Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P18	• Collection Line Buffer • Road Buffer • Turbine 86	April 26, 2012	• The pond is located in a field of winter wheat, surrounded by deciduous trees.	• The pond is a dugout offline feature.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 2. Pond overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
C31	• Turbine 67	July 27, 2011	• No channel was observed as it has been ploughed through. The site is a crop agricultural field adjacent to a deciduous forest (classified as FOD, ELC Feature ID 325).	• No water body feature present. It is classified as tiled by ABCA.	Not Sensitive

Watercourse Name	Brock Drain
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
D56	• Collection Line Buffer	November 17, 2011	• The feature is surrounded by agricultural fields. There was no water body present. It appears to be tile drained.	• The water body is not present. It is classified as tiled by ABCA.	Not Sensitive

Watercourse Name	Smith Rader Drain
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
C127	• Turbine 71	December 9, 2011	• The watercourse is located in an agricultural field. The water body has been tile drained.	• The water body has been tile drained, no feature is present. It is classified as a tiled by ABCA.	Not Sensitive

Watercourse Name	Dinney Municipal Drain
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
C211	• Collection Line Buffer	December 15, 2011	• The feature is located in crop agricultural fields. The water body has been ploughed through and could be tile drained.	• The water body was not present and could be tile drained. The system is classified as tiled by ABCA.	Not Sensitive

Watercourse Name	Martene Drain Tributary
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
C109	• Collection Line Crossing	November 17, 2011	• The feature is located in agricultural fields and crosses Goshen Line. No water body is present. It has been tile drained. Surrounding topography is flat.	• The water body was tile drained. Classified as tile drain by ABCA.	Not Sensitive

Watercourse Name	Haugh Drain
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

Photograph 2. Tile drain Goshen Line ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
C189	• Collection Line Crossing • Road Crossing • Turbine 34	July 13, 2011 December 22, 2011	• The feature is a low lying area with no water body present. Surrounding land use is agricultural field with flat topography. **Watercourse Name**: Wein Drain **DFO Drain Classification**: T	• No water body present. It is classified as tiled by ABCA.	Not Sensitive

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
C106	• Collection Line Buffer	November 18, 2011	• The feature is located in an agricultural field. There was no water body present, only a low lying area.	• The water body is not present and may be tile drained. It is classified as tiled by ABCA.	Not Sensitive

Watercourse Name	Hartman Drain
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
C210	• Collection Line Crossing	December 15, 2011	• The water body is buried, appears to be tile drained. Location is corn field that has been ploughed through.	• No water body present. Classified as tile drain by ABCA.	Not Sensitive

Watercourse Name	Unknown Hay D
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
D30	• Transmission Line Crossing	May 9, 2012	• The feature is located in crop agricultural fields. No water body is present. It has been ploughed through and possibly tile drained.	• The water body is not present, only a depression in the field. It is classified as tiled by UTRCA. Downstream fish species consist of baitfish community, Rock Bass and Northern Pike (UTRCA, 1974, 2000, 2001, 2003, 2005, 2007, 2008).	Not Sensitive

Watercourse Name	Szabo Drain
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P3	• Turbine 67	July 27, 2011	• The feature is located in a corn field. No water body is present, it has been ploughed through.	• No water body present.	Not Sensitive

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
D41	• Transmission Line Crossing	June 22, 2012	• The water body has been ploughed through in the agricultural fields and unknown in the deciduous forest (classified as FOD6-5, ELC Feature ID 723). It may be tile drained.	• The water body may be tiled drained. It is classified as tiled by UTRCA. Downstream fish species consist of baitfish community, sunfish and Rock Bass (UTRCA, 2000, 2005).	Not Sensitive

Watercourse Name	Mc Elreck Drain
DFO Drain Classification	T

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P17	• Collection Line Buffer • Turbine 37	November 18, 2011	• The pond is surrounded by a mix of deciduous forest, cultural meadow and cultural thicket (classified as FOC9b, CUM1-1, CUT1h, ELC Feature ID 236). The pond is 40 m long. Riparian vegetation	• The pond is dugout offline feature. Emergent aquatic vegetation is present. No groundwater indicators were noted at time of investigation.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 1. Pond view ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P15	• Collection Line Buffer	April 17, 2012	• Pond is located on Credition Road, east of D18. It is surrounded by crop agricultural fields. Surrounding land topography is flat. Riparian buffer is 2 m of cultural meadow (CUM1-1) containing trees and shrubs. Pond is approximately 20 m by 10 m.	• The pond may be a dugout pond since the surrounding vegetation is not associated with a wetland. The pond appears to be offline, as no connection was evident. The pond was turbid with brown colour during the investigation. *In-situ* cover is moderate and consists of aquatic vegetation followed by woody debris. No groundwater indicators were noted.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 2. Pond overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P5	• Turbine 39	November 18, 2011	• The pond is located in an agricultural field. The pond is 100 by 40 m. Riparian buffer is 10 m of trees, shrubs and grasses.	• The pond is a dugout offline feature. Substrate consists of silt, sand and gravel. There is no *in-situ* habitat cover. No groundwater indicators were observed.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 1. Pond overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P10	• Collection Line Buffer • Road Buffer	December 22, 2011	• The pond is located in an agricultural field. There is no riparian buffer for the pond.	• The pond is a dugout offline feature that is used for farming. Substrate consists of silt. The pond was filled with garbage. No groundwater indicators were observed.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 2. Pond view ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P2	• Turbine 34	July 13, 2011	• The pond is bordered by cultural plantation (classified as CUP3-1, ELC Feature ID 759) on the east and corn field on the west. Surrounding topography is flat. Riparian buffer in the agricultural field is 3 m and is greater than 3 m in the cultural plantation.	• The pond is defined as a permanent feature. The water was clear and had moderate flow during the time of investigation. The banks are stable. Canopy cover is low and consists of grasses, shrubs and herbaceous vegetation. Instream habitat cover is low and consists algae, submergent and emergent vegetation. No groundwater indicators were observed.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P9	• Collection Line Buffer	May 11, 2012	• Pond is located in mixed forest (classified as FOM5-2, ELC Feature ID 255) with a riparian buffer of greater than 5 m along the roadsides and greater than 30 m to the north and west.	• The pond feature appears to be natural but could not be confirmed. The water was clear during the time of investigation. Pond was approximately 40 m by 20 m and appeared to be shallow. Cattails surrounded the pond and algae were seen in the pond. No groundwater indicators were observed.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P13	• Transmission Line Buffer	June 13, 2012	• The pond is located in a swamp thicket (classified as SWT2-2, ELC Feature ID 609) adjacent to corn fields. The pond is 50 by 15 m. The riparian buffer is 5-15 m of swamp thicket.	• The pond is dugout offline feature, which is possibly used for farming. The water was turbid at time of investigation. The substrate is silt and clay. No groundwater indicators were observed.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 2. Pond view ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P12	• Transmission Line Buffer	June 22, 2012	• Pond is located in a deciduous forest and cultural meadow (classified as FOD7f, CUM1-1, FOD6-5, ELC Feature ID 720) that is surrounded by agricultural fields. The pond is 15 by 20 m and greater than 0.3 m deep. The riparian buffer is greater than 10 m of forest.	• The pond is a dugout offline feature. The water was clear at time of investigation. The substrate is muck and detritus. *In-situ* cover is high and consists of aquatic vegetation followed by woody debris. The majority of aquatic vegetation is duckweed. No groundwater indicators were observed.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 2. Pond view ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P14	• Collection Line Buffer	June 25, 2012	• The pond is located in a cultural plantation (classified as CUP3-2, ELC Feature ID 209). The pond is 20 by 20 m. The riparian buffer is 5 to 15 m of cultural plantation.	• The pond is a dugout offline pond that has an outflow pipe directly into another pond (P8). The water was turbid at time of investigation. Substrate consists of sand and silt followed by muck. *In-situ* cover is low and consists of aquatic vegetation and woody debris. No groundwater indicators were observed.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 2. Outflow pipe ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P7	• Collection Line Buffer • Road Buffer	December 15, 2011	• The pond could not be assessed as access was not granted and it could not be seen from the road.	• From aerial photo interpretation it appears this pond is a low lying feature in a parking lot of an agricultural business.	Not Sensitive

No photos available.

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P6	• Collection Line Buffer	June 21, 2012	• The pond is located in an agricultural field behind a barn. The pond is approximately 52 by 77 m. Pond investigation was conducted through aerial photo interpretation.	• The pond is an offline dugout feature that may be used for farming purposes.	Not Sensitive

No Photos Available.

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P20	• Collection Line Buffer	May 2, 2012	• The pond is surrounded by swamp thicket (classified as SWT2b, ELC Feature ID 754) in an agricultural field. The pond is approximately 20 by 9 m and 2 m deep.	• The pond is an offline dugout feature. The water was clear at time of investigation. *In-situ* vegetation was low and consisted of emergent vegetation.	Not Sensitive

Photos

Photograph 1. Pond overview ↑

Photograph 2. Pond view ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P17	• Collection Line Buffer	April 19, 2012	• The pond is located in a mix of cultural meadow, cultural thicket and meadow marsh (classified as CUM1-1, CUT1h, MAM2-2, ELC Feature ID 236). The pond is 19 by 13 m and 0.55 m deep.	• The pond is an offline dugout features. The water was clear at time of investigation. *In-situ* cover is moderate and consists of submergent, emergent and floating vegetation	Not Sensitive

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

Table 4-3 Site Investigations

Feature ID	Project Component	Investigation Date	Description of Site	Feature Description	Feature Sensitivity
P16	• Collection Line Buffer • Road Buffer	April 17, 2012	• The pond is located in a mix of cultural thicket and deciduous forest (classified as CUT1h, FOD7-2, ELC Feature ID 198). The pond is approximately 70 by 30 m.	• The pond is an offline dugout feature. The water was turbid at time of investigation. There was no submergent or emergent vegetation within the pond.	Not Sensitive

	D36
MWW(m):	7.0
MBW(m):	8.25

	D36
MWD(m):	n/a
MBD(m):	n/a

Photos

Photograph 1. Site overview ↑

*Note: * Denotes feature where an Alternative Site Investigation was conducted*

4.4.3 Alternative Site Investigations

Alternative site investigations were conducted at 35 sites, with physical site investigations being conducted at 34 locations (access to roadside or adjacent properties), and one site assessment using air photo interpretation. Table 4-4 provides a summary of the Alternative Site Investigations conducted for the Goshen Wind Energy Centre. Of the 35 sites investigated only two sites remain unknown with regard to REA water body classification, which are sites D41 and P9.

Regarding D41, the reach that was observed was buried and the upstream reach that was not accessible was shown as tiled drain on OMAFRA drainage mapping (2012). Therefore this site was not considered further. Regarding P9, this site was not considered further due to its location in relation to the Project Components (i.e., it is located across a municipal road from a collection line).

Table 4-4 Alternative Site Investigations

Location	Rationale for Alternative Site Assessment	Field Visit Date	Type of Field Assessment	Results
D32	No land access to parcel	May 9, 2012	Visual inspection from roadside	Confirmed REA water body
		June 22, 2012	Visual inspection from adjacent parcel	Confirmed REA water body
C44	No land access to parcels	September 7, 2011	Visual inspection from roadside	Confirmed REA water body
C106	No land access to parcel	November 18, 2011	Visual inspection from roadside	Confirmed non-REA water body
C96	No land access to parcel	December 9, 2011	Visual inspection from roadside	Confirmed REA water body
C9	No land access to parcel	September 8, 2011	Visual inspection from roadside	Non-REA water body - buried
C144	No land access to parcels	December 16, 2011	Visual inspection from roadside	Confirmed REA water body
C45	No land access to parcel	December 6, 2011	Visual inspection from adjacent parcel and from roadside	Confirmed REA water body
D13	No land access to parcel	April 18, 2012	Visual inspection from roadside	Confirmed REA water body
D31	No land access to parcels	May 9, 2012	Visual inspection from roadside	Confirmed REA water body
D27	No land access to parcel	May 9, 2012	Visual inspection from roadside	Confirmed REA water body
D12	No land access to parcel	May 10, 2012	Visual inspection from roadside	Confirmed REA water body
D05	No land access to parcel	May 11, 2012	Visual inspection from roadside	Confirmed REA water body
D37	No land access to parcel	June 13, 2012	Visual inspection from adjacent parcels	Confirmed REA water body
D40	No land access to parcel	June 22, 2012	Visual inspection from adjacent parcel	Confirmed REA water body
D41	No land access to parcels	June 22, 2012	Visual inspection from adjacent parcel	Confirmed non-REA water body feature on 3068 Could not confirm water body feature on 2843 and 2962
D23	No land access to parcels	May 10 and June 22, 2012	Visual inspection from adjacent parcel and roadside	Confirmed REA water body
D11	No land access to parcel	July 12, 2012	Visual inspection from roadside	Confirmed REA water body
C11	No land access to parcels	December 15, 2011	Visual inspection from roadside	Confirmed REA water body
C33	No land access to parcel	November 18, 2011	Visual inspection from roadside	Confirmed REA water body
C32	No land access to parcel	December 9, 2011	Visual inspection from roadside	Confirmed REA water body
C61	No land access to parcel	October 6, 2011	Visual inspection from roadside	Confirmed REA water body
C189	No land access to parcels	December 9 and 22, 2011	Visual inspection from roadside	Confirmed non-REA water body feature
D09	No land access to parcel	December 22, 2011	Visual inspection from roadside	Confirmed REA water body
P7	No land access to parcel	December 15, 2011	Visual inspection from roadside	Confirmed non-REA water body feature
C209	No land access to parcels	December 15, 2011	Visual inspection from roadside	Confirmed REA water body
C211	No land access to parcel	December 15, 2011	Visual inspection from roadside	Confirmed non-REA water body feature
C109	No land access to parcel	November 17, 2011	Visual inspection from adjacent parcels	Confirmed non-REA water body feature
D20	No land access to parcels	April 26, 2012	Visual inspection from roadside	Confirmed REA water body
C52	No land access to parcel	December 16, 2011	Visual inspection from roadside	Confirmed REA water body

Location	Rationale for Alternative Site Assessment	Field Visit Date	Type of Field Assessment	Results
D30	No land access to parcel	May 9, 2012	Visual inspection from roadside	Confirmed non-REA water body feature
P18	No land access to parcel	April 26, 2012	Visual inspection from adjacent parcel	Confirmed REA water body
D36	No land access to parcel	June 13, 2012	Visual inspection from adjacent parcel	Confirmed REA water body
D45	No land access to parcel	July 12, 2012	Visual inspection from roadside	Confirmed REA water body
P9	No land access to parcel	May 11, 2012	Visual inspection from roadside	Could not confirm water body feature
P6	Confirmed pond used for agricultural use	June 21, 2012	Air photo interpretation	Confirmed Non-REA water body

4.4.4 Seepage Areas

The seepages identified in the Project Study Area are described as localized and isolated seeps (Table 4-5). No large defined seepage areas were identified in the Project Study Area.

Table 4-5 Seepage Areas within 120 m of Project Location

Feature ID	Project Component (associated infrastructure)	Indicators Found	Description of Site Where Found (water body or terrestrial feature – ELC code)
C83	Collection Line Crossing	Watercress	Water body
C44	Collection Line Crossing	Watercress	Water body
C68	Collection Line and Road Crossing; Turbine 57	Watercress	Water body
D11	Collection Line Crossing	Water Speedwell	Water body
D17	Collection Line Crossing; MET Tower Buffer; Turbine 19	Watercress	Water body
D18	Collection Line Crossing	Watercress, Water Speedwell	Water body
D20	Collection Line Crossing	Watercress	Water body
D19	Collection Line Crossing	Water speedwell	Water body
D35	Transmission Line Crossing	Watercress, Water Speedwell	Water body
D12	Collection Line and Road Crossing	Water Speedwell	Water body
C7	Turbine 11	Iron staining	Water body
C15	Collection Line and Road Buffer; Turbine 13	Watercress	Water body
C33	Collection Line Crossing	Watercress	Water body
D55	Turbine 33	Watercress	Water body
C42	Collection Line Crossing	Watercress	Water body
C43	Collection Line Crossing; Turbines 20 and 66	Watercress	Water body
D27	Transmission Line Crossing	Watercress	Water body
D38	Transmission Line Crossing	Watercress	Water body
C52	Collection Line and Road Crossing; Turbine 86	Watercress	Water body
C124	Collection Line Crossing; Road Buffer; Turbine 22	Watercress	Water body
C208	Collection Line and Road Crossing	Watercress	Water body
D57	Turbine 85	Watercress	Water body
C48	Collection Line Crossing; Turbine 17	Water Speedwell	Water body
D44	Turbine 63	Watercress	Water body
D43	Collection Line Crossing	Water Speedwell	Water body
D37	Transmission Line Crossing	Watercress, Water Speedwell	Water body
D35	Transmission Line Crossing	Watercress, Water Speedwell, Bittercress	Water body
D40	Transmission Line Crossing	Watercress, Water Speedwell, Bittercress	Water body
D23	Transmission Line Crossing	Watercress, Water Speedwell	Water body
D39	Transmission Line Buffer	Bank seepage	Water body
C75	Collection Line and Road Crossing; Turbines 59 and 61	Watercress	Water body
P19	Collection Line and Road Buffer	Seepage	Pond

Of the 83 REA water bodies, 32 locations contained seepage indicators including the presence of watercress, water speedwell, bittercress and bank seepage.

4.5 Corrections to Records Review

Table 4-6 summarizes any corrections that were made to the Records Review based on the findings from the Site Investigations. The table below outlines un-mapped features that were identified and changes to mapped features identified through site investigations.

Table 4-6 Summary of Corrections to Records Review

Feature #	Correction	Reason for Correction
C189	Not as mapped	Tiled feature, no channel was found, however some low lying areas that may provide seasonal surface water conveyance
C212	Swale feature, no water body found	No channel was found field ploughed through, however some low lying areas that may provide seasonal surface water conveyance.
C213	Swale feature, no water body found	No channel was found, however some low lying areas that may provide seasonal surface water conveyance.
C217	Swale feature, no water body found	No channel was found, however some low lying areas that may provide seasonal surface water conveyance.
C214	Swale feature, no water body found	No channel was found field ploughed through, however some low lying areas that may provide seasonal surface water conveyance.
C215	Swale feature, no water body found	No channel was found field ploughed through, however some low lying areas that may provide seasonal surface water conveyance.
C216	Swale feature, no water body found	No channel was found field ploughed through, however some low lying areas that may provide seasonal surface water conveyance.
C9	Not as mapped	Tile drain feature – no surface channel
C31	Not as mapped	Tile drain feature – no surface channel
P3	Not as mapped	Temporarily ponded area that is farmed
C127	Not as mapped	Tile drain feature – no surface channel
C211	Not as mapped	Tile drain feature – no surface channel
C109	Not as mapped	Tile drain feature – no surface channel
C106	Not as mapped	Tile drain feature – no surface channel
C210	Not as mapped	Tile drain feature – no surface channel
D30	Not as mapped	Tile drain feature – no surface channel
D41	Not as mapped	Tile drain feature – no surface channel
D52	New water body feature observed – previously unmapped	A channel was observed in Feature 290, which flows through a deciduous forest
D51	New water body feature observed – previously unmapped	A channel was observed in Feature 258, which flows through a deciduous forest
D53	New water body feature observed – previously unmapped	A channel was observed in Feature 273, which flows through a deciduous forest
D56	Not as mapped	Tile drain feature – no surface channel
P1	Not as mapped	Temporarily ponded area that is farmed
P19	New water body feature observed – previously unmapped	A pond was observed.
P12	New feature observed – previously unmapped	A dugout pond was observed.
P11	New water body feature observed – previously unmapped	A pond was observed.
P13	New feature observed – previously unmapped	A dugout pond was observed.
P15	New feature observed – previously unmapped	A dugout pond was observed.
P18	New feature observed – previously unmapped	A dugout pond was observed.
P17	New feature observed – previously unmapped	A dugout pond was observed.
P14	New feature observed – previously unmapped	A dugout pond was observed.
P17	New feature observed – previously unmapped	A dugout pond was observed.
P20	New feature observed – previously unmapped	A dugout pond was observed.

