Kent Breeze Corporation
MacLeod Windmill Project Inc.

KENT BREEZE WIND FARMS

Construction Plan Report

MAY 2010

IBI GROUP

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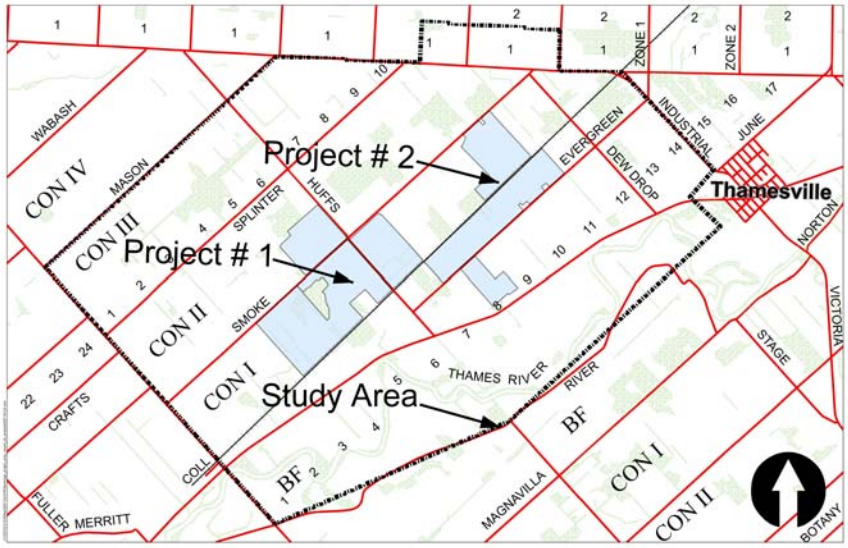
1. INTRODUCTION

The purpose of this management plan is to outline the methodology to be used by Kent Breeze Corporation & MacLeod Windmill Project in implementing construction activities during the construction phase of the Kent Breeze Wind Farms projection in the Municipality of Chatham-Kent. The report fulfills the requirement of Item 2 in Table 1 of Ontario Regulation 359/09. The proponents are proposing to construct two 4-turbine wind farms at the following locations:

- Project 1 – Part Lots 8-11, Concession 1, in the geographic Township of Camden, in the Municipality of Chatham-Kent, on the south side of Smoke Line, east of Huffs Side Road; and
- Project 2 – Part Lots 4-6, Concession 1 & 2, in the geographic Township of Camden, in the Municipality of Chatham-Kent, on the north and south side of Smoke Line, west of Huffs Side Road.



The original owners of the proponent companies are the owners of all the lands and are involved in the day-to-day farming of the subject lands, and as such have made great efforts to establish good relations with the local community and plan to be a long-term member of the community. Suncor, the new owner of the proponent companies, continues to work with both the original developers and the community to foster positive working relationships. During construction, the company's emphasis will always be on control and mitigation of wind farm effects on the local community and the environment.

The goal of the proponents during the construction of the wind farm projects will be:

- Safe work performance;
- On-schedule facility completion;
- Quality assurance (QA);
- Municipal cooperation; and
- Excellent community relations.

2. PURPOSE

This document will provide general information to neighbours and the general public, municipal staff and the Provincial approval authority regarding the wind farm projects as well as outline implementation procedures and protocols. This will facilitate understanding of the *construction* of the wind farm.

2.1 Scope of the Construction Plan

The Construction Plan includes the following specific areas:

Construction Activities – This section addresses the pre-construction studies, construction surveys, project management, and all aspects of construction of the project to be completed before the operational stage of the projects is reached.

Construction Timeframe – This section addresses the expected timeframe from the commencement of construction to the point at which the project begins to operate.

Environmental Impacts of Construction Activities and Mitigation Measures – This portion of the Construction Plan addresses any expected negative environmental impacts as a result of construction activities based on background research. The section also outlines the commitments by the owners of the wind farms to mitigate any negative environmental impacts.

3. PRE-CONSTRUCTION ACTIVITIES

3.1 Pre-Construction Surveys

3.1.1 CONSTRUCTION SURVEYS

Site surveys will be carried out to accurately record the exact locations and position of the wind turbines, the access road routes, and various terminal points and interfaces of the services required, in conformance with the site plans provided in Tab 4 of this application, the Design and Operations Report. Prior to proceeding with construction, the survey will clearly identify, for the construction crews:

- Access roads, cable routing;
- Wind turbine locations;
- Limits of the construction service area and temporary storage area;
- Electrical distribution line connections and arrangement; and
- The proximity of overhead lines, natural gas, water, communication, power supply and drainage point connections as necessary.

The survey will be undertaken by an Ontario Land Surveyor who will define, on plan, the boundaries of the facilities related to the legal property survey and UTM coordinates, NAD83, for registration of the plan after construction is complete. Levels will be taken as necessary to fully define the site profile and will be used as the vertical and horizontal control points for the project.

3.1.2 ELECTRICAL WORK

The following electrical work will be undertaken to finalize the detailed electrical design of the projects:

- Short Circuit Study – to evaluate and determine the peak duty and maximum break duty fault currents on all of the wind turbines and the interconnecting switchgear of the grid systems.
- Electrical System Coordination Study – to fully specify power fuse ratings, protective relay characteristics and settings, ratios and characteristics;
- Grounding System Study - utilizing information on soil resistivity that has been made available through on-site testing.
- It is noted that, because the wind turbine generating equipment produces electricity at the distribution system voltage where the project interconnects (27.6kV), no substation transformers are required for the project. Instead of a substation, electrical lines will collect at a switching station complete with a metering device and various

protection equipment where it will then connect to the Hydro One 27.6kV distribution system.

3.2 Site Supervision

The pre-construction activities will be managed by lead discipline engineers reporting to a Project Manager. Detailed engineering packages will be provided for the procurement of engineered equipment from vendors and third party suppliers. Detailed engineering drawings and material take-off lists will be provided for procuring bulk electrical materials and construction of the balance of plant.

The Project Manager will have overall responsibility for managing this phase of the project. Senior discipline engineers and the project manager will review and approve each of the vendors' packages, drawings, specifications and designs to ensure that the design of the project will meet the intended duty and will comply with specified requirements of the Owners.

3.3 Project Management

3.3.1 ROLE

The Owner's Project Manager will be responsible for the successful completion of the wind farm projects. The Project Manager will be supported on the Project by off-site design, procurement, project administration, planning/scheduling, construction management and supervision and other personnel assigned from affiliated companies, as required, to manage subcontractors and to self-perform work required to complete the Project.

3.3.2 SITE CONSTRUCTION

The Project Manager, or delegated team member, will monitor and review all aspects of the construction of the project to ensure that the work is undertaken safely in accordance with the requirements of the drawings and specifications and in accordance to the project programme. The Project Manager will be responsible for the entire projects site activities until the construction phase of the projects close out. The Project Manager will be assisted and supported at various times throughout the construction phase by construction superintendents; civil and electrical personnel; commissioning and quality control; and/or health and safety professionals.

3.3.3 SITE MANAGEMENT RESPONSIBILITIES

The Project Manager and the team will:

- Maintain good safety and health programs and practices as well as good environment control programs as part of all work activities;

- Execute site construction, installation and testing of equipment to a high standard of quality;
- Act as an interface with operational staff, the subcontractors, third party inspectors (TPI) and other organizations involved with the Project;
- Manage any environmental and safety issues during construction and commissioning;
- Assist the Commissioning Engineer and their team in conducting site tests, including pre-commissioning, plant start-up, commissioning and supervise the TPI as required;
- Organize and attend regular site co-ordination meetings, progress meetings and prepare minutes of meetings;
- Maintain on-site, complete and proper records of the progress of the Project;
- Maintain accounts and records of the cost of the works;
- Maintenance of correct as-built drawings reflecting all changes and modifications;
- Training of operations and maintenance personnel; and
- Construction completion, testing and commissioning of all balance of plant items.

3.3.4 SUBCONTRACT MANAGEMENT

Subcontract control will be conducted to ensure that any subcontractors carry out their work at the site in accordance with the Project safety and quality requirements and complete their work in accordance with the Project schedule. Any subcontractors will be controlled, with emphasis on safety; control of technical information; fulfilling reporting requirements; inspection and testing of construction material; and non-conformance and quality control.

4. CONSTRUCTION AND INSTALLATION ACTIVITIES

4.1 Materials

Construction of the project will involve the materials outlined in the attached Appendix 2 (Materials Description). Heavy machinery, metal re-bar and wiring will be stored temporarily at the construction service area and temporary storage area (Appendix 1). Aggregate for the access roads and turbine staging areas will be delivered on-site as required. Upon completion of the roads and underground cabling, concrete for the turbine foundations will be delivered as required. Following curing of the concrete, turbines will be delivered and temporarily laid down adjacent to foundation areas. It is anticipated that the temporary turbine lay down areas will not last longer than 4-5 days as installation of an individual turbine can be completed within this approximate timeframe.

4.1.1 TRANSPORTATION TO AND FROM SITE

The following chart outlines the detailed size, type and approximate number of trucks used to construct the project. It is estimated that approximately 3882 trips will be required through this process.

Task	Description	Number of loads
Mobilization and Offices	Office and Storage Set up. Approximately 4 loads for each 6 contractors	24
Large Equipment Deliveries	2 Excavator 2 floating	4
	2 Loader 2 floating	4
	1 Grader 2 floating	2
	2 80-Ton Crane 2 floating	4
	1 300-Ton Crane 2 floating	12
	1 1600-Ton Crane 2 floating	112
Access Road Materials	Soil Excavation and Spread 1/2 quantity - 15,652 m^3	525
	granular A & B	850
Crane pad and erection Area	Excavation	335
	Backfill	270
Foundation	Excavation	750
	Engineering Fill	35
	Mud Slab 7m^3 per truck	55
	Concrete footing	640
	Concrete Pumps	24
	Formwork 8 floating total	16
	Steel Reinforcement 2 loads per footing	16
	Anchor bolts and adaptor	8
Wind Turbines	16 truck loads for each tower	128
Cable and Trenching	Cable reel delivery	20
	Trenching equipment (2 sets) transport	4
	Directional drilling equipment transport	4
Electrical Misc	Major Equipment Deliveries	6
	HONI line work deliveries	2
General Delivery Not Elsewhere Listed	Assume 2 delivery per week for the construction duration	32
	Total loads	**3882**

4.2 Construction Equipment

Construction of the project will involve the machinery outlined in the attached Appendix 2 (Construction Equipment). Such machinery will involve noise and dust emissions to within norms established for the construction industry in Ontario. Movement of earth and travel on turbine access roads will generate small amounts of dust which will fall on the project area. Water sprayers for the purposes of dust control are planned for public and turbine access roads as required by the municipality.

Fuels (diesel and gasoline), lubricants (motor oils, hydraulic oils), and coolants (glycol blends) are used in the construction equipment; typical refuelling practice for mobile equipment is as follows:

- re-fuelling for smaller vehicles will take place at the construction service area (Appendix 1) that include a 500 gallon (double wall, vacuum) fuel tank, complete with fuel pump and safeties such as excess flow valves, and level limit controls
- for larger vehicles and cranes that cannot come to the construction service area, fuel is taken to them in fuel trucks;
- spill kits are available at the construction service area and within fuel trucks.

Equipment is transported to and from the project area on flatbed trailers (referred to as "floated") between each wind turbine site, as well as on/off site where it is not permitted for the equipment to travel on public roads. In general, machines with "tracks" have to be floated (tracked cranes, front end loader) over public roads.

4.3 Wind Turbines

4.3.1 STORAGE

The majority of the project components will be temporarily stored at a central location identified in Appendix 1 (Temporary Storage Area). Wind turbines may be stored in this location, or, if delivery schedules permit, stored adjacent to the individual permanent erection locations.

4.3.2 FOUNDATIONS

Wind turbine foundation areas will be excavated by tracked excavators to a depth of 2.5 meters (m). The projects will employ the use of piled foundations (see picture) due to local soil conditions which include a flat, soft, thick upper strata. The excavation compromises

the existing drainage tiles within the field resulting in some collection of surface water after a rain event. As a result small quantities of surface water may be required to be pumped from the excavation. Due to the shallow depth of the turbine bases (2.5m), the depth of the surrounding water table (approximately 5 metres) and the permeability of the soils, groundwater is not expected to enter the excavation (see Dewatering Memorandum - Appendix 3). Water collected in the foundation would be limited to surface water run-off during a rain event, thus dewatering activities would be periodic with precipitation events. Dewatering methods will employ a silt bag on the end of the pump discharge and use a sump as a suction point to pick up less saturated soil. Given the small amount of dewatering required, the outlets for any dewatering activities will be located adjacent to foundation areas and directed away from crops to avoid crop damage.

4.3.3 TURBINE ERECTION

Wind turbine erection will be carried out using a crawler crane or truck mounted crane across identified access roads on privately owned lands. All movement of heavy machinery is conducted by engineered lifts. A crane movement plan will be expedited with the objective of minimizing impacts to public rights-of-way and public traffic.

Turbines will be installed as per specifications provided by GE Energy. Wind turbine erection will occur when conditions allow for safe assembly conditions including wind speed and meteorological conditions. Wind speeds on-site will be measured at ½ hour intervals using a wind anemometer located on the top of the main crane.

4.4 Electrical Infrastructure

These projects are distribution level projects and do not require the construction of any electrical transformers or transmission lines and as a result will contain no noise generating equipment. Two self-contained electrical switching stations (see picture) will be delivered on flatbed trailers and mounted on concrete pads at the identified locations. Underground cabling will connect to the switching stations at these locations and be connected directly to the existing Hydro One Networks 27.6kv lines overhead.

4.5 Timing

4.5.1 OBJECTIVE

The development of an achievable and comprehensive schedule is essential to the success of the Project. A project schedule will be updated, based on approval of the REA application, which will form the basis of progress monitoring and act as principal indicator toward overall completion of the Project.

The subcontractor programmes will be reviewed to ensure that they accurately reflect the sequence and timing of Project activities. If any anomalies are identified, the Project Manager will discuss these with the subcontractors to ensure that the detailed schedule is agreed to and is acceptable to all parties.

4.5.2 TIMELINE

It is expected that project construction will take approximately six (6) months to complete. Construction of the project will begin as soon as building permits are granted by the Municipality of Chatham-Kent. Timing of activities will be as follows:

Mobilization and office setup:	1-2 weeks
Large equipment deliveries:	1-2 weeks
Access road and crane pad / erection area construction:	4-8 weeks
Foundations:	6-12 weeks
Wind Turbines	2-4 weeks
Cable and Trenching	2-4 weeks
Approximate timing of construction phase:	**16-24 weeks**

Hours of operation for the above-noted activities will range from 8-12 hours a day depending on seasonal limitations and project deadlines. Construction activities will generally not occur outside the hours of 7am to 7pm. However, some construction activities may happen outside of this timeframe for items such as concrete finishing, late deliveries, critical lifts (may best be done later in the evening when winds reduce), and bolt ups once tower sections are put in place, which need to be secured before releasing the crane. These after-hours activities will not produce noise exceeding the municipal guidelines.

4.6 Temporary Uses of Land

A construction service area and temporary storage area is identified on the conceptual plan being within and adjacent to the existing machine shed located on-site (Appendix 1). The approximate

outdoor temporary storage area will be 0.75 hectares in size. These lands are currently used for storage and field crop agricultural purposes and will be used for such purposes after the completion of the construction phase of the project in accordance with the above-noted timing of this phase of the project.

4.7 Excavation Materials

All areas of disturbance due to construction of project components will be remediated for agricultural purposes. All topsoil excavated will be used elsewhere on-site for agricultural improvements where possible. Approximately half of the fill excavated for turbine foundations will be required to be trucked off-site. Such off-site materials will be clean and offered to surrounding landowners or taken to area contractors for future construction purposes. Such activities would involve approximately 5000m³ of clean fill and 150 vehicle trips.

4.8 Traffic Management

The purpose of this section is to identify the safety measures, transport routes, monitoring and rehabilitation of municipal roads as needed over the duration of the project construction. The intent will be to maintain safe use of the roadways and minimize interference with the existing farm and passenger traffic around the wind farm sites.

4.8.1 PRE-CONSTRUCTION

The Project Manager will meet with the municipality to identify the location of the temporary laydown area, the expected use of abutting roads, any road improvements or changes needed for access points or drain crossings in accordance with established municipal criteria. The Project Manager will identify the expected number of days of construction and hours of construction. It is expected the construction process will take six months. The Project Manager will advise the municipality of any unexpected changes to transport routes or timing due to delays. The Project Manager will work with the Municipality to determine best routes and timing related to school bus routes.

The Project Manager and the municipal roads superintendent will inspect the proposed access routes to the construction sites to confirm the road conditions, sight lines, signage locations, drain crossings, and need for possible road improvements. This inspection will form the base line for future road rehabilitation as required. The Project Manager and municipality will determine a reasonable deposit in the form of a letter of credit or parental company guarantee to ensure rehabilitation of any road damage.

4.8.2 CONSTRUCTION

The Project Manager will manage traffic in accordance with all Provincial and municipal laws in the applicable jurisdiction. The Project Manager will ensure that the appropriate signage is posted at the entrance and exit to the construction site, warning of the activity. The Project Manager will provide the necessary personnel to ensure safe ingress, egress, and traffic flow, to and through the project area as needed. The site will ensure safe turning movements to and from the site to avoid the need to back onto public roads. During construction all signage, signalling and related controls will be undertaken in accordance with the *Manual of Uniform Traffic Control Devices, Ministry of Transportation Division 5, Temporary Conditions, April, 1987*.

The Project Manager will ensure the road is maintained and cleaned as needed in accordance with municipal standards. On a weekly basis, the Project Manager will ensure that no construction debris or mud from the site is left on the public roadway. The Project Manager will report any damage resulting from construction activity to the municipality.

4.8.3 POST-CONSTRUCTION

Once construction of the projects is completed, the Project Manager will undertake an inspection of public roads used during construction with municipal staff to identify any required maintenance or damage. The results of the inspection will be documented. Where road damage is identified, the Project Manager will obtain estimates to repair the road to the pre-construction condition. The Project Manager will also restore any temporary site access points and remove any temporary road improvements related to the project. The municipality will return the deposit upon satisfactory inspection of the public roads and any repair work within three months of the end of construction.

5. ENVIRONMENTAL EFFECTS, MITIGATION MEASURES, AND MONITORING

This section gives detailed descriptions of the potential negative environmental **impact** that may be encountered during the construction phase, in or within 300 metres of the project area. Following each description are details of how the proponents will address any negative effects through **mitigation and impact management measures**. Next, a summarization of the expected **net effect** will be outlined based on any mitigation and impact management measures. Such net effects will be described on the following basis:

- *Minimal* – potential negative effects may be encountered during construction phase, but is otherwise not encountered during life of project;
- *Low* – potential negative effects may result in small deviations to the baseline data, but further commitments are not normally required;
- *Medium* – potential negative effects may result in significant but stable deviations to the baseline data, and further commitments through research, monitoring, should be considered;
- *High* – potential negative effects could create unsustainable impacts and are considered a concern. Further commitments should be considered to reduce effects.

Finally, each subsection will conclude with a discussion of **future commitments** where necessary based on level of net effects.

5.1 Potential Negative Effects – Surface and Groundwater

5.1.1 IMPACT

5.1.1.1 Surface water

During the construction period of the wind farms, a potential exists for negative impacts to surface water features in the project area as a result of soil runoff and/or erosion, particularly where crossing of municipal drains is required during construction of access roads and underground cabling. The only surface water on site is in the form of drainage ditches adjacent to roads.

5.1.1.2 Groundwater

During the construction period of the wind farms, a potential would exist for negative impacts to groundwater quality primarily as a result of turbine base construction.

5.1.1.3 Accidental Spills

During the construction period of the wind farms, a potential would exist for the accidental spilling of oil/fuel related to construction machinery and generator equipment.

5.1.2 MITIGATION AND IMPACT MANAGEMENT MEASURES

5.1.2.1 Surface water

The proponents will utilize a combination of best management practices (BMP's); DFO supervision (through the LTVCA as the acting DFO agents); and in the case of the Shaw-Ferguson Drain crossing, a permit issued by the Saint Clair River Conservation Authority (SCRCA) in co-operation with the Department of Fisheries and Oceans (DFO). The DFO will require construction in accordance with their Operational Statement for High Pressure Directional Drilling and Operational Statement for Culvert Maintenance. The list of BMP's is included in Appendix 3 to this report.

5.1.2.2 Groundwater

The proponents will utilize best management practices (BMP's) to prevent groundwater contamination. The list of BMP's is included in Appendix 3 to this report. Groundwater contaminated from accidental spills is not anticipated if the mitigation measures below are implemented and contained to avoid contact with the groundwater table.

5.1.2.3 Accidental Spills

Any accidental spills will be dealt with immediately in accordance with the Ontario Ministry of the Environment's *Spills and Discharges Reporting Protocol* as required by the Ontario Environmental Protection Act (s.92 and s.15) and Ontario Regulation 675/98. All construction vehicles transporting fuels during construction will be supplied with a spill kit for limiting the migration of the spills. Personnel will be trained on what actions to take should a accidental spill occur. Should a spill occur the proponent will remediate the contaminated area in accordance with Ontario Regulation 347.

5.1.3 NET EFFECT

5.1.3.1 Surface water

The net effects to any surface water features based on the background research and after all mitigation and impact management measures outlined in the technical memorandums (Appendix 3) are implemented will be *minimal*.

5.1.3.2 Groundwater

The net effects to any groundwater resources based on the background research after all mitigation and impact management measures outlined in the technical memorandums (Appendix 3) are implemented will be *minimal*.

5.1.3.3 Accidental Spills

Should any accidental spills occur, it is expected that compliance with the impact management procedures outlined, will result in *minimal* net effects.

5.1.4 FUTURE COMMITMENTS

5.1.4.1 Surface water

None required as construction phase is temporary.

5.1.4.2 Groundwater

None required as construction phase is temporary.

5.1.4.3 Accidental Spills

None required as construction phase is temporary.

5.2 Potential Negative Effects – Land Use

5.2.1 IMPACT

Construction activities may inhibit enjoyment of use of surrounding land uses. The construction activities will impact the agricultural land use of a small percentage of the land the project is situated on during the 6 month construction phase.

5.2.2 MITIGATION AND IMPACT MANAGEMENT MEASURES

Abidance by this document will ensure that construction activities occur in accordance with best management practices. Upon completion of the construction phase (approximately 6 months) this effect will be removed.

5.2.3 NET EFFECT

The net effect of construction activities on surrounding land uses is temporary in nature and may therefore be considered *minimal*.

5.2.4 FUTURE COMMITMENTS

None required.

5.3 Potential Negative Effects – Air and Noise

5.3.1 IMPACT

5.3.1.1 Air pollutants

Construction activities will involve the use of heavy machinery (ie. trucks, cranes) that emit air pollutants consistent with any construction project.

5.3.1.2 Greenhouse Gas Emissions

As with air pollutants described above, the construction phase of the project will require heavy machinery that contributes to greenhouse gas emissions.

5.3.1.3 Dust / Odour

The construction phase of the project will require heavy machinery that creates dust during dry months and odour related to vehicle emissions.

5.3.1.4 Construction Noise

The construction phase of the project will require heavy machinery that creates noise associated with vehicle movements.

5.3.2 MITIGATION AND IMPACT MANAGEMENT MEASURES

5.3.2.1 Air pollutants

All heavy duty vehicles operating in southern Ontario (diesel and non-diesel) are subject to the Ministry of the Environment's Drive Clean vehicle emissions testing program.

5.3.2.2 Greenhouse Gas Emissions

As above, the MOE Drive Clean requirements will address CO_2 emissions associated with construction vehicles.

5.3.2.3 Dust/Odour

The proponents will undertake water spraying of access roads during dry months to reduce dust; minimize construction vehicle idling on public rights-of-way; and cleanup of debris on public rights-of-way caused by construction vehicles.

5.3.2.4 Construction Noise

The proponents will restrict hours of construction activities based on enforced municipal standards, and abide by any regulations regarding idling on public rights-of-way in proximity to off-site noise receptors. The proponents will ensure effective mufflers are installed on all diesel exhausts. The proponents will keep traffic as much as possible to Huff's Side Road and minimize traffic on roads

with a greater number of dwellings such as on Smoke Line. The proponents will restrict engine braking along sensitive public roads such as Huff's Side Road, Evergreen Line, and Smoke Line.

5.3.3 NET EFFECT

5.3.3.1 Air pollutants

Any net effects associated with air pollutants are temporary and *minimal* in terms of the lifespan of the project.

5.3.3.2 Greenhouse Gas Emissions

Any net effects associated with CO^2 emissions are temporary and *minimal* in terms of the lifespan of the project.

5.3.3.3 Dust/Odour

Any net effects associated with dust and odour is temporary in nature and *minimal* in terms of the lifespan of the project.

5.3.3.4 Construction Noise

Any net effects associated with construction noise are temporary in nature and *minimal* in terms of the lifespan of the project.

5.3.4 FUTURE COMMITMENTS

5.3.4.1 Air pollutants

None required as construction phase is temporary.

5.3.4.2 Greenhouse Gas Emissions

None required as construction phase is temporary.

5.3.4.3 Dust/Odour

None required as construction phase is temporary.

5.3.4.4 Construction Noise

None required as construction phase is temporary.

5.4 Potential Negative Effects – Natural Environment

5.4.1 IMPACT

5.4.1.1 Wildlife

During the construction period there may exist a potential for faunal disturbance as a result of construction noise and human presence on the project area. The two species of concern in the

Study Area are the Bald Eagle and the Eastern Fox Snake. The Natural Heritage Study (NHS) report did not identify any significant faunal habitat or corridors within the Study Area. The NHS also indicates that provided the project components are not located within any woodlots in the Study Area there will be no direct impacts on faunal wildlife. Some disturbance to hedgerows and scrub vegetation area will occur with underground cable routing at MacLeod-4 and in the area located between MacLeod-1 turbine and the southwesterly direct drill location under the Mason Drain as shown on the Conceptual Site Plan. However such activities are expected to occur late in the calendar year based on the project schedule and therefore not disturb any bird nesting areas.

The Avian Impact Study specifically noted the bald eagle nesting location along the Thames River as a potential area of concern. The bald eagle nesting location was confirmed as being over 1km south of the project area, which is beyond the 800m tertiary buffer for such nesting locations as described by the Ministry of Natural Resources.

5.4.1.2 Fish

Several water crossings have been identified for access road construction and cabling routes. However, refined site planning has eliminated all surface water crossings, with only direct drilling required under drain crossings. Construction at water crossings may have an impact on downstream fish habitat. The NHS indicates the majority of watercourses in the project area are agricultural drains that are intermittent and ephemeral in nature.

5.4.1.3 Migratory Birds

During the construction phase of the project there may exist a potential for negative effects to migratory birds. However, the relatively small area of the projects and absence of any other planned projects within the surrounding 5 kilometres would allow for alternative routes for migratory birds. In addition, the project areas include no staging areas for migratory birds. Spring and fall migration studies indicate that the majority of migrating birds fly well above or below the swept area of the wind turbines. The turbine erection is scheduled for late December early January after the fall migration period.

5.4.1.4 Bats

Past research indicates that bat mortality is lowest in open grassland and farmland away from forests and shorelines. The NHS also indicates there are no known bat hibernacula, potential bat habitat or linear habitat features in the project areas.

5.4.2 MITIGATION AND IMPACT MANAGEMENT MEASURES

5.4.2.1 Wildlife

To mitigate any potential impacts on wildlife habitat, the wind farms have been designed to locate all project components including turbines, access roads, cabling and switching station outside of

any woodlots located on the subject lands. The following paragraphs outline how previous mitigation measures have been addressed through reduction of the project area and refined site planning.

Recommended impact management measures related to ensuring the protection of the local bald eagles and their nest site(s) were identified in the original Avian Study when the project area included lands south of Longwoods and adjacent to the Thames River and within the 800 metre tertiary buffer zone of nest location, and included:

- Placement of turbines at maximum practical distance from the noted nest locations, and the Thames River in general.
- Restriction of construction activities so that they do not occur near the nest site between the time of initial return of parents to the nest to 3 or 4 weeks after fledging.
- Restrictions on operation of those turbines closest to the nest site during the same period noted above for restrictions on construction activity.

Given that the project area has removed all lands south of Longwoods Road and do not include any construction activities within 1km of the nesting location, which is beyond the 800 metre tertiary buffer area of bald eagle nesting locations, these mitigation measures have been met to protect the nesting sites along the Thames River.

Recommended mitigation measures to limit disruption of the Eastern Fox Snake habitat are to conduct proper timing of culvert installation. Construction activities near the habitat of the eastern fox snake should be completed during the hibernation period.

5.4.2.2 Fish

The proponents have consulted with the local conservation authorities in their capacity as representatives of the Department of Fisheries and Oceans (DFO) and have not identified any concerns. Mitigation measures will include construction in accordance with the DFO Operational Statement for High Pressure Directional Drilling and Operational Statement for Culvert Maintenance, administered through permitting (SCRCA) and/or direct DFO supervision (LTVCA).

5.4.2.3 Migratory Birds

Mitigation recommendations for migratory birds include placing all turbines as far as possible from the Thames River and restricting operation of the turbines during periods of heavy fog. It is noted that during the construction phase, turbines will not be in operation, and therefore will not be rotating. Operational mitigation measures are discussed in the Design & Operations Report.

5.4.2.4 Bats

Mitigation measures for protecting bats include locating wind turbines at least 50 metres from woodlots. It is noted that during the construction phase, turbines will not be in operation, and therefore will not be rotating. Operational mitigation measures are discussed in the Design & Operations Report.

5.4.3 NET EFFECT

5.4.3.1 Wildlife

It is anticipated based on the recommended mitigation and impact management measures and subsequent wind farm design that the net effects to any faunal wildlife will be *low*.

In regards to the bald eagle nesting locations, the initial Avian Impact Study included studying lands for potential project components south of Longwoods Road and adjacent to the Thames River. Subsequent wind farm design work has removed lands south of Longwoods Road from the project area and placed the nearest turbine approximately 1.7 kilometres from the identified bald eagle nesting site, and the nearest areas of construction activities over 1 kilometre from the nesting location, and 750 metres north of the Thames River in general. Based on these mitigation measures, the expected net effects to bald eagles and their nesting sites in the area is *low*.

5.4.3.2 Fish

Based on compliance with the DFO operational statements and the required permit for crossing the Shaw-Ferguson Drain (SCRCA), the expected net effects to fish habitat are *minimal*.

5.4.3.3 Migratory Birds

Based on the monitoring conducted on-site and location and features of Study Area, there is no obvious reason to expect significant occurrence of migratory birds, particularly at turbine height, in the Project Area. As such the expected net effects to migratory birds are *low*.

5.4.3.4 Bats

Based on the background research and placement of turbines almost 3 times beyond the recommended 50 metre setback, it is expected the net effect to bats and bat habitat will be *minimal*.

5.4.4 COMMITMENTS

5.4.4.1 Wildlife

Future commitments for determining effects to wildlife include additional field monitoring efforts conducted in the first year of operations. Details of such commitments will be confirmed by the local conservation authorities and/or Environment Canada – Canadian Wildlife Service.

5.4.4.2 Fish

There are no proposed future commitments to address the net effects to fish habitat.

5.4.4.3 Migratory Birds

Future commitments for determining effects to migratory birds include additional field monitoring efforts conducted for up to three years in accordance with the Ministry of Natural Resources requirements during the operational phase of the projects. Operational commitments are discussed in the Design & Operations Report.

5.4.4.4 Bats

Future commitments for determining effects to bats and bat habitat include additional field monitoring efforts conducted for up to three years in accordance with the Ministry of Natural Resources requirements during the operational phase of the projects. Operational commitments are discussed in the Design & Operations Report.

5.5 Potential Negative Effects – Resources

5.5.1 IMPACT

5.5.1.1 Prime Agricultural Lands

The project components will require approximately 75,000 m² of Canada Land Inventory Class 2 soils to be taken out of agricultural production.

5.5.1.2 Agricultural Production

The landowners will lose approximately 1.7% of their lands that are currently used for cash crop purposes.

5.5.2 MITIGATION AND IMPACT MANAGEMENT MEASURES

5.5.2.1 Prime Agricultural Lands

All areas of disturbance due to construction of project components will be remediated for agricultural purposes. All topsoil excavated will be used elsewhere on-site for agricultural improvements where possible.

5.5.2.2 Agricultural Production

Access roads will be designed in a manner that minimizes the length required and locates them as close to the edge of cultivated fields as possible.

5.5.3 NET EFFECT

5.5.3.1 Prime Agricultural Lands

The proposed mitigation measures will result in a net effect on prime agricultural lands which is *minimal*.

5.5.3.2 Agricultural Production

The proposed mitigation measures will result in a net effect on agricultural production which is *minimal*.

5.5.4 FUTURE COMMITMENTS

5.5.4.1 Prime Agricultural Lands

None required.

5.5.4.2 Agricultural Production

None required.

5.6 Potential Negative Effects – Socio-Economic

5.6.1 IMPACT

Construction and delivery traffic will result in temporary short-term disruptions for local traffic. The probability for traffic accidents is also increased where construction vehicles are entering/exiting private lands along rural roads.

5.6.2 MITIGATION AND IMPACT MANAGEMENT MEASURES

Impact management measures related to such issues as hours of construction activity, required road closures, and road maintenance and repairs will be undertaken in accordance with municipal regulations. Signs warning of construction activity will be provided in accordance with requirements of the applicable road authority.

5.6.3 NET EFFECT

The impacts of construction traffic on surrounding roads are temporary in nature (approx. 6 months) and are therefore considered to have *minimal* net effect.

5.6.4 FUTURE COMMITMENTS

None required

5.7 Potential Negative Effects – Heritage and Culture

5.7.1 IMPACT

A Stage 1 Archaeological Assessment was conducted and determined that there is a moderate to high potential for archaeological resources due to the location of the project area, particularly its proximity to the Thames River. There are no protected heritage properties that are part of the project or within 120 metres of the project area that would be impacted by construction activities.

5.7.2 MITIGATION AND IMPACT MANAGEMENT MEASURES

A Stage 2 Archaeological Assessment was undertaken and determined the potential for archaeological materials where construction of project components is to occur for two turbine locations. A Stage 3 Archaeological Assessment was undertaken at those 2 locations. The results have indicated no concerns with proceeding with construction at the locations identified in the Project Description Report. The Ministry of Tourism and Culture has signed off on the archaeological assessments.

5.7.3 NET EFFECT

The net effect to archaeological and heritage resources is considered *minimal* given the mitigation measures used to document and recover any potential archaeological materials, and the absence of any cultural heritage resources on the project area.

5.7.4 FUTURE COMMITMENTS

There are no further commitments proposed without results from the detailed Stage 2 assessment.

5.8 Potential Negative Effects – Waste

5.8.1 IMPACT

Construction activities will result in use of lubricating and hydraulic fluids that require proper disposal.

5.8.2 MITIGATION AND IMPACT MANAGEMENT MEASURES

Any hazardous wastes shall be disposed of at provincially licensed facilities.

5.8.3 NET EFFECT

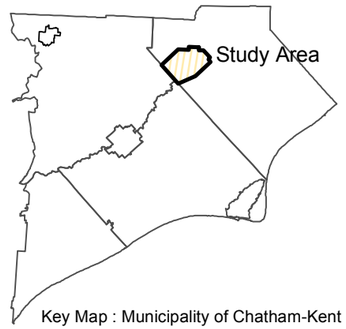
Proper disposal of any hazardous wastes during the construction period suggests that the net effect of this issue is *minimal*.

5.8.4 FUTURE COMMITMENTS

The facilities will be licensed as a waste generation facility as per Ontario Regulation 347 and will be subject to regulated disposal of waste at licensed facilities. Emergency spill kits will be maintained in the project areas at all times during the construction phase. Operational commitments are discussed in the Design & Operations Report.

APPENDIX 1 – SITE PLANS

Kent Breeze Wind Farms & Macleod Windmill Project



Site Plan

Legend

- Turbine
- Removed Turbine
- Points of Reception
- Points of Reception (Participating)
- Farm Buildings
- Access Road
- Underground Cable
- Utility Line
- 300m Project Area Buffer
- Significant Woodlot (As per Official Plan)
- Other Vegitation
- Contour Line
- Railroad
- Road
- Watercourse
- Closed Tile Drain
- Agriculture

0 500 1,000
Metres

1:17,500 (11 X 17 Layout)

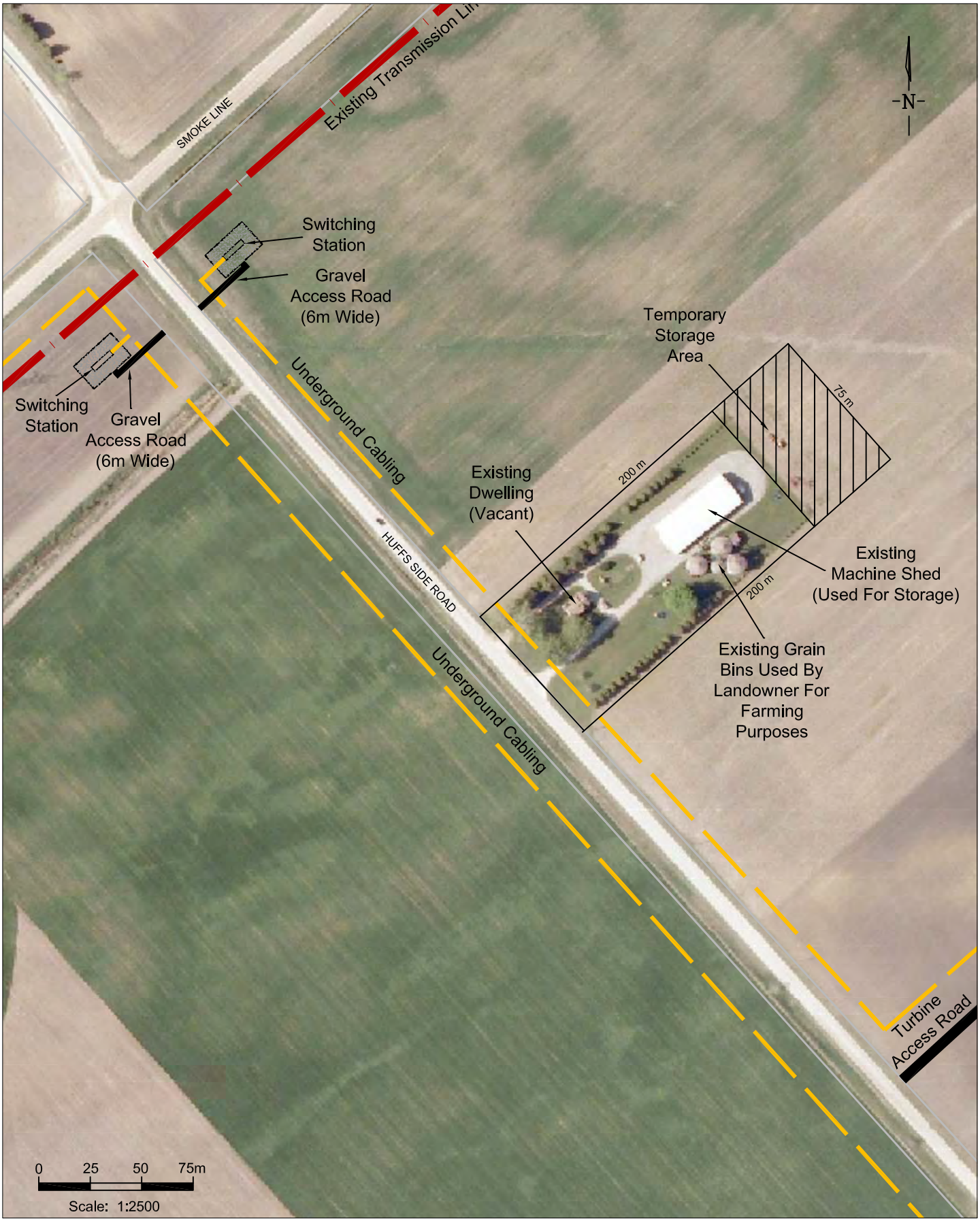
July 9, 2010

IBI GROUP

J:\20443\5.8 GIS\Maps\Map Created For Suncore 2010-03-24\PMMConceptual Site Plan-2010-07-09.mxd

Detailed Location

Switching Stations, Construction Service Area, and Temporary Storage Area



APPENDIX 2 – CONSTRUCTION MATERIALS AND EQUIPMENT DETAILS

HATCH

Prepared by R.Skinner
3-May-10

General Description of Materials Used For Construction

Kent Breeze Corporation
Kent Breeze Wind Farm and MacLeod Windmill Project (8 Ea x 2.5 MW = 20MW, 2 Points of Interconnection)
GE 2.5 x I with a 100m rotor and 85 m tower hight
Deliveries: Heavy (Mult-Axle) Vehicle Movements To/From Each Wind Turbine Location, or Common Areas

Item	Description	Qty	Unit	Deliveries	Comments
1	**Construction Indirects & General Items, Civil and Electrical**				
1.1	**General Costs / Suppervision & Site Cost**				
	Mob and Demob (General Contractor)	1	LS	6	Office Trailers and Equipment
	Mob and Demob (Electrical Contractor)	1	LS	6	Office Trailers and Equipment
	Const. Facilities, Temporary Areas/Cleanup	1	LS	inc.	
	Fencing / Barriers / Signage	1	LS	1	
	Temp road maintenance - contract snow removal / dust control	4	Mths	0	See construction equipment
	Commissioning, Temporary Power (Diesel generators)	1	LS	1	Truck mounted diesel generator if req'd
	Sanitation Units, Janitorial Service	4	Mths	12	Waste bins / portable toilets
	Total Construction Indirects & General Items			**26**	
2	**Civil Works**				
2.1	Improve Existing Roads/ Drainage				
	Regrading at Tracks	488	m3	33	Granular A/B or pit run
	Intersection improvements (x3)	573	m3	38	Granular A/B or pit run
	Intersection improvements / pole signage relocation	1	ea	0	See construction equipment
	Subtotal			**71**	
2.2	New Access Roads	3,913	m		straight and bends = total (m)
	Soil Excavation and Spreading	14,674	m3	0	Spread on site
	Subgrade Compaction	39,130	m2	0	See construction equipment
	Geogrid	27,391	m2	16	7 m2/m
	Supply & Place Granular B (95% Comp)	11,739	m3	783	6m x 0.5m = 3 m3/m
	Supply & Place Granular A (100% compaction)	978	m3	65	5m x 0.05m = 0.25m3/m
	Subtotal			**864**	
2.3	Crane Pads and Erection Areas	8	EA		
	Unclassified Excavation (for 16mx30m crane pad, surface dimensions)	5,880	m3	0	Spread on site
	Surface Timming/Preparation	1	Ea	0	See construction equipment
	Geogrid	3,840	m2	8	100% (30m x 16m)
	Supply and Place Granular B	4,216	m3	281	17mx31mave, accounts for 1:1 edge slope
	Subtotal			**289**	
2.4	**Foundation for Wind Turbines**	8	EA		
	Unclassified Excavation	10,960	m3	365	Assume 1/2 trucked off site, "clean" fill
	Engineered Fill	480	m3	32	Gradation control granular material
	Conduit, 4" PVC	1,920	m	8	240 m each, foundation to S&C switch
	Ground wire 4/0 copper	2,040	m	8	255 m each
	Mud slab - 15 MPa concrete	360	m3	51	mud slab: 15 cm x 300m2/ea
	Concrete - 30 MPa - Supply and Install	4,440	m3	634	Con volume 555 m3/Ea
	Formwork	444	m2	16	One steel / timber formwork set each
	Sika Grout - 55 Mpa	8	m3	8	1m3/turbine
	Steel Anchor Bolt System and Anchor Ring	8	Ea	8	
	Structural Steel Leveling Frame	8	ea	8	
	Concrete Finishing	3,330	m2	0	See construction equipment
	Reinforcing Steel - 400 MPa - Supply and Place	444,000	kg	16	100kg steel/m3 concrete
	Backfill - Unclassified Material	7,200	m3	0	Replacement of excavated material
	Dewatering	8	Ea	8	One portable pump set each if req'd
	Reinstate topsoil area	6,520	m2	0	Replacement of stockpiled topsoil
	Subtotal			**1,163**	
	Total Civil Works			**2,387**	
3	**Electrical Works**				
3.2	**27.6 kV Swiching Station**				
	Civil Works, Subtotal (Details Below)				
	Station Prep (Strip topsoil, Geogrid, Stone)				
	- Clear and grub (50%)	600	m2		See construction equipment
	- Strip topsoil (50 x 25 x 0.3) x 2	300	m3		Stockpile on site
	- Place station stone (20 x 25 x 0.3) x 2	300	m3	20	
	- Install Geogrid (20*25) x 2	1,000	m2	1	
	- Cable Trench	100	m		inc. in trenching
	- Station Drainage	200	m	1	Perforated PVC drainage tile

HATCH

Prepared by R.Skinner
3-May-10

General Description of Materials Used For Construction

Kent Breeze Corporation
Kent Breeze Wind Farm and MacLeod Windmill Project (8 Ea x 2.5 MW = 20MW, 2 Points of Interconnection)
GE 2.5 x I with a 100m rotor and 85 m tower hight
Deliveries: Heavy (Mult-Axle) Vehicle Movements To/From Each Wind Turbine Location, or Common Areas

Item	Description	Qty	Unit	Deliveries	Comments
	Concrete Slab (Switchgear building)	30	m3	4	
	Fence & Gate (Galvanized steel)	180	m	2	
	WTG Connection Station 27.6 kV Equipment Subtotal				
	- 27.6 kV Switchgear: CB, PTs, CT	2	LS		Installed in E House
	- 27.6 V / 600 V SST	2	LS		Installed in E House
	- Grounding transformer and resistor	2	LS		Installed in E House
	- Substation Protection Equipment (Relay, Panels, & cables)	2	set		Installed in E House
	- SCADA hardware and programming	1	LS	1	Installed in service center (Demeter)
	- SCADA, misc telecomm equipment and connections	1	LS	inc.	
	- Revenue Metering	2	LS	1	
	Switching station auxiliaries :				
	- 27.6 kV Switchgear building & Services	2	LS		In E House package
	- Outdoor lighting	2	LS	1	
	- Switching station grounding	500	m	1	
	- LV cables	2	LS		
	- Aux. 600v & 120/240V AC Power System	2	LS		In E House package
	- Aux 125VDC system, including DC cables	2	LS		In E House package
	E-House Package	2	ea	4	
	Subtotal			**36**	
	27.6 kV Collection System				
	U/G Collection System - Trenches				
	Trench for Single Circuit, neat quantity	7,977	m		1,000 mm trenching
	Excavation	4,800	m3	0	See construction equipment
	Sand Backfill	2,400	m3	160	0.6mx0.5m=0.3m3/m, included above
	Granular B Backfill	2,400	m3	160	0.3m3/m, included above
	Subtotal			**320**	
	Directional Drill Allowance	7	EA	0	See construction equipment
	Directional Drill HDPE Casing, 4"	210	m	1	30m each
3.3	**27.6 kV U/G Collection System Subtotal**				
	U/G 27.6 KV cables, neat quantity:	7,977		40	Cable reels
	AWG # 1, 3C CU 28kV 133% or equal in Alum	7,366	m	inc.	
	AWG 250, 3C CU 28kV 133% or equal in Alum	1,572	m	inc.	
	AWG 300, 3C CU 28kV 133% or equal in Alum	635	m	inc.	
	Additional cost for power cable steel armor	1	LS	inc.	
	Collection system grounding wire copper 4/0	9,572	m	8	
	Collection system fiber cables & auxiliaries	9,572	m	4	
	Collection system fiber auxiliaries	1	LS	1	
	Collection system control cable (8c, 14 AWG)	600	m	1	
	Cable terminations	48	set	inc.	
	Cabe connectors	6	set	inc.	
	34.5 kV, 25kA, S&C Vista Switchgear, cat # 853214-P94	8	each	inc.	
	34.5 kV, 25kA, S&C Vista Switchgear, cat # TBA (3 pole)	1	each	inc.	
	S&C Switches	1	LS	2	
	Pad Mounted Lightning Arrestor	12	set	inc.	
	Concrete Bollards for Switches (Steel casing used for form)	8	each	8	
	Grounding for WTG (moved to foundations)	moved	m	inc.	
	Subtotal			**64**	
	Total Electrical Works (3.1 to 3.3)			**420**	
5	**Turbine Erection (formerly in Suncor's Budget)**				
5.1	**Turbine Erection and Mechanical Completion**	8	ea		
	- Turbine erection and mechanical completion - material deliveres	8	ea	144	Various - see GE document
	- Aviation Lights	5	ea	inc.	
	Total Turbine Erection and Mechanical Completion			**144**	

HATCH

Prepared by R.Skinner
3-May-10

General Description of Materials Used For Construction

Kent Breeze Corporation
Kent Breeze Wind Farm and MacLeod Windmill Project (8 Ea x 2.5 MW = 20MW, 2 Points of Interconnection)
GE 2.5 x I with a 100m rotor and 85 m tower hight
Deliveries: Heavy (Mult-Axle) Vehicle Movements To/From Each Wind Turbine Location, or Common Areas

Item	Description	Qty	Unit	Deliveries	Comments
6	**Owner's Scope**				
	Upgrade Existing Drainage/Drain Tile repairs - coupling kits (rubber)	200	Ea	1	Repair made by landowner
	Permanent Meteorlogical Towers	1	ea	2	
	Remediation of Local Roads - granular	6,000	m	50	25mm topping
	Riser Poles For Interconnection - wood, 50ft	6	ea	2	Hydro One scope
	Crane Pad Site Clearing (Brushing, Applicable to MacLeod 4)	10,560	m2	0	See construction equipment
	New Access Roads Granular Removal	1,200	m3	80	400m of passing lanes (the roads stay)
	New Access Roads Reinstate topsoil area	2,250	m3	0	See construction equipment
	Crane Pads Granular Removal	4,216	m3	281	
	Crane Pads Reinstate topsoil area	5,880	m3	0	See construction equipment
	Service Center, Renovations to Existing Property	1	LS	2	General materials, eg. drywall, timber
	Total Owner's Scope			**417**	
	Total Construction Including Owner's Scope			**3,394**	

HATCH

Prepared by R.Skinner
3-May-10

General Description of Construction Equipment

Kent Breeze Corporation
Kent Breeze Wind Farm and MacLeod Windmill Project (8 Ea x 2.5 MW = 20MW, 2 Points of Interconnection)
GE 2.5 x I with a 100m rotor and 85 m tower hight
Quantity of Construction Equipment Movements to/from Each Wind Turbine and Common Areas
Equipment is Floated (Loaded onto Flatbeds) Where not Mobile

Item	Description	Qty	Unit	Crane Mobile 15t	Crane Mobile 80t	Crane Mobile 300t	Crane, Track, 1600t (Float)	Excavator (Float)	Loader	Grader	Roller/ Compactor (Float)	Other Mobile Equipment	Comments
1	**Construction Indirects & General Items, Civil and Electrical**												
1.1	**General Costs / Suppervision & Site Cost**												
	Mob and Demob (General Contractor)	1	LS	1									Crane to lift into place
	Mob and Demob (Electrical Contractor)	1	LS	1									Crane to lift into place
	Const. Facilities, Temporary Areas/Cleanup	1	LS	inc.					1				
	Fencing / Barriers / Signage	1	LS						1				Loader to move materials as required
	Temp road maintenance - contract snow removal / dust control	4	Mths	0								12	Snow plow, water trucks
	Commissioning, Temporary Power (Diesel generators)	1	LS	0									Truck mounted diesel generator if req'd
	Sanitation Units, Janitorial Service	4	Mths	0									Waste bins / portable toilets
	General Material Movements for Maintenance and Pre-Comm	1	LS	8								8	Crane and flatbed truck to move parts
	Total Construction Indirects & General Items			**10**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**12**	
2	**Civil Works**												
2.1	Improve Existing Roads/ Drainage												
	Regrading at Tracks	488	m3	0					1	1	1		
	Intersection improvements (x3)	573	m3	0					3	3	3		
	Intersection improvements / pole signage relocation	1	ea	1					1			2	Flatbed, pole puller (vehicle TBD)
	Subtotal			**1**	**0**	**0**	**0**	**0**	**5**	**4**	**4**	**2**	
2.2	New Access Roads	3,913	m										
	Soil Excavation and Spreading	14,674	m3	0				8					Spread on site
	Subgrade Compaction	39,130	m2	0						8			
	Geogrid	27,391	m2	8									
	Supply & Place Granular B (95% Comp)	11,739	m3	0				8		8	8		
	Supply & Place Granular A (100% compaction)	978	m3	0						8	8		
	Subtotal			**8**	**0**	**0**	**0**	**16**	**0**	**24**	**16**	**0**	
2.3	Crane Pads and Erection Areas	8	EA										
	Unclassified Excavation (for 16mx30m crane pad, surface dimensions)	5,880	m3	0									Spread on site
	Surface Timming/Preparation	1	Ea	0					2				
	Geogrid	3,840	m2	8									
	Supply and Place Granular B	4,216	m3	0				8		8	8		
	Subtotal			**8**	**0**	**0**	**0**	**8**	**2**	**8**	**8**	**0**	
2.4	**Foundation for Wind Turbines**	8	EA										
	Unclassified Excavation	10,960	m3	0					8				Assume 1/2 trucked off site, "clean" fill
	Engineered Fill	480	m3	0				8					Gradation controlled granular material
	Conduit, 4" PVC	1,920	m	8									
	Ground wire 4/0 copper	2,040	m	8									
	Mud slab - 15 MPa concrete	360	m3	0								8	Concrete pump truck
	Concrete - 30 MPa - Supply and Install	4,440	m3	0								8	Concrete pump truck
	Formwork	444	m2	8									One steel / timber formwork set each
	Sika Grout - 55 Mpa	8	m3	8								8	On-site mixer and grout pump
	Steel Anchor Bolt System and Anchor Ring	8	Ea	8									
	Structural Steel Leveling Frame	8	ea	8									
	Concrete Finishing	3,330	m2	0								8	Vibration equipment
	Reinforcing Steel - 400 MPa - Supply and Place	444,000	kg	8								16	Bobcat to move materials to work area
	Backfill - Unclassified Material	7,200	m3	0				8		8			Replacement of excavated material
	Dewatering	8	Ea	0								8	Forklift or bobcat
	Reinstate topsoil area	6,520	m2	0				8		8			Replacement of stockpiled topsoil
	Subtotal			**56**	**0**	**0**	**0**	**24**	**8**	**16**	**0**	**56**	
	Total Civil Works			**73**	**0**	**0**	**0**	**48**	**15**	**52**	**28**	**58**	
3	**Electrical Works**												
3.2	**27.6 kV Swiching Station**												
	Civil Works, Subtotal (Details Below)												
	Station Prep (Strip topsoil, Geogrid, Stone)												
	- Clear and grub (50%)	600	m2					2					See construction equipment
	- Strip topsoil (50 x 25 x 0.3) x 2	300	m3					inc.					Stockpile on site
	- Place station stone (20 x 25 x 0.3) x 2	300	m3							2			
	- Install Geogrid (20*25) x 2	1,000	m2	2									
	- Cable Trench	100	m									2	Trenching machine
	- Station Drainage	200	m									2	Backhoe
	Concrete Slab (Switchgear building)	30	m3									2	Concrete vibrator
	Fence & Gate (Galvanized steel)	180	m	2									
	WTG Connection Station 27.6 kV Equipment Subtotal												
	- 27.6 kV Switchgear: CB, PTs, CT	2	LS										Installed in E House
	- 27.6 V / 600 V SST	2	LS										Installed in E House
	- Grounding transformer and resistor	2	LS										Installed in E House
	- Substation Protection Equipment (Relay, Panels, & cables)	2	set										Installed in E House
	- SCADA hardware and programming	1	LS										Installed in service center (Demeter)
	- SCADA, misc telecomm equipment and connections	1	LS										
	- Revenue Metering	2	LS	2								2	Electric utility truck with bucket
	Switching station auxiliaries :												
	- 27.6 kV Switchgear building & Services	2	LS										In E House package
	- Outdoor lighting	2	LS									2	Electric utility truck with bucket
	- Switching station grounding	500	m									2	Trenching machine
	- LV cables	2	LS									inc.	Trenching machine
	- Aux. 600v & 120/240V AC Power System	2	LS										In E House package
	- Aux 125VDC system, including DC cables	2	LS										In E House package
	E-House Package	2	ea		2								Crane to place on foundation
	Subtotal			**6**	**2**	**0**	**0**	**2**	**0**	**2**	**0**	**12**	
	27.6 kV Collection System												
	U/G Collection System - Trenches												
	Trench for Single Circuit, neat quantity	7,977	m										
	Excavation	4,800	m3	0								8	Trenching machine (floated between sites)
	Sand Backfill	2,400	m3	0									
	Granular B Backfill	2,400	m3	0									
	Subtotal			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	
	Directional Drill Allowance	7	EA	0								7	Cable reel on trailer transported by truck
	Directional Drill HDPE Casing, 4"	210	m									7	Driectional drill machine
3.3	**27.6 kV U/G Collection System Subtotal**												
	U/G 27.6 KV cables, neat quantity:	7,977		24								24	Offloaded to laydown, later loaded onto trailers
	AWG # 1, 3C CU 28kV 133% or equal in Alum	7,366	m	inc									
	AWG 250, 3C CU 28kV 133% or equal in Alum	1,572	m	inc									
	AWG 300, 3C CU 28kV 133% or equal in Alum	635	m	inc									
	Additional cost for power cable steel armor	1	LS	inc									
	Collection system grounding wire copper 4/0	9,572	m	inc									
	Collection system fiber cables & auxiliaries	9,572	m	inc									
	Collection system fiber auxiliaries	1	LS	inc									
	Collection system control cable (8c, 14 AWG)	600	m	inc									
	Cable terminations	48	set	inc									
	Cabe connectors	6	set	inc									
	34.5 kV, 25kA, S&C Vista Switchgear, cat # 853214-P94	8	each	8									
	34.5 kV, 25kA, S&C Vista Switchgear, cat # TBA (3 pole)	1	each	1									
	S&C Switches	1	LS										
	Pad Mounted Lightning Arrestor	12	set										Small item
	Concrete Bollards for Switches	8	each	8									Small item
	Subtotal			**32**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**31**	
	Total Electrical Works (3.1 to 3.3)			**38**	**2**	**0**	**0**	**2**	**0**	**2**	**0**	**51**	

Prepared by R.Skinner
3-May-10

General Description of Construction Equipment

Kent Breeze Corporation
Kent Breeze Wind Farm and MacLeod Windmill Project (8 Ea x 2.5 MW = 20MW, 2 Points of Interconnection)
GE 2.5 x I with a 100m rotor and 85 m tower hight
Quantity of Construction Equipment Movements to/from Each Wind Turbine and Common Areas
Equipment is Floated (Loaded onto Flatbeds) Where not Mobile

Item	Description	Qty	Unit	Crane Mobile 15t	Crane Mobile 80t	Crane Mobile 300t	Crane, Track, 1600t (Float)	Excavator (Float)	Loader	Grader	Roller/ Compactor (Float)	Other Mobile Equipment	Comments
5	**Turbine Erection**												
5.1	**Turbine Erection and Mechanical Completion**	8	ea										
	- Turbine erection and mechanical completion - truck offloading	8	ea	16	112	8							
	- Turbine erection and mechanical completion - erection	5	ea	0	8	8	112						
	Total Turbine Erection and Mechanical Completion			**16**	**120**	**16**	**112**	**0**	**0**	**0**	**0**	**0**	
6	**Owner's Scope**												
	Upgrade Existing Drainage/Drain Tile repairs - coupling kits (rubber)	200	Ea									20	Assumes misc. backhoe work on 10%, rest are exposed ready for repair and backfill
	Permanent Meteorlogical Towers	1	ea	1	1								
	Remediation of Local Roads - granular	6,000	m					2		2	2		Assumes 2 regrading crews
	Riser Poles For Interconnection - wood, 50ft	6	ea	2									Hydro One scope
	Crane Pad Site Clearing (Brushing, Applicable to MacLeod 4)	10,560	m2					2	2				
	New Access Roads Granular Removal	1,200	m3					8	8				400m of passing lanes (the roads stay)
	New Access Roads Reinstate topsoil area	2,250	m3					inc.					
	Crane Pads Granular Removal	4,216	m3					8	8				
	Crane Pads Reinstate topsoil area	5,880	m3					inc.					See construction equipment
	Service Center, Renovations to Existing Property	1	LS										General materials, eg. drywall, timber
	Total Owner's Scope			**3**	**1**	**0**	**0**	**20**	**18**	**2**	**2**	**0**	
	Total Construction Including Owner's Scope			**140**	**123**	**16**	**112**	**70**	**35**	**56**	**30**	**121**	**Grand Total = 703**

2.5xl Transport information

Tower section transportation

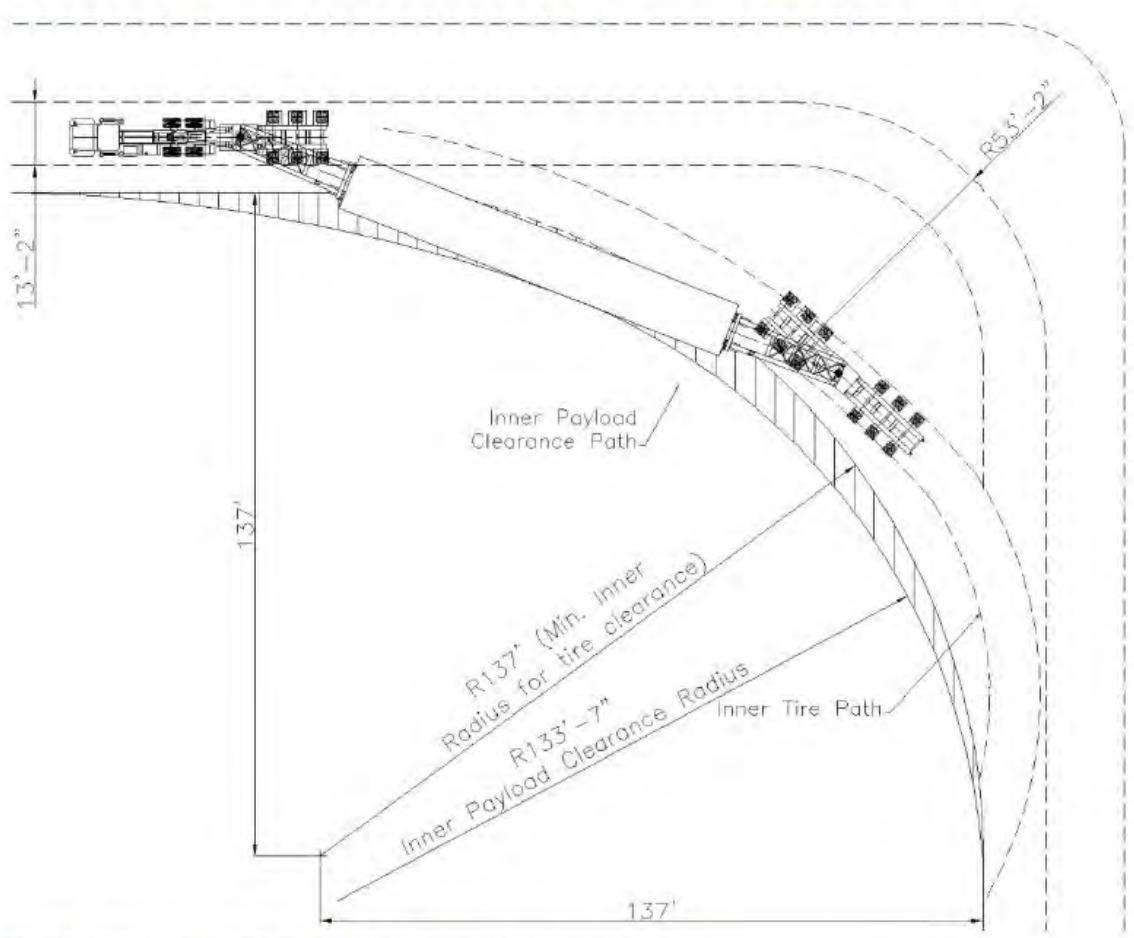


Figure 5: 90° turning radius of 9-axle Schnable trailer loaded with top section (80')

4.4 Blade Transportation

There are several different styles of trailer types that could be used for blade transportation. Tractor and trailer axles need to have adequate fendering system in place to reduce road grime to components. The Trail King has steerable rear axles that allow the driver to reduce the cut-in of the trailer axles when going around a corner. The Trail King blade hauler has a maximum steering angle of the rear axle of 30 degrees.

Figure 9 shows a 48.7-meter blade typical turning radius, the cut in and trailer path of the Trail King blade hauler is illustrated. Maximum loads per axle are similar or lower than that of the tower transporter.

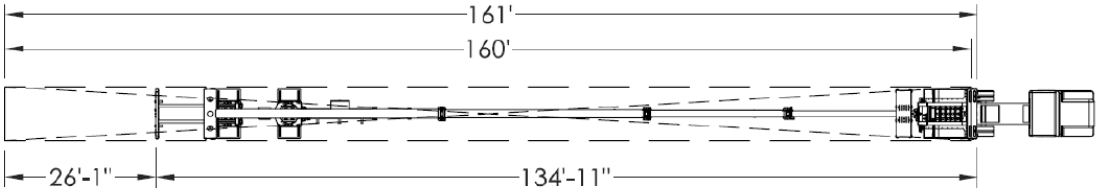


Figure 8: Typical blade transport configuration

Blade transportation

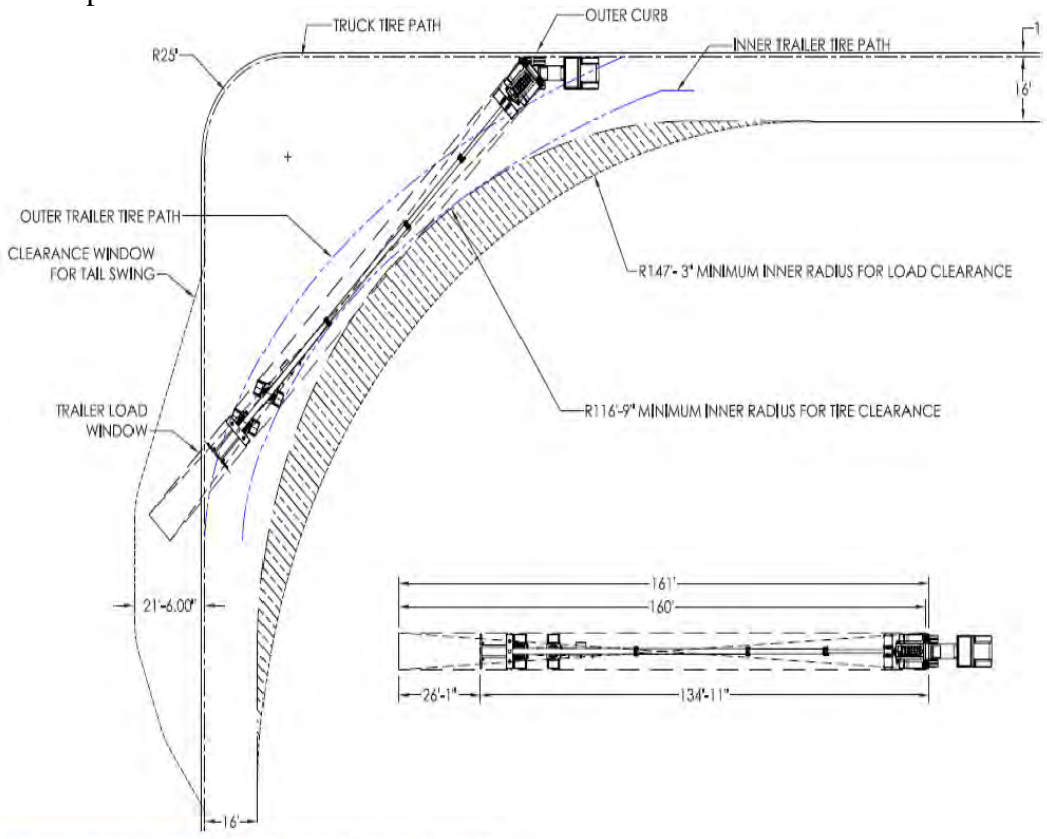


Figure 9: 90° turning radius of Trail King blade trailer (156' blade)

Nacelle transportation (Gearbox shipped separately)

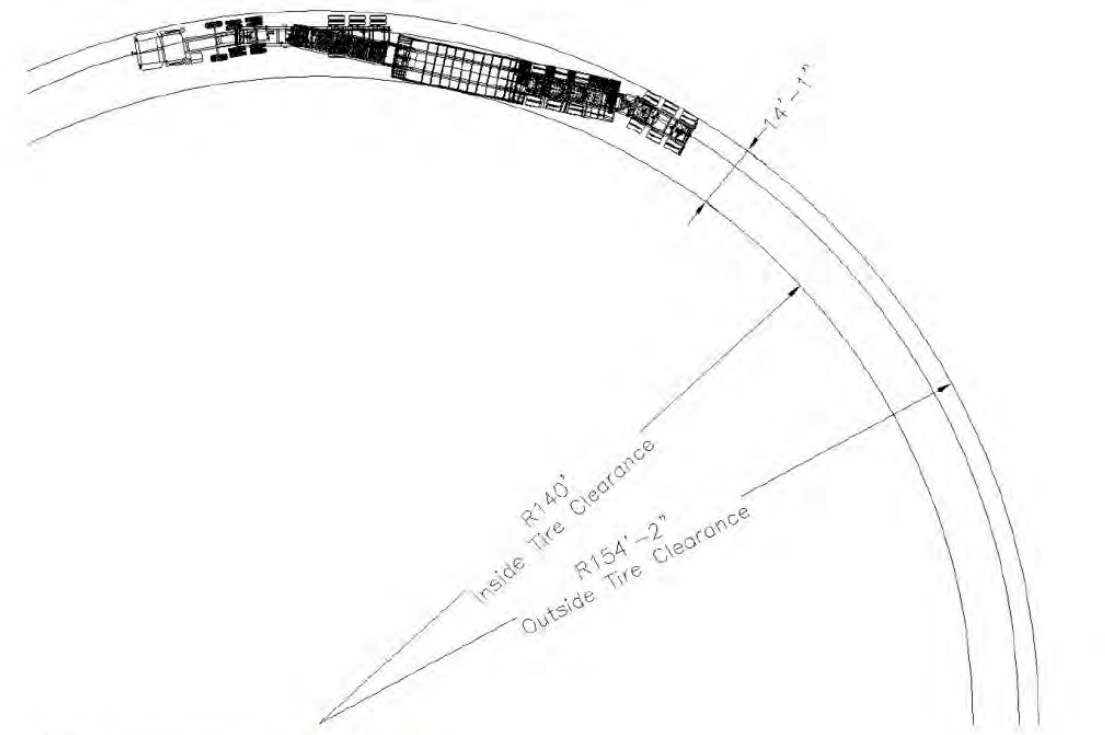


Figure 11: Turning radius 13-axle with 30' deck insert

5 Access and Site Roads

5.1 Site Roads

The main access road to site, off the public road, must be a minimum of 30 feet wide for a distance of 200 feet to allow a fully loaded tower trailer and an empty blade trailer to pass each other side by side, while entering or exiting the site.

See Figure 15 for space requirements for nacelle transport on an 18+ axle combination trailer. Corners need to allow for shown tire path and for overhang in center of trailer.

Grade: Maximum grade achievable for 18+ axle loaded: 6 % (see 4.5.2 for a description of a typical load configuration). Maximum grade for a 2-piece nacelle configuration load: 8 % (see 4.5.1 for a description of the load configuration). This maximum grade will need to be corrected for proper road surface. For example, mostly packed gravel: reduce –1.00 %. See Table 1 for gradeability loss for different types of surface. For angles over 6 %, or angles with sharp corners, additional pulling power may be required at the discretion of the carrier; the customer would inherit all cost.

Rolling Surface	Surface resistance (pounds)	Gradeability Loss (% Grade)	Correction Factor
Best Concrete	10	No Loss	0
Worn Concrete Asphaltic concrete (cold) Sheet Asphalt (cold) Brick	12	0.20 %	0.20
Packed Gravel (clay bound) Asphaltic concrete (summer heat)	15	0.50 %	0.50
Natural Soil (hard packed)	15 to 20	0.75 %	0.75
Packed Gravel Sheet Asphalt (summer heat)	20	1.00 %	1.00
Natural soil (spongy pack)	25 to 40	2.25 %	2.25
Loose Gravel	75 to 100	7.75 %	7.75
Sand	100 to 150	11.50 %	11.50

Table 1: Grade loss for different type of surfaces

The adverse rolling surface horsepower demand is a factor of the grade HP percentage and is, therefore, not a function of the rolling resistance HP demand. If, for example, sheet asphalt has a rolling resistance rating of 20 Lbs., the surface condition is 10 Lbs. over normal and any calculated gradeability would be reduced by -1 % grade. Looking at it in terms of HP requirement, the power demand would be that of a 1 % grade for the given load and road speed.

See also Figure 24 and Figure 25 for reference. If these properties are exceeded, transport layout and configuration will need to be re-evaluated.

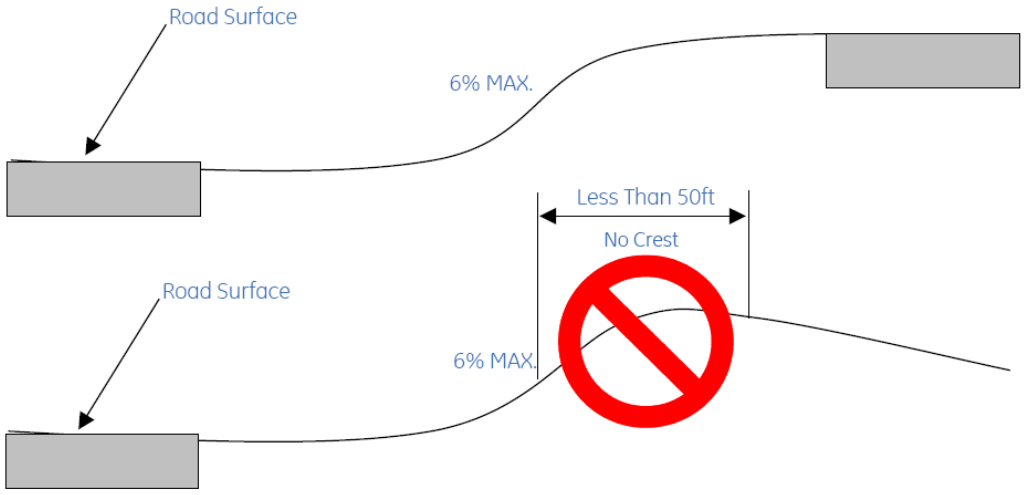


Figure 24: Typical road allowable grades

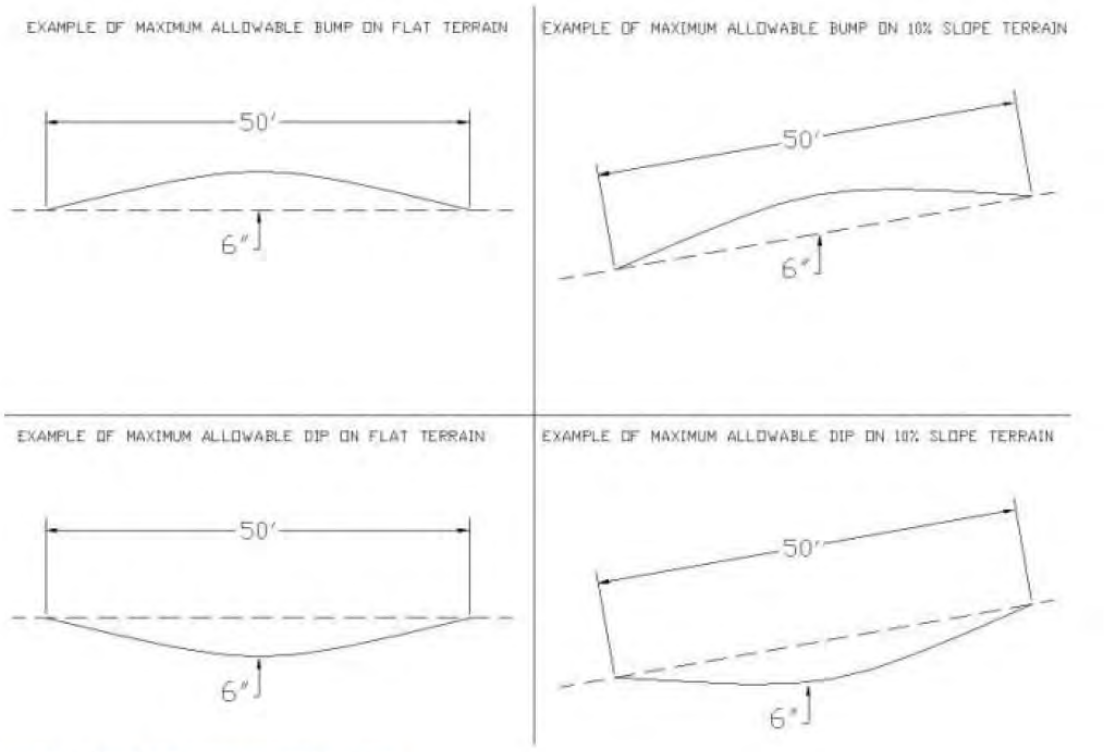


Figure 25: Typical road allowable bumps and dips

Overall height clearance needs to be minimum of 18 feet (communication lines etc.). Power lines require additional clearance for safety, depending on the voltage of the lines.

Overall drive through width needs to be a minimum of 16'6", in corners and turns, more space is required. Levelness across the roads and embankments at the edges need to be constructed in such a way to prevent trailer axles from sliding off the road.

When existing roads are widened for the projects, special care needs to be taken regarding the road base under the width extensions, since these areas will be heaviest loaded when a heavy haul transport passes through.

5.2 Road Camber

Maximum of 2 %.

5.3 Clearance

The customer has to ensure that on all access roads any overhanging tree branches, power lines & telephone cables are removed to avoid damage to turbine components.

Minimum height = 18' feet, minimum width = 16'6'' feet.

5.4 New Site Roads

All access roads from the common carrier point to all pad locations within the project site are to be constructed to a minimum width of 16 ft. The roads are to be constructed with a camber of 2 % (maximum), so that rainwater can flow off and hence the risk of rutting/potholes is reduced.

A typical trailer is 10' wide maximum. Axle loadings are 20,000 Lbs maximum, per axle. The top layer needs to be such as to prevent rutting from multiple axles driving over the same area. The tire pressure is 116 psi/ 16,700 psf (8 bar) for truck / trailer tires. Although the contact pressure is high, the high local pressure translates into a required ground bearing strength of approx. 1,500 psf. approx. 2' below grade. This translates in road build-up with regular limestone base, compacted to 95 % according to local DOT standards. Road foundation will need to be tailored for local conditions taking into consideration ground water table, sub soil conditions etc.

Care must be taken to backfill trenches for collection lines etc. in such a way to restore the original strength of the roadbed. This implies backfilling and compacting in 6 – 8" increments.

GE Energy requires that during inclement weather conditions the access roads have to be monitored continuously, by the customer, to be in accordance with GE specifications. Reworking measures and repair work on access roads have to be carried out during the project delivery phase and immediately if required.

Generally the widening of these roads is done for safety reasons. It helps to reduce the risk of the road edges breaking off, since vehicles and cranes with a track width of 10' ft. have to be used/employed to ensure the erection of the WTGS. If drainage ditches run directly up against the sides of the access road special safety measures must be taken.

APPENDIX 3A – TECHNICAL MEMORANDUM (STORMWATER MANAGEMENT)

TECHNICAL MEMORANDUM

DATE October 18, 2010 **PROJECT No.** 10-1151-0123

TO Brad West
Suncor Energy Products Inc.

CC Chris Scott

FROM Ian Callum **EMAIL** Ian_Callum@golder.com

KENT BREEZE WIND FARMS – STORMWATER MANAGEMENT

Introduction

Kent Breeze Corporation and MacLeod Windmill Project Inc. (the Proponent) are proposing to develop a wind energy project in the northern portion of the Municipality of Chatham-Kent. The Kent Breeze Wind Farms Project (the Project) is a Class 4 wind facility consisting of eight wind turbines with a total nameplate generating capacity of 20 megawatts (MW).

The Project will comprise a land area of 436 hectares (ha) and involves the construction of turbines, access roads, and related electrical infrastructure to connect with the Hydro One overhead transmission corridor. There are currently no plans to expand the Project beyond its current scope. The existing land use at the Project Area is predominated by agriculture with some woodlot.

This technical memorandum was completed to assess the potential effects of stormwater runoff attributed to the Project activities and to provide stormwater management options in accordance with Table 1 of O. Reg. 359/09 for a Renewable Energy Approval (REA); noting the following key tasks/objectives:

- Develop a water balance analysis at the Project Area to determine the anticipated changes to runoff and infiltration processes following the construction of the turbine foundations and access roads (i.e., land surfaces of typically reduced permeability relative to existing conditions);
- Outline additional approvals and authorizations that may be required (beyond Table 1 of O. Reg. 359/09); and
- Describe Best Management Practices (BMPs) to mitigate the potential effects from stormwater runoff and erosion during site preparation and construction.

The following sections detail each of the tasks/objectives identified above.

Water Balance

Environment Canada (EC) meteorological water budget data for London, Ontario (1936-1998) was acquired to develop a water balance at the Project Area. The water budget data obtained from EC is computed daily (and summarized monthly) based on methods/principals described by Thornthwaite and Mather (1955). The models used by EC to generate the meteorological information are based exclusively on temperature and precipitation and involve a series of assumptions and limitations (Johnstone and Louie, Year Unknown).

The water balance analysis presented herein represents a screening level hydrological assessment. The model applies lumped meteorological data to relatively uniform watershed characteristics; hence, the analysis is not an exact quantification of water moving in specific areas of a given catchment or at specific times during the season. However, the method is important in showing the relative proportions of water moving through different flow pathways.

General Overview

The total amount of surface water that flows from a particular discharge point is a function of how much water is gained and lost in the upstream catchment area. Precipitation (rainfall and snowmelt) represent the input to the system, while evapotranspiration (ET) and soil storage represent losses to the total available free water. A net gain of water is considered surplus and is available for runoff and/or infiltration. The water balance can be summarized as follows:

Rainfall + Snowmelt – ET – Change in Soil Storage = Surplus (Runoff and/or Infiltration)

The water balance model combines accumulated rainfall and snowmelt to estimate total precipitation. Rainfall represents precipitation when monthly mean temperatures are greater than 0^{o}C. Snowmelt is computed when snow is on the ground and monthly mean temperatures are greater than 0^{o}C (i.e., depletion of snow storage; accumulated precipitation during periods of sub-zero temperatures).

The potential or maximum ET is estimated, in this case, by the empirical Thornthwaite equation (using average monthly temperature and hours of daylight) and represents the amount of water that would be evaporated or transpired under saturated soil water conditions. The actual ET is the total evapotranspiration for the period of study based on evapotranspiration demand, available soil water storage and the rate at which that soil water is drawn from the ground (as defined by an established drying curve specific to the soil type).

The maximum soil storage is quantified using a Water Holding Capacity (WHC) that is based on guidelines provided in the Ministry of the Environment (MOE) Stormwater Management Planning and Design Manual (MOE, 2003). The WHC represents the total amount of water that can be stored in the soil capillaries and is defined as the water content between the field capacity and wilting point (the practical maximum and minimum soil water content, respectively). WHCs are specific to the soil type and land use, whereby values range from 50 mm for a shallow rooted crop over sand to 350 mm for mature forest over hard clay. For temperate region watersheds, soil storage is relatively stable year round, remaining at or near field capacity with the exception of the typical mid to late summer dry period. As such, the change in soil storage is a minor component in the water balance, particularly at an annual scale.

Surplus water remains in the system after actual ET has been removed (ET demand is met) and the maximum WHC is exceeded (soil water storage demand is met). The surplus is further allocated to runoff or infiltration and is largely dependent on catchment conditions (i.e., land use and soil characteristics/properties). Some infiltrated

water will be conveyed laterally in the near-surface soil layers as interflow and can re-surface at a point further downgradient or report directly to a watercourse. A portion of infiltrated water may also report to the groundwater zone as recharge.

Development of Model at Project Area

The water balance analysis was developed for each lot area where a turbine has been sited to estimate the anticipated changes in runoff and infiltration processes under existing and proposed development conditions; noting the following:

- Average annual estimates of Precipitation were obtained from the EC meteorological water budget data for London, Ontario.
- Lot areas were delineated by soil type and land cover, whereby WHCs of 5 mm, 150 mm and 300 mm were selected for the respective access roads (assumed to be 6 m wide) and turbine foundation (20 m by 20 m), cultivated land of fine sandy loam and wooded areas of fine sandy loam.
- Average annual estimates of Potential ET and Actual ET were obtained from the EC meteorological water budget data for London, Ontario, where lot area specific ET was estimated based on the relative proportion of each soil type / land cover.
- Average annual surplus was estimated at each of the lot areas based on the net changes to the water balance (see equation in overview section).
- External drainage to lot areas (from upstream catchment areas) were assumed unaltered under existing and proposed development conditions.

The average annual surplus at the various lot areas was distributed into runoff and infiltration components in accordance with MOE Guidelines (MOE, 2003). Infiltration factors were chosen for the various land types and multiplied by the total surplus to estimate the amount of annual infiltration: 0.7 (or 70%) for wooded areas; 0.6 (60%) for cultivated areas; and 0.0 (0%) for access roads and turbine foundations.

Results

The construction of less permeable surfaces (i.e., access roads and turbine foundations) on agricultural land may affect stormwater runoff and infiltration rates, in turn affecting overall water surplus in the Project Area. However, the area in which access roads and turbine foundations are constructed is relatively small compared to the Project Area. Table 1 presents the results of the water balance analysis under existing and proposed conditions. The anticipated increase in annual runoff (and associated decrease in annual infiltration) for lots sited with a turbine is in the range of 0% to 3.9% or an average of 1.1 (relative to existing conditions). Overall, the estimated change in the runoff/infiltration at the Project Area is considered negligible and hence does not warrant further investigation.

Table 1: Anticipated Change in Runoff Under Existing and Proposed Conditions

Turbine Location	Approximate Lot Area (m^2)	Access Road and Turbine Foundation Area (m^2)	Existing Runoff (m^3/year)	Proposed Runoff (m^3/year)	Change in Runoff (m^3/year)
Kent-1	532,500	1,770	79,000	80,000	1.3
Kent-3	514,500	3,370	77,000	78,000	1.3
Kent-4	384,000	4,970	51,000	53,000	3.9
Kent-5	474,000	1,770	71,000	71,000	0.0
MacLeod-1	554,250	1,770	83,000	83,000	0.0
MacLeod-3	274,500	1,310	41,000	41,000	0.0
MacLeod-4	298,500	2,910	45,000	46,000	2.2
MacLeod-5	641,250	3,930	96,000	97,000	1.0
Total	**3,673,500**	**21,800**	**543,000**	**549,000**	**1.1**

Approvals and Authorizations

There are two instances in which underground cabling will cross agricultural drainage ditches within the Project Area. These locations are as follows:

- Shaw Ferguson Drain and Barnhart Drain at Huffs Side Road; and
- Mason Drain.

Additionally, an underground conduit will be connected from the Kent Switching Station and the MacLeod switching Station, which crosses the Barnhart Drain and Huffs Side Road, For all locations identified here, the installation of underground cabling will be completed by directional drill (i.e., to prevent potential disturbance to the drainage ditches) in accordance with the Fisheries and Oceans Canada (DFO) *Operational Statement for High Pressure Directional Drilling*.

An existing culvert crossing is located in the Barnhart Drain. Therefore, there is a possibility of it being disturbed during the transfer of cranes to the turbine sites. If maintenance is required at this culvert crossing location, the DFO *Operational Statement for Culvert Maintenance* will be followed.

Best Management Practices

Although the results presented in Table 1 demonstrate a negligible change in post-development runoff potential (relative to existing conditions), Best Management Practices (BMPs) will be implemented prior to and during construction to minimize potential erosion/sedimentation and associated effects to water quality. Table 2 outlines scenarios that may be encountered during site preparation and construction of the Project and the BMPs described in guidelines by various conservation authorities and provincial ministries (MOE, MNR) that will be employed to mitigate the potential effects of stormwater runoff.

Table 2: Best Management Practices to Address Potential Environmental Effects attributed to Stormwater Runoff

Scenario	Best Management Practices
Construction of access roads, clearing of turbines construction and switchyard stations, and trenching for interconnection cabling will involve striping of topsoil and subsoil. The stripped soil will be stockpiled adjacent to the construction site and can be a source of sediment load to stormwater runoff if proper sediment control measures are not implemented.	Construction access or activities occurring on unpaved areas will be minimized. Where necessary, entrances adjacent to public/private roads will be gravelled/ stabilized/ compacted to minimize the tracking of sediment onto the roads. Wheel washing, street sweeping, and street cleaning will be employed to prevent sediment from entering waterways. Silt fences will be installed around staging areas and stockpiles/waste areas, and on the downstream side of disturbed construction areas such as turbine sites, substation site, access road, trenching of underground electrical collector line, lay down and temporary storage areas to provide a temporary physical barrier to sediment and to reduce runoff velocities of overland volumes. Silt fences would be either machine sliced into the soil or installed by hand. Hand-installed silt fences will have the edge buried or weighted by sand bags. Disturbed areas will be graded and seeded, as appropriate, to match existing vegetation. These areas include turbine sites, trenching of underground electrical collector line, equipment lay down and temporary storage areas and access roads. Plastic covers will be used to cover exposed soil and sand stockpiled material areas. The covers will be placed over stockpiles prior to forecast storm events, and anchored to prevent damage by wind.
Truck and trailers will be used to transport equipment and materials to the site. In addition, bulldozers and hoes will be used to strip topsoil and subsoil. There is possibility that an oil spill from the designated fuelling areas could find its way into the site stormwater runoff. Equipment and material may be stored at temporary storage areas. The storage site can be a source of potentially hazardous material release to stormwater runoff.	Equipment such as service trucks, construction equipment, etc., will not undergo routine maintenance activities at the project site. In order to perform emergency repairs on site, spill prevention measures such as drip pans will be used, and temporary plastic will be placed beneath and, if raining, over the vehicle. Equipment fuelling will only be done by fuel delivery trucks, which come on site to fuel the construction vehicles and then leave. All vehicles, construction equipments including generators/welders/pumps, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills. Any fuel or oil leaks associated with the respective equipment will be immediately repaired and the construction contractor will be notified to evaluate the situation. Vehicle fuel will be utilized by contractors and any other personnel accessing the site via vehicle and/or utilizing fuel driven equipment. The amount of fuel used in each vehicle will be commensurate for the type of work being performed and within requirements for the specific equipment operated. Excess fuels will not be stored on any vehicle.

Scenario	Best Management Practices
	During construction of the project, no waste materials will be treated, stored, reused, or disposed of at the Project site. These wastes including all construction/demolition wastes composed of building materials will be shipped to an off-site waste materials disposal location for disposal in accordance with applicable laws. Contaminated surfaces will be cleaned immediately following any discharge or spill incident. Any accidental spills will be dealt with immediately in accordance with the MOE's Spills and Discharges Reporting Protocol as required by the *Ontario Environmental Protection Act* (s. 92 and s. 15)
If a rainfall event occurs during the excavation for the turbine foundation, the excavated area could fill up with rainwater. This will increase sediment load in stormwater runoff, which may be deposited in nearby watercourses if proper BMPs are not implemented.	The rainwater will be pumped from the excavated area using a screen at the pump inlet and a silt bag at the outlet to collect sediment before the rainwater is released into the adjacent agricultural field. This will avoid the accumulation of sediment in stormwater runoff and subsequently prevent sedimentation in nearby watercourses.

The implementation of appropriate BMPs and mitigation measures will preclude or minimize potential adverse effects to sediment and/or water quality as a result of erosion/sedimentation processes. As part of the erosion and sediment control plan, the appropriate BMPs will be implemented prior to site preparation and construction. In addition, construction staff will continually monitor site conditions and, if unexpected conditions occur, alternate or additional BMPs may need to be implemented at the time of construction.

We trust that the above content meets your needs. If you have any questions or concerns, please do not hesitate to contact us.

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APPENDIX 3B – TECHNICAL MEMORANDUM (DEWATERING)

TECHNICAL MEMORANDUM

DATE July 19, 2010 **PROJECT No.** 10-1151-0123

TO Brad West
Suncor Energy Products Inc.

CC Christopher Scott, Ian Callum

FROM Alex Ivanoff, P.Geo.
Stephen Di Biase, P. Geo. **EMAIL** aivanoff@golder.com;
sdibiase@golder.com

DESKTOP REVIEW OF GROUNDWATER ELEVATION.
KENT BREEZE WIND FARM SITE, TOWNSHIP OF CAMDEN, ONTARIO

Suncor Energy Products Inc. (Suncor) is proposing to install eight wind turbines within a 5 km^2 area, referred to as the Kent Breeze Wind Farm (the Site). The location of the Site and the wind turbines are shown on Figure 1. Golder Associates Ltd. (Golder) has been retained by Suncor to complete a desktop review of the groundwater elevation in the vicinity of the Site. The purpose of this desktop review is to determine if foundation construction for the proposed wind turbines will intercept groundwater and potential dewatering rates that may be required in support of foundation construction.

As part of this desktop study, the following information was reviewed:

- Available topographic and surficial geology mapping from MNR NRVIS database;
- Available Ontario Ministry of the Environment (MOE) Water Well Records (WWR) within 500 m of the Site;
- Planned excavations depths for the wind turbine foundation construction; and
- Logs of eight geotechnical boreholes that were installed at each proposed turbine location.

It is to be noted that geotechnical boreholes at the proposed wind turbine locations were installed by Hatch Ltd. (Hatch). A copy of the borehole logs (attached in Appendix A) has been provided to Golder by Suncor. Golder has received no further reporting regarding Hatch's geotechnical investigation.

Based on a review of the above information, an assessment of groundwater levels and potential dewatering requirements are provided within the technical memorandum herein.

Local Geology

Near surface soils in the vicinity of the Site, which has been mapped by the Ontario Geological Survey (OGS), is shown on Figure 1. Based on this mapping, shallow overburden soils can generally be separated into two types:

1) Coarse-textured glaciolacustrine soils (sand to silty sand); overlying; and

2) Massive well laminated soils (silt and clay).

Coarser-textured glaciolacustrine soils (shown in yellow on Figure 1) are mapped throughout the Site area. This mapping is consistent with Hatch borehole logs, which shows a thin (approximately 0.3 to 3 m) layer of sand overlying thick deposits of silty clay. Silty clay soils extend from near ground surface to the top of bedrock, which is encountered from approximately 20 to 25 m below ground surface (bgs) in the vicinity of the Site.

It is noted that the Hatch borehole logs do not report groundwater levels observed within the geotechnical boreholes.

Topography and Drainage

Ground surface elevation contours in the vicinity of the Site are shown on Figure 2. Local terrain is flat-lying, ranging in elevation from approximately 180 to 185 metres above sea level (masl). The Thames River is the principal water course in the area, flowing in a south westerly direction approximately 1 km south of the Site. Several surface water courses and engineered drains (e.g., Courtney Drain and Shaw-Ferguson Drain) are also located in the vicinity of the Site.

In addition to these surface water courses, several off-line ponds are located near the project area. Many are constructed ponds intended for irrigation, aesthetics and/or storm water retention.

Groundwater Elevation

As shown on Figure 2, a total of 73 MOE Water Well Records (WWR) are located within 500 m of the Site. Depths to groundwater, which were reported in 50 of the 73 WWRs, have been summarized in Table 1. The depth to groundwater ranges from 1.5 to 10 m bgs, with a median depth of approximately 4.6 m bgs locally.

Using the reported groundwater elevations from the WWRs, groundwater elevation contours in the vicinity of the Site have also been inferred on Figure 2. The inferred groundwater elevation (or water table surface) is generally flat, ranging from approximately 180 masl near the Thames River to approximately 185 masl in the upland areas north of the Site. These results indicate that the water table elevation is generally within 5 m of ground surface in the vicinity of the wind farm.

Potential For Construction Dewatering

Golder has been advised by Suncor that the foundation excavations required for construction of the Wind Turbines will be approximately 20 m in diameter and a depth of 2.5 m bgs. Based on the assessment provided above, there is a relatively low potential that the depth of these excavations will intercept the water table (i.e., saturated ground conditions).

In order to confirm the water table elevation is below the base of the excavation, installation of piezometers into the shallow overburden (to a depth of approximately 3 m bgs) at each of the proposed construction locations would be required.

In the event that the proposed construction intercepts the water table elevation, construction dewatering will be required to capture groundwater inflow and/or remove direct precipitation into the excavation. Considering the

shallow depth of dewatering and the low permeability of massive well laminated soils, dewatering rates are not expected to exceed 50 m^3/day. As such, an MOE Permit to Take Water (PTTW) is not likely required to support construction.

Limitations

This technical memorandum, which has been prepared for Suncor Energy Products Inc., represents a desktop review to determine the depth to groundwater in the vicinity of the Kent Breeze Wind Farm Site. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the sole responsibility of such third parties.

This report is based on data and information collected by Hatch Ltd. and provided to Golder by Suncor. Golder has completed no independent field investigation to assess hydrogeological or environmental conditions. Golder has relied in good faith on the data and information provided by Suncor and on other materials as noted in this report. Golder has assumed that the information provided was factual and accurate. Golder accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

References

Ontario Geological Survey. 2006. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revised.

Hatch Ltd. 2010. Borehole Reports.

ADI/SMD/wlm

Attachments:

	Table 1	Summary of MOE Water Well Record Information
	Figure 1	Surficial Geology
	Figure 2	Groundwater Elevations and Inferred Groundwater Flow Direction
	Appendix A	Borehole Reports (Hatch, 2010)

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TABLES

Table 1: Summary of MOE Water Well Record Information

Well ID	Date	Ground Elevation[1] (m)	GW elevation[2] (m)	Depth to Water (m)
3300026	11/21/1962	182.9	178.6	4.3
3300027	8/23/1960	182.9	173.1	9.8
3300031	10/10/1949	182.9	177.7	5.2
3300032	12/20/1953	182.9	179.2	3.7
3300033	7/31/1954	182.9	173.7	9.1
3300034	8/18/1954	182.9	174.3	8.5
3300036	8/14/1962	182.9	176.2	6.7
3300037	9/14/1962	182.9	177.1	5.8
3300078	11/20/1958	184.7	182.3	2.4
3300084	1/26/1967	186.5	181.4	5.2
3300085	2/17/1967	186.5	178.6	7.9
3300086	8/5/1953	186.5	182.0	4.6
3300087	7/1/1951	185.9	183.2	2.7
3300088	5/12/1966	185.9	182.6	3.4
3300089	9/20/1960	185.9	182.3	3.7
3300090	10/20/1967	185.9	181.1	4.9
3300091	11/4/1967	185.9	181.4	4.6
3300115	2/10/1967	186.2	180.7	5.5
3300117	10/20/1960	186.8	183.8	3.0
3300118	8/31/1965	186.8	184.4	2.4
3300122	5/11/1954	185.9	184.1	1.8
3304903	8/7/1969	182.9	175.6	7.3
3305137	5/8/1970	184.4	179.8	4.6
3305180	10/23/1970	184.4	180.7	3.7
3305313	5/24/1971	185.9	182.9	3.0
3305708	9/15/1972	185.9	182.6	3.4
3305709	7/1/1972	185.9	182.6	3.4
3305710	6/5/1972	184.4	180.4	4.0
3305721	4/7/1973	185.3	177.4	7.9
3305820	9/11/1973	184.4	180.7	3.7
3305821	9/8/1973	184.4	179.5	4.9
3306119	12/19/1974	185.9	182.9	3.0
3306370	4/29/1976	184.4	182.9	1.5
3306481	7/20/1976	185.9	181.4	4.6
3306577	7/25/1977	185.9	180.7	5.2
3306760	5/3/1978	186.5	180.4	6.1
3306849	8/2/1978	189.0	187.5	1.5
3306869	8/1/1978	189.0	184.1	4.9
3306934	12/20/1978	189.0	184.1	4.9
3306945	11/29/1978	189.3	188.1	1.2
3307444	4/26/1981	185.9	183.2	2.7
3307445	6/8/1981	185.9	183.2	2.7
3307502	5/8/1981	185.9	182.9	3.0
3307675	9/15/1983	182.9	173.7	9.1
3307730	10/15/1983	182.9	178.0	4.9
3308157	9/11/1987	187.5	182.6	4.9
3308158	9/16/1987	187.8	182.9	4.9
3308265	5/6/1988	187.5	180.4	7.0
3308266	5/13/1988	187.5	181.1	6.4
3308299	8/16/1988	188.1	185.0	3.0
3308307	7/21/1988	187.5	182.9	4.6
Median:		**185.9**	**181.4**	**4.6**

Notes:
1. Based on digital elevation model (DEM)
2. As reported in Ontario Ministry of Environment (MOE) Water Well Records

FIGURES

410000

420000

4710000

N

DAWN MILLS RD

GROVE MILLS LINE

Dawn Mills

SMITH RD

FLAT ROCK RD

SHARROW RD

BEAR CREEK RD

OAKDALE RD

BRICK RD

FLORENCE RD

1 ZONE RD

2 ZONE RD

JANE RD

FAIRFIELD LINE

8a

Wabash

BASE LINE

North Thamesville

PAVEY LINE

WABASH LINE

DEW DROP RD

INDUSTRIAL RD

JANE ST

PITT RD

Macleod - 5

9

7a

Thorncliffe

Thamesville

NORTON LINE

MASON LINE

BROOK LINE

Kent - 1

Macleod - 4

SPLINTER LINE

HUFFS SIDE RD

Macleod - 1

EVERGREEN LINE

Macleod - 3

Kent - 5

LONGWOODS RD

EBERTS LINE

Kent - 4

SMOKE LINE

Kent - 3

RIVER LINE

19

VICTORIA RD

STAGE RD

DARRELL LINE

CRAFTS LINE

PIONEER LINE

Kent Bridge

12

FYSH LINE

LINDSAY RD

FULLER RD

MERRITT LINE

SCANE RD

17

KENT BRIDGE RD

MAGNAVILLA LINE

BLOCK LINE

BOTANY LINE

SELTON LINE

410000

420000

4710000

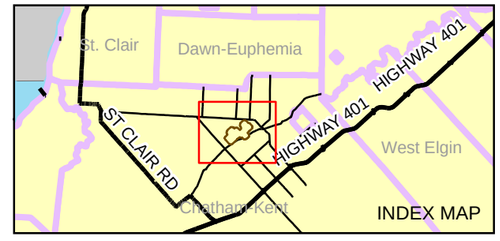
G:\Projects\2010\10-1151-0123_KentBreezeWindFarmGIS\MXDs\Draft\Working\SurficialGeology.mxd

LEGEND

- Proposed Turbine Location
- Community
- Railway
- Major Road
- Local Road
- Watercourse
- Waterbody
- Kent Breeze Wind Farm Area

Surficial Geology

- 5d: Glaciolacustrine-derived silty to clayey till
- 7a: Sandy deposits
- 8a: Massive-well laminated
- 9: Coarse-textured glaciolacustrine deposits
- 12: Older alluvial deposits
- 14: Coarse-textured lacustrine deposits
- 17: Eolian deposits
- 19: Modern alluvial deposits



REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008.4
Oil Wells - Oil, Salt and Gas Resources, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2010
Surficial Geology Dataset produced by the Ontario Geological Survey,
Ministry of Northern Development and Mines, © Queen's Printer for Ontario, 2003.
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

0 500 1,000 2,000 3,000

SCALE 1:50,000 METRES

PROJECT

KENT BREEZE WIND FARM

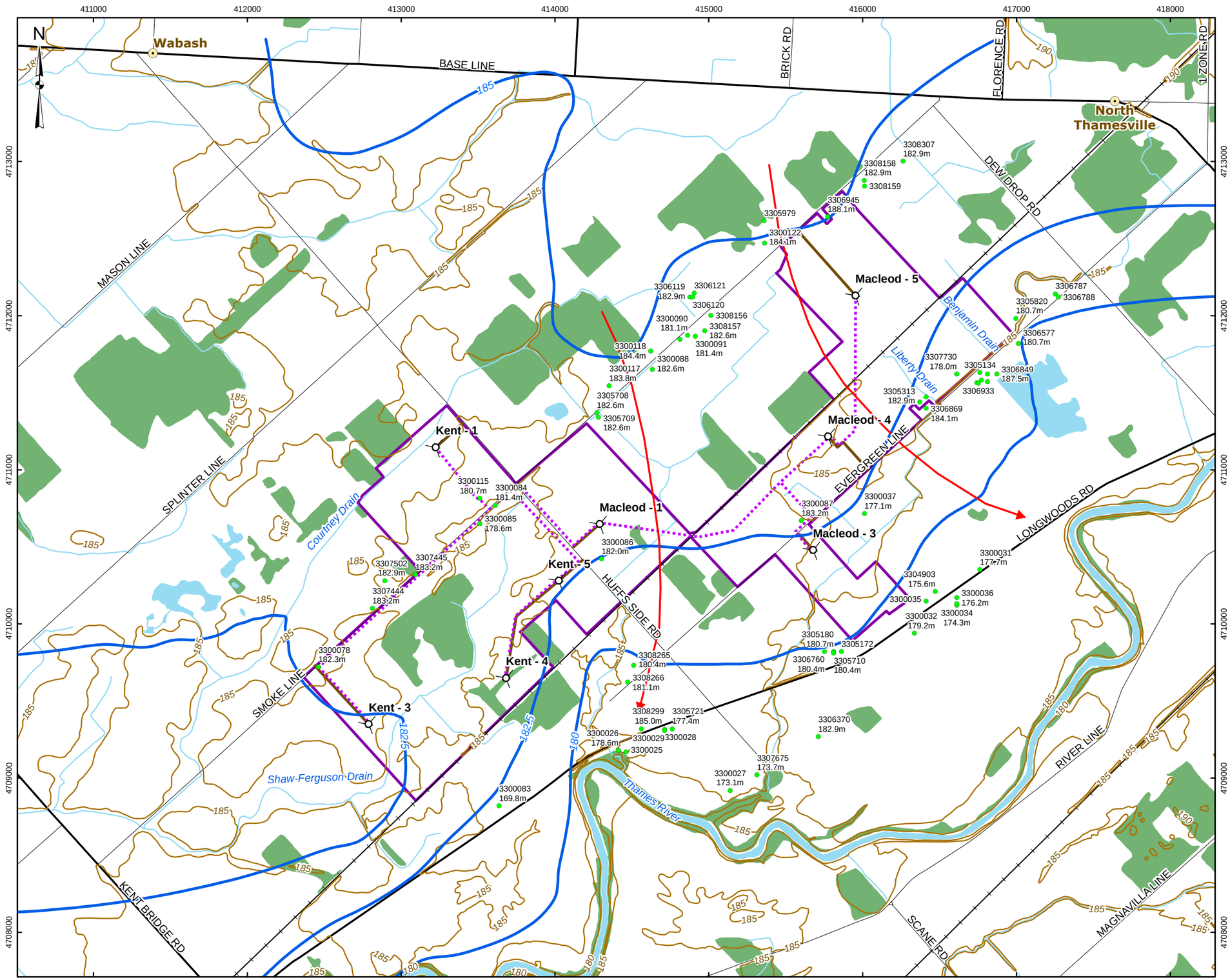
TITLE

SURFICIAL GEOLOGY

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1151-0123			SCALE AS SHOWN	REV.
DESIGN	PP	8 Jul. 2010		
GIS	JO	16 Jul. 2010		
CHECK	AI	16 Jul. 2010		
REVIEW	SMD	16 Jul. 2010		

FIGURE: 1

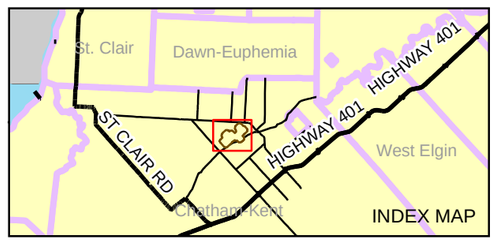


LEGEND

- Water Well Record
- Proposed Turbine Location
- Contour
- Cable
- Access Road
- Community
- Railway
- Major Road
- Local Road
- Groundwater Inferred Flow Direction
- Groundwater Contour
- Watercourse
- Waterbody
- Wooded Area
- Kent Breeze Wind Farm Area

NOTES:

3300036 → MOE Well ID
176.2m → Groundwater Elevation



REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008.4
Oil Wells - Oil, Salt and Gas Resources, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2010
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

0 250 500 1,000 1,500
SCALE 1:25,000 METRES

PROJECT
KENT BREEZE WIND FARM

TITLE
GROUNDWATER ELEVATIONS AND INFERRED GROUNDWATER FLOW DIRECTION

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1151-0123			SCALE AS SHOWN	REV.
DESIGN	PP	8 Jul. 2010		
GIS	JO	16 Jul. 2010		
CHECK	AI	16 Jul. 2010		
REVIEW	SMD	16 Jul. 2010		

FIGURE: 2

G:\Projects\2010\10-1151-0123_KentBreezeWindFarm\GIS\MXDs\Draft\Working\GroundwaterContours.mxd

APPENDIX A

Borehole Reports

BOREHOLE REPORT

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm
HOLE: BH-Kent-01
PAGE: 1 **OF:** 2

SITE: Kent Breeze Farm

COORDINATES: N 4711135, E 413230
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 270
END OF HOLE: 259.24

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter 4" HQ
CORE: HQ-Single Barrel

STARTED: Apr 28/10
FINISHED: Apr 28/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECV (mm)	RECV(%)	BLOW COUNTS	DEPTH (m)
270								
0.0 / 269.80		Topsoil	0	AS1	432		2 2 4 7	
.2 / 269.09		SAND Sand, brown, loose, moist	0.61					
.914		CLAY Silty clay, grey, firm to soft, moist, stratified	0.76	AS2	381		2 2 3 2	1
			1.37					
			1.52	AS3	432		2 2 3 2	2
			2.13					
			2.29	AS4	483		2 2 2 2	
			2.9					3
			3.05	AS5	508		2 2 2 2	
			3.66					
			3.81	AS6	432		2 1 3 3	4
			4.42					
			4.57	AS7	356		1 1 2	

SPT N-VALUES / DYNAMIC CONE PENETRATION: 20 40 60 80
SHEAR STRENGTH (kPa): UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN.: 50 100 150 200
HYDRAULIC CONDUCTIVITY (m/s): 10^{-6} 10^{-5} 10^{-4}
WATER CONTENT & ATTERBERG LIMITS: 15 30 45 (%)
DRY DENSITY (kg/m3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL
PIEZOMETER INSTALLATION

0 2 43 55

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-01

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 2

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80)	SHEAR STRENGTH (kPa) □ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ● LAB VANE ✪ POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4})	WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			5.18				2								
			6.1	AS8	508		1 2 2 3	6							
			6.71												
			7.62	AS9	406		2 2 3 4	7							
			8.23					8							
			9.14	AS10	483		2 2 4 4	9							
			9.75					10						Auger refusal @ 10.76 m. Hole grouted upon completion.	
259.24			10.66	AS11	30		3/0.08 -								
10.76		**END OF BOREHOLE**													

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm

HOLE: BH-Kent-03
PAGE: 1 **OF:** 4

SITE: Kent Breeze Farm

COORDINATES: N 4709343
E 412788
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 270
END OF HOLE: 249.27

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter
4" HQ
CORE: HQ-Single Barrel

STARTED: Apr 28/10
FINISHED: Apr 29/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y(%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) □ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ✚ LAB VANE ❖ POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
270													
0.0		Topsoil	0	AS1	305		1 2 2 3						
269.80			0.61										
.2		SAND Sand, grey, loose to compact, moist	0.76	AS2	483		2 2 6 10	1					
			1.37										
			1.52	AS3	533		4 9 13 14	2					
			2.13										
267.56			2.29	AS4	483		3 2 3 4						
2.44		CLAY Silty clay, grey, firm, moist	2.9					3					
			3.05	AS5	457		2 2 3 3						
			3.66										
			3.81	AS6	533		2 3 2 3	4					
			4.42										
			4.57	AS7	382		2 3 3						

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-03

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECY (mm)	RECY (%)	BLOW COUNTS	DEPTH (m)
			5.18				3	
264.08 / 5.92		CLAY Silty clay, grey, soft to firm, moist	6.1	AS8	483		1 1 2 2	6
			6.71					7
			7.62	AS9	508		2 1 2 3	8
			8.23					
			9.14	AS10	483		1 1 2 2	9
			9.75					10
			10.67	AS11	483		1 1 2 3	11
			11.28					

SPT N-VALUES; DYNAMIC CONE PENETRATION (20 40 60 80)

SHEAR STRENGTH (kPa): □ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ● LAB VANE ✤ POCKET PEN. (50 100 150 200)

HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4})

WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))

DRY DENSITY (kg/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL — 0 1 36 63

PIEZOMETER INSTALLATION

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-03

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 3 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			12.19	AS12	457		2 3 4 5	12	●				
			12.8										
								13					
			13.72	AS13	610		1 2 4 5	14	●	○			
			14.33										
255.37 / 14.63		CLAY Silty clay, trace and and gravel, grey, hard (Till)						15					
			15.24	AS14	330		11 28 53 57		●				
			15.85					16					
			16.76	AS15	250		10/.25 - - -			○			
			17					17					

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
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E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

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Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Kent-03

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 4 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECY (mm)	RECY (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80)	SHEAR STRENGTH (kPa) (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4})	WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
251.71								18						Black oil material coming up with samples	
18.29		CLAY Silty clay, weathered shale mix, hard (Till) Gravel layer @ 18.5 m	18.29 18.75	AS16	406		18 27 56 -	19							
			19.61 20.34	AS17	406		2 46 70 50	20						Auger refusal @ 20.73 m. Hydrocarbon smell. Hole grouted upon completion of drilling.	
249.58 20.42		Bedrock infered from cuttings and hard drilling													
249.27 20.73															

END OF BOREHOLE

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm

HOLE: BH-Kent-04
PAGE: 1 **OF:** 3

SITE: Kent Breeze Farm

COORDINATES: N 4709641, E 413679
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 270
END OF HOLE: 256.89

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter 4" HQ
CORE: HQ-Single Barrel

STARTED: Apr 28/10
FINISHED: Apr 28/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y(%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
270													
0.0		Topsoil	0	AS1	305		1 1 3 4		●				
269.80			0.61										
.2		CLAY Silty clay, grey, firm to soft, moist	0.76	AS2	483		4 2 3 4	1	●				
			1.37										
			1.52	AS3	533		2 2 3 5	2	●	○			
			2.13										
			2.29	AS4	483		2 3 3 3		●				
			2.9					3					
			3.05	AS5	457		1 1 1 2		●	○			
			3.66										
			3.81	AS6	533		1 1 2 2	4	●				
			4.42										
			4.57	AS7	508		1 1 2		●	○			

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-04

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 3

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80); SHEAR STRENGTH (kPa) UNCONFINED / QUICK TRIAXIAL / FIELD VANE / LAB VANE / POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}); WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			5.18				2						
			6.1	AS8	381		1 1 2 2	6					
			6.71										
262.99 / 7.01		CLAY Silty clay, grey, firm, moist						7					
			7.62	AS9	483		2 2 3 4	8					
			8.23										
			9.14	AS10	483		2 3 4 4	9					
			9.75										
								10					
			10.67	AS11	457		2 3 4 4	11					
			11.28										

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P — W_N — W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-04

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 3 **OF:** 3

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECY (mm)	RECY (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80); SHEAR STRENGTH (kPa) □ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ♣ LAB VANE ✿ POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}); WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			12.19	AS12	483		1 2 4 4	12	●			Augar refusal @ 13.11 m. Hole grouted upon completion of drilling.	
			12.8										
257.05													
12.95		Bedrock inferredfrom cuttings and hard drilling						13					
256.89													
13.11		**END OF BOREHOLE**											

SAMPLING METHOD

A - Split Tube
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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P W_N W_L

□ Constant Head Test
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▩ Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm

HOLE: BH-Kent-05
PAGE: 1 **OF:** 7

SITE: Kent Breeze Farm

COORDINATES: N 4710276
E 414023
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 270
END OF HOLE: 239.26

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter
4" HQ
CORE: HQ-Single Barrel

STARTED: Apr 26/10
FINISHED: Apr 27/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y(%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, FIELD VANE, QUICK TRIAXIAL, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
270													
0.0		Topsoil	0	AS1	203		1 1 1 2						
			0.61										
			0.76	AS2	381		1 1 2 3	1					
268.78			1.37										
1.22		SAND											
268.42		Sand, brown, very loose											
1.58		CLAY	1.52	AS3	508		4 3 3 3	2		O			
		Silty clay, grey, firm to soft, moist	2.13										
			2.29	AS4	533		1 2 3 5						
			2.9					3					
			3.05	AS5	457		2 3 4 4			O			
			3.66										
			3.81	AS6	457		0 1 1 2	4		H		0 1 76 23	
			4.42										
			4.57	AS7	508		1 1 2			O			

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P — W_N — W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-05

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 7

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECV (mm)	RECV (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-8} 10^{-6} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			5.18				2						
			6.1	AS8	508		1 1 3 3	6					
			6.71										
			7.62	AS9	584		0 1 2 2	7					
			8.23					8					
261.47 / 8.53		CLAY Silty clay, grey, firm to stiff											
			9.14	AS10	508		2 4 4 3	9					
			9.75					10					
			10.67	AS11	508		1 1 4 4	11					
			11.28										

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

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Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-05

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 3 **OF:** 7

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
256.89			12.19	AS12	203		4 7 12 12	12					
13.11		CLAY Silty clay, grey, firm, trace sand	12.8					13					
			13.72	AS13	254		6 11 12 15	14					
255.22			14.33										
14.78		Gravel Sand and gravel, grey (Till)	15.24	AS14	432		14 32 50/.13	15					
			15.67				-	16					
			16.76	AS15	250		30 50/.08	17					
			17				-						

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PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Kent-05

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 4 **OF:** 7

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECY (mm)	RECY (%)	BLOW COUNTS
			18.29 / 18.53	AS16	255		33 50/.10 -
250.20 / 19.8		CLAY Silty clay, trace sand and gravel, grey, hard (Till)	19.81 / 20.42	AS17	559		8 16 25 27
		Sand seams, stones and black oil material on augers @ 22.86 m	21.34 / 21.95	AS18	610		4 9 16 17
			22.86 / 23.32	AS19	406		6 11 51 -

DEPTH (m): 18, 19, 20, 21, 22, 23, 24

SPT N-VALUES; DYNAMIC CONE PENETRATION (20 40 60 80)

SHEAR STRENGTH (kPa): ☐ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ● LAB VANE ✥ POCKET PEN. (50 100 150 200)

HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4})

WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))

DRY DENSITY (kg/m3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

PIEZOMETER INSTALLATION

SAMPLING METHOD

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PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

☐ Constant Head Test
▨ Variable Head Test
▩ Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-05

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 5 **OF:** 7

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECY (mm)	RECY (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80); SHEAR STRENGTH (kPa) UNCONFINED / QUICK TRIAXIAL / FIELD VANE / LAB VANE / POCKET PEN. (50 100 150 200); HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}); WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			24.38	AS20	150		51 -					Black oil material coming up from augers @ 24.38 m
		24.54 m - TOP OF BEDROCK see next sheet						25				
								26				
								27				
								28				
								29				
								30				

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PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Kent-05

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 6 **OF:** 7

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	CORE CONDITION	DISCONTINUITY CHARACTERISTICS	SAMPLE: DEPTH (m)	SAMPLE: TYPE/ NUMBER	SAMPLE: REC/SCR (%)	SAMPLE: RQD (%)	DEPTH (m)	RECOVERY AND RQD (%)	PERMEABILITY (lugeons) / (m/sec)	NOTES	PIEZOMETER INSTALLATION
245.46 24.54		Bedrock Dolomite (Calcitic): Light grey to medium light grey, fine to medium grained, medium strong, fresh, thinly laminated to massive, relic mineral grain in recrystallized dolomite, reacts with HCL. Occasional very thin clay seams. 25.2-25.33: Core shown tendency of splitting along horizontal laminations upon handling. 25.57-26.02: Weak zone, slightly weathered, light grey clay filling (0.02 m thick) along joint at 25.76 m, shows strong tendency of horizontal splitting upon handling. 27.09-27.21: Cataclastic texture with medium size relict grains.				DY1	100/	93	25	20 40 60 80	No take 0.1 1 10 100 / 10^{-8} 10^{-7} 10^{-6} 10^{-5}		
					25.97				26				
						DY2	97/	97					
									27				
242.52 27.48		Dolomite (Calcitic): Medium light grey, fine to medium grained, medium strong, fresh to faintly weathered, thinly laminated to massive, relic mineral grains and trace fossiliferous limestone grains, weakly to moderately reacts HCL. 27.48-27.94: Core shows tendency of splitting along horizontal planes. 29.36-29.63: Cataclastic texture with relic medium size grains of calcite and fossiliferous dolomitized grains. 30.34-30.46: Core shows tendency of splitting along horizontal laminations.			27.46								
						DY3	99/	96	28				
					29.01				29				
						DY4	102/	102					
									30				

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U - Wooden Box
Y - Core Box
Z - Discarded

Core Condition: Fragmented, Lost, 5 No. of discontinuities

Permeability units: RQD, Recovery, Lugeons, m/sec

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Kent-05

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 7 **OF:** 7

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	CORE CONDITION	DISCONTINUITY CHARACTERISTICS	SAMPLE: DEPTH (m)	SAMPLE: TYPE/ NUMBER	SAMPLE: REC/SCR (%)	SAMPLE: RQD (%)	SAMPLE: DEPTH (m)	RECOVERY AND RQD (%) 20 40 60 80	PERMEABILITY (lugeons) 0.1 1 10 100 / (m/sec) No take 10^{-8} 10^{-7} 10^{-6} 10^{-5}	NOTES	PIEZOMETER INSTALLATION
239.26													
30.74		Hole grouted upon completion of drilling		**END OF BOREHOLE**									

SAMPLING METHOD

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Q - Jar
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

Core Condition: Fragmented, Lost, 5 No. of discontinuities

Permeability units: RQD, Recovery, Lugeons, m/sec

Project: 335112

HATCH™ Discontinuity Log

Project: Kent-Breeze

Site: 27/04/2010

Project No. H335142

Borehole Kent5

Sheet 1 **of** 1

Inspector M. M.

Date

Depth* ☐ (m) ☒ (ft)	Discontinuity Details: Joint, Bedding plane joint, Solution cavity, Extremely closely spaced zone, Very closely spaced zone, Fragmented zone, Broken zone, Etc	Angle with Core Axis (°)	Plane	Curved	Irregular	Smooth	Rough	Slick	Slickensided	Staining[1]	Coating/Filling[2]	Aperture[3]	Healed[4]	Weathering[5]
80'2"-80'5"	Fragmented Zone													
81'5"	Drill Break													
83'2"	Drill Break													
84'	Drill Break													
84'1"	Drill Break													
84'4"	Fracture	90	X			X					CL			M
84'5"	Fracture	90	X			X					CL			M
84'6"	Fracture	90	X			X					CL			S
85'2"	Drill Break													
85'4"	Drill Break													
86'1"	Fracture	90	X			X					CL			S
86"2'	Drill Break													
87'	Drill Break													
89'9"	Drill Break													
90'1"	Drill Break													
91'7"-91'8"	Weathered Zone	90			X		X				CL			H
93'9"	Drill Break													
94'	Drill Break													
94'4"	Drill Break													
95'	Drill Break													
95'2"	Drill Break													
96'5"	Drill Break													
98'5"	Drill Break													
99'	Drill Break													
100'	Drill Break (End of Hole)													

1 = Fe - Iron, Mn - Manganese
2 = C - Carbonate, G - Gypsum, SC - Silt/Clay
Py - Pyrite, St - Serpentine, Ch - Chlorite
3 = T - Tight
4 = P - Partially
5 = F - Faintly, S - Slightly

} Use other Symbols - If Required, Identify in Legend

*Measured to nearest 0.01 m/0.1 ft

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm

HOLE: BH-Mac-01
PAGE: 1 **OF:** 4

SITE: Kent Breeze Farm

COORDINATES: N 4710645
E 414288
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 269.96
END OF HOLE: 248.62

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter
4" HQ
CORE: HQ-Single Barrel

STARTED: Apr 29/10
FINISHED: Apr 29/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECV (mm)	RECV(%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
269.96													
0.0		Topsoil, some sand	0	AS1	254		2 2 4 6		●				
269.35			0.61										
.61		CLAY Silty clay, grey, firm to soft, moist	0.76	AS2	330		3 2 4 4	1	●				
			1.37										
			1.52	AS3	381		1 1 2 4	2	●	○			
			2.13										
			2.29	AS4	432		2 1 2 2		●				
			2.9					3					
			3.05	AS5	483		1 1 2 3		●	○			
			3.66										
			3.81	AS6	584		2 2 2 2	4	●				
265.54			4.42										
4.42		CLAY Silty clay, grey, firm to stiff, moist	4.57	AS7	559		1 2 3		●	○			

SAMPLING METHOD

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P — W_N — W_L

Constant Head Test
Variable Head Test
Leb. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-01

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80)	SHEAR STRENGTH (kPa) (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4})	WATER CONTENT & ATTERBERG LIMITS (15 30 45 %)	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			5.18				2								
			6.1	AS8	381		2 3 3 5	6							
			6.71												
								7							
			7.62	AS9	406		3 3 3 5								
			8.23					8							
								9							
			9.14	AS10	431		2 2 3 3								
			9.75					10							
			10.67	AS11	508		2 3 3 4								
			11.28					11							

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Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Mac-01

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 3 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) □ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ◆ LAB VANE ♣ POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
256.86 / 13.1		SAND Silty sand, some clay, grey, very dense (Till)	12.19 – 12.8	AS12	330		3 4 9 14	12	●	○			
			13.72	AS13	114		100 -	13					
			15.24 – 15.64	AS14	250		9 43 53/.08 -	14					
								15		○			
			16.76 – 17.06	AS15	250		34 75 -	16					
252.28 / 17.68		CLAY						17					

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▨ Variable Head Test

▩ Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Mac-01

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 4 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
		Silty clay, trace sand and gravel, grey, hard (Till)	18.29 – 18.59	AS16	255		17 65 -	18					
			19.84 – 19.92	AS17	150		86 - -	19					
								20					
248.62 / 21.34								21				Auger refusal @ 21.34 m. Hole grouted upon completion of drilling	
		END OF BOREHOLE											

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm

HOLE: BH-Mac-02
PAGE: 1 **OF:** 6

SITE: Kent Breeze Farm

COORDINATES: N 4710927
E 415469
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 270.1
END OF HOLE: 244.04

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter
4" HQ
CORE: HQ-Single Barrel

STARTED: May 3/10
FINISHED: May 4/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECV (mm)	REC'Y(%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 %)	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
270.1													
0.0		Topsoil/Sand	0	AS1	229		1 3 3 3		●				
269.49			0.61										
.61		CLAY Silty clay, grey, some sand, firm, moist	0.76	AS2	432		1 2 2 5	1	●				
			1.37										
			1.52	AS3	406		1 3 4 4	2	●	○			
267.97			2.13										
2.13		CLAY Silty clay, grey, soft to firm, moist	2.29	BO4								USC = 67.36 KPa. Wet Density = 2040 kg/m3	
			2.9					3					
			3.05	AS5	508		1 2 1 2		●				
			3.66										
			3.81	AS6	559		1 1 2 3	4	●	○			
			4.42										
			4.57	AS7	533		1 2 2		●				

SAMPLING METHOD

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R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P — W_N — W_L

Constant Head Test
Variable Head Test
Lab. Permeability

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-02

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 6

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80)	SHEAR STRENGTH (kPa) (UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN.) (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4})	WATER CONTENT & ATTERBERG LIMITS (15 30 45 %)	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			5.18				3								
			5.33	BO8										USC = 95.04 KPa. Wet Density = 1900 kg/m3 0 0 35 65	
			5.94					6							
			6.1	AS9	381		1 2 3 3								
			6.71					7							
			7.62	AS10	483		2 2 3 3								
			8.23					8							
								9							
			9.14	AS11	457		1 2 3 3								
			9.75					10							
			9.91	BO12											
			10.52												
			10.67	AS13	610		1 2 4 4	11							
			11.28												

SAMPLING METHOD

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Mac-02

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 3 **OF:** 6

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION; SHEAR STRENGTH (kPa) □ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ● LAB VANE ✪ POCKET PEN.	HYDRAULIC CONDUCTIVITY (m/s); WATER CONTENT & ATTERBERG LIMITS	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
257.60 / 12.5		CLAY Silty clay, grey, hard, moist (Till)	12.19 – 12.8	AS14	610		1 6 31 61	12	●	○			
			13.7 – 13.85	AS14A	0		57	13	●				
			15.24 – 15.85	AS15	255		15 27 39 36	14					
								15					
								16					
			16.76 – 17.37	AS15A	0		22 27 27 38	17	●	○			
252.42 / 17.68													

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P — W_N — W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-02

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 4 **OF:** 6

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
		Grey, Sand and Gravel, dense	18.29	AS16	610		1 8 31 117	18	●			39 51 5 5	
			18.9					19					
			19.5	AS	0		2 50/.03						
		19.66 m - TOP OF BEDROCK see next sheet						20					
								21					
								22					
								23					
								24					

SAMPLING METHOD

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P W_N W_L

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Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-02

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 5 **OF:** 6

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	CORE CONDITION	DISCONTINUITY CHARACTERISTICS	SAMPLE DEPTH (m)	SAMPLE TYPE/ NUMBER	SAMPLE REC/SCR (%)	SAMPLE RQD (%)	DEPTH (m)	RECOVERY AND RQD (%)	PERMEABILITY (lugeons) / (m/sec)	NOTES	PIEZOMETER INSTALLATION
250.44 19.66		Bedrock			19.66								
		Dolomite(Calcite): Light grey to medium lightgrey, fine grained with medium grained relic calcite grains and dolomitized fossils, weak to medium strong, fresh to moderately weathered, thinly laminated to massive. Occasional very thin clay seems.				DY1	99/	99	20				
		20.14-20.58: Fragmented zone with horizontal splitting along lamination with very thin interlamination of mud/clay, relics of dolomitized fossils.			20.15	DY2	102/	70	21				
		20.78-20.8: Clay layer			21.59								
		20.8-20.98: Broken layer							22				
		20.98-21.03: Clay layer				DY3	97/	97					
		21.03-21.21: Broken zone											
		21.21-21.3: Cataclastic texture with relics of calcite grains (medium) within recrystallized dolomite.							23				
		21.3-21.54: Broken zone			23.09								
		21.64-21.95: Cataclastic texture with relics of calcite and dolomitized fossils.				DY4	98/	90					
		22.29-22.48: Cataclastic texture							24				
		22.63-22.99: Cataclastic texture											
		23.09-23.70: Broken zone showing tendency of splitting along bedding.											
		23.54-23.65: Shaly dolomite zone			24.54								
		24.41-24.75: Cataclastic texture and fossiliferous zone.							25				
		24.75-25.34: Broken zone, slightly weathered, shale dolomite layer				DY5	60/	60					

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U - Wooden Box
Y - Core Box
Z - Discarded

Core Condition: Fragmented, Lost, 5 No. of discontinuities

Permeability units: RQD, Recovery, Lugeons, m/sec

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-02

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 6 **OF:** 6

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	CORE CONDITION	DISCONTINUITY CHARACTERISTICS	SAMPLE: DEPTH (m)	SAMPLE: TYPE/ NUMBER	SAMPLE: REC/SCR (%)	SAMPLE: RQD (%)	DEPTH (m)	RECOVERY AND RQD (%) 20 40 60 80	PERMEABILITY (lugeons) 0.1 1 10 100 / (m/sec) No take 10^{-8} 10^{-7} 10^{-6} 10^{-5}	NOTES	PIEZOMETER INSTALLATION
244.04									26				
26.06		Hole grouted upon completion of drilling		END OF BOREHOLE									

SAMPLING METHOD

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Z - Discarded

Core Condition: Fragmented, Lost, 5 No. of discontinuities

Permeability units: RQD, Recovery, Lugeons, m/sec

Project: 335112

HATCH™ Discontinuity Log

Project: Kent-Breeze

Site: 4/05/2010

Project No. H332299
Borehole Mac-2
Sheet 1 **of** 1
Inspector M. M.
Date

Depth* ☐ (m) ☒ (ft)	Discontinuity Details: Joint, Bedding plane joint, Solution cavity, Extremely closely spaced zone, Very closely spaced zone, Fragmented zone, Broken zone, Etc	Angle with Core Axis (°)	Plane	Curved	Irregular	Smooth	Rough	Slick	Slickensided	Staining[1]	Coating/Filling[2]	Aperture[3]	Healed[4]	Weathering[5]
64'6"	Top of Bedrock													
65'3"	Drill Break													
66'0"	Drill Break													
66'1"	Drill Break													
66'1"-67'3"	Fragmented Zone	90			X		X				CL			M
67'8"	Drill Break													
68'4"-68'5"	Fragmented Zone	90			X	X					CL			M
68'8"	Drill Break													
68'11"	Drill Break													
69'	Fracture	90			X	X					CL			M
69'3"	Fracture	60			X	X					CL			M
69'10"	Drill Break													
69'11"	Fracture	90			X	X					CL			M
70'	Fracture	90			X	X					CL			M
70'3"	Drill Break													
70'4"	Drill Break													
70'6"-70'8"	Fractured Zone	90	X		X						CL			M
70'9"	Drill Break													
70'10"	Drill Break													
71'2"	Drill Break													
73'2"	Drill Break													
74'	Drill Break													
74'4"	Drill Break													
74'6"	Drill Break													
75'9"	Drill Break													
76'2"	Drill Break													
77'2"	Drill Break													
77'4"-77'9"	Fragmented Zone	90			X	X					CL			M
78'1"	Drill Break													
80'4"	Drill Break													
80'6"	Drill Break													
83'6"	Drill Break (End of Hole)													

1 = Fe - Iron, Mn - Manganese
2 = C - Carbonate, G - Gypsum, SC - Silt/Clay, Py - Pyrite, St - Serpentine, Ch - Chlorite
3 = T - Tight
4 = P - Partially
5 = F - Faintly, S - Slightly

} Use other Symbols - If Required, Identify in Legend

*Measured to nearest 0.01 m/0.1 ft

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm

HOLE: BH-Mac-03
PAGE: 1 **OF:** 4

SITE: Kent Breeze Farm

COORDINATES: N 4710482
E 415670
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 275.76
END OF HOLE: 257.78

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter
4" HQ
CORE: HQ-Single Barrel

STARTED: Apr 30/10
FINISHED: May 3/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECV (mm)	RECV(%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION; SHEAR STRENGTH (kPa)	HYDRAULIC CONDUCTIVITY (m/s); WATER CONTENT & ATTERBERG LIMITS	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	PIEZOMETER INSTALLATION
275.76									20 40 60 80	10^{-6} 10^{-5} 10^{-4}		GR SA SI CL	
0.0		Sandy Topsoil	0	AS1	381		1 2 3 5		50 100 150 200	15 30 45 (%)			
275.15			0.61										
.61		SAND											
		Sand, grey, compact, wet	0.76	AS2	457		6 10 14 15	1					
			1.37										
274.11			1.52										
1.65		CLAY		AS3	406		1 2 4 5	2					
		Silty clay, grey, soft to firm, moist	2.13										
			2.29	BO4									
			2.9					3					
			3.05	AS5	457		1 1 3 3						
			3.66										
			3.81	AS6	559		2 2 2 3	4					
			4.42										
			4.57	AS7	559		1 2 2						

SAMPLING METHOD

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-03

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			5.18				3						
			5.33	BO8									
			5.94					6					
			6.1	AS9	483		2 2 3 3						
268.75 / 7.01		CLAY Silty clay, grey, soft to firm, moist	6.71					7					
			7.62	AS10	533		0 0 0 0						
			8.23					8					
			8.38	BO11								USC = 42.08 KPa. Wet Density = 1940 kg/m3 0 1 39 60	
			8.99					9					
			9.14	AS12	559		1 1 2 3						
			9.75					10					
			10.67	AS13	559		1 3 3 3						
			11.28					11					

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

BOREHOLE REPORT

HATCH

CLIENT: Suncor Energy **HOLE:** BH-Mac-03

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 3 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80)	SHEAR STRENGTH (kPa) □ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ✤ LAB VANE ✪ POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4})	WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
262.36 / 13.4		CLAY Silty clay, trace sand and gravel, grey, hard (Till)	12.19 – 12.8	AS14	559		1 3 3 3	12	●		○			Odourless gas observed @ 13.26 m	
			12.95 – 13.56	BO15				13							
			13.72 – 14.18	AS16	406		11 39 67 -	14			●»				
								15							
			15.24 – 15.54	AS17	305		42 80 -				○				
259.00 / 16.76		GRAVEL Stones and rock fragments, very dense	16.76 – 17.37	AS18	457		20 30 50 45	16							
258.26 / 17.5		Bedrock inferred on cutting and hard drilling						17			●			Auger refusal @ 17.53 m. Hole grouted upon completion of drilling.	

SAMPLING METHOD

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-03

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 4 **OF:** 4

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECY (mm)	RECY (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
257.78 17.98		**END OF BOREHOLE**											

SAMPLING METHOD

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PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P W_N W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm

HOLE: BH-Mac-04
PAGE: 1 **OF:** 3

SITE: Kent Breeze Farm

COORDINATES: N 4711215, E 415773
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 270.1
END OF HOLE: 255.62

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter 4" HQ
CORE: HQ-Single Barrel

STARTED: May 4/10
FINISHED: May 4/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y(%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION; SHEAR STRENGTH (kPa)	HYDRAULIC CONDUCTIVITY (m/s); WATER CONTENT & ATTERBERG LIMITS	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
270.1													
0.0		Topsoil/SAND	0	AS1	457		1 2 5 7						
269.49			0.61										
.61		SAND Sand, grey, compact, wet	0.76	AS2	406		4 5 10 6	1					
268.42			1.37										
1.68		CLAY Silty clay, grey, soft to firm, moist	1.52	AS3	457		2 3 3 5	2				USC = 99.87 KPa. Wet Density = 2040 kg/m3	
			2.13										
			2.29	BO4									
			2.9										
			3.05	AS5	584		2 1 2 3	3					
			3.66										
			3.81	AS6	533		2 1 2 2	4					
			4.42										
			4.57	AS7	533		1 1 2						

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT
W_P — W_N — W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-04

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 3

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECY (mm)	RECY (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			5.18				2						
			5.33	BO8									
			5.94					6					
			6.1	AS9	432		1 2 3		●	○			
			6.71					7					
			7.62	AS10	381		1 1 2 3		●				
			8.23					8					
								9					
			9.14	AS11	432		1 2 3 3		●	○			
			9.75									USC = 156.3 KPa. Wet Density = 1940 kg/m3	
			9.91	BO12				10					
			10.52										
			10.67	AS13	508		1 2 4 5	11	●				
			11.28										

SAMPLING METHOD

A - Split Tube
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D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-04

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 3 **OF:** 3

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) □ UNCONFINED ■ QUICK TRIAXIAL ✖ FIELD VANE ✱ LAB VANE ✥ POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
								12					
			12.19	AS14	508		1 2 4 4		●	○			
			12.8					13					
256.98													
13.12		CLAY Silty clay, some gravel (stones), very stiff											
			13.72	AS15	330		4 6 11 17	14	●			Auger refusal @ 14.48 m. Borehole grouted upon completion of drilling.	
255.62			14.33										
14.48		**END OF BOREHOLE**											

SAMPLING METHOD

A - Split Tube
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C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT (W_P) NATURAL MOISTURE CONTENT (W_N) LIQUID LIMIT (W_L)

□ Constant Head Test
▒ Variable Head Test
▩ Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy
PROJECT: Kent Breeze Wind Power Farm
HOLE: BH-Mac-05
PAGE: 1 **OF:** 3

SITE: Kent Breeze Farm

COORDINATES: N 4712127, E 415955
DIP DIRECTION: -
DIP: -90 deg
ELEVATIONS (m)
DATUM: CGD
PLATFORM: N/A
GROUND: 272.1
END OF HOLE: 254.57

CONTRACTOR: All Terrain Drilling
DRILL TYPE: Track Mount CME-75
METHOD SOIL: 8" Hollow Stem Auger
ROCK: Core Diamond Bit
CASING: 4" Inside Diameter, 4" HQ
CORE: HQ-Single Barrel

STARTED: May4/10
FINISHED: May 5/10
INSPECTOR: M. Mammoliti
LOGGED BY: J. Black
REVIEWED: Brian Sinclair
DATE: June 29/10

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) (UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN.) (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
272.1													
0.0		Topsoil/SAND	0	AS1	305		1 1 2 3						
271.49			0.61										
.61		SAND											
		Silty sand, grey, compact to dense, wet	0.76	AS2	432		7 11 13 15	1					
			1.37										
			1.52	AS3	508		4 7 11 14	2					
			2.13										
269.30			2.29	AS4	610		7 14 21 24						
2.8		CLAY	2.9					3					
		Silty clay, some sand, grey, soft, moist	3.05	AS5	610		4 3 2 3						
			3.66										
			3.81	AS6	610		1 1 1 1	4					
267.68			4.42										
4.42		CLAY											
		Silty clay, grey, soft, moist	4.57	AS7	610		0 0 2						

SAMPLING METHOD

A - Split Tube
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E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

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P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-05

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 2 **OF:** 3

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	REC'Y (mm)	REC'Y (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) (UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN.) (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			5.18				2						
			5.33	BO8								USC = 85.59 KPa. Wet Density = 1990 kg/m3 0 0 75 25	
			5.94					6					
			6.1	AS9	432		2 2 2 3						
			6.71					7					
			7.62	AS10	533		1 1 1 2	8					
			8.23										
			9.14	AS11	610		2 1 2 3	9					
			9.75										
			9.91	BO12				10					
			10.52										
			10.67	AS13	610		2 1 3 3	11					
			11.28										

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
R - Cloth Bag
S - Plastic Bag
U - Wooden Box
Y - Core Box
Z - Discarded

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W_N — LIQUID LIMIT W_L

Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BOREHOLE REPORT

CLIENT: Suncor Energy **HOLE:** BH-Mac-05

PROJECT: Kent Breeze Wind Power Farm **PAGE:** 3 **OF:** 3

ELEV. / DEPTH (m)	SYMBOL	DESCRIPTION	SAMPLE or RUN: DEPTH	TYPE/ NUMBER	RECV (mm)	RECV (%)	BLOW COUNTS	DEPTH (m)	SPT N-VALUES / DYNAMIC CONE PENETRATION (20 40 60 80) / SHEAR STRENGTH (kPa) UNCONFINED, QUICK TRIAXIAL, FIELD VANE, LAB VANE, POCKET PEN. (50 100 150 200)	HYDRAULIC CONDUCTIVITY (m/s) (10^{-6} 10^{-5} 10^{-4}) / WATER CONTENT & ATTERBERG LIMITS (15 30 45 (%))	DRY DENSITY (kg/m3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	PIEZOMETER INSTALLATION
			12.19 – 12.8	AS14	610		1 2 3	12	●				
								13					
			13.72 – 14.33	AS15	482		1 1 2 3	14	●	○			
257.47 / 14.63		SAND Silty sand, trace clay, grey, compact, wet						15					
			15.24 – 15.85	AS16	406		3 7 10 14		●				
								16					
			16.76 – 17.19	AS17	432		6 25 64 -	17	●	○		Bedrock inferred @ 17.53 m based on auger refusal. Hole grouted upon completion of drilling.	
254.57 / 17.53		**END OF BOREHOLE**											

SAMPLING METHOD

A - Split Tube
B - Thin Wall Tube
C - Piston Sample
D - Core Barrel (sonic or diamond drill)
E - Auger
F - Wash
G - Shovel Grab
K - Slotted

SHIPPING CONTAINER

N - Insert
O - Tube
P - Water Content Tin
Q - Jar
X - Plastic & PVC Sleeve
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U - Wooden Box
Y - Core Box
Z - Discarded

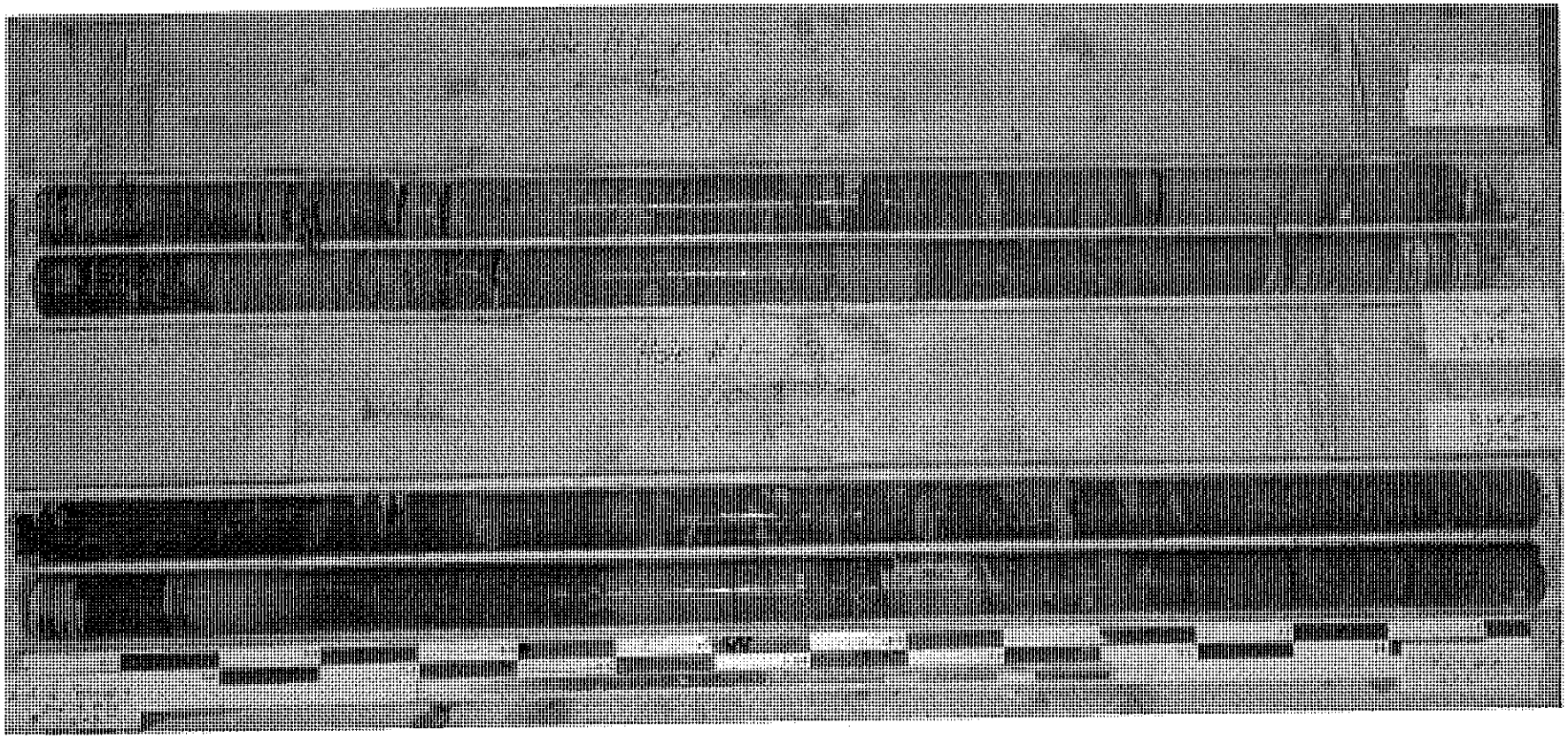
PLASTIC LIMIT — NATURAL MOISTURE CONTENT — LIQUID LIMIT

W_P — W_N — W_L

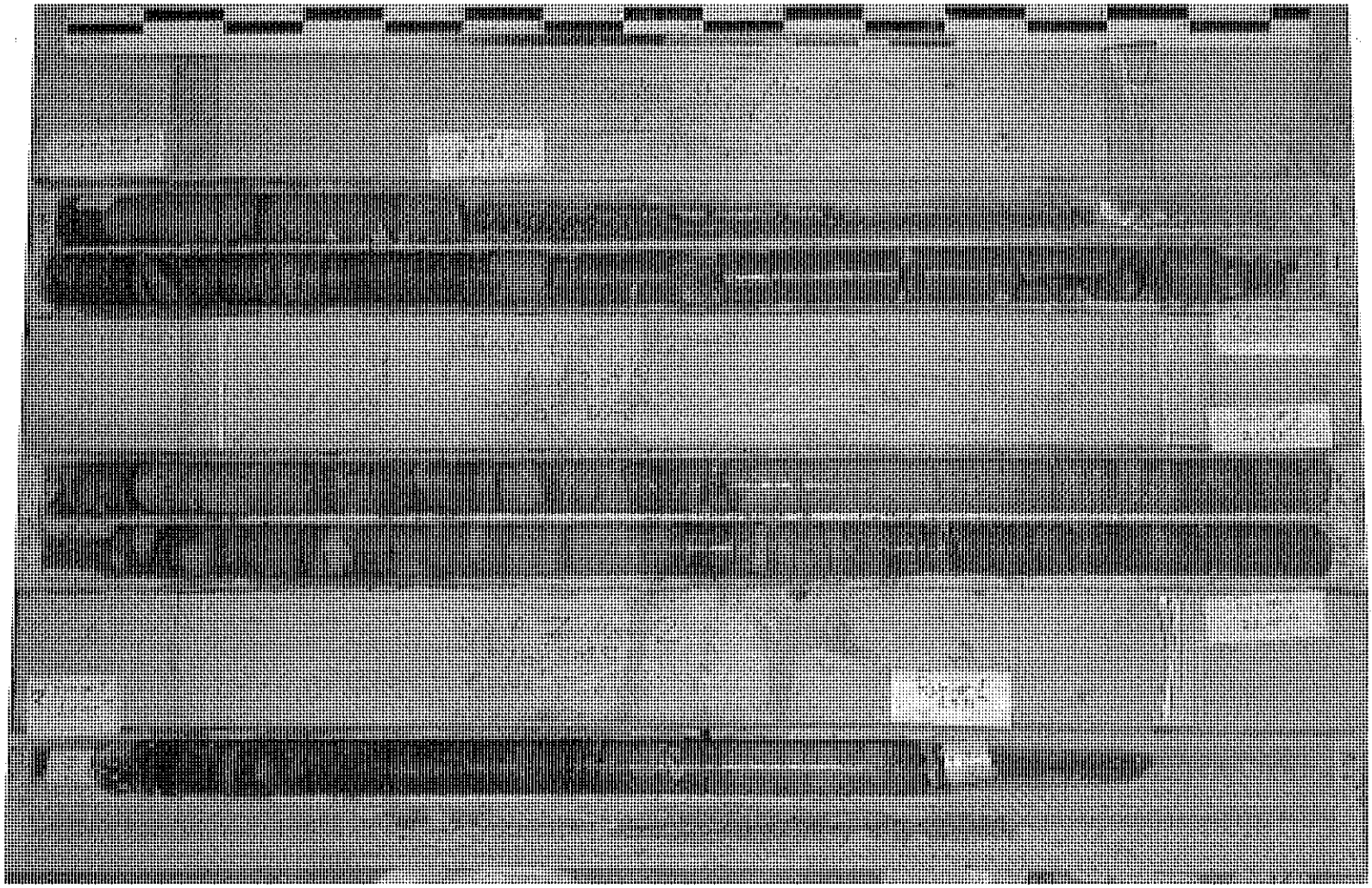
Constant Head Test
Variable Head Test
Lab. Permeability

Project: 335112

BH-Kent-05



BH-Mac-02



APPENDIX 3C – TECHNICAL MEMORANDUM (WATER CROSSINGS)

TECHNICAL MEMORANDUM

DATE July 22, 2010 **PROJECT No.** 10-1151-0123

TO Brad West
Suncor Energy Products Ltd.

CC Christopher Scott

FROM Andrew Evers **EMAIL** Andrew_Evers@golder.com

**KENT BREEZE WIND FARMS CONSTRUCTION PLAN REPORT –
AUTHORIZATION AND APPROVAL REQUIREMENTS FOR WATERCOURSE CROSSINGS**

Introduction

Kent Breeze Corporation and MacLeod Windmill Project Inc. (the Proponent) are proposing to develop a wind energy project in the northern portion of the Municipality of Chatham-Kent. The Kent Breeze Wind Farms Project (the Project) is a Class 4 wind facility consisting of eight wind turbines with a total nameplate generating capacity of 20 megawatts (MW).

The Project will involve the construction of turbines, access roads, and related electrical infrastructure to connect with the Hydro One overhead transmission corridor located on approximately 436 hectares (ha) of land.

This technical memorandum summarizes correspondence between IBI Group (the Consultant for the Proponent) and the associated Conservation Authorities regarding approvals and authorizations required for the construction of the Project. Specifically, authorizations and approvals, or permission will be required for directional drilling under the Shaw Ferguson and Mason Drains for the installation of underground cabling. Additional contact was conducted with the SCRCA and LTVCA outside of conversations with the MOE. Correspondence with the LTVCA indicates that a permit will not be required for direct drilling under the Mason Drain, but activities must follow the Department of Fisheries and Oceans (DFO) *Operational Statement for High Power Direction Drilling* (DFO, 2010). Correspondence with the SCRCA indicates that a permit will be required for direct drilling under the Shaw Ferguson Drain. Further details regarding correspondence with the local CAs is presented below and email correspondence is attached.

Details of the site preparation and construction activities and the associated environmental effects on watercourses can be found in the Construction Plan Report. The authorization and approvals presented here are based on the details provided in the Construction Plan Report.

Approvals and Authorizations

Site preparation and construction activities for the Project are not expected to have negative effects on the agricultural drains located within the Project Area. However, where improvements or construction of new water

crossings are necessary, and where harmful alteration, disruption or destruction of fish habitat may occur, authorization under the *Fisheries Act* by the DFO Canada may be necessary. Although all watercourse crossings for service connections will be completed by directional drill, which will not disturb the channels, the *Operational Statement for High Pressure Direction Drilling* will be used (DFO, 2010). No culverts will be installed because directional drilling will be used.

Directional drilling for the installation of underground cabling crossing the Shaw Ferguson Drain is within the jurisdiction of the St. Clair Region Conservation Authority (SCRCA). Contact was made with Alison Seidler (GIS/Resource Planner) from the SCRCA on April 28th, 2010 (see attached). A permit application will have to be submitted to the SCRCA for direct drilling under the Shaw Ferguson Drain in accordance with Section 28 of the *Conservation Authorities Act* as detailed in correspondence with Alison Seidler from the SCRCA (see attached email). The Regulation requires that the Proponent obtain written consent from the CA prior to construction activities in a regulated area. The permit application is available on the SCRCA's website.

The Barnhart Drain was installed in June of 1954 as an open ditch and then subsequently closed in with drainage tile at a later date. The drain is within the jurisdiction of the SCRCA; however it is not currently located on SCRCA watercourse mapping (see attached). No work is expected to occur on the drain and steel plates and extra overburden will be used to protect the integrity of the drain at the time of construction.

Directional drilling for the installation of underground cabling across the Mason Drain is within the jurisdiction of the Lower Thames Valley Conservation Authority (LTVCA). Contact was made with Valerie Towsley (Resource Technician) from the LTVCA on April 9th, 2010 (see attached). Through this contact, notification via email to Valerie Towsley 30 days prior to directional drilling at the Mason Drain is required. As mentioned above, the *Operational Statement for High Pressure Direction Drilling* (DFO, 2010) will have to be followed in accordance with LTVCA approval.

Upgrades and construction of watercourse crossings will proactively consider Eastern fox snake habitat in accordance with the *Endangered Species Act* (2007). Culvert maintenance, if required, will occur between June and mid-September when temperatures are sufficiently warm so that Eastern fox snake can readily escape disturbance or after the fall freeze when snakes are in their hibernacula.

Best Management Practices (BMPs) will be considered at the time of construction to prevent sedimentation and erosion in the drains. For drains that have standing water at the time of site preparation and construction, the site will be isolated upstream and downstream. Sediment and erosion control will also be monitored and actions to prevent this will include installation of a silt fence or re-vegetation along riparian areas. All equipment arriving at the site will be cleaned and maintained to avoid leaks (i.e., oil, lubricants, hydraulic fluids, etc.). All equipment will be stored, maintained and refuelled at temporary storage areas away from the drains to avoid spills.

We anticipate the above meets your needs. If you have any questions, please do not hesitate to contact us.

AE/Dd/vc

\\mis1-s-filesrv1\data\active\2010\1151\10-1151-0123 suncor - kent solar - peer review\kent breeze eis\water assessment\authorizations\water assessment tech memo 10oct18 (1).docx

From: Valerie Towsley
To: Derek Dudek
Cc: "Muriel Andreae"
Subject: RE: Kent Breeze
Date: Thursday, June 03, 2010 11:09:38 AM

Derek

Cleaning out the e-mails. Have sites been confirmed for culvert crossing locations for this project? If so, are engineer reports being done up for review by the CA's?

Valerie Towsley
Resource Technician
Lower Thames Valley Conservation Authority
100 Thames Street
Chatham, Ontario
N7L 2Y8

Phone: 519-354-7310 Ext.: 226
Fax: 519-352-3435

E-mail: Valerie.Towsley@ltvca.ca

Web site: www.lowerthames-conservation.on.ca

From: Derek Dudek [mailto:DDudek@IBIGroup.com]
Sent: Friday, March 26, 2010 2:32 PM
To: lt2@mdirect.net; Valerie.Towsley@ltvca.ca
Subject: Kent Breeze

Not sure which email address is correct.

Derek Dudek MCIP, RPP

IBI Group
Suite 203 - 350 Oxford Street West
London ON N6H 1T3 Canada

tel 519 472 7328 ext 230
cell 519 318 0237
fax 519 472 9354
email ddudek@ibigroup.com
web www.ibigroup.com

From: Alison Seidler
To: Derek Dudek
Subject: RE: Kent Breeze
Date: Wednesday, April 28, 2010 2:33:18 PM

Derek,
I was referring to the Barnhart Drain depicted on your earlier version of Map 5 Project Infrastructure(east side of Huffs Side road). We do not have that drain on our drainage maps and so I assumed that it was an omission error on our watercourse mapping, as it is so close the watershed divides. So to confirm there are NO culvert installations within project # 1. You just need to apply for the directional drill under the Shaw Ferguson Drain

Alison Seidler
GIS/Resources Technician

St. Clair Region Conservation Authority
205 Mill Pond Cres.
Strathroy, On
N7G 3P9
Ph:(519)245-3710 ext. 33

From: Derek Dudek [mailto:DDudek@IBIGroup.com]
Sent: April-28-10 2:00 PM
To: Alison Seidler
Cc: Skinner, Robin
Subject: RE: Kent Breeze

Thanks Alison,
To confirm, where is the culvert you are referring to off Huff's Side Road. West side to Kent-5? West side to Kent-1?
I've attached a slightly revised map we did after field checking the drain crossings….and it is my understanding that the drains along Huff that appear on the map, don't actually exist, so no culvert is required on either side of Huffs to Kent 5 or MacLeod 1.

Can you confirm where you are referring to?

Derek

From: Alison Seidler [mailto:aseidler@scrca.on.ca]
Sent: Wednesday, April 28, 2010 1:49 PM
To: Derek Dudek
Subject: RE: Kent Breeze

Hi Derek,

I apologize for the length of time it has taken to get back to you.

I have reviewed the proposed wind farm project and offer the following. The 2 proposed projects are bisected by the watershed boundary of the St. Clair Region Conservation Authority(SCRCA) and the Lower Thames Valley Conservation Authority(LTVCA). I can confirm that Project # 2 is entirely within the jurisdiction of the Lower Thames Valley Conservation . You will need to contact the LTVCA to obtain information on their permit requirements.

Within Project #1 there are is one watercourse crossing , on the Shaw Ferguson Drain (west of Huff's road) and one culvert installation (at the proposed access laneway off of Huff's Road) that will require a Permit from the SCRCA. The permit is required under the Authority's "Development, Interference with Wetlands and Alterations to Shorelines and Watercourse" Regulations, implemented pursuant to Section 28 of the Conservation Authorities Act. The regulation requires the proponent of a development to obtain the written permission of the Authority prior to the commencement of development activities within a regulated area. Development activities include: the construction of a structure; placement or removal of fill; re-grading; altering a watercourse or shoreline in any manner; or interfering with the function of a wetland.

In addition the Authority has a Level II Agreement with the Department of Fisheries and Oceans (DFO) and is responsible for assessing any proposed works with respect to potential impact on fish or fish habitat. It should be expected that any project proposing a potential negative impact on fish or fish habitat would be referred to DFO for their review.

You can download a permit application from the SCRCA website at www.scrca.on.ca. or alternatively I can forward an application to you either by email or mail. The fee for this application is $150 ($50 per directional drill review and $100 for the culvert installation) . Cheques can be made payable to the St. Clair Regional Conservation Authority.

In support of your completed application, please provide the following information:

1. Drawing/details (dimensions, embedding depth, location.etc) of the proposed structures (please reference other significant features);
2. Grading /fill details;
3. Sediment/erosion control methods;
4. Details of the construction and installation techniques.

If you have any further questions please do not hesitate to contact me.

Alison Seidler
GIS/Resources Technician

St. Clair Region Conservation Authority

205 Mill Pond Cres.
Strathroy, On
N7G 3P9
Ph:(519)245-3710 ext. 33

From: Derek Dudek [mailto:DDudek@IBIGroup.com]
Sent: March-26-10 2:45 PM
To: Alison Seidler
Subject: Kent Breeze

As we just discussed.

Derek Dudek MCIP, RPP

IBI Group
Suite 203 - 350 Oxford Street West
London ON N6H 1T3 Canada

tel 519 472 7328 ext 230
cell 519 318 0237
fax 519 472 9354
email ddudek@ibigroup.com
web www.ibigroup.com

APPENDIX 3D – TECHNICAL MEMORANDUM (RESPONSE TO WATER-TAKING INQUIRY)

TECHNICAL MEMORANDUM

DATE October 18, 2010 **PROJECT No.** 10-1151-0123

TO Chris Scott
Suncor Energy Products Inc.

CC Brad West, Suncor; Kristina Rudzki, MOE

FROM Andrew Evers **EMAIL** Andrew_Evers@golder.com

RESPONSE TO THE MINISTRY OF THE ENVIRONMENT RE: WATER TAKINGS FOR THE KENT BREEZE WIND FARMS PROJECT

Introduction

The purpose of this technical memorandum is to address questions posed by Ministry of the Environment (MOE) in a letter dated October 15, 2010 with regard to potential water takings for the Kent Breeