Stantec Consulting Ltd. (Stantec) was retained by Windlectric Inc. (the Proponent or Windlectric) to assess the need for and, if necessary, provide a plan detailing erosion and sediment control (ESC) and stormwater management (SWM) measures associated with the proposed development of the Amherst Island Wind Energy Project (herein referred to as the "Project"). Stormwater management analyses and designs have been completed to address the requirements for SWM measures as described in Section H of the project's REA Approval (#7123-9W9NH2) and supplement the information included as part of the application for a Renewable Energy Approval (the REA Application). SWM Analyses have been completed in multiple-phases to accommodate project scheduling and construction requirements. The *Amherst Island Wind Energy Project, Erosion and Sediment Control and Stormwater Management Plan Report Phase 1* (Stantec, 2016) and *Amherst Island Wind Energy Project, Erosion and Sediment Control and Stormwater Management Plan Report Phase 2* (Stantec, 2017) were previously submitted to the Ministry of Environment and Climate Change (MOECC), Cataraqui Region Conservation Authority (CRCA) and Loyalist Township.[1] The Phase 1 report discussed the SWM and Erosion and Sediment Control (ESC) requirements for the Island Dock Access Road construction and the private land access road, south of Front Road, connecting the Island Dock Access Road to the future Central Staging Area. The Phase 2 report discussed the SWM and ESC requirements for the Central Staging Area (CSA) including a dry-pond SWM facility.

The Phase 3 report summarizes the assessment of potential hydrologic impacts associated with the construction phase (i.e., ESC) and operational phase (i.e., SWM) of the Project for all other proposed infrastructure on the Island (i.e., the turbine locations, crane pads and associated private land access roads). This 'technical memo' was prepared as a summary of that Phase 3 SWM, for the specific purpose of informing the Loyalist Township/Windlectric "Road Use Agreement" "Operations Plan" as there are negligible changes to the stormwater impact on the public road infrastructure on the Island.

Potential hydrologic impacts assessed include changes to the quality and/or quantity discharged to the surface or sub-surface receiving systems. The objective of the report is to demonstrate that the Project design and proposed mitigation measures associated with the construction and operation phases of the Project are sufficient to minimize any potential impacts to environmental features within the Project area and, further, to provide details on the mitigation measures and control measures that will be implemented.

[1] The Phase 1 and Phase 2 reports have been approved by the MOECC and the CRCA through their Development Permit process. The Phase 1 report has been approved by Loyalist Township through a Fill Permit application while the Phase 2 report is currently under review by Loyalist Township.

Study Approach

The Phase 3 study approach involved the following components (note: A detailed assessment report will be provided to the MOECC, CRCA and Loyalist Township in the near future, for approval):

- A qualitative assessment of existing hydrologic conditions of the area and receiving systems.
- A review of the proposed Project activities as described in the REA Application with an emphasis on assessing potential for impacts associated with changes in hydrology.
- A semi-quantitative analysis of existing and proposed conditions to determine potential for short-term or long-term effects on receiving systems and mitigative approaches, if necessary.
- Development of an erosion and sediment control (ESC) strategy outlining the anticipated approach to minimize of impacts related to construction.

Study Results

The proposed Project is situated on predominantly agricultural lands with very low existing impervious coverage. Runoff drains overland to local drainage draws, small watercourses, and/or wetland features, ultimately discharging to Lake Ontario. Drainage patterns are to be maintained through the use of limited grading, maintenance of surrounding land uses (e.g., agricultural operations, and the provision of conveyance infrastructure (e.g., culverts)). As such, impervious coverage represents the primary parameter of potential impact to the hydrology of the Project area.

A series of 32 catchment areas were delineated which encompass all proposed Project infrastructure and, therefore, any hydrologic impacts associated with proposed impervious coverage increases, allowing for a comparison between existing and proposed conditions (Figure 1, attached). Owing to the dispersed characteristic of the proposed wind farm, with infrastructure distributed at very low density across a large area, deriving a reasonable comparison point at which to compare pre- and post-development conditions is somewhat subjective. For the purposes of the analysis, comparison points have been set at the closest downstream road crossing of a given catchment within which development (i.e., the creation of new impervious surfaces) is proposed. These locations have been selected since, should a hydrologic impact occur as a result of development, this is the location at which it would be most noticeable and of most interest to the public.

Industry-standard approaches to assessing the potential for hydrologic impacts related to changes in the amount of urban impervious coverage, as supported by literature[2,3], generally conclude that watersheds typically maintain pre-development hydrology characteristics until

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[2] *Impacts of Impervious Cover on Aquatic Systems, Watershed Protection Research Monograph No. 1,* Schueler, T., Center for Watershed Protection, March 2003.

[3] *The Importance of Imperviousness,* from *Watershed Protection Techniques, Vol.1, No.3 – Fall 1994,* Schueler, T., Centre for Watershed Protection, 1994

they exceed 10-15% impervious coverage. As in the summary table below, the impervious coverage in 31 of the 32 catchments identified as part of this study remains below 11.28% under the during construction scenario and below 3.23% over the life of the Project. The impervious coverage in catchment 15 increases from the existing 0.78% to 23.87% during construction and then drops to 3.23% post construction. Stormwater management controls, for catchment 15, to be installed during the construction phase, are documented in *Amherst Island Wind Energy Project, Erosion and Sediment Control and Stormwater Management Plan Report Phase 2* (Stantec, 2017), which has been subsequently approved by the MOECC, CRCA and is currently under review by Loyalist Township. It is concluded, therefore, that the development of the Project will have negligible impact on the hydrology of the area and receiving systems.

Table 1: Impervious Coverage Summary

Receivers / Catchment	Drainage Area (ha)	Impervious Coverage (%)		
		Existing	During Construction	Post Construction
1	20.48	0.05	9.59	1.69
2	30.42	0.01	4.78	0.57
3	46.38	0.04	3.75	0.50
4	81.16	0.22	2.86	1.18
5	7.15	0.59	6.13	2.67
6	112.95	0.36	2.61	0.78
7	29.13	1.11	5.14	2.42
8	4.39	1.30	1.55	1.30
9	4.69	0.12	6.77	2.14
10	78.68	0.00	1.03	0.39
11	63.12	0.01	1.65	0.61
12	17.31	-	-	-
13	35.88	-	4.64	0.70
14	35.59	1.32	7.79	2.56
15	76.53	0.78	23.87	3.23
16	21.29	0.06	1.95	1.95
17	67.38	0.03	1.84	0.52
18	96.87	0.03	4.63	0.78
19	13.49	-	11.28	1.61
20	20.11	0.01	2.62	0.69
21	825.15	0.28	1.23	0.52
22	14.55	0.99	5.54	2.56
23	888.36	0.66	4.47	1.30
24	167.51	0.17	4.06	0.88
25	393.41	0.12	1.75	0.36
26	22.95	1.18	8.57	1.76
27	47.16	0.12	4.73	1.11
28	20.61	0.24	5.29	0.98
29	14.75	0.46	7.89	1.96
30	20.56	0.03	2.39	0.92

31	17.62	0.14	2.88	1.17
32	10.21	0.05	0.05	0.05
Grand Totals	**3303.63**	**0.35**	**3.46**	**0.88**

Note: Stormwater management controls for proposed infrastructure within Catchment 15 have been documented in *Amherst Island Wind Energy Project, Erosion and Sediment Control and Stormwater Management Plan Report Phase 2* (Stantec, 2017)

Erosion and Sediment Control

While a site assessment yields a "high" erosion potential classification, a number of factors combine to limit the potential for impact on the receiving systems. Specifically, the relatively small area proposed to be disturbed, the short-term nature of the disturbance prior to stabilization whether through granular placement or re-vegetation, and the existing land use of the surrounding area as agricultural operations all combine to create a condition where a "standard" approach to erosion and sediment control will suffice to minimize potential for off-site impacts. The ESC plan accompanied by a monitoring and maintenance program will be implemented to prevent migration of sediment to downstream features during the construction phase of the Project.

Conclusion

Owing to the dispersed characteristic of the proposed wind farm, with infrastructure distributed at very low density across a large area, it was concluded that both the relative lack of change in impervious coverage associated with the proposed development and the resultant total impervious coverage within the local drainage catchments are sufficiently limited as to not impact the pre-development hydrologic characteristics of the area during construction or long-term operation of the Project, including any impact to the drainage features associated with the existing public road network. There should be negligible change/impact on the quality and/or quantity of surface water runoff and/or groundwater recharge and, therefore, there is no requirement for the implementation of formal stormwater quality or quantity controls.

We trust that the preceding technical memo meets your requirements for summarizing the ESC/SWM analysis. Should you have any comments or questions, please do not hesitate to contact the undersigned at your convenience.

Sincerely,

STANTEC CONSULTING LTD.

David Williams, P.Eng.
Water Resources Engineer
Tel: (519) 585-7320
Fax: (519) 579-6733
dave.williams@stantec.com

Attachments: Figure 1 – Results of GIS DEM Analysis and SWM Catchments

c. Mr. Sean Fairfield, Mr. Riley Griffin, Mr. Jim Stewart, Mr. Ariel Bautista and Mr. Homer Lensink, Algonquin Power Co.
Ms. Kerrie Skillen and Mr. Rob Rowland, Stantec Consulting Ltd.

