #~~ C5 Page 3 of 4

Other General Comments Regarding the Study Area:

Photolog

Picture #	Description	Picture #	Description
209	overview of site + surrounding landuse		
210	downstream		
211	upstream		
212	upstream - different drainage point		
213	downstream @ top of bank		

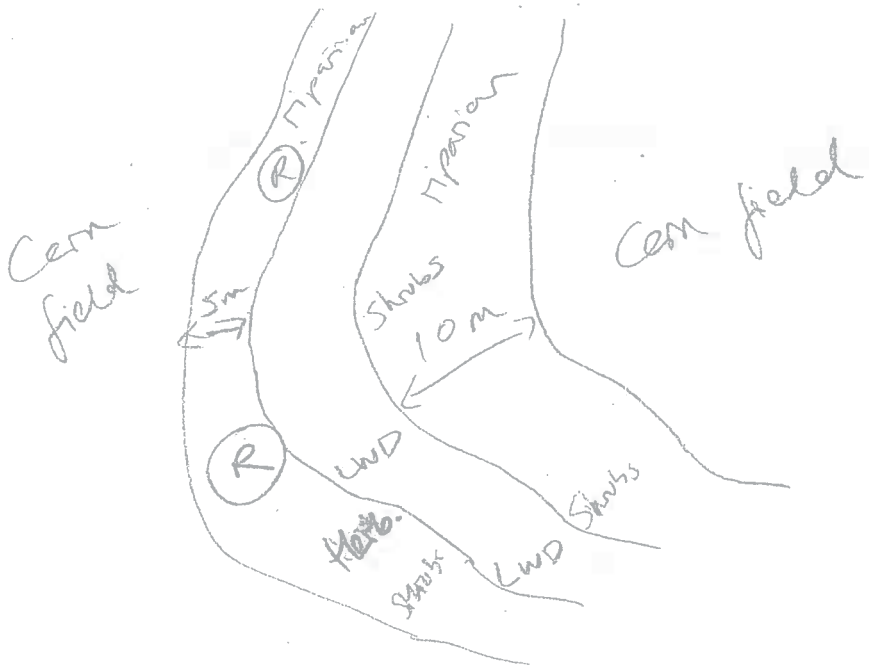
AECOM

C5

Watercourse Sketch

Study Area: Jericho Goshen Bluewater **Land Parcel#** 1059 **Turbine #**

N



LEGEND
- 10d depth (cm)
- 6w width
- Riffle
- Run/Glide
- Pool
- Island/Bar
- Fine Substrate
- ### Gravel Substrate
- oOooO Cobble /Boulder
- *** Debris
- CT Cattail
- SV/FV Submerg/Float Veg
- EV Emergent
- W Watercress
- Fe Iron Staining
- /////// Eroded Bank
- xxx Riprap / Other Stabilization
- Instream Log/Tree
- ^^^ Dam/Weir/
- Riparian Tree
- Seep/Spring
- Undercut Bank
- Barrier to Fish Movement
- -S- Seasonal Barrier
- -x--x- Fence line
- Culvert

LWD - Large woody debris

Horizontal View of Channel steep banks

AECOM

Field Crew: AD. TS

General Information

Study Area: Jericho Goshen Bluewater Land Parcel# GSH1059 Turbine # ~~15~~ C5

Date: 17-Nov-11 Start time: 11:00 a.m End Time: 11:48

Weather Conditions: overcast, windy, OC

Field Notes By: DART

Site Location

C5 - north east end of GSH 1059

UTM Co-ordinates

Easting:	448511	Northing:	4804735	Description:	C5 a west end
Easting:	448691	Northing:	4804775	Description:	C5 b east end
Easting:		Northing:		Description:	
Easting:		Northing:		Description:	

Surrounding Landuse/Pollution Sources

Residential ☐ Meadow ☐
Agriculture ☒ Wetland ☐
Forest ☐ Livestock ☐
Other:

Type of Watercourse

Intermittent ☐ Channelized ☒
Permanent ☒ Natural Channel ☐
Ephemeral ☐

Notes: (include any inputs into the system i.e. tile drainage, seepages, overland flow)
, agriculture on both sides of creek

In-Situ Water Quality

WT (°C):	4.4	AT(°C):	OC
pH:	7.01	Cond (µs/cm):	665

Water Clarity: Clear ☒ Turbid ☐

Ground Water Indicators

Watercress ☐ Bank Seepage ☐
Iron Staining ☐ None ☒
Bubbling ☐ Other ☐

Notes:
water chemistry taken @ C5a west end.

Stream Morphology

Site Length (m):

Channel Dimensions
Bank Height: 2.4m Bank width: 7m

Mean Wetted Width (m):	0.75	Mean Bankfull Width (m):	2.30
Mean Wetted Depth (m):	0.08	Mean Bankful Depth (m):	0.80

Bank Stability:

	Stable	Slightly unstable	Moderately unstable	Unstable
Left Bank	☐	☒	☐	☐
Right Bank	☐	☒	☐	☐

Flow Description:
steady flow ~ 10s/m - flowing west

Notes:
Uniform channel - vegetated banks
Bank near C5b become steep on east bank ~ 10m high + 8m wide (top of bank)

AECOM

Stream Morphology (continued)

Substrate (< = >)

Bo - Boulder
Co - Cobble
Gr - Gravel
Sa - Sand
Si - Silt
Cl - Clay
MK-Muck
DT-Detritus
Other

Description

Gr > Sa > Si

Morphological Structure (%)			
Pool	Riffle	Run	Flat
	50%	50%	

Notes:

Habitat

Instream Cover (%)

None	Woody Debris	Boulders	Cobble	Aquatic Vegetation*	Undercut Bank	Other:
				40	90%	overhang grasses 90%

*Aquatic Vegetation Types Present (algae, submergent, emergent etc.)

some algae on rocks

Canopy Cover (% closed cover):

100-90% ☒ 30-1% ☐
90-60% ☐ 0% ☐
60-30% ☐

Types of Cover (% cover)

Trees _____ Shrubs _____ Man-made structures _____
Grasses 100% Herbaceous _____ Other _____
of cover is grass

Notes:

vegetated islands within channel.
Buffer ~ 3m on either side.

Obstructions to Fish Passage

No Obstructions ☐ Man-Made ☐
Natural ☒

Description:

small forming land bridges occur throughout reach spanning almost entire width of channel.

Drainage Features within Study Area

Observations of Land Topography within 120 m buffer area:

land from south + north sloping to creek. And from the east

Terrestrial features Present Yes No

Terrestrial Recon Form Filled out Yes (No)

C5

AECOM

Other General Comments Regarding the Study Area:

