DURHAM-YORK ENERGY CENTRE GROUNDWATER AND SURFACE WATER MONITORING PLAN

Prepared for:
Regional Municipality of Durham
605 Rossland Rd. E.
Whitby, ON L1N 6A3

and

Regional Municipality of York
17250 Yonge Street
Newmarket, ON L3Y 6Z1

Prepared by:
Stantec Consulting Ltd.
300 - 675 Cochrane Drive, West Tower
Markham, ON L3R 0B8

September 14, 2011

Project No:160930024

Table of Contents

List of Figures

Appendix A

List of Tables

1.0 Introduction

1.1 BACKGROUND

The Durham-York Energy Centre (facility) is an energy from municipal solid waste facility to be constructed in the Municipality of Clarington, Ontario. Owned by The Regional Municipality of Durham and The Regional Municipality of York (the "Regions"), the facility will process up to 140,000 tonnes of solid, non-hazardous, municipal solid waste per year. The facility will be designed, built, and operated by an experienced contractor, Covanta Durham York Renewable Energy Limited Partnership. The facility is to be located near the Courtice Road interchange of Highway 401, as shown on Figure 1 (Appendix A). The Regions received approval for the facility from the Ministry of the Environment (MOE) under the *Environmental Assessment Act* on November 19, 2010. Three applications for Certificates of Approval under the *Environmental Protection Act* (EPA) for waste; air and noise; and stormwater were submitted to the MOE on March 3, 2011.

1.2 OBJECTIVE

This Groundwater and Surface Water Monitoring Plan has been prepared in accordance with Condition 20 of the Environmental Assessment (EA) Notice of Approval, as well as applicable regulatory criteria and accepted industry practices regarding groundwater and surface water monitoring. The Plan has been developed in consultation with MOE's Central Region Technical Support Section. The monitoring program is designed to provide an understanding of both groundwater and surface water quality during the construction and operation phases of the Durham-York Energy Centre and to ensure ongoing environmental management of the site. For ease of reference, the text of Condition 20 of the EA Notice of Approval is provided in its entirety below:

20. Groundwater and Surface Water Monitoring and Reporting

20.1 Prior to the start of construction, the proponent shall identify any areas where the undertaking may affect groundwater or surface water. For those areas, the proponent shall prepare and implement, in consultation with the ministry's Central Region Office and to the satisfaction of the Regional Director, a Groundwater and Surface Water Monitoring Program.

20.2 The proponent shall provide the Groundwater and Surface Water Monitoring Plan to other any government agencies for review and comment, as may be appropriate.

20.3 The Groundwater and Surface Water Monitoring Plan shall include at a minimum;

a) A groundwater and surface water monitoring program;

b) The proposed start date and frequency of groundwater and surface water monitoring;

c) The contaminants that shall be monitored as part of the groundwater and surface water monitoring program; and,

d) At least one meeting each year between the proponent and the Regional Director to discuss the plan, the results of the monitoring program and any changes that are required to be made to plan by the Regional Director.

20.4 The proponent shall submit the Groundwater and Surface Water Monitoring Plan to the Regional Director a minimum of 90 days prior to the start of construction or such other date as agreed to in writing by the Regional Director.

20.5 The Regional Director may require changes to be made to the Groundwater and Surface Monitoring Plan and the proponent shall implement the plan in accordance with the required changes.

20.6 The groundwater and surface water monitoring program shall commence prior to the receipt of non-hazardous municipal solid waste at the site or such other time as agreed to in writing by the Regional Director, and shall continue until such time as the Regional Director notifies the proponent in writing that the groundwater and surface water monitoring program is no longer required.

20.7 Thirty days after waste is first received on site, the proponent shall prepare and submit to the Director and Regional Director, a report containing all of the results of the groundwater and surface water monitoring program.

20.8 The proponent shall prepare and submit to the Director and Regional Director, an annual report containing the results of the groundwater and surface water monitoring program. The first report shall be submitted 12 months from the start of the monitoring program and every year thereafter.

20.9 The proponent shall prepare and submit to the Director and Regional Director, a report containing the results of the groundwater and surface water monitoring program within 30 days of any of the following events:

a) A spill occurs on site;

b) A fire or explosion occurs on site;

c) A process upset; or

d) Any disruption to normal operations that may directly or indirectly have an impact on groundwater or surface water.

20.10 The proponent shall post the Groundwater and Surface Water Monitoring Plan and all reports required by this condition on the proponent's web site for the undertaking following submission of the plan and reports to the ministry.

Per the definitions provided in the EA Notice of Approval, references in Condition 20 to "Director" means the Director of the Environmental Assessment and Approvals Branch and to "Regional Director" means the Director of the Ministry's Central Regional Office.

1.3 COMPETENT ENVIRONMENTAL PRACTITIONER (CEP)

The Regions retained Stantec Consulting Ltd. (Stantec) to prepare the groundwater and surface water monitoring plans required by Condition 20 of the EA Notice of Approval. In accordance with "Monitoring and Reporting for Waste Disposal Sites, Groundwater and Surface Water, Technical Guidance Document" (MOE, 2010), this monitoring plan has been prepared by both a groundwater Competent Environmental Practitioner (CEP) and a surface water CEP.

1.4 REPORT ORGANIZATION

The report is organized into six (6) general sections, including this introduction. Section 2.0 outlines the proposed groundwater monitoring program. Section 3.0 outlines the proposed surface water monitoring program. Section 4.0 provides details regarding reporting requirements associated with the monitoring programs. Section 5.0 provides closure and Section 6.0 provides a list of references. All figures referenced throughout the report are presented in Appendix A.

2.0 Groundwater Monitoring Program

2.1 DESCRIPTION OF EXISTING GEOLOGY AND GROUNDWATER CONDITIONS

The Durham-York Energy Centre is located in Clarington, Ontario and occupies approximately 12.1 ha of rural land, as shown on Figure 1 (Appendix A). The site is located southeast of Tooley Creek and just north of Lake Ontario. It is on the west side of Osbourne Road, north of the CN Railway and the Courtice Water Pollution Control Plant. The site is located within the1,050 ha Tooley Creek watershed area and is located in the Central Lake Ontario Conservation Authority (CLOCA) jurisdiction.

The Site is located in the physiographic region defined by Chapman & Putnam (1984) as the Iroquois Plain. The Iroquois Plain runs for a distance of approximately 300 km from the Niagara River to the Trent River, occupying the area between the current Lake Ontario shoreline and the historical Lake Iroquois shoreline, varying in width from a few hundred metres to about 12.5 km. The Durham-York Energy Centre is approximately 600 m north of the sand bluffs that make up the current Lake Ontario shoreline. In the vicinity of the Durham-York Energy Centre, the Iroquois Plain is comprised of silty lacustrine deposits and tills. A review of mapping by the Ontario Geological Survey (OGS, 2003), provided in Figure 2, shows that the Durham-York Energy Centre is underlain by Newmarket till, a dense till comprised of clayey silt and sand till. The Newmarket till can be traced across much of the Greater Toronto Area (Sharpe et al, 1999). This layer is estimated to be between 25 and 30 m in depth (Genivar and Jacques Whitford Ltd., 2007; CLOCA 2008; DFO et al. 2000). Further beneath lies an approximate 5 m thick layer of intertill sediments including both Thorncliffe and Scarborough formations (DFO et al., 2000). Directly beneath this 5 m layer is Whitby shale bedrock.

The site is approximately trapezoidal in shape. The width (east-west) is approximately 320 m and the length (north-south) varies from 300 to 460 m. The ground surface slopes gradually south. Mapping by the OGS (2003) indicated sandy silt to silty sand Newmarket till over the entire Site. In 2008, Jacques Whitford completed seventeen (17) boreholes within the Site, as part of a geotechnical investigation. The boreholes extended to depths ranging from 5 m to 12 m below ground surface (BGS), and generally indicated topsoil up to 0.6 m BGS underlain by dense to very dense silty sand material for the full depth of the borehole.

A geotechnical investigation conducted on the adjacent Courtice WPCP (Geo-Canada, 2004) immediately to the south of the CN Railway described the underlying lithology as comprised of mostly glacial till. Boreholes drilled for the Courtice WPCP, located approximately 150 m south of the facility site, identified bedrock at a depth of 16 m (Geo-Canada, 2004). Boreholes installed during the geotechnical investigation on the Durham-York Energy Centre site by Jacques Whitford in 2008 were not deep enough to encounter bedrock.

Based on regional data and the results of a geotechnical investigation conducted at the nearby Courtice WPCP, groundwater flow is interpreted to be in a northeast to southwest direction towards Lake Ontario (DFO et al., 2000; Geo-Canada, 2004). Groundwater flow direction across the Site will be confirmed as part of the baseline groundwater monitoring program.

Based on the 2008 borehole data, groundwater levels at the Site are interpreted to be approximately 1 m to 3 m BGS. The geotechnical investigation conducted at the nearby Courtice WPCP indicated groundwater levels typically ranged from 0.3 to 2.4 m BGS. Directly adjacent to Lake Ontario, groundwater levels were up to 14 m BGS (Geo-Canada, 2004).

The facility is located in a rural area, and surrounding residents are likely not serviced with municipal servicing, but rather private water wells. However, as the anticipated groundwater flow direction is to the south toward Lake Ontario, and the Courtice WPCP is located between the Facility and Lake Ontario, it is interpreted that no private groundwater users have the potential to be impacted. Figure 2 illustrates the locations of MOE water well records in the vicinity of the Facility. A review of Figure 2 indicates a handful of records were returned that plot on the Courtice WPCP and are likely related to historical geotechnical drilling at that property.

2.2 POTENTIAL SOURCES OF IMPACTS TO GROUNDWATER

A Groundwater Impact Study completed during the EA study concluded that development of the Durham-York Energy Centre would not have any noticeable effects on the surrounding groundwater resources during normal operations. Unprocessed waste will be stored indoors in a sealed concrete pit, set 5.5 m below grade, which will not allow leachate from the waste to come into contact with groundwater. Ash will be transported to a dedicated storage building with concrete floors using fully enclosed conveyors, and subsequently removed for off-site disposal. The primary means by which groundwater could potentially become affected would be through an upset condition at the facility. This monitoring program would provide an early warning if a potential affect were to occur.

Construction of the Durham-York Energy Centre may have some localized short-term effects on groundwater. The most significant potential effects would relate to dewatering operations during construction of the pit. If extensive dewatering is needed to construct the pit, then a Permit to Take Water may be required. Mitigation measures for construction dewatering would be addressed through the contractor’s application to the MOE for a Permit to Take Water.

2.3 ESTABLISHMENT OF MONITORING WELLS

2.3.1 Description of Locations

Groundwater monitoring wells will be established at five (5) locations to evaluate overburden stratigraphy, groundwater flow and water quality conditions throughout the Durham-York Energy Centre. Based on the Durham-York Energy Centre facility pit/foundation depth of about

9 mBGS, it is proposed to include some nested monitoring wells to evaluate vertical groundwater flow conditions.

Preliminary well placements are shown on Figure 3 in relation to surrounding Site features, and overlain on a development plan for the Facility on Figure 4. The following provides a description and rationale for each of the monitoring locations:

- MW1-11 is positioned in the northwest corner of the Durham-York Energy Centre, and is designed to monitor upgradient groundwater quality;
- MW2A/B-11 is positioned in the northeast corner of the Durham-York Energy Centre, and is also designed to monitor upgradient groundwater quality. This represents one of the nested monitoring well locations;
- MW3A/B-11 is positioned in the southwest corner of the Durham-York Energy Centre, near the west stormwater management pond, and is designed to monitor downgradient groundwater quality. This represents one of the nested monitoring well locations;
- MW4-11 is positioned in the southeast corner of the Durham-York Energy Centre, near the east stormwater management pond, and is also designed to monitor downgradient groundwater quality; and
- MW5A/B-11 (Note: suffix will likely change depending on year well is installed) is positioned in an area central to the Durham-York Energy Centre, and is designed to monitor for potential compromise of the waste storage pit, as indicated on Figure 4. The exact location of the well in the central facility area will be determined at the time of well installation to avoid interference with surface and sub-surface infrastructure. This well represents one of the nested monitoring well locations. Due to the potential for damage at this location during construction, it will not be installed during the initial phase of implementation of the groundwater monitoring plan. Rather this monitoring well nest will be installed following construction of the facility, but prior to receipt of any waste. Alternately, if suitable wells are installed during construction for dewatering, they will be preserved and converted to monitoring wells post-construction.

The target depth for the shallow wells is approximately 6 m BGS at all five (5) locations. The target depth for the deeper wells at MW2-11, MW3-11 and MW5-11 is approximately 9 mBGS. Actual depth of each monitoring well will be dependent on borehole conditions encountered during installation.

Note that an existing monitoring well (BH 121) installed by Geo-Canada as part of an earlier investigation for the Courtice WPCP located near the southern property boundary of the facility, partway between MW3-11 and MW4-11, as indicated on Figure 3. The condition and suitability of BH121 for integration into this groundwater monitoring plan will be assessed, and it may be added to the monitoring program as a bonus downgradient monitoring point. If it is found to not be suitable, then it will not be included neither will it be replaced by a new monitoring well.

2.3.2 Borehole Advancement and Soil Sampling

The Regions will retain a well contractor licensed in the Province of Ontario to complete all drilling and monitoring well construction services in accordance with Ontario Regulation 903 (O.Reg 903), made under the *Ontario Water Resources Act*.

Once the location for all monitoring wells have been finalized and agreed to by all parties, utility clearances will be obtained for each proposed drilling location.

Boreholes for each monitoring well will be advanced using 108 mm (4 ¼ inch) inside-diameter (ID) hollow-stem augers (HSA), which produces a borehole 204 mm (8 inch) in diameter. During borehole advancement, samples of the soils will be collected using 0.61 m long, 50 mm ID split-spoon samplers. The standard penetration test (SPT) will be conducted during driving of the split-spoon sampler, and the results used to determine soil resistance N values. Observations will be made of soil type, grain size, moisture, and visual or olfactory evidence of environmental impacts in the field, and will be noted on borehole log field forms.

2.3.3 Monitoring Well Construction

Following completion of borehole advancement to the target depths, monitoring wells will be constructed in each borehole. At each location 50 mm (2-inch) diameter, Schedule 40, polyvinyl chloride (PVC) pipe with 1.52 m long (5 feet), No. 10 slot, PVC well screens attached to flush-threaded riser pipe will be used for monitoring well construction. The annular space between the well screen and the formation will be filled with silica sand. A bentonite seal (e.g. Holeplug™) will be placed above the sand pack, with the remaining annular space to ground surface filled with bentonite grout. Each monitoring well will be equipped with a friction cap and completed with a lockable above-ground steel protective casing.

2.3.4 Monitoring Well Development

Following installation, all new monitoring wells will be developed to remove any water added during installation, as well as any fine-grained material from around the screened interval. Development is intended to establish good hydraulic communication between the monitoring well screen and surrounding aquifer material, so that any samples collected from the monitoring well are representative of the subsurface conditions.

It is proposed that all development of the monitoring wells be completed using new dedicated 16 mm ($^{2}/_{3}$ inch) inside diameter (ID)high or low-density polyethylene (HDPE / LDPE) tubing connected to an inertial-lift sampling system).

2.3.5 Hydraulic Response Testing

After well development, single well response tests will be completed at each new monitoring well to provide estimates of the horizontal hydraulic conductivity of the formation material surrounding the screened interval. In turn, the horizontal hydraulic conductivity data will be used in conjunction with groundwater level data to estimate horizontal groundwater flow velocity at the Durham-York Energy Center, using Darcy's Law.

Testing will be completed by either introducing (falling head test) or removing (rising head test) a known volume of water or a solid slug to the water column, and monitoring the change in water level as the water column returns to static conditions. Pressure transducers and dataloggers will be temporarily installed within each monitoring well at the time of the test to provide continuous monitoring and ensure reliable data collection.

Analysis of the hydraulic response data to estimate the horizontal hydraulic conductivity of the aquifer material in the immediate vicinity of the monitoring well screens will be completed using an appropriate analytical method based on the aquifer conditions using specialty computer software.

2.3.6 Survey

Each new monitoring well will be surveyed for spatial coordinates and geodetic elevation. Coordinates will be referenced to a geodetic benchmark. Surveying will be completed to allow for placement of the monitoring wells on plans in relation to site features, and to allow for accurate determination of groundwater elevations.

2.4 ANALYTICAL PARAMETERS

The list of groundwater analytical parameters has been established in consultation with the MOE Central Region Technical Support Section bearing in mind the processes at the Facility. As outlined in Section 2.2., solid waste received by and ash generated at the Facility will be isolated from the groundwater environment. The purpose of the groundwater monitoring program is to evaluate if there are any upset conditions, and should focus on parameters that may allow for determination of such.

Monitoring should include field measurements which provide a basic understanding of the groundwater geochemistry. Recommended field parameters are temperature, pH, conductivity and oxidation reduction potential (ORP). To complement the field parameters, groundwater samples should be submitted for laboratory analysis of major cations (calcium, magnesium, sodium, potassium) and anions (chloride, sulphate, carbonate, bicarbonate).

Because both municipal solid waste and ash may contain metals, it is recommended that select metals be included in the analysis. Clark and Piskin (1977) assessed the suitability of a number of parameters for use in monitoring groundwater downgradient of landfills and found that boron and iron were the most useful metals. However, since iron can naturally be elevated in groundwater in Ontario its use is often complicated. As a result, it is recommended that boron be included as a trace metal in the monitoring program related to the municipal solid waste. With respect to the ash, arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver may be of concern (Tchobanoglous et al., 1993), although based on Stantec's experience cadmium, cobalt, lead and mercury are considered to be of primary importance.

Table 1 summarizes the groundwater analytical parameters to be included in the monitoring program.

Table 1: Groundwater Analytical Parameters

Field Measurements	water level, temperature, pH, conductivity, oxidation reduction potential (ORP)
Major Anions	Carbonate (CO_3), Bicarbonate (HCO_3), Chloride (Cl), Sulphate (SO_4)
Major Cations	Calcium (Ca), Magnesium (Mg), Potassium (K), Sodium (Na),
Metals	Boron (B), Cadmium (Cd), Cobalt (Co), Lead (Pb), Mercury (Hg)

2.5 METHODS

All sampling will be performed to industry standards and in accordance with protocols established by the MOE (1996).

Prior to sampling, each monitoring well will be purged using the dedicated Waterra™ inertial-lift sampling system installed during well development, or other equivalent sampling method. Purging is completed to remove standing water within the monitoring well casing, and to draw fresh water into the well ensuring samples collected are representative of the surrounding formation.During well purging, measurements of field parameters (pH, temperature, and conductivity) will be made, and purging will continue until a minimum of three well volumes have been removed or until the field parameters stabilize to within ±10 percent of the last measurement. However, if the monitoring well goes dry prior to removing three well volumes, the well will be allowed to recover, and then purged dry a second time, and following recovery the sample will then be collected.

Following purging, the groundwater samples will be poured directly from the sampling tubing into laboratory supplied sample containers, with appropriate preservative and labelled as to sample number. Groundwater samples for analysis of metals will be filtered in the field using 0.45 micron in-line filters. Field measurements of the final groundwater samples will be made for temperature, pH, conductivity and oxidation reduction potential (ORP). The groundwater samples will be stored in coolers with ice, and shipped to an accredited analytical laboratory under chain-of-custody documentation outlining the required analysis.

During each sampling event, a field duplicate sample will be obtained from one monitoring well for Quality Assurance/Quality Control purposes (QA/QC), to assess analytical precision in laboratory analysis.

2.6 SAMPLING SCHEDULE

2.6.1 Pre-Construction and During Construction

The groundwater monitoring plan is proposed to commence in the Fall, 2011, pending regulatory approval.

The pre-construction and during construction monitoring program will consist of collection of groundwater samples from the following monitoring wells:

- MW1-11;
- MW2A-11;
- MW2B-11;
- MW3A-11;
- MW3B-11
- MW4-11; and
- BH121, if monitoring well is found to be of suitable condition for inclusion.

Samples will be collected three (3) times per year, once each in the spring, summer and fall, for the parameters listed in Table 1.

2.6.2 Post Development – Years 1-3

The post development monitoring program in Years 1 to 3 of operations will be the same as the pre-construction and during construction monitoring program.

The one exception would be the establishment of monitoring wells MW5A-11 and MW5B-11 (Note: suffix will likely change depending on year well is installed), as outlined above in Section 2.3.1.

2.6.3 Post Development – Long Term

Following completion of the third year of the post-development monitoring program, the results will be subject to a critical review by a CEP to evaluate if revisions to the monitoring program may be appropriate. The review should include:

- Review of existing groundwater monitoring wells to ensure that adequate monitoring is completed within both upgradient and downgradient portions of the Site. Install/replace monitoring wells as needed.

- Evaluate water quality trends, including a comparison of post-construction to post development/facility operation. Three years represent a reasonable minimum duration for assessing post development changes to the groundwater regime.

- Demonstrated compliance with applicable compliance criteria and stable contaminant concentrations over time will support a reduction in the number of monitoring locations, monitoring parameters and/or monitoring frequency. All changes to the monitoring program must be approved in writing by the Regional Director.

2.7 REGULATORY CRITERIA AND DATA EVALUATION

2.7.1 Criteria

The groundwater component of the environmental monitoring program will be evaluated by comparing the groundwater quality data with the criteria provided in the Technical Support Document for Ontario Drinking Water, Standards, Objectives and Guidelines (MOE, 2006). These standards are collectively referred to as the Ontario Drinking Water Standards (ODWS). The ODWS prescribe standards of quality for all drinking water supplies to protect public health. Since the area surrounding the Durham-York Energy Center is rural, local groundwater has the potential for use as drinking water, so the use of drinking water quality limits is appropriate.

Although groundwater from waste disposal sites is also typically evaluated in relation to the Reasonable Use Concept (RUC) (MOE, 1994a and 1994b), consultation with the MOE’s Central Region Technical Support Section during preparation of this monitoring plan indicated that this was not appropriate for the Durham-York Energy Center. The Reasonable Use concept applies only to facilities that are explicitly designed and/or expected to discharge potential contaminants to the subsurface natural environment. Examples are natural attenuation landfills and sewage works that are designed to ex-filtrate to the subsurface. The Durham-York Energy Center is not designed or expected to discharge to the subsurface.

2.7.2 Data Evaluation

The results of the monitoring well installations implemented as part of this monitoring plan, as well as available borehole logs from historic geotechnical drilling programs, will be used to develop cross-sections illustrating the sub-surface stratigraphy at the facility. The results of groundwater level monitoring will be used to develop groundwater flow contours. The groundwater flow contours should be used to guide an assessment to confirm the assumption presented in Section 2.1 that there are not any downgradient private well users. If private well users are identified, then consideration should be given to adding some of these private wells to the water quality monitoring program.

It will be critical for the evaluation of the groundwater quality data to focus on determining whether or not an exceedance of an ODWS can be directly related to Facility operations. The quality of the downgradient groundwater will be compared to the upgradient groundwater, so should any parameters be naturally elevated above an ODWS or impacted by upgradient off-site sources, this is accounted for in the evaluation.

The basic geochemistry information provided through the collection of field parameters and laboratory analysis of major cations and anions should be used to evaluate the basic geochemical conditions of the groundwater upgradient and downgradient of the Facility, with an aim to distinguish whether or not differing sources of water are interpreted and thus allow for identification of any failures in the Facility controls.

For the heavy metals data, it will be important to evaluate the data from the upgradient locations versus the downgradient locations, and also the data from pre-construction to post-construction closely, and to focus on identifying if any trends can be established that may suggest failures in the Facility controls.

Lastly, it will be important to remember during the data evaluation that the Facility is located hydraulically downgradient from Highway 401, and changes in concentrations of parameters such as chloride or sodium may be related to road salt usage and not a failure of the Facility.

2.8 CONTINGENCY PLAN

In the event that the evaluation of the groundwater monitoring data suggests a possible failure in the Facility controls, The Regions will notify the MOE and submit contingency plan recommendations for corrective action.

In the event of a spill or other upset condition at the Facility, environmental monitoring and inspection personnel or the Region(s) will contact the MOE Spills Action Center (SAC) and follow procedures established in the Emergency Response Plan (ERP). On a case-by-case basis in reference to the spilled materials, nature of the upset condition, direction from the ERP and recommendations from SAC, additional groundwater sampling may be completed and may also include additional analytical parameters.

3.0 Surface Water Monitoring Plan

3.1 DESCRIPTION OF EXISTING SURFACE WATER ENVIRONMENT

The site is within the Tooley Creek watershed which drains approximately 1050 ha of mainly agricultural and rural land (CLOCA, 2008b). The Tooley Creek watershed has an approximate length of 5 km from north to south between its headwaters near Highway No.2 and its discharge point into Lake Ontario. It is a permanently flowing, warm water stream throughout its northern reaches. Immediately north of Highway 401, CLOCA has reported areas which may be inhabited by migratory salmon and as such the site is subject to an enhanced (Level 1) level of protection for stormwater management criteria.

3.2 POTENTIAL SOURCES OF IMPACTS TO SURFACE WATER

Potential sources of impacts to surface water are unique to the construction and operational (post-construction) phases of the facility. As such monitoring locations, methods, frequency and focal parameters are unique to each phase.

During the construction phase potential impacts include erosion of soils and the release of sediment which increases turbidity and total suspended solids concentrations in receiving waters and alters receiving water quality. In addition, construction phase spills or other upset conditions also have the potential to release deleterious substances into receiving waters. Primary sources of sediment release include site grubbing and clearing, the removal of existing vegetation and exposure of bare soils to runoff as well as release of sediment laden water during dewatering activities. Primary sources of spills include improper storage, handling, cleaning and loading of equipment, fuels and lubricants. The construction phase erosion and sedimentation control (ESC) plan, potential dewatering plan and spill contingency and emergency response plan documents are regulatory requirements and respective sources of impact and mitigation activities intended to eliminate or minimize impacts. Therefore the purpose of surface water monitoring during the construction phase is to monitor the facility site to ensure that approved surface water protection plans are implemented , maintained and are providing the intended surface water protection against sediment and spill release to receiving waters.

The operational facility is a Zero Process Water Discharge Facility. There will be no discharge of water from inside the facility buildings other than sanitary sewer discharges from the washrooms, which, will be treated at the Courtice WPCP. Stormwater drainage from outdoor surfaces such as rooftops, driveways, and landscaped areas will be collected in two stormwater management ponds, as shown on Figure 3.Discharge from the facility's stormwater management ponds will be conveyed westward via an existing swale within the CN Rail right-of-way before discharging into a small tributary of Tooley Creek approximately 1000 m west of the site. As part of drainage development plans for the Darlington Energy Park, within which the

Durham-York Energy Centre resides, a new or expanded stormwater conveyance swale is being considered to route westward adjacent to the CN Railway from Osborne Road to Tooley Creek. The purpose of surface water monitoring during the operations phase is to monitor the effectiveness of stormwater management controls in mitigating adverse water quality impacts to Tooley Creek receiving waters.

3.3 MONITORING STATION ESTABLISHMENT

During construction, early works will install site perimeter erosion and sedimentation control fencing, sedimentation pond(s) and early site grading. Subsequently, excavations may require temporary dewatering which will discharge to appropriate filtration/sedimentation features. During the construction phase, the entire site is considered to be a monitoring station for spills and upset conditions however, ESC monitoring will focus on sedimentations pond(s), silt fencing, dewatering sediment controls and other ESC features.

During the operations phase surface water monitoring will be conducted within Tooley Creek. Initial monitoring station establishment will involve station location selection based on access, monitoring requirements and station representivity. Two monitoring stations on Tooley Creek are proposed approximately 50 m upstream and downstream of the confluence of the eastern tributary immediately north of the CN railway tracks. These monitoring station locations are proposedto determine Tooley Creek quality upstream and downstream of the stormwater swale discharge point. The locations of proposed surface water monitoring locations are indicated in Figures 2 and 3.

3.4 SAMPLE FREQUENCY AND METHODS

3.4.1 Analytical Parameters

The list of surface water analytical parameters has been established based on recommendations provided in regulatory guidance for construction phase monitoring and operations phase stormwater management monitoring (MOE, 1995 & 2003; GGHA CA, 2006). In addition, the parameter list was developed in consultation with MOE Central Region Technical Support Section.

During construction, the primary parameters of interest will be Total Suspended Solids (TSS) and Turbidity. Temperature will also be monitored. During the operations phase the list of monitored parameters will be pH, Turbidity, Temperature and Electrical Conductivity (EC).

Additionally, in the event of a spill or other upset condition, environmental monitoring and inspection personnel or the Region(s) will contact the MOE Spills Action Center (SAC) and follow procedures established in the Emergency Response Plan (ERP). The sampling laboratory analytical suite will be determined on a case-by-case basis in reference to the spilled materials, nature of the upset condition, direction from the ERP and recommendations from SAC.

3.4.2 Methods

During construction, surface water monitoring will be conducted primarily through visual monitoring and inspection of ESC features and effluent turbidity by a qualified environmental monitor and inspector (EMI). If at any time, ESC measures are suspected by the EMI to not be achieving the goal of reducing erosion and sedimentation, the EMI may collect water quality samples for subsequent laboratory submission and analyses. Similarly, in the event of a spill or other upset condition potentially affecting surface water, the EMI may collect surface water quality samples for laboratory submission and analyses based on an analytical parameter suite determined on a case-by-case basis. Surface water quality samples will be stored in coolers with ice, and shipped to an accredited analytical laboratory under chain-of-custody documentation outlining the required analysis. During each sampling event, a field duplicate sample will be obtained from one surface water monitoring location for Quality Assurance/Quality Control purposes (QA/QC), to assess analytical precision in laboratory analysis.

During operations, surface water monitoring will be conducted in Tooley Creek at stations established upstream and downstream of the stormwater swale discharge point into Tooley Creek. Monitoring will be conducted continuously by *in-situ* multi parameter sondes measuring temperature, pH, turbidity and electrical conductivity. Sondes will be connected to dataloggers and will be downloaded and maintained by monitoring personnel. Subsequent to each data download a CEP will review the data, compare to relevant Provincial Water Quality Objectives (PWQO)(MOE, 1994) and Canadian Water Quality Guidelines (CWQG)(CCME, 2011) and provide interpretation and comment on water quality trends and potential adverse impacts. Additionally, surface water quality monitoring may be conducted at the facility in the event of a spill or other process upset potentially affecting surface water. In case of such an event, monitoring personnel will monitor surface water conveyance and end-of-pipe facilities for the visual presence of spilled or other relevant material and may also collect surface water samples for subsequent laboratory analyses.

3.4.3 Frequency

During Construction, surface water monitoring will be conducted on a weekly basis. Additional monitoring visits may also be undertaken during and/or after surface water runoff events such as rain storms or snowmelt. Monitoring will commence prior to the start of construction and continue until the commencement of facility commissioning for the receipt of solid waste.

During the operations phase, continuous *in-situ* monitoring will be conducted at a minimum daily frequency. However, the frequency of multi parameter sonde interrogation may be increased to hourly dependant on selected equipment memory capacity, power, cleaning and calibration requirements. Operational phase monitoring will commence with facility commissioning for the receipt of solid waste and will continue for a period agreed to by the Regions and MOE. *In-situ* monitoring equipment will be installed in Tooley Creek after ice-out in spring and removed in fall prior to freeze-up.

3.4.4 Pre-construction and During Construction Phase Monitoring

The purpose of the construction phase monitoring is to ensure that approved erosion and sedimentation control (ESC) works, as well as dewatering controls and measures are installed as per design, maintained and functioning to expectations, with the ultimate goal of mitigating adverse erosion/sediment impacts to Tooley Creek.

The surface water monitoring plan should start prior to construction, as early as Fall 2011, pending regulatory approval of the monitoring plan. Pre-construction and during-construction monitoring will be conducted by a qualified Environmental Monitor and Inspector (EMI). The role of EMI will include, but not be limited to:

1. Weekly monitoring of ESC and dewatering activities and controls for compliance with regulatory guidance and specified permit conditions

2. Monitoring the construction site for spills or other construction phase upset conditions that have the potential to impact surface water .

3. Periodic monitoring of surface water runoff events to ensure that ESC controls are achieving the goal of mitigating erosion and sediment release during and subsequent to wet weather and snowmelt conditions;

4. The EM Inspector may collect water quality samples at points where ESC and/ or dewatering controls have failed or are not suspected to be meeting TSS and/ or turbidity reduction objectives based on visual inspection. Such sampling may also extend to Tooley Creek to confirm no adverse impact to the receiver based on inadvertent ESC failures or other relevant upset conditions at the site.

5. The EMI will document ESC, dewatering and other surface water related control feature deficiencies, communicate these deficiencies to construction management and the contractor and make recommendations for remedial actions.

6. EMI reporting will be undertaken weekly and include the completion of a project specific EMI checklist, photographic records and a summary report highlighting weekly ESC works including deficiency reporting record, remedial recommendations and subsequent documentation of remedial works completion.

7. Weekly EMI reporting will be reviewed by a surface water CEP. In addition, when required, surface water quality sampling, parameter selection, data interpretation and subsequent remedial recommendations will be undertaken by a surface water CEP in collaboration with the EMI.

It is recommended that an approved copy of the Groundwater and Surface Water Monitoring Plan, weekly EMI reports and EMI personnel contact information be kept on site for review by MOE Enforcement personnel visiting the site. Reporting to MOE will be as per Condition 20 and as detailed in Section 4.

3.4.5 Post-Development Operations Phase Monitoring

The monitoring program will be reviewed and revised based on the findings of the pre-construction and construction phase monitoring program and a long term monitoring program will be developed. As mentioned above, there will be no process water discharged to the natural environment. During operation, monitoring will be conducted for the purpose of assessing the surface water impacts from adverse effects arising from facility stormwater discharging to the receiving water body, Tooley Creek.

The long term surface water monitoring program will include:

- Continuous *in-situ* monitoring of water quality in Tooley Creek at monitoring stations and by methods and monitoring frequency as indicated in Sections 3.4.1 – 3,4.3 above.
- Maintenance and calibration of continuous *in-situ* monitoring equipment in accordance with manufacturer's specifications;
- Review of continuous *in-situ* water quality data after each equipment download event by a CEP, comparison to the relevant PWQO/ CWQG, data interpretation and comment on water quality trends;
- The CEP review will also note water quality data and/or trends that may indicate that stormwater management water quality controls are not functioning to expectations or the occurance of an upset condition;
- Although the Operations phase surface water monitoring plan is proposed to continue for the duration agreed to by MOE and the Regions, the continuous nature of water quality data may provide adequate data after the first year of monitoring to support alterations to the plan or demonstrate no adverse impacts to Tooley Creek; and
- Annual reporting to MOE may include recommendations for surface water monitoring plan adaptations.

3.5 REGULATORY CRITERIA

Surface water quality data will be compared to the PWQOs and CWQGs. The CEP will review weekly EMI reporting during construction, any surface water quality sampling analytical results and continuous monitoring data.

The CEP will evaluate the upstream/ downstream water quality data to discern if ecologically meaningful change has occurred between upstream and downstream water quality, and to determine if mitigation is warranted. The CEP will use PWQOs; background conditions and CWQG as reference and for comparison purposes and make recommendations on whether corrective action is needed or not. The CEP would provide water quality interpretation sufficient to detect short-term issues and long-term (negative/positive) trends.

3.6 CONTINGENCY PLAN

In the event of a spill or upset condition, the EMI and CEP will review and monitor the effectiveness of remedial activities. Remedial actions for such events are documented in the facility's Spill Contingency and Emergency Response Plan. Notwithstanding regulatory and monitoring plan reporting requirements for spills or upset conditions potentially affecting surface water, the EMI, CEP and Regions may consult with MOE Central Region Technical Support Section if remedial activities are not meeting water quality improvement expectations to develop further contingency actions.

4.0 Reporting

4.1 POSTING TO WEB SITE

In accordance with Condition 20.10 of the EA Notice of Approval, this Groundwater and Surface Water Monitoring Plan, and all subsequent monitoring reports to the MOE, shall subsequently be posted on the Durham-York Energy Centre project website.

4.2 ANNUAL MONITORING REPORTS

In accordance with Condition 20.8 of the EA Notice of Approval, annual reports will be prepared containing the results of the ground and surface water monitoring program. The first report will be submitted to the MOE Director and Regional Director 12 months from the start of the monitoring program. Subsequent reports will be submitted every year thereafter.

The monitoring reports will be prepared in general accordance with the MOE (2010) Technical Guidance Document on Monitoring and Reporting for Waste Disposal Sites, by both a groundwater and surface water CEP.

At a minimum, the annual monitoring reports will contain:

- Description and characterization of the hydrogeologic and surface water settings;
- A description of the groundwater and surface water monitoring locations;
- Documentation and the dates and methods employed for all sample collection;
- Laboratory and monitoring equipment analytical results;
- A compilation of all data obtained during the monitoring programs;
- Interpretation of results and comparison against applicable regulatory criteria;
- Identification of potential contaminant mechanisms and migration pathways; and
- Recommendations for changes to the monitoring plan.

4.3 FACILITY INITIATION REPORT

In accordance with Condition 20.7 of the EA Notice of Approval, a report shall be prepared containing the results of the ground and surface water monitoring program from the pre-construction and construction phases will be submitted to Director and Regional Director within 30 days after waste is first received at the Durham-York Energy Centre.

This report will be similar to annual monitoring reports, and may contain similar information as outlined above, but will focus on the results of the pre-construction and construction phases, and summarize the baseline conditions at the facility.

4.4 EMERGENCY REPORTING

In accordance with Condition 20.9 of the EA Notice of Approval, a report shall be prepared to the Director and Regional Director detailing potential impact to groundwater or surface water within 30 days of any of the following events:

a. a spill occurs on site

b. a fire or explosion occurs on site

c. a disruption to normal operations that may directly or indirectly have an impact on groundwater or surface water.

The report shall recommend any additional monitoring or testing required as a result of the event.