Features that were identified as watercourses during the records review process and found to be either tiled or buried after the site investigations, were compared against the drainage mapping provided by the Huron County website and the OMAFRA Agriculture Information Atlas. Based on this information, 11 watercourses were found to be either tiled or buried within the Project Study Area and this was confirmed by the drainage mapping.
A total of 13 new features were identified after site investigations, of these 10 were pond features and 3 were new watercourses.

4.6 Number of Confirmed Water Bodies in Project Study Area

A total of 104 potential water bodies (10 ponds, 88 watercourses and 6 swale features) were identified in the vicinity of the Project Location during the Records Review and carried forward to Site Investigations. During site investigations, 13 additional features were found identified and assessed for a total of 117 features. This included 3 previously unidentified water bodies (D51, D52 and D53) and 10 additional pond features within 120 m of the Project Location.

Of the 117 features investigated, 33 were identified as non-REA water bodies (16 ponds, 6 swales and 11 watercourse features) because they did not fit the REA definition of a water body as outlined in Section 1.3 of this report. In addition, one feature could not be confirmed because of lack of access to the property to complete a site investigation. In total, 83 REA water bodies were carried forward to the Effects Assessment. This is summarized below in Table 4-7.

Table 4-7 Summary of Water Bodies in the Project Study Area Confirmed through Site Investigations and Carried Forward to Effects Assessment

Process stage	Number of Water Bodies
Features identified through Records Review	104
Additional features identified through site investigations	13
Total sites visited for field investigations	117
Features identified as non-REA water bodies	(33)
Features unconfirmed	(1)
Features identified as REA water bodies and carried forward to Effects Assessment	83

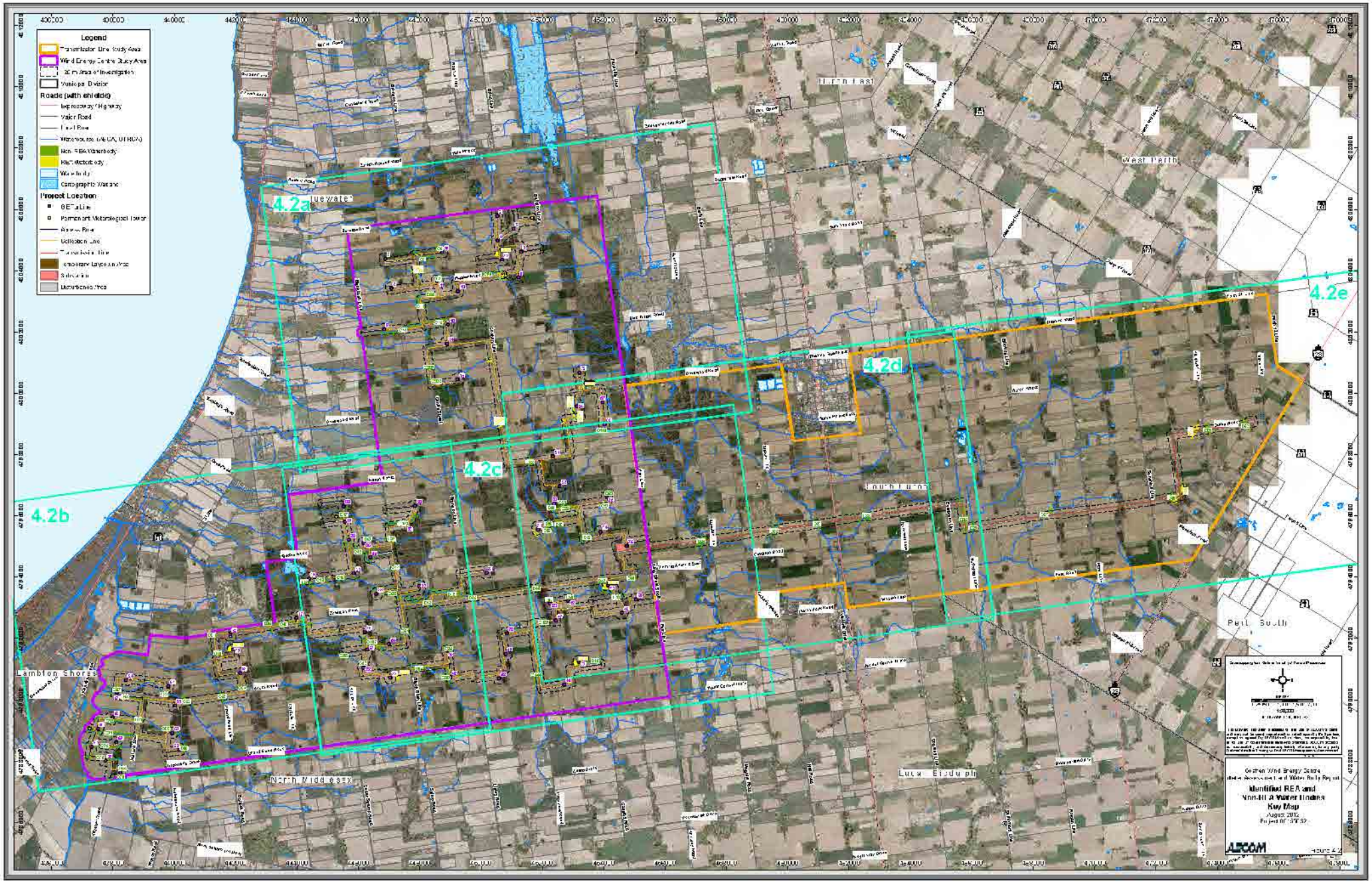
With regard to the location of the Project Components in relation to the 83 REA water bodies:

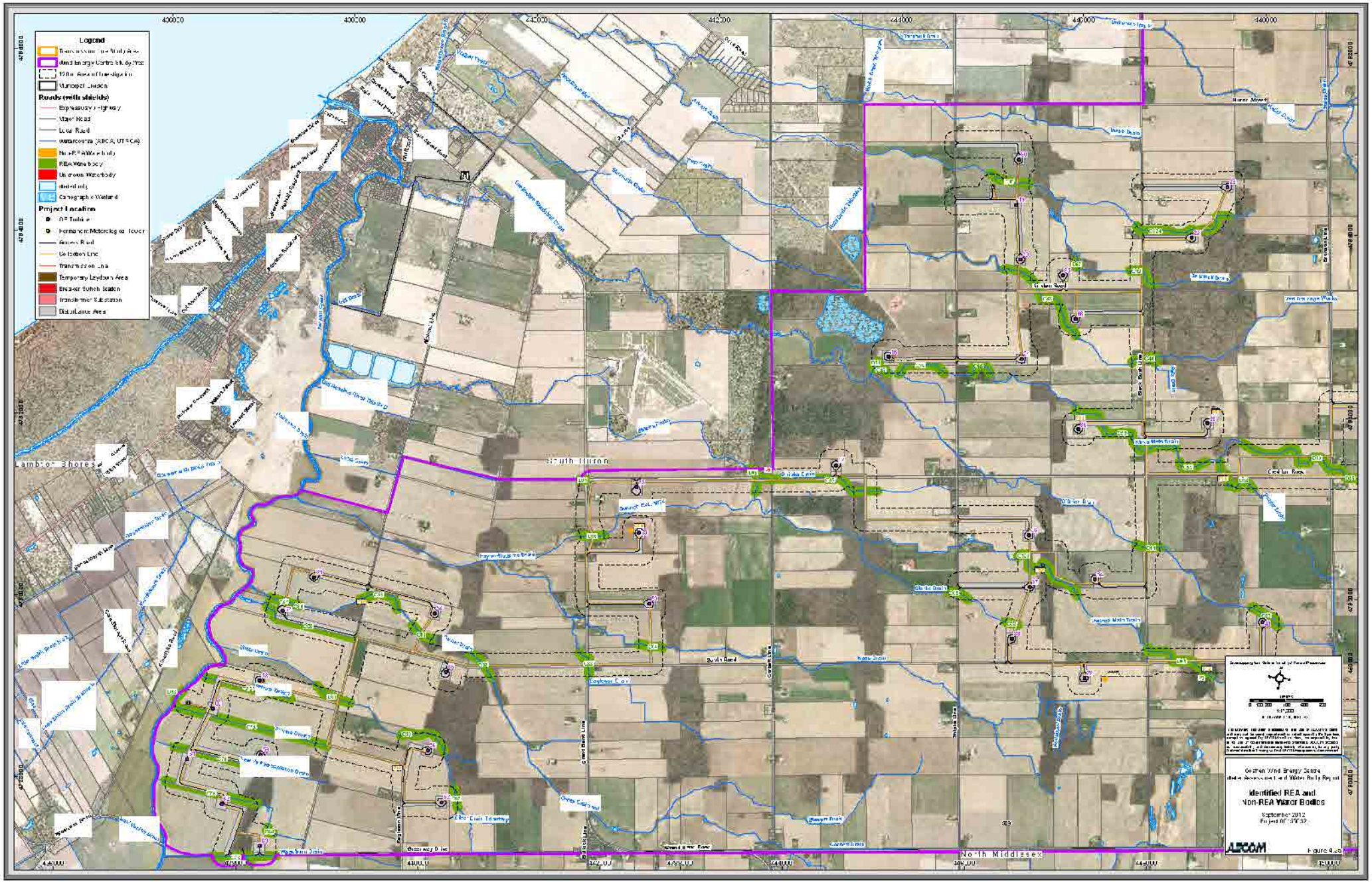
- 31 are located within 120 m of a wind turbine;
- 42 are crossed by a collection line, with an additional 14 located within 120 m of a collection line;
- 8 are crossed by an access road, with an additional 15 located within 120 m of an access road;
- 9 are crossed by overhead wires for a transmission line, 1 is crossed via horizontal direction drilling for the transmission line and 2 are located within 120 m of the transmission line;
- 1 is located within 120 m of the breaker switch station; and,
- 3 are located within 120 m of meteorological towers

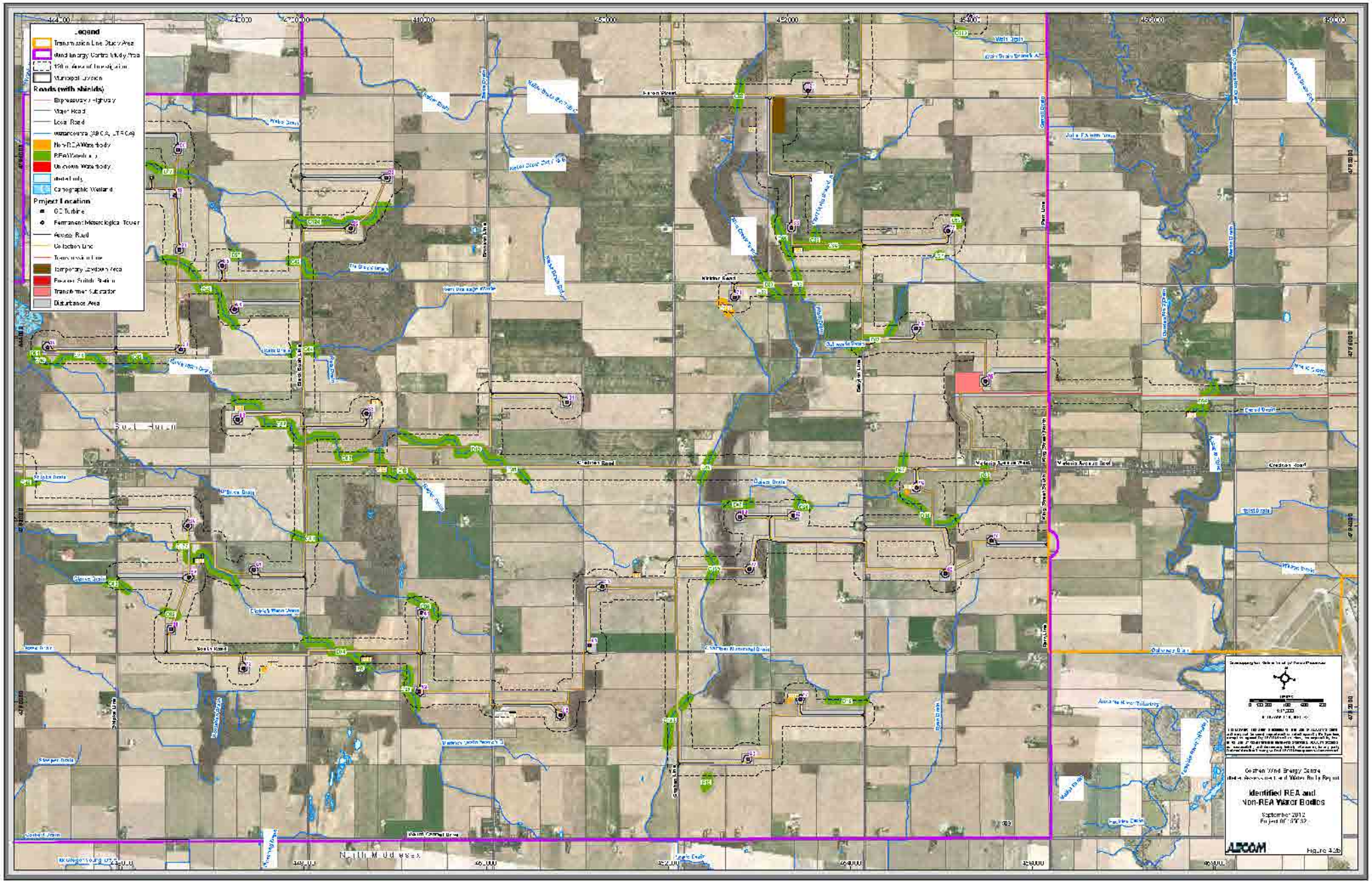
Please note that many of the 83 water bodies intersect more than one Project Component.

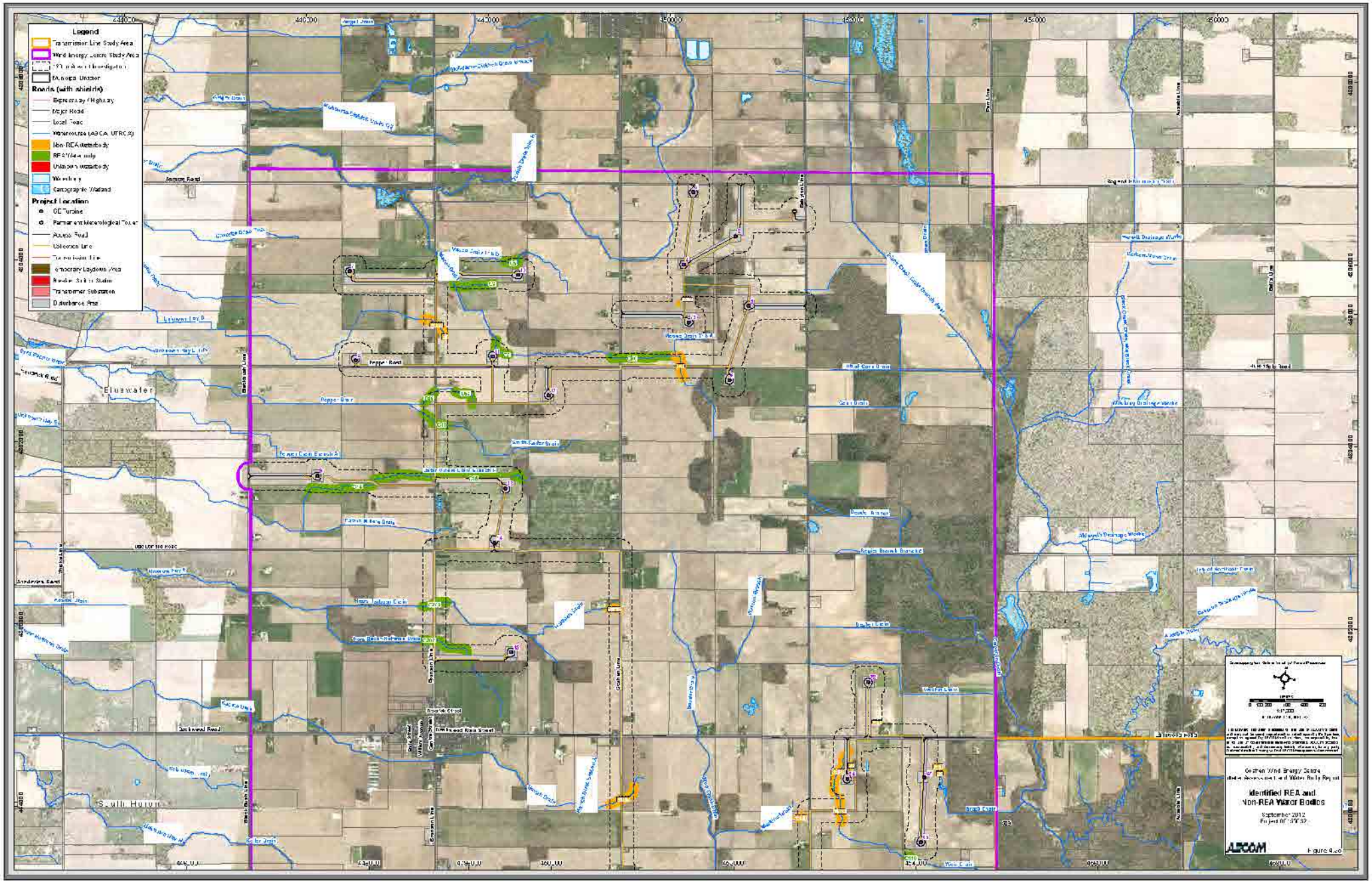
Appendix F provides a summary of the REA water bodies and land within 30 m investigated in the Project Study Area and describes the Project Component associated with the water body and the shortest distance (m) to the Project Component.

Each of the effects and mitigation measures associated with each of the Project Components are discussed further in Section 5.


Legend
Transmission Line Study Area
Wind Energy Centre Study Area
Other Areas of Investigation
Municipal Division
Roads (with shields)
Expressway / Highway
Major Road
Local Road
Watercourse (MNR, UTRCA)
Non-PSW Waterbody
PSW Waterbody
Water Body
Cartographic Wetland
Project Location
OEB Line
Permanent Meteorological Tower
Access Road
Collection Line
Transmission Line
Temporary Laydown Area
Substation
Disturbance Area
4.2a
4.2b
4.2c
4.2d
4.2e
Lambton Shores
North Middlesex
Lucan Biddulph
Perth South
West Perth
North Huron
South Huron
Identified REA and Non-REA Water Bodies
Key Map
August 2012
AECOM


Legend
Project Location
Roads (with shields)
Project Location
Lambton Shores
South Huron
North Middlesex
Identified REA and Non-REA Water Bodies
September 2012
AECOM


Legend
Transmission Line Study Area
Wind Energy Centre Study Area
100 m Area of Investigation
Municipal Division
Roads (with shields)
Expressway / Highway
Major Road
Local Road
Watercourse (ABCA, LTRCA)
Non-REA Waterbody
REA Waterbody
Unknown Waterbody
Wetland
Cartographic Wetland
Project Location
GE Turbine
Permanent Meteorological Tower
Access Road
Collection Line
Transmission Line
Temporary Laydown Area
Passive Switch Station
Transformer Substation
Disturbance Area
South Huron
North Middlesex
Kirkton Road
Victoria Avenue West
Victoria Avenue East
Delaware Line
Parr Line
Ross Line
Bryanston Line
Scotch Line
Nairn Line
Ausable River Tributary
Identified REA and
Non-REA Water Bodies
September 2012
AECOM


Legend
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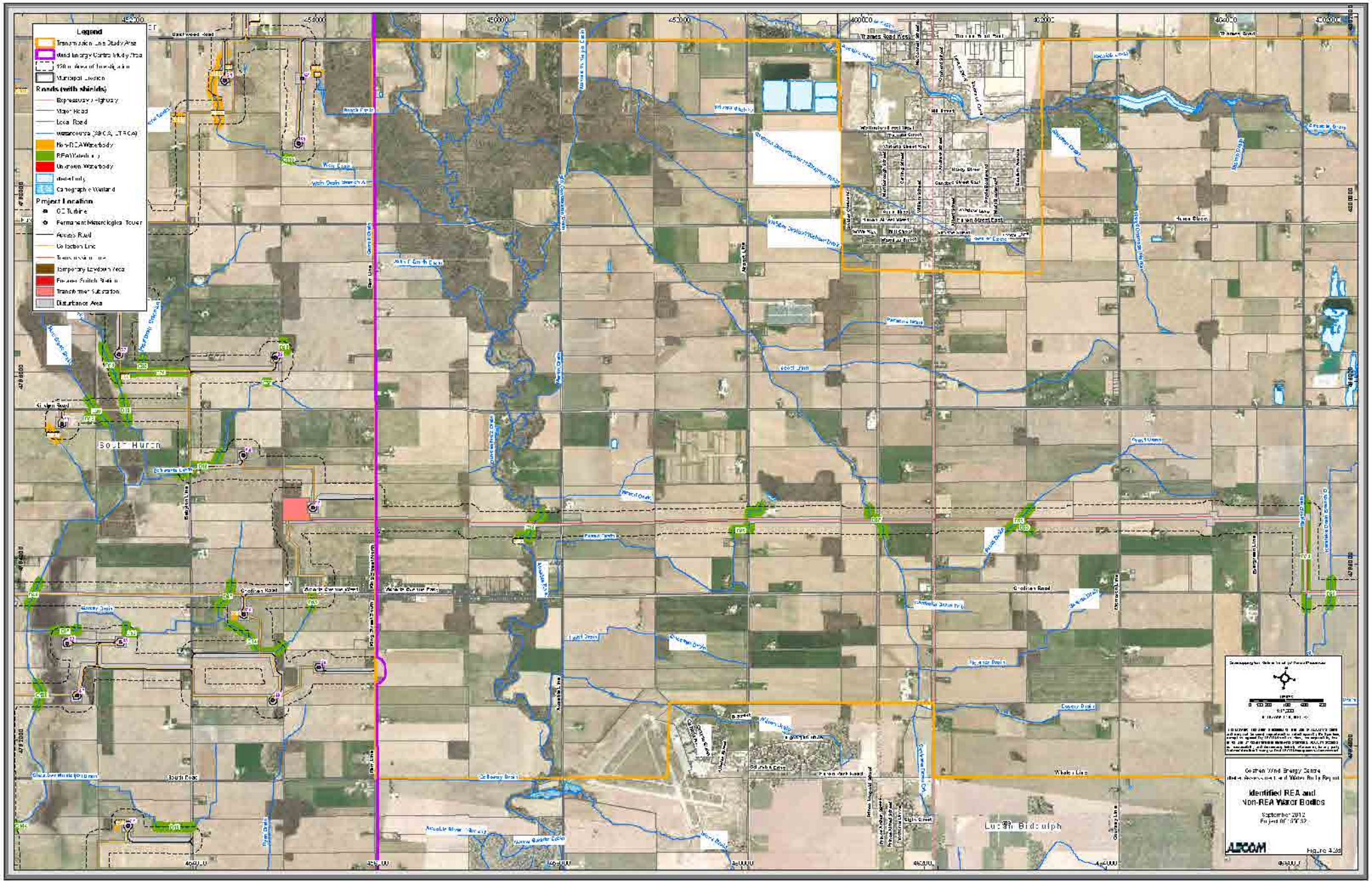
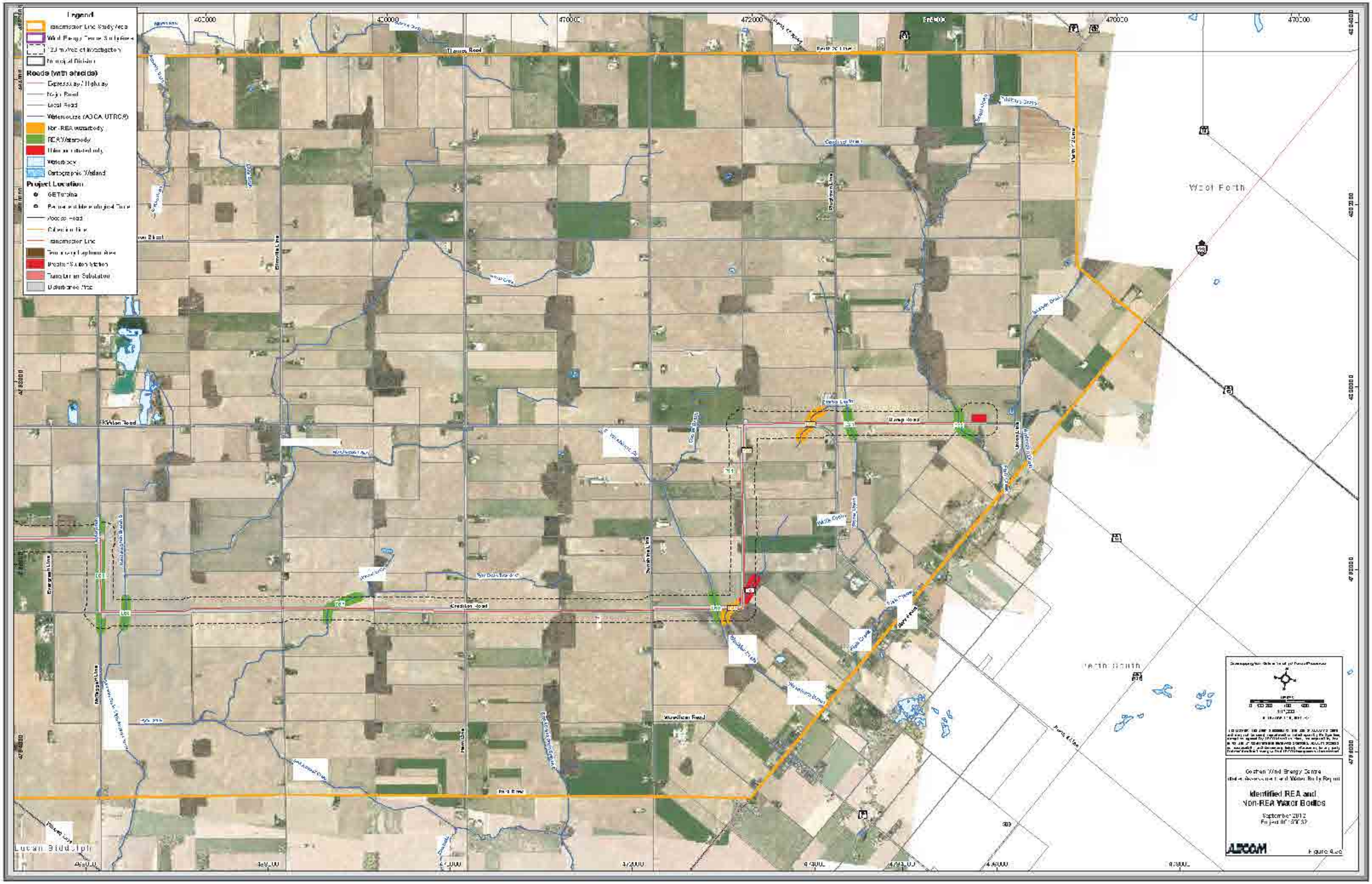
Wind Energy Centre Study Area
Project Location
Access Road
Collection Line
Transmission Line
Temporary Laydown Area
Transformer Substation
Disturbance Area
Elimatale
South Huron
Identified REA and
Non-REA Water Bodies
September 2012
AECOM


Legend
Transmission Line Study Area
Wind Energy Centre Study Area
Municipal Division
Roads (with shields)
Expressway / Highway
Major Road
Local Road
Watercourse (ABCA, LTRCA)
Non-REA Waterbody
REA Waterbody
Unknown Waterbody
Wetland
Cartographic Wetland
Project Location
GE Turbine
Permanent Meteorological Tower
Access Road
Collection Line
Transmission Line
Temporary Laydown Area
Project Switching Station
Transformer Substation
Disturbance Area
South Huron
Lucan Biddulph
Identified REA and Non-REA Water Bodies
September 2012
AECOM



Legend
Transmission Line Study Area
Wind Energy Centre Study Area
120 m Area of Investigation
Municipal Division
Roads (with shields)
Expressway / Highway
Major Road
Local Road
Watercourse (ABCA, UTRCA)
Non-REA Waterbody
REA Waterbody
Disturbance Area
Waterbody
Cartographic Wetland
Project Location
GE Turbine
Access Road
Collection Line
Transmission Line
Transformer Substation
Thames Road
Perth 20 Line
Kirkton Road
Crediton Road
Woodham Road
Sunshine Line
Hern Line
Mcgaggart Line
Union Line
West Perth
Perth South
Lucan Biddulph
Goshen Wind Energy Centre
Identified REA and
Non-REA Water Bodies
September 2012
AECOM

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

The discussion of effects arising from turbines assumes a 122 m x 122 m area in which construction activities will occur and turbine components may be stored. The turbines will be installed within this area, which therefore represents the full extent of potential physical disturbance associated with turbine construction.

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

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

Collection lines will be buried and will be located adjacent to the turbine access roads, where feasible. 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

One transmission line is proposed for the Project Study Area. A 115 kV transmission line will connect the transformer substation to the Hydro One transmission system. The transmission line will be installed on poles with overhead wires. 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 metres 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

A transformer substation and separate breaker switch station will be built to connect the turbines to the Hydro One transmission system through the transmission line. A secondary containment system will be installed around the transformer in the event of an oil leak to prevent any soil contamination. Construction is expected to last about four months.

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 the same property as the substation or an existing suitable structure will be purchased/leased 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 if required, 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. Both will be constructed in accordance with applicable municipal and provincial standards. Construction of the operations building may take up to three months to complete and will require a crew of approximately 10 to 15 people.

Equipment will include, at a minimum, forklifts, concrete trucks and smaller crew trucks. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment.

5.2.7 Permanent Meteorological Towers

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	Road Crossing • Moderate Sensitivity – C6, C52, C74, C208, D12 • Low Sensitivity – C73, C75, C76 Buffer • 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	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 Collection Line Buffer • 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	• Minimise 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.	• 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.
Obstruction of lateral flows in watercourses and other water bodies due to design of culverts and debris build-up at water crossings.	• No obstructions of lateral flows.	• Design culverts to accommodate high flows of the watercourse. • Inspect culverts during routine maintenance activities for buildup of debris.	• Obstruction of lateral flows in watercourses and other waterbodies will be avoided through culvert design and maintenance activities. • No likelihood of effect occurring.	• Inspect culverts during routine maintenance activities for buildup of debris.
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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