slight perched culvert D/S of C5a (not within boundary) ② land bridge for farmer

Photo log

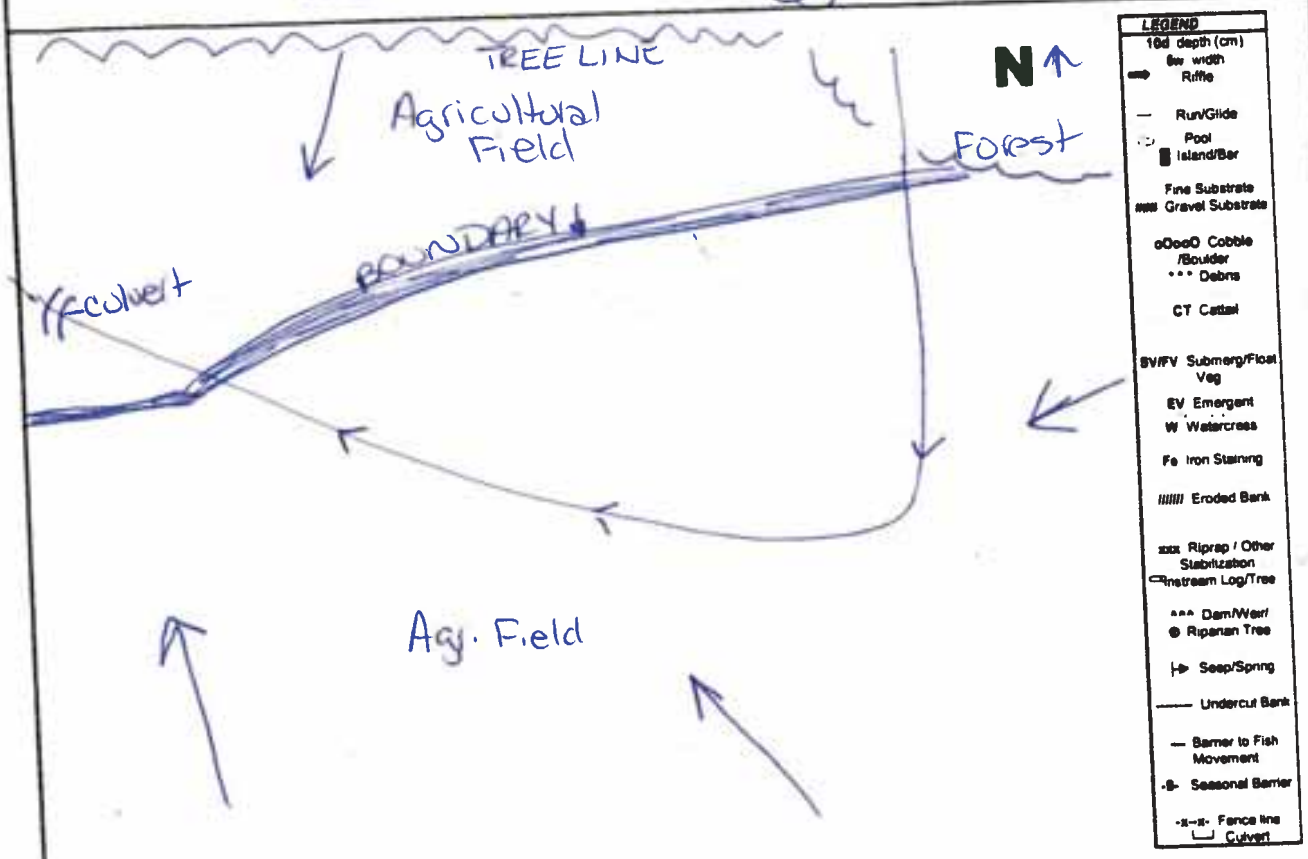
Picture #	Description	Picture #	Description
46-48	Taken from C5a		
49-50	② bend in creek.		
51-52	from bend looking towards C5b		
53-55	From C5b		

C5

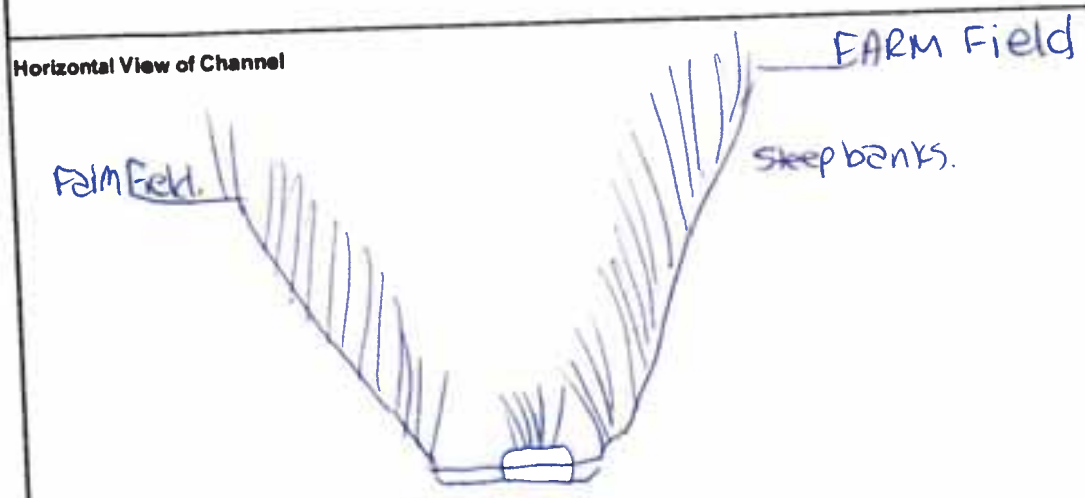
AECOM

Watercourse Sketch

Study Area: Jericho (Goshen) Bluewater Land Parcel# GSH1059 C5 Turbine # C5



Horizontal View of Channel



AECOM

Field Crew: CB, MO

General Information

Study Area: Jericho (Goshen) Bluewater Land Parcel# 1059 Turbine # GOS-16

Date: Sep 13/11 Start time: 9:15 End Time: 10:55

Weather Conditions: Cloudy 15°C

Field Notes By: CB, MO

Site Location

Bronson Line - north of pepper Rd

UTM Co-ordinates

Easting: 0447785 Northing: 4804742 Description: road culvert

Easting: Northing: Description:

Easting: Northing: Description:

Easting: Northing: Description:

Surrounding Landuse/Pollution Sources

Residential ☐ Meadow ☐
Agriculture ☒ Wetland ☐
Forest ☐ Livestock ☐
Other:

Type of Watercourse

Intermittent ☐ Channelized ☒
Permanent ☐ Natural Channel ☒
Ephemeral ☐

Notes: (include any inputs into the system i.e. tile drainage, seepages, overland flow)

- no tile drains noted

In-Situ Water Quality

WT (°C): AT(°C):

pH: Cond (s/cm):

Water Clarity: Clear ☒ Turbid ☒

Ground Water Indicators

Watercress ☐ Bank Seepage ☐
Iron Staining ☐ None ☒
Bubbling ☐ Other ☐

Notes: w/q meter not available

- water turbid near bridge, clear further up/s.

Stream Morphology

Site Length (m): ~100m

Channel Dimensions

Mean Wetted Width (m):	1.5	Mean Bankfull Width (m):	3
Mean Wetted Depth (m):	Stream# 0.10 / Pool 0.25	Mean Bankful Depth (m):	0.70

Bank Stability:

	Stable	Slightly unstable	Moderately unstable	Unstable
Left Bank	☐	☒	☐	☐
Right Bank	☐	☒	☐	☐

Flow Description: no visible flow

Notes: bank slumping and erosion evident on both sides

AECOM

Stream Morphology (continued)

Substrate (< = >)

Bo - Boulder
Co - Cobble
Gr - Gravel
Sa - Sand
Si - Silt
Cl - Clay
MK-Muck
DT-Detritus
Other

Description

Si, Cl, m >> Co

Morphological Structure (%)			
Pool	Riffle	Run	Flat
50	/		50

Notes:

Habitat

Instream Cover (%) 20

None	Woody Debris	Boulders	Cobble	Aquatic Vegetation*	Undercut Bank	Other:
	20		40	40		

***Aquatic Vegetation Types Present (algae, submergent, emergent etc.)**

algae, grasses

Canopy Cover (% closed cover):

- 100-90% ☐
- 90-60% ☐
- 60-30% ☒
- 30-1% ☐
- 0% ☐

Types of Cover (% cover)

Trees 10 Shrubs 20 Man-made structures ____
Grasses 70 Herbaceous ____ Other ____

Notes:

random trees in riparian meadow

Obstructions to Fish Passage

No Obstructions ☒ **Man-Made** ☐
Natural ☐

Description:

Drainage Features within Study Area

Observations of Land Topography within 120 m buffer area:

- flat

Terrestrial features Present Yes (No)

Terrestrial Recon Form Filled out Yes (No)

C6

AECOM Sep 13/11 Bros - CG

Other General Comments Regarding the Study Area:

- fishes observed in pool :
- series of pools broken up by flat/narrow areas run

Photo log

Picture #	Description	Picture #	Description
1	down/S west side of		
2	culvert		
3	up/S inlet culvert (E)		
4	upstream, east side culvert. (S)		
5	upstream, east side culvert (N)		
6	up/S, east side culvert (S)		
7	up/S. east side culvert, looking at stream		
8	up/S, east side culvert (S)		

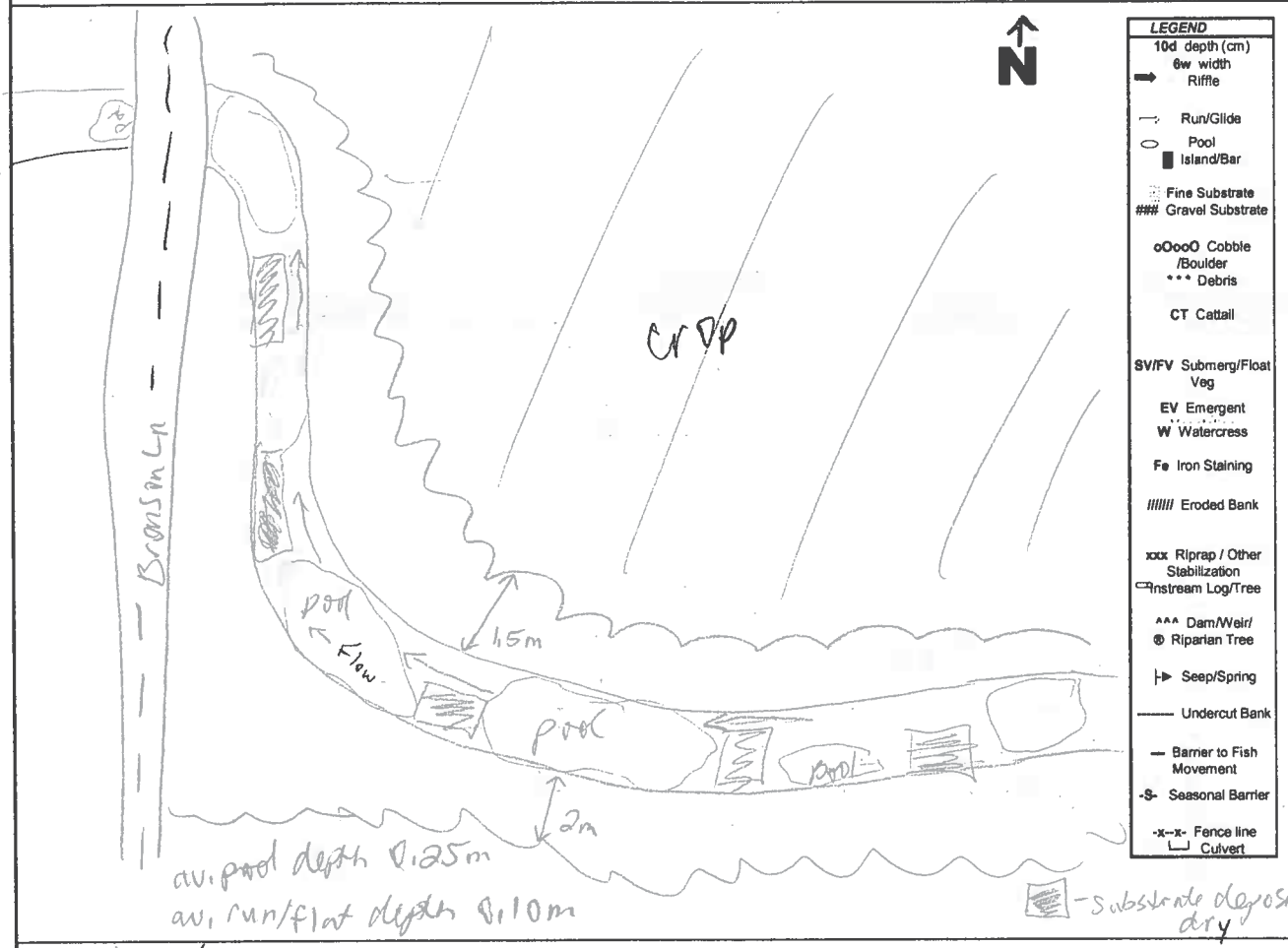
C6

AECOM

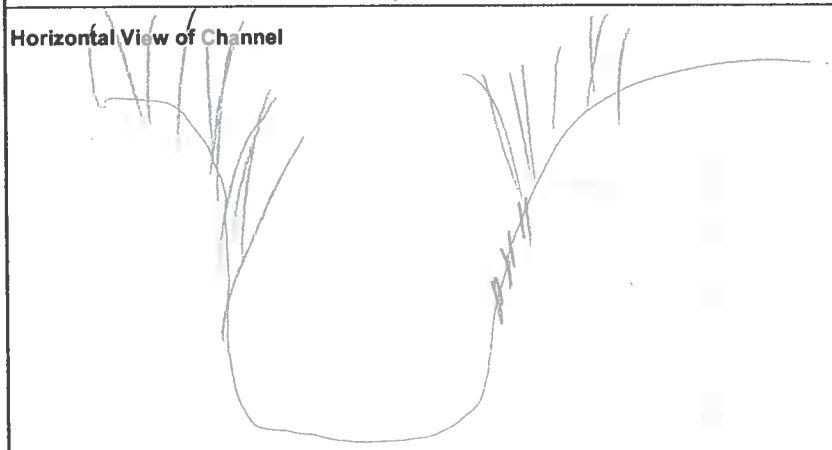
Watercourse Sketch

GIS-

Study Area: Jericho (Goshen) Bluewater **Land Parcel#** 1059 **Turbine #** C6



Horizontal View of Channel



Water Bodies Assessment Field Collection Form

AECOM

General Information

Study Area: Jericho (Goshen) Bluewater **Land Parcel#** GS # 1139 **Site ID:** C6

Date: Nov 22/12 **Start time:** 9:20 **End Time:**

Weather Conditions: Sunny 5°C

Field Crew: C. Boros

Field Notes By: C. Boros

Site Location

Branson Line - north of Pepper Rd. Roadside Survey

UTM Co-ordinates (continue on page 3 if necessary)

Easting:	447785	**Northing:**	4804742	**Description:**	Road
Easting:		**Northing:**		**Description:**	
Easting:		**Northing:**		**Description:**	
Easting:		**Northing:**		**Description:**	

Surrounding Landuse

Residential	☒	Meadow	☒
Agriculture	☐	Wetland	☐
Forest	☐	Livestock	☐
Other			

Description: - front yard of house on north - grazing area for cattle on South

Type of Watercourse

Intermittent	☐	Channelized	☑
Permanent	☒	Natural Channel	☑
Ephemeral	☐		☐

Description: ⇒ historical dumping - starting to naturalize

Notes: (include any inputs into the system i.e. tile drainage, seepages, overland flow)

tile drain from South side observed - could not see if it was flowing

Is any portion of the water body underground or not as mapped? Y / (N)

If Yes describe:

GPS Coordinate: Easting - **Northing -** **Description-**

Description of Land Topography Surrounding Water Body (rolling hills, sloping towards water body)

Slightly hilly

In-Situ Water Quality

WT (°C):	4.82	**AT(°C):**	5
pH:	7.95	**Cond (µs/cm):**	466
D.O. (mg/L)	13.33		

Water Clarity: Clear ☒ Turbid ☐

Water Colour: C/C, N/O

Notes: taken off side of bridge

Ground Water and Seepage Indicators

Watercress	☐	Bank Seepage	☐
Iron Staining	☐	None	☒
Bubbling	☐		☐
Other	☐		

Details:

Water Bodies Assessment Field Collection Form

Stream Morphology

Site Length (m): ~200m

Channel Dimensions

Mean Wetted Width (m):	1.5	Mean Wetted Depth (m):	0.15
Mean Bankfull Width (m):	2	Mean Bankfull Depth (m):	0.45
Mean Top of Bank Width (m):	7	Mean Top of Bank Depth (m):	2

Bank Stability:

	Stable	Slightly unstable	Moderately unstable	Unstable
Left Bank	☐	☒	☐	☐
Right Bank	☐	☒	☐	☐

Description: slumping occurring

Flow Description: (high or low flow conditions, stagnant, etc)

slow flow

Habitat

Substrate (< = >)

Bo - Boulder
Co - Cobble
Gr - Gravel
Sa - Sand
Si - Silt
Cl - Clay
MK-Muck
DT-Debrtus

Description

Sa > Gr = Co

Morphological Structure (%)			
Pool	Riffle	Run	Flat
10		90	

Notes:

pool observed at bend ~20m from road

Instream Cover (%)

Other	Woody Debris	Boulders	Cobble	Aquatic Vegetation*	None	Undercut Banks
			5	30		Average Depth: unknown (% Cover) 2

Note: Low = 0 - 30%; Moderate = 30 - 75%; High = 75 - 100%

***Aquatic Vegetation Species Present (algae, submergent, emergent etc.)**

grasses - emergent

Canopy Cover (% closed cover):

100-90%	☐	30-1%	☐
90-60%	☐	0%	☐
60-30%	☒		

Types of Cover (% cover)

Trees 85 Shrubs 15 Man-made structures ____
Grasses ____ Herbaceous ____ Other ____

Note: Low = 0 - 30%; Moderate = 30 - 60%; High = 60 - 100%

Notes: (vegetation species, types of structures)

deciduous trees → could observed riparian to front of house ~200m

Riparian Vegetation

Width and Description of riparian vegetation: LB - 2.5 m - grasses RB - 2.5 m - grasses

Overhanging Vegetation Present Y / N

% Overhanging Vegetation:

Description of Overhanging Vegetation:

Obstructions to Fish Passage

None Observed ☒ **Man-Made** ☐ **Natural** ☐ **Low Flow Barrier** ☐

Description of Barrier:

Height of Barrier (m)

GPS Coordinates:

Water Bodies Assessment Field Collection Form

AECOM | Date: | Land Parcel/Site ID: |

Other General Comments Regarding the Study Area:

→ Could not see stream past 20m but could observe riparian to 200m → just past house

- fairly straight channel w some slumping. Substrate appears to be very sandy. Grasses (emergent) in stream - moderate. Banks well vegetated w grasses.

Additional UTM Coordinates:

Photo log

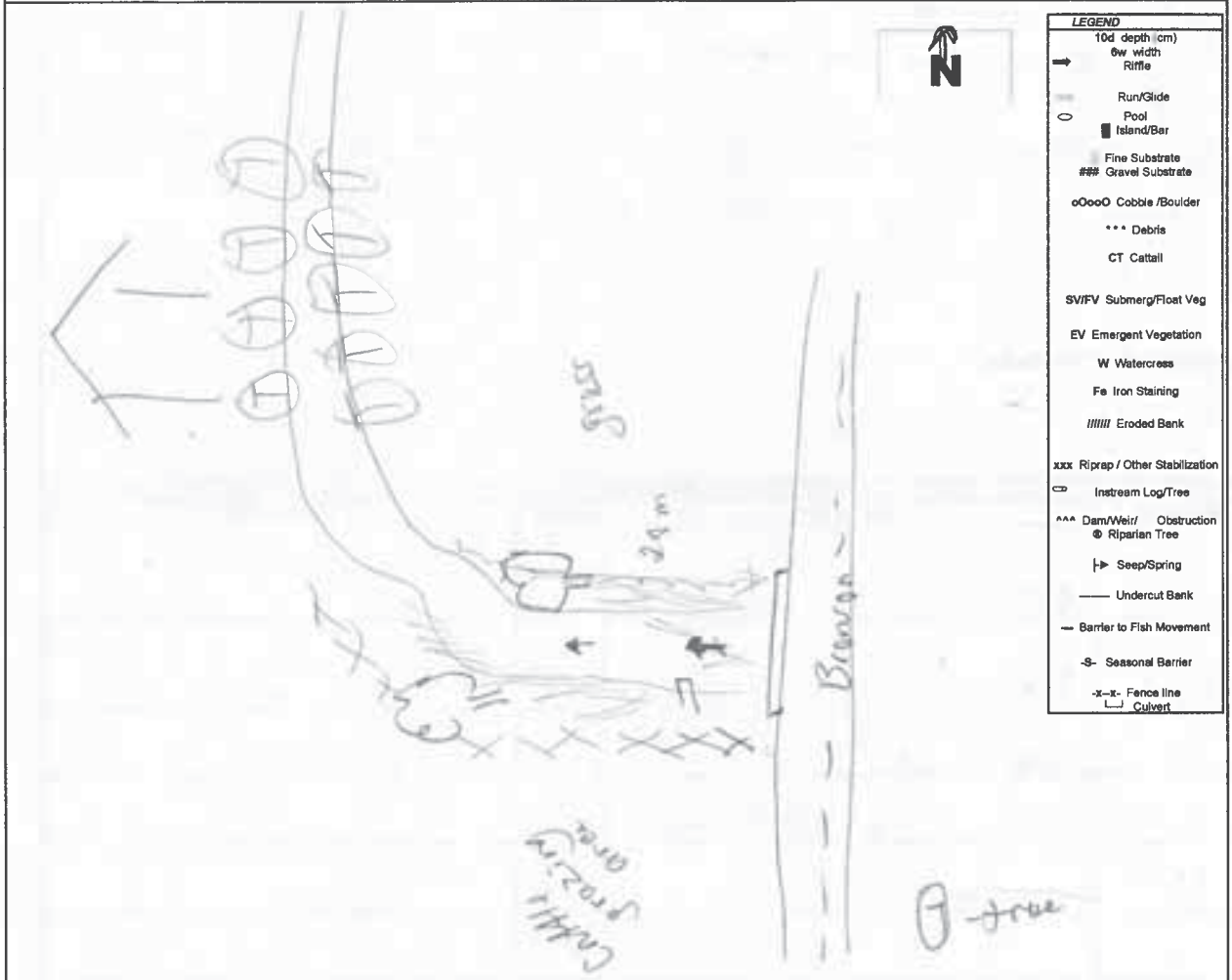
Picture #	Description	Picture #	Description
1	overview		
2-3	channel		
4	substrate		
5	looking to south side		
6	- looking east.		

Water Bodies Assessment Field Collection Form

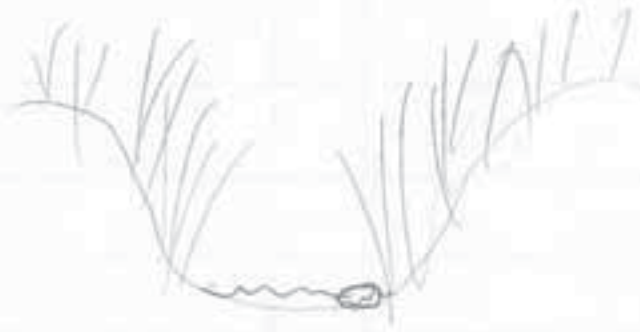
AECOM

Watercourse Sketch

Study Area: Jericho (Goshen) Bluewater **Land Parcel#** _____ **Site ID** _____



Horizontal View of Channel



Initial QA/QC By:	Date	Technical QA/QC By:	Date:

Waterbodies Assessment Field Collection Form

AECOM

Field Crew:

General Information

Study Area: Jericho Goshen Bluewater Land Parcel: 605ϕ59 Turbine # C6

Date: NOV 7, 2011 Start time: 10:20 a.m End Time: 11:00

Weather Conditions: Overcast, windy 0°C

Field Notes By: DART

Site Location

C6 - creek flowing north through 605ϕ59.

UTM Co-ordinates

Easting:	447821	Northing:	4804658	Description:	C6-a North end
Easting:	448432	Northing:	4804431	Description:	C6-b south end
Easting:		Northing:		Description:	
Easting:		Northing:		Description:	

Surrounding Landuse/Pollution Sources

Residential	☐	Meadow	☐
Agriculture	☒	Wetland	☐
Forest	☐	Livestock	☐

Other:

Type of Watercourse

Intermittent	☐	Channelized	☒
Permanent	☒	Natural Channel	☐
Ephemeral	☐		

Notes: (include any inputs into the system i.e. tile drainage, seepages, overland flow)

agriculture on both sides of creek - C6

In-Situ Water Quality

WT (°C):	5.0	AT(°C):	0°C
pH:	7.50	Cond (μs/cm):	769

Water Clarity: Clear ☒ Turbid ☐

Ground Water Indicators

Watercress	☐	Bank Seepage	☐
Iron Staining	☐	None	☒
Bubbling	☐	Other	☐

Notes: Steady flow

water chemistry taken u/s of road @ C6a

Stream Morphology

Site Length (m):

Bank Height - 2.0m, Bank Width: 5m

Channel Dimensions

Mean Wetted Width (m):	1.5	Mean Bankfull Width (m):	3.2
Mean Wetted Depth (m):	0.12	Mean Bankful Depth (m):	1.0

Bank Stability:

	Stable	Slightly unstable	Moderately unstable	Unstable
Left Bank	☐	☒	☐	☐
Right Bank	☐	☒	☐	☐

Flow Description:

Steady - 8sec/m.

Notes:

Banks become very high + steep mid way down creek ~8m height + 10m wide

vegetated banks

AECOM

Stream Morphology (continued)

Substrate (< = >)

Bo - Boulder
Co - Cobble
Gr - Gravel
Sa - Sand
Si - Silt
Cl - Clay
MK-Muck
DT-Detritus
Other

Description

Sa = Gr > Si

Morphological Structure (%)			
Pool	Riffle	Run	Flat
30%	25%	30%	15%

Notes:

Habitat

Instream Cover (%)

None	Woody Debris	Boulders	Cobble	Aquatic Vegetation*	Undercut Bank	Other:
			3%		10%	overhanging bank vegetation - 50%

*Aquatic Vegetation Types Present (algae, submergent, emergent etc.)

—

Canopy Cover (% closed cover):

100-90% ☐ 30-1% ☐
90-60% ☒ 0% ☐
60-30% ☒

Types of Cover (% cover)

Trees 2% Shrubs 15%
Grasses 70% Herbaceous _____
Man-made structures _____
Other _____

Notes:

Vegetated banks - grasses w some shrubs + trees
Buffer strip ~ 2m either side

Obstructions to Fish Passage

No Obstructions ☐ Man-Made ☐
Natural ☐

Description:

perched culvert @ driveway ~ 0.5 m from streambed - north side only

Drainage Features within Study Area

Observations of Land Topography within 120 m buffer area:

Land sloping west towards creek

Terrestrial features Present	Yes	No
Terrestrial Recon Form Filled out	Yes	(No)

Photos # 27-29 C-2

AECOM

Other General Comments Regarding the Study Area:

- Spoke w farmer + Ausable C.A. member while in field
  - general conversation- inquired about monitoring

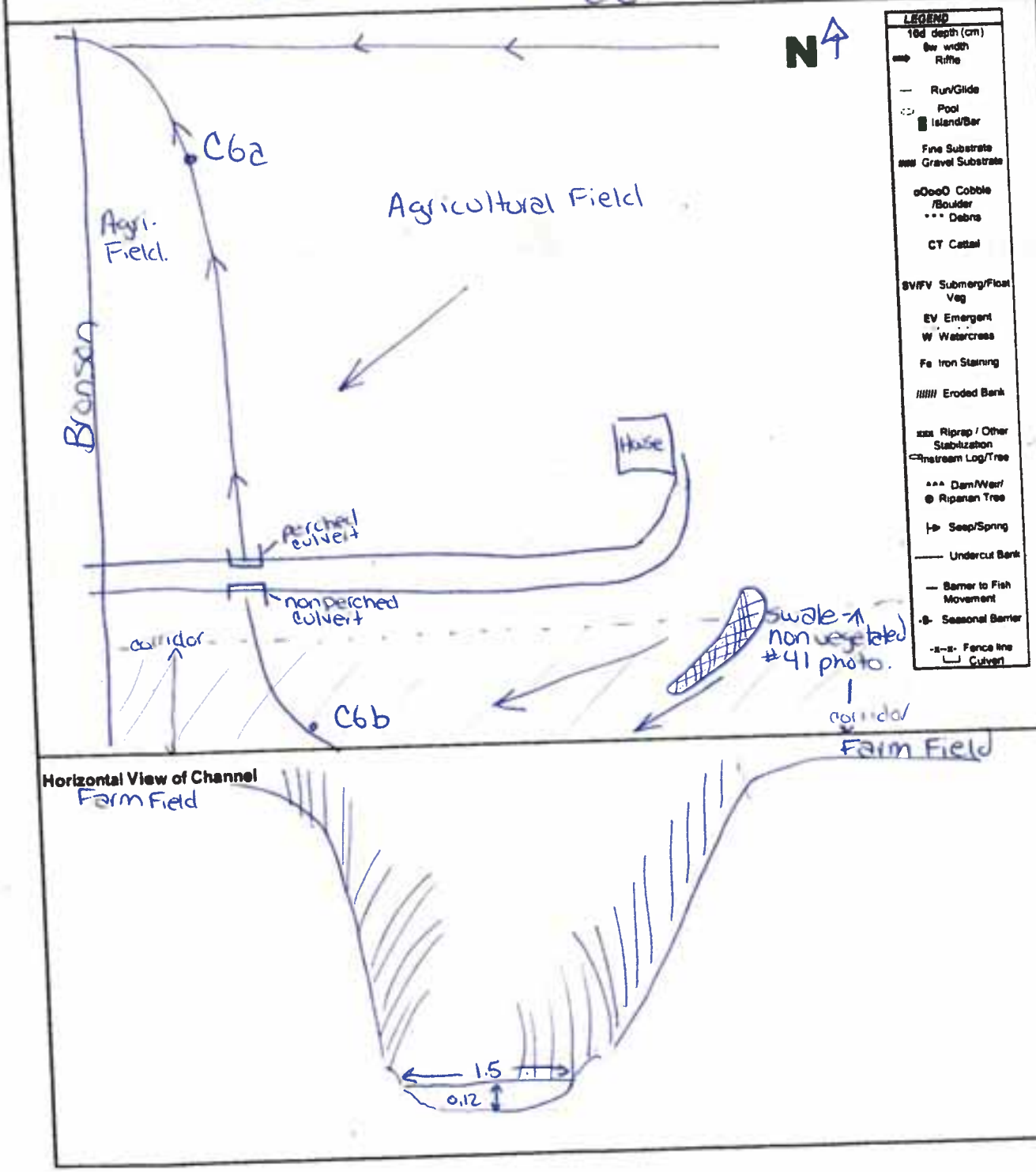
Photo log

Picture #	Description	Picture #	Description
27-29	C6-a - north end		
30-31	mid way - South of C6a.		
32-33	C6-a just north of driveway		
34-	perched culvert - north		
35	north view from drive way.		
36	south side of creek		
37	South from driveway		
38-40	C6-B		

AECOM

Watercourse Sketch

Study Area: Jericho (Goshen) Bluewater **Land Parcel#** 605 1859 C6 **Turbine #** C6



Horizontal View of Channel

AECOM

Field Crew: SA, JN

General Information

Study Area: Jericho (Goshen) Bluewater Land Parcel# 1038 Turbine # ~~SAE12~~ C7

Date: July 13, 2011 Start time: 10:30 End Time: 11:16

Weather Conditions: Sunny N26°C

Field Notes By: SA

Site Location

entered from Pepper Road through Soybean field

UTM Co-ordinates

Easting: Northing: Descritpion:

Easting: Northing: Descritpion:

Easting: Northing: Descritpion:

Easting: Northing: Descritpion:

Surrounding Landuse/Pollution Sources

Residential ☐ Meadow ☐
Agriculture ☑ Wetland ☐
Forest ☑ Livestock ☐
Other:

Type of Watercourse

Intermittent ☐ Channelized ☐
Permanent ☑ Natural Channel ☐
Ephemeral ☐

Notes: (include any Inputs into the system i.e. tile drainage, seepages, overland flow)

large valley w deciduous trees + shrubs

In-Situ Water Quality

WT (°C):	AT(°C):
pH:	Cond (s/cm):

Water Clarity: Clear ☑ Turbid ☐

Ground Water Indicators

Watercress ☐ Bank Seepage ☐
Iron Staining ☐ None ☒
Bubbling ☐ Other ☐

Notes: no GW indicators observed

Stream Morphology

Site Length (m):

Channel Dimenions

Mean Wetted Width (m):	2	Mean Bankfull Width (m):	6
Mean Wetted Depth (m):	0.20	Mean Bankful Depth (m):	1.5

Bank Stability:

	Stable	Slightly unstable	Moderately unstable	Unstable
Left Bank	☐	☐	☐	☑
Right Bank	☐	☐	☐	☑

Flow Description: ~~fast~~ flow moderate

Notes: high steep banks, slumping, exposed roots no veg

AECOM

Stream Morphology (continued)

Substrate (< = >)

Bo - Boulder
Co - Cobble
Gr - Gravel
Sa - Sand
Si - Silt
Cl - Clay
MK-Muck
DT-Detritus
Other

Description

Sa > Co = Gr > Bo

Morphological Structure (%)			
Pool	Riffle	Run	Flat
	50	50	

Notes:

Habitat

Instream Cover (%)

None	Woody Debris	Boulders	Cobble	Aquatic Vegetation*	Undercut Bank	Other:
	10	40	50			

***Aquatic Vegetation Types Present (algea, submergent, emergent etc.)**

Canopy Cover (% closed cover):

- 100-90% ☑
- 90-60% ☐
- 60-30% ☐
- 30-1% ☐
- 0% ☐

Types of Cover (% cover)

Trees 100 Shurbs _____ Man-made structures _____
Grasses _____ Herbaceous _____ Other _____

Notes:

Obsructions to Fish Passage

No Obstructions ☐ Man-Made ☐
Natural ☐

Description:

none observed

Drainage Features within Study Area

Observations of Land Topography within 120 m buffer area:

Sloping towards watercourse

Terrestrial features Present (Yes) No

Terrestrial Recon Form Filled out Yes (No)

AECOM July 13/11 ~~C6~~ C7

Other General Comments Regarding the Study Area:

- deep valley w severe erosion
- nice meandering watercourse w lots of morphological structure. Good fish habitat cover.
- lots of birds - ovenbird

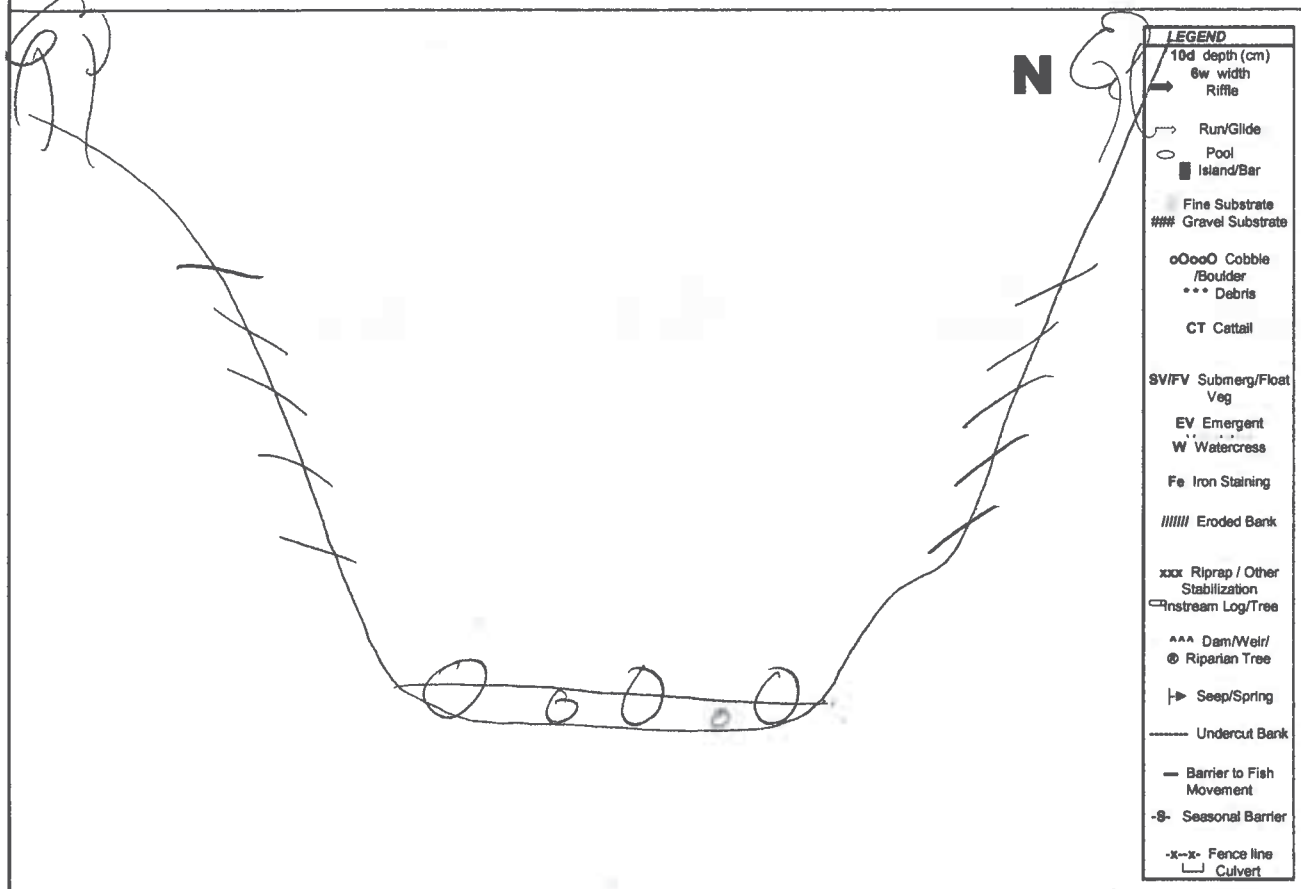
Photolog

Picture #	Description	Picture #	Description
7	at start facing d/s		
8	at start facing u/s		
9	at end of site facing u/s		
10	at end of site facing d/s		
11	view of eroded banks		

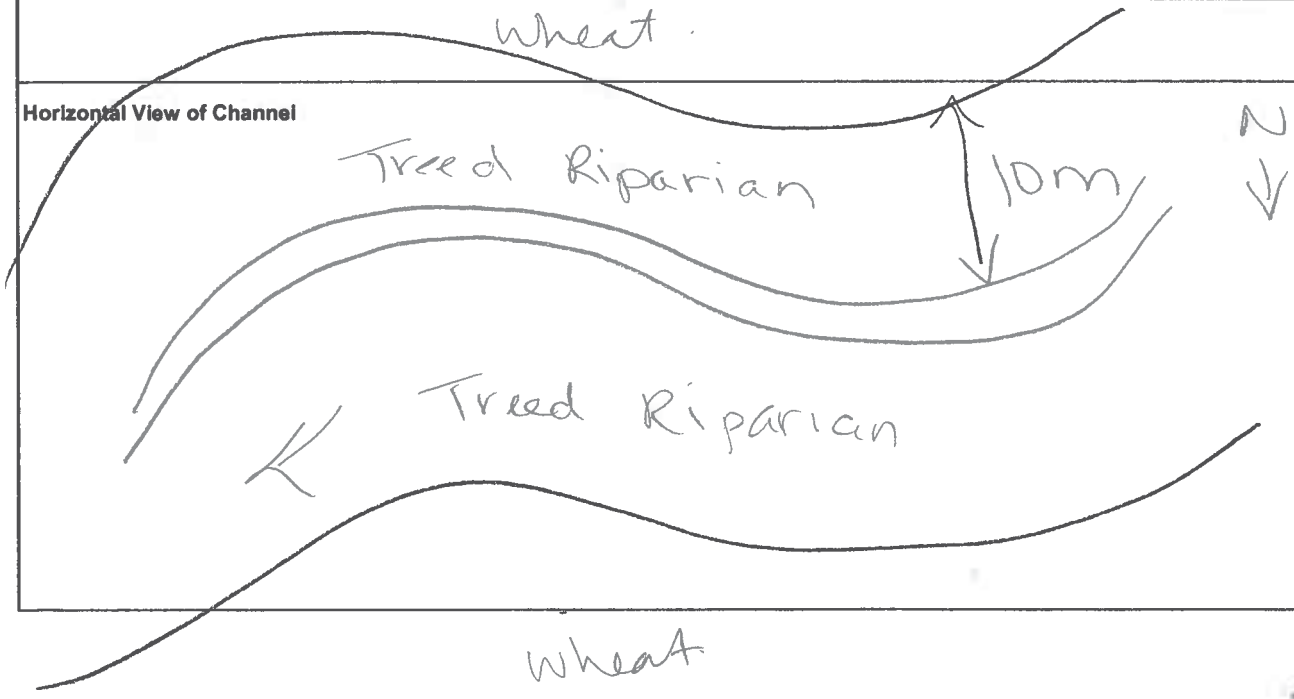
AECOM

Watercourse Sketch

Study Area: Jericho Goshen Bluewater **Land Parcel#** 1038 **Turbine #** WE12 C7



Horizontal View of Channel



AECOM

Field Crew: CB, MP

General Information

Study Area: Jericho (Goshen) Bluewater Land Parcel# 1038 & 1170 Turbine # GOS - C7

Date: Sep 13/11 Start time: 12:20 End Time: 1:00

Weather Conditions: Cloudy, 15°C

Field Notes By: CB, MP

Site Location

Pepper Ln → West of Goshen

UTM Co-ordinates

Easting: Northing: Description: → GPS dead

Easting: Northing: Description:

Easting: Northing: Description:

Easting: Northing: Description:

Surrounding Landuse/Pollution Sources

Residential	☐	Meadow	☐
Agriculture	☒	Wetland	☐
Forest (riparian)	☒	Livestock	☐

Other:

Type of Watercourse

Intermittent	☐	Channelized	☒
Permanent	☒	Natural Channel	☒
Ephemeral	☐		

Notes: (include any inputs into the system i.e. tile drainage, seepages, overland flow)

→ tile drain inputs on both E + W sides noted

In-Situ Water Quality

WT (°C):	AT(°C):
pH:	Cond (s/cm):

Water Clarity: Clear ☒ Turbid ☒

Ground Water Indicators

Watercress	☐	Bank Seepage	☐
Iron Staining	☒	None	☐
Bubbling	☐	Other	☐

Notes: w/q meter not available

→ turbid in pools, clear in riffle/run

Stream Morphology

Site Length (m): ~ 200m

Channel Dimensions

Mean Wetted Width (m):	2	Mean Bankfull Width (m):	6.2
Mean Wetted Depth (m):	0.2	Mean Bankful Depth (m):	1.50

Bank Stability:

	Stable	Slightly unstable	Moderately unstable	Unstable
Left Bank	☐	☐	☐	☒
Right Bank	☐	☐	☐	☒

Flow Description: no visible flow

Notes:

AECOM

Stream Morphology (continued)

Substrate (< = >)

Bo - Boulder
Co - Cobble
Gr - Gravel
Sa - Sand
Si - Silt
Cl - Clay
MK-Muck
DT-Detritus
Other

Description Co > Sa, gr > cl, mk, dt

Morphological Structure (%)			
Pool	Riffle	Run	Flat
40			60

Notes: * diagram provide in second page.

Habitat

Instream Cover (%) 40

None	Woody Debris	Boulders	Cobble	Aquatic Vegetation*	Undercut Bank	Other:
	20	10	65	5		

***Aquatic Vegetation Types Present (algae, submergent, emergent etc.)**

- algea.

Canopy Cover (% closed cover):

100-90% ☐ 30-1% ☐
90-60% ☒ 0% ☐
60-30% ☐

Types of Cover (% cover)

Trees 80 Shrubs 10 Man-made structures
Grasses 10 Herbaceous Other

Notes: forest riparian

Obstructions to Fish Passage

No Obstructions ☒ Man-Made ☐
Natural ☐

Description:

Drainage Features within Study Area

Observations of Land Topography within 120 m buffer area:

- slight rolling hills

Terrestrial features Present Yes (No)

Terrestrial Recon Form Filled out Yes (No)

C7

AECOM Sep 18/11

Other General Comments Regarding the Study Area:

→ appears to be a 'flashy' system → extreme erosion occurring v. high.

→ can be used for 'C8' as well.

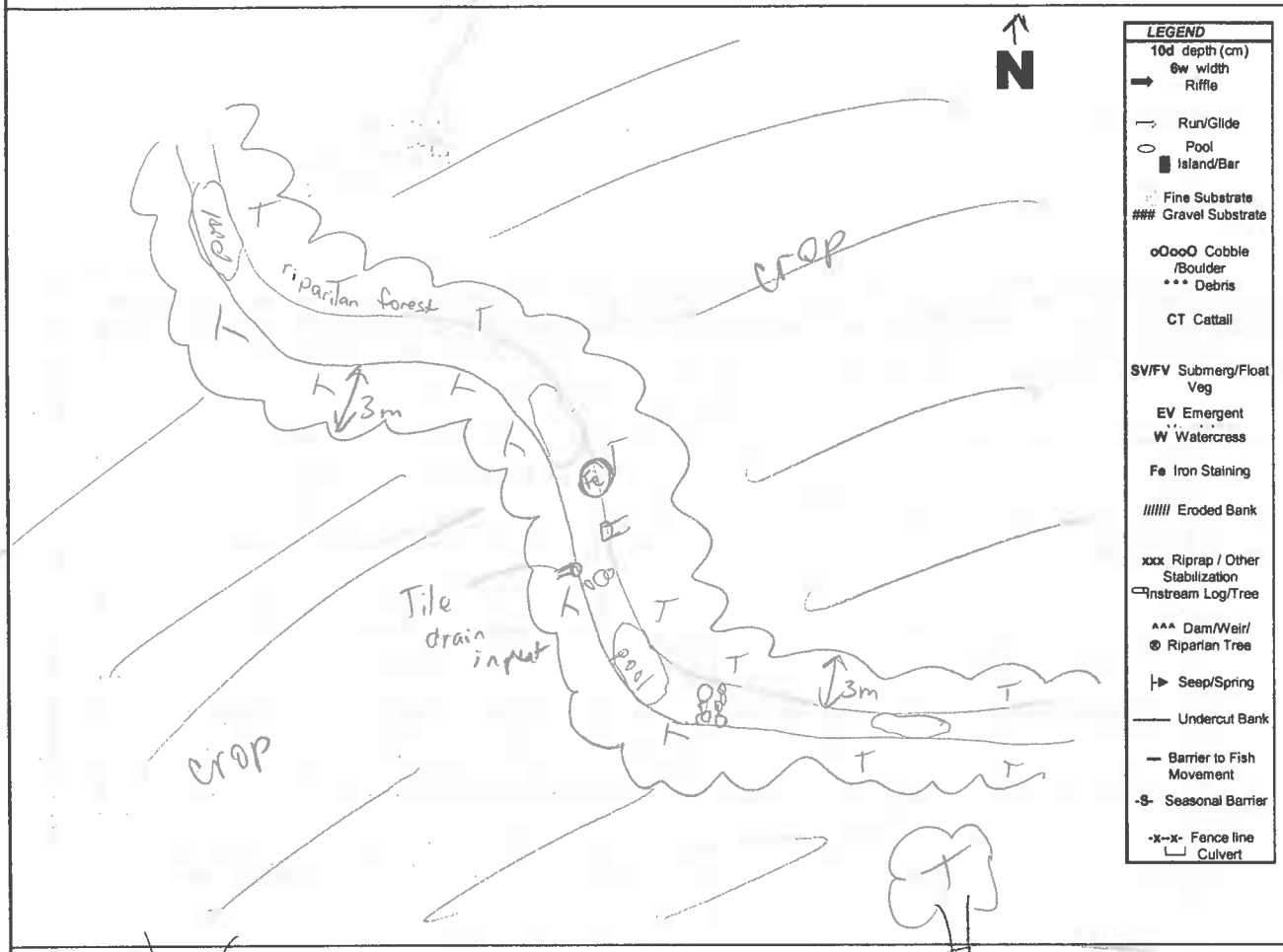
Photo log

Picture #	Description	Picture #	Description
1	Overview, looking N	12	tile drain input W side
2	looking N veg, algae, low water	13	tile drain input E side
3	looking N, clay, erosion	14	site overview
4	undercutting	15	site overview
5	substrate	16	site overview
6	stream overview	17	scale shot/steep bank
7	Inukshuk	18	iron staining
8	Inukshuk + Caroline	19/20	overview northern end of site
9	looking S by eroded bend	20	
10	looking N by eroded bend		
11	tree roots looking N		

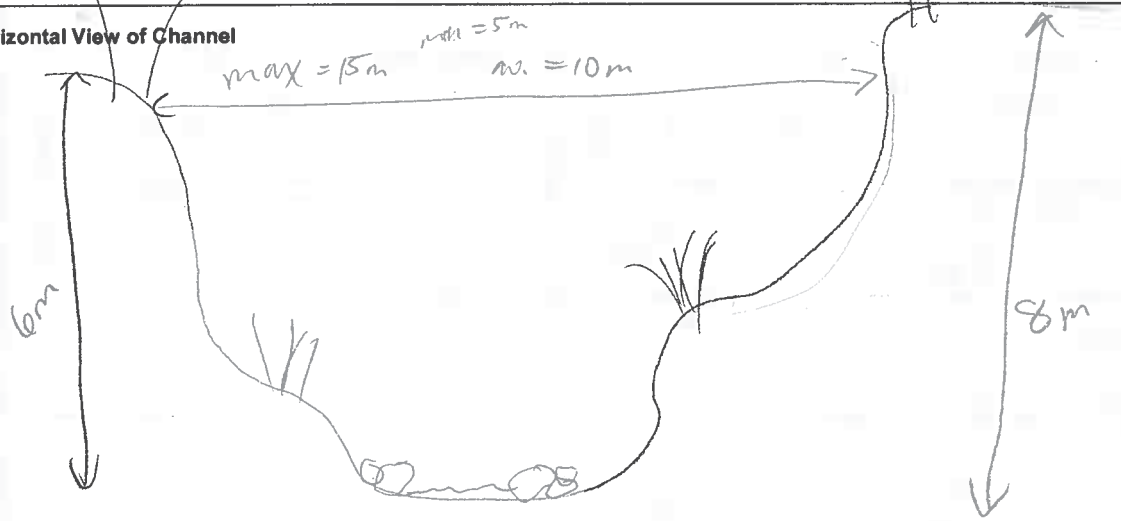
AECOM

Watercourse Sketch

Study Area: Jericho Goshen Bluewater **Land Parcel#** 1038 + 1170 **Turbine #** GOS-E7



Horizontal View of Channel



AECOM

Field Crew: CB, JP

General Information

Study Area: Jericho (Goshen) Bluewater Land Parcel# 358 Turbine # GO5 + C9

Date: Sept 8/11 Start time: 13:45 End Time: 14:25

Weather Conditions: Cloudy, 16°C

Field Notes By: CB

Site Location

Pepper Rd. - east of Goshen

UTM Co-ordinates

Easting: 0450720 Northing: 4813838 Description: at road culvert

Easting: Northing: Description:

Easting: Northing: Description:

Easting: Northing: Description:

Surrounding Landuse/Pollution Sources

Residential	☐	Meadow	☐
Agriculture	☒	Wetland	☐
Forest	☐	Livestock	☐

Other:

Type of Watercourse

Intermittent	☐	Channelized	☐
Permanent	☐	Natural Channel	☐
Ephemeral	☒		

Notes: (include any inputs into the system i.e. tile drainage, seepages, overland flow)

In-Situ Water Quality

WT (°C):	AT(°C):
pH:	Cond (s/cm):

Water Clarity: Clear ☐ Turbid ☐

Ground Water Indicators

Watercress	☒	Bank Seepage	☐
Iron Staining	☐	None	☒
Bubbling	☐	Other	☐

Notes: → dry channel along road and then plowed through in field.

Stream Morphology

Site Length (m):

Channel Dimensions

Mean Wetted Width (m):		Mean Bankfull Width (m):	
Mean Wetted Depth (m):		Mean Bankful Depth (m):	

Bank Stability:

	Stable	Slightly unstable	Moderately unstable	Unstable
Left Bank	☐	☐	☐	☐
Right Bank	☐	☐	☐	☐

Flow Description: Dry.

Notes:

AECOM

Stream Morphology (continued)

Substrate (< = >)

Bo - Boulder
Co - Cobble
Gr - Gravel
Sa - Sand
Si - Silt
Cl - Clay
MK-Muck
DT-Detritus
Other

Description

Morphological Structure (%)			
Pool	Riffle	Run	Flat

Notes:

Habitat

Instream Cover (%)

None	Woody Debris	Boulders	Cobble	Aquatic Vegetation*	Undercut Bank	Other:

*Aquatic Vegetation Types Present (algae, submergent, emergent etc.)

Canopy Cover (% closed cover):

100-90% ☐ 30-1% ☐
90-60% ☐ 0% ☐
60-30% ☑

Types of Cover (% cover)

Trees _____ Shrubs _____ Man-made structures _____
Grasses _____ Herbaceous _____ Other _____

Notes:

Obstructions to Fish Passage

No Obstructions ☐ Man-Made ☐
Natural ☐

Description:

Drainage Features within Study Area

Observations of Land Topography within 120 m buffer area:

Terrestrial features Present (Yes) No ELC Completed by JP

Terrestrial Recon Form Filled out Yes (No)

C 9

AECOM

Other General Comments Regarding the Study Area:

- watercourse dry but evidence of ephemeral flow
  - ↳ dark green patches in the crop show a flooding + flowing pattern of water

Photo log

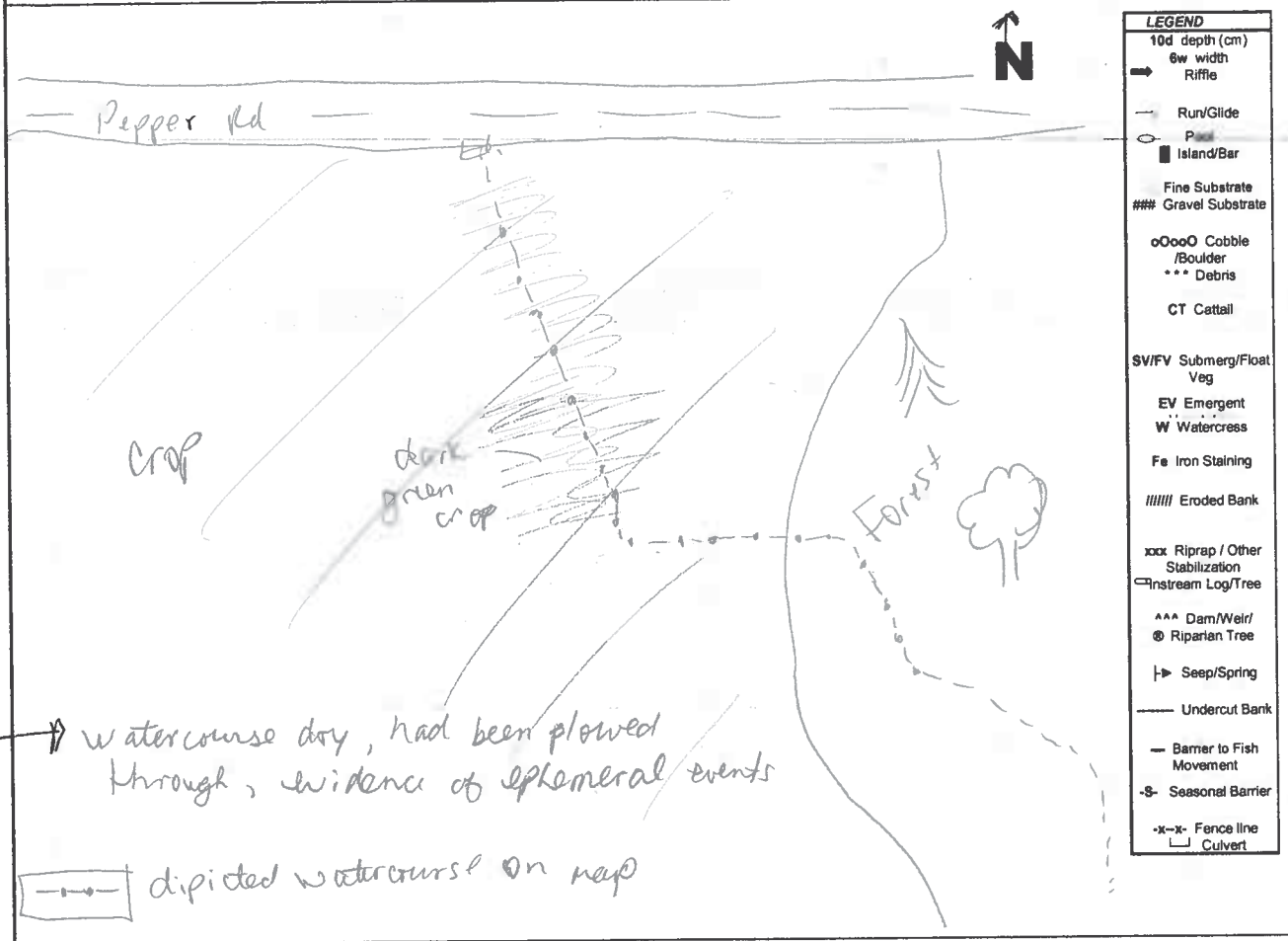
Picture #	Description	Picture #	Description
1	overview looking ~~East~~ West		
2	"		
3	Culvert on South side of road		
4	"		
5	overview looking South from road		
6	overview looking East.		

C 9

AECOM

Watercourse Sketch

Study Area: Jericho (Goshen) Bluewater **Land Parcel#** 1358 **Turbine #** G05, C9



Horizontal View of Channel