As required by Condition 17 of the EA approval, the Regions will prepare and submit to the MOE a Spill Contingency and Emergency Response Plan including notification and reporting procedures and describing measures to prevent, contain, and mitigate the effects of spills, fires, explosions or other disruptions to operations at the facility. This monitoring program will provide a mechanism for monitoring the effects of spills or other emergency occurrences potentially affecting surface water and/or groundwater, over time, as required by Condition 20.9 of the EA approval.

4.5 MEETINGS

In accordance with Condition 20.3 of the EA Notice of Approval, one (1) meeting per year shall be held with the Regional Director to discuss the results of the monitoring program and any proposed changes.

5.0 Closure

This Groundwater and Surface Water Monitoring Plan has been prepared on behalf of, and for the exclusive use of, the Regions, and their representatives, for the Durham-York Energy Centre. This Plan only represents the information and literature available at the time of its preparation. The statements presented herein represent the best judgment of Stantec Consulting Ltd. based on current knowledge and standards. Stantec Consulting Ltd. attests that to the best of our knowledge, the information presented in this report is accurate.

Respectfully Submitted

STANTEC CONSULTING LTD.

Clare L. Stewart, M.Sc., P.Eng.	Sheldon Smith, MES, P.Geo.
Senior Hydrogeologist	Senior Hydrologist

v:\01609\active\160930024\planning\report\monitoring_plan\final_20110914\rpt_dyec_mon_plan_stantec_2011-09-14.docx

6.0 References

Chapman L.J. and Putnam D.F., 1984. The Physiography of Southern Ontario, 3rd ed., Ontario

CCME, 2011 Canadian Water Quality Guidelines for the Protection of Aquatic Life. Canadian Council of Ministers of the Environment.

Clark T.P. and R. Piskin, 1977. Chemical Quality and Indicator Parameters for Monitoring Landfill Leachate in Illinois. Environmental Geology, Vol. 1, pp.329-339.

CLOCA, 2008. Lynde Creek Watershed: Existing Conditions Report. Central Lake Ontario Conservation Authority.

DFO, CLOCA and MNR, 2000. Bowmanville/Soper Creek Aquatic Resource Management Plan. Department of Fisheries and Oceans, Central Lake Ontario Conservation Authority and Ministry of Natural resources.

Genivar and Jacques Whitford Ltd., 2007. Application of Short List Evaluation Criteria: Report on Potential Water Quality Impacts (Surface Water & Groundwater).

Geo-Canada Ltd., 2004. Courtice WPCP Geotechnical Investigation Report.

GGHA CA, 2006. Erosion and Sediment Control Guideline for Urban Construction. Greater Golden Horseshoe Area Conservation Authorities (GGHA CA)

Jacques Whitford, 2008. Geotechnical Investigation: Durham/York Residual Waste Study, Clarington, Ontario.

Jacques Whitford, 2009. Surface Water and Groundwater Assessment - Technical Study Report, Durham-York Residual Waste EA Study. July 2009.

Ministry of Environment and Energy (MOE), 1994a. The Incorporation of the Reasonable Use Concept into the MOE Groundwater Management Activities. Guideline B 7.

Ministry of Environment and Energy (MOE), 1994b. Determination of Contaminant Limits and Attenuation Zones. Procedure B 7 1.

Ministry of Environment and Energy (MOE), 1994c. Water Management Policies, Guidelines and Provincial Water Quality Objectives of the Ministry of Environment and Energy. First Published July 1994, Reprinted February 1999. Publication No. PIBS 3303E.

Ministry of the Environment (MOE), 1995. Guidelines for Evaluating Construction Activities Impacting on Water Resources. Guideline B-6 (Guideline B-6 – a consolidation of former Ministry guidelines B-6, B-8, B-10 and B-11.). Program Development Branch, January, 1995)

Ministry of the Environment (MOE), 1996. Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario. Version 1.1. December, 1996.

Ministry of the Environment (MOE), 1998. Landfill Standards, A Guide on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites. May 1998. Last Revision Date: June 2010.

Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March, 2003.

Ministry of the Environment, 2010. Monitoring and Reporting for Waste Disposal Sites. Groundwater and Surface Water Technical Guidance Document. MOE Operations Division, November, 2010.

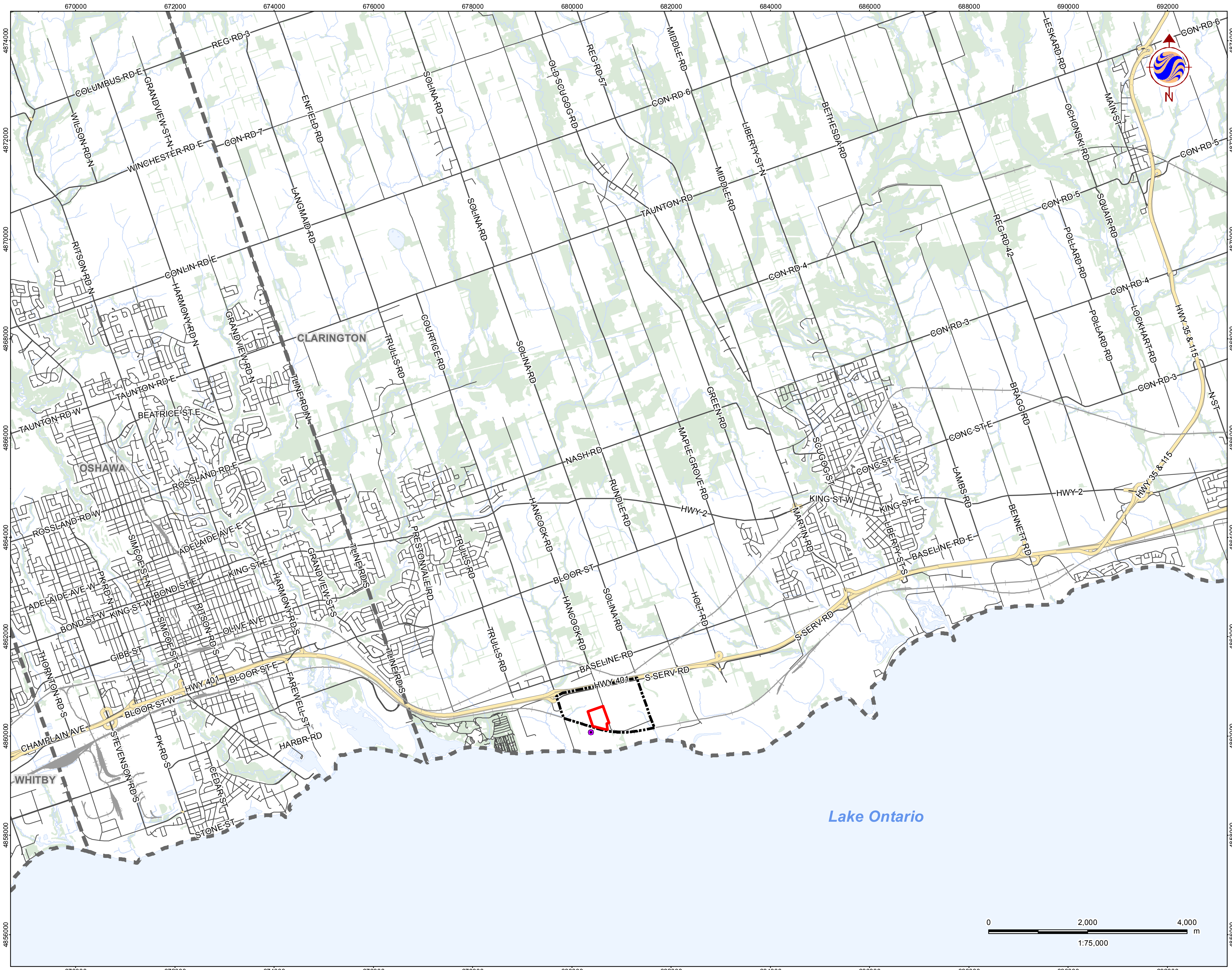
Ontario Geological Survey (OGS), 2003. Surficial Geology of Southern Ontario. MRD 128.