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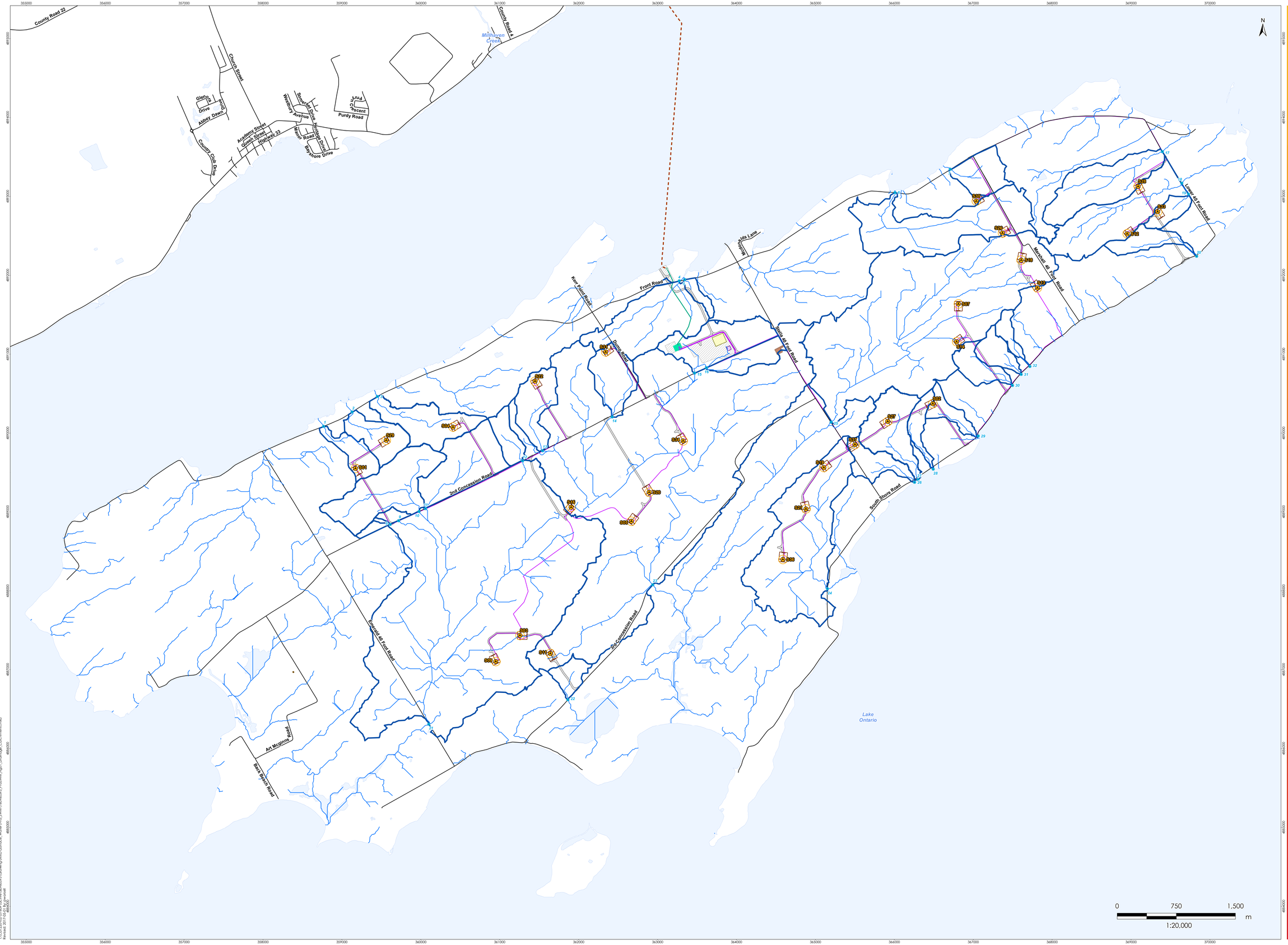
ATTACHMENTS



Stantec

Legend

- Point of Interest
- Flow Accumulation (minimum 4.5
- Point of Interest Catchment
- Turbine
- Island Cable Vault
- Submarine Cable Path
- Island Transmission Line
- Laydown Area and Crane
- Collector Line
- Access Road
- Storage Shed
- Batch Plant (Potential
- Site Office (Potential
- Turbine Blade Tip
- Substation (Potential
- Operation and Maintenance Building (Potential Location)
- Central Staging Area
- Road
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2017.

May 2017
160960595

Client/Project
Windlectric Inc.
Amherst Island Wind Energy Project

Figure No.
1

Title
Results of GIS DEM Analysis and SWM Catchments

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Revised: 2017-05-25 By: jennell
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