Sharpe, D.R., Barnett, P.J., Russell, H.A.J., Brennand, T.A. and Gorrell, G. 1999. Regional Geological Mapping of the Oak Ridges Moraine, Greater Toronto Area, Southern Ontario. Geological Survey of Canada. P. 123-136.

Tchobanoglous G, Theisen H, and Vigil S. (1993). Integrated Solid Waste Management, Engineering Principles and Management Issues. New York: McGraw-Hill, Inc.

APPENDIX A

FIGURES



Legend

- Courtice Water Pollution Control Plant
- Durham-York Energy Centre
- Clarington Energy Park
- Railway
- Municipal Lower tier Boundaries
- Road
- Waterbody
- Watercourse
- Wooded Area

Notes

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2011.

Stantec

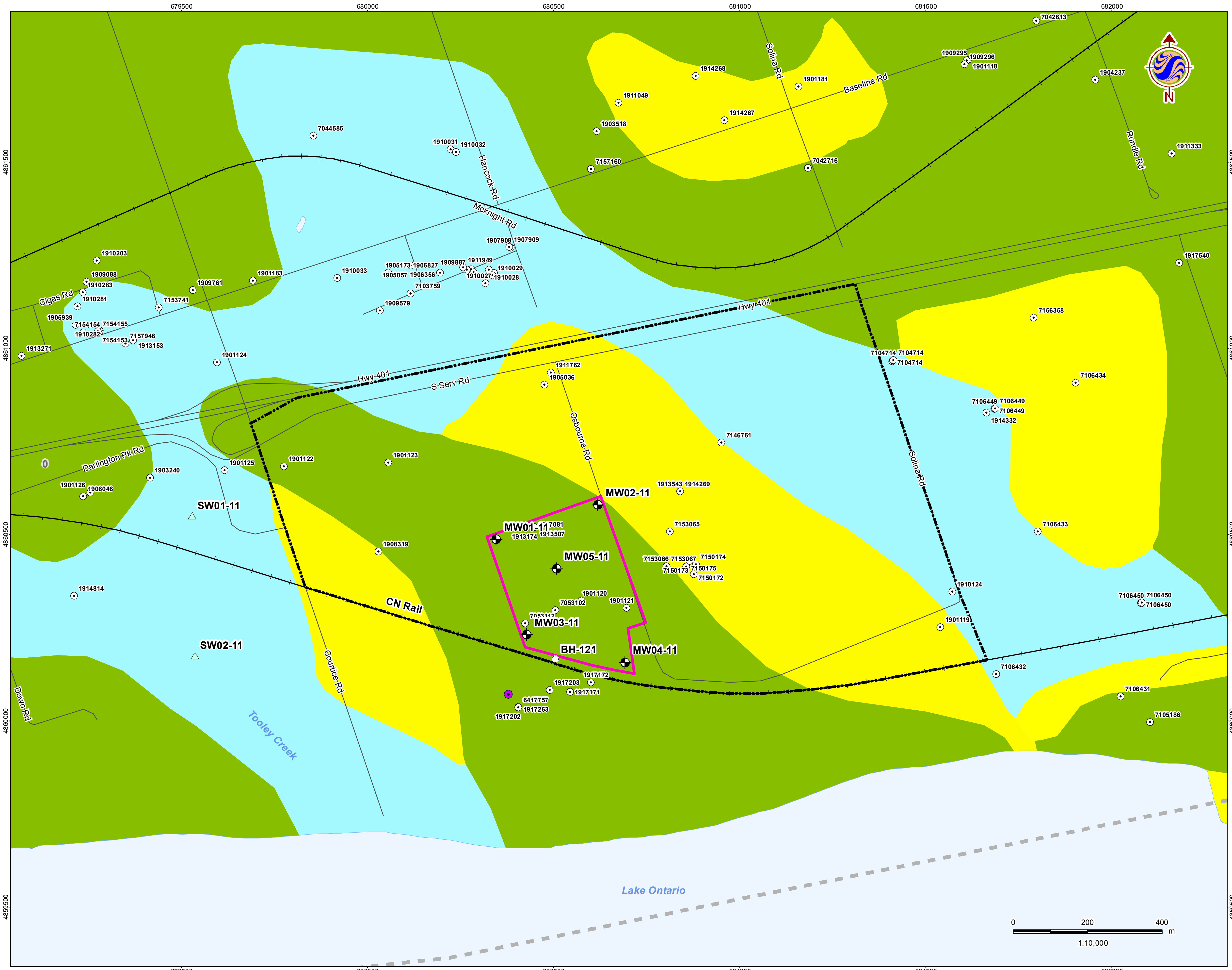
September, 2011
160930024

Client/Project
Durham-York Energy Centre
Groundwater and Surface Water
Monitoring Plan

Figure No.
1

Title
Site Location

Path: V:\01223\active_other_pcs\160930024 Durham York GW-SW monitoring\drawing\MXD\Fig01_RegionalSitesetting.mxd
Revised: 2011-09-06 By: bcowper



Legend

- Proposed Surface Water Monitoring Location
- Proposed Groundwater Monitoring Location
- Groundwater Monitoring Location (Geo-Canada Ltd.)
- MOE Water Wells
- Courtice Water Pollution Control Plant
- Clarington Energy Park
- Railway
- Municipal Lower tier Boundaries
- Durham-York Energy Centre
- Roads
- Waterbody
- Watercourse

Surficial Geology

- 5b: Stone-poor, carbonate-derived silty to sandy till
- 8a: Massive-well laminated
- 9b: Littoral-foreshore deposits
- 9c: Foreshore-basinal deposits
- 14b: Littoral-foreshore deposits

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2011.
3. Surficial geology produced by the Ontario Geological Survey 2003. Surficial geology of Southern Ontario; Ontario Geological Survey, MRD 128.

Stantec

September, 2011
160930024

Client/Project

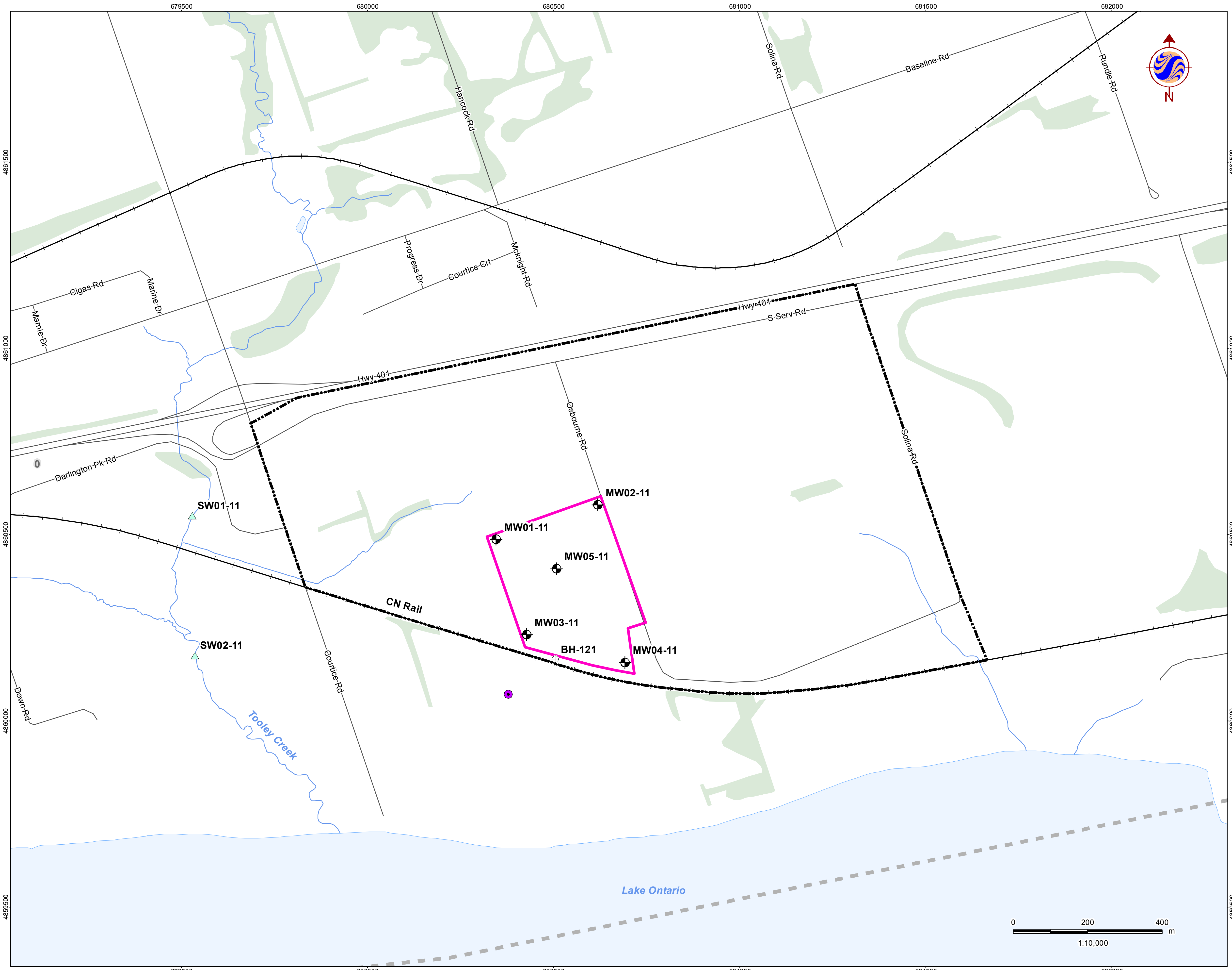
Durham-York Energy Centre
Groundwater and Surface Water
Monitoring Plan

Figure No.
2

Title

Surficial Geology and MOE Water Well Records

Path: V:\01223\active_other_pcs\160930024 Durham York GW-SW monitoring\drawing\MXD\Fig02_Surficial_Geology.mxd
Revised: 2011-09-06 By: bcowper



Path: V:\01223\active_other_pcs\160930024 Durham York GW-SW monitoring\drawing\MXD\Fig03_Proposed_GW_SWMonLocations .mxd
Revised: 2011-09-06 By: bcowper

Legend

- Proposed Surface Water Monitoring Location
- Proposed Groundwater Monitoring Location
- Groundwater Monitoring Location (Geo-Canada Ltd.)
- Courtice Water Pollution Control Plant
- Clarington Energy Park
- Railway
- Municipal Lower tier Boundaries
- Durham-York Energy Centre
- Roads
- Waterbody
- Watercourse
- Wooded Area

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2011.

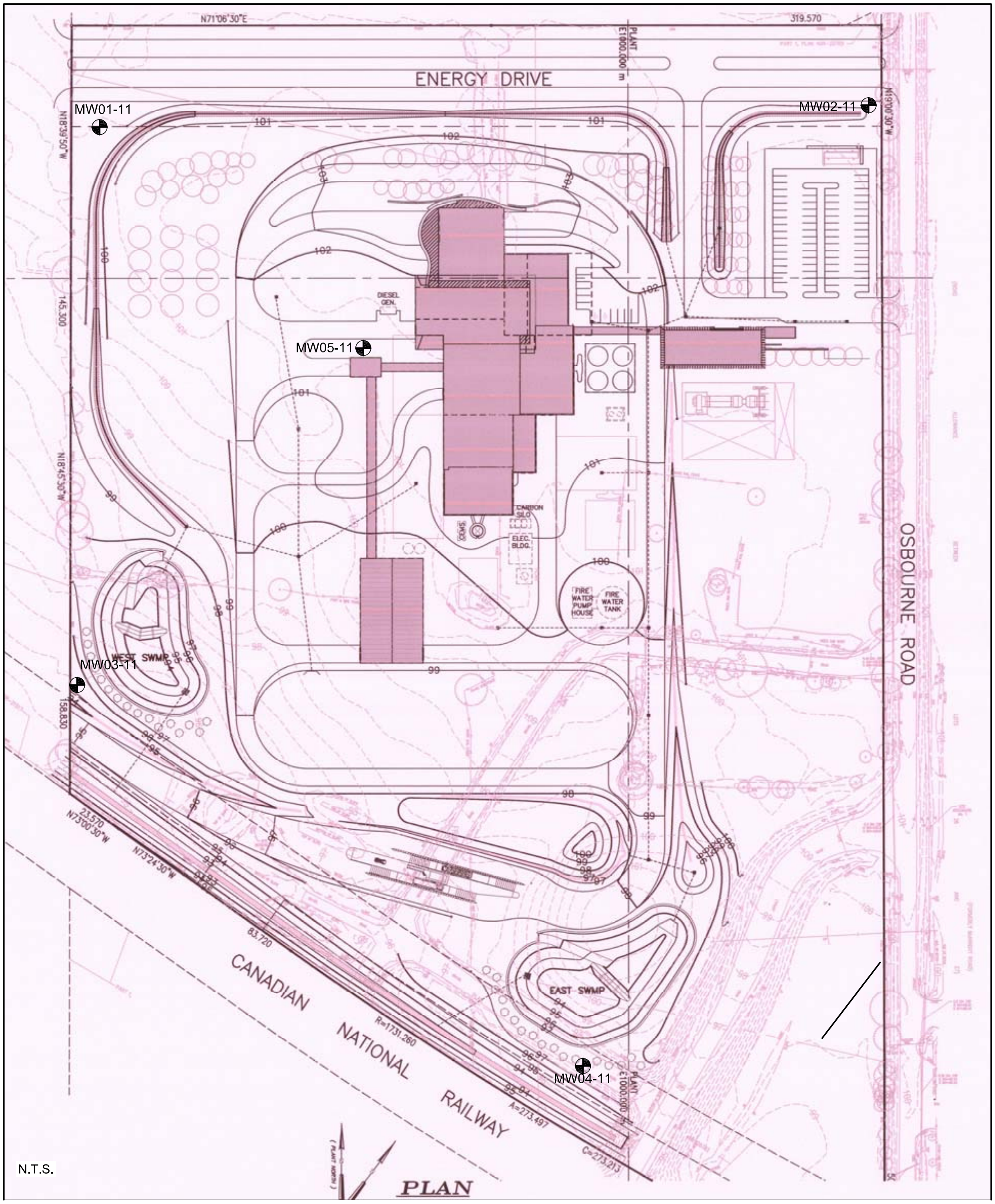
Stantec

September, 2011
160930024

Client/Project
Durham-York Energy Centre
Groundwater and Surface Water
Monitoring Plan

Figure No.
3

Title
Proposed Groundwater and Surface Water Monitoring Locations



V:\01223\active_other_pcs\160930024 Durham York GW-SW monitoring\drawing\CAD\201102_ProposedMonitoring\Fig02_EFWMonLoc.dwg
Revised on: 2011-09-06 By: bcowper
Printed on: 2006-07-24 09:50AM By: BCowper

September 2011
160930024

Legend

MW01-11 Proposed Borehole/Groundwater Monitoring Location

Notes

1. Plan source: EFW Facility Monitoring Locations, by Covanta Energy Inc., December 13, 2010 for Durham & York Regions..
2. Monitoring well MW05-11 to be installed after construction is complete and prior to the receipt of municipal solid waste.

Stantec

Client/Project
Durham-York Energy Centre
Groundwater and Surface Water Monitoring Plan

Figure No.
4

Title
Facility Plan and Proposed Groundwater Monitoring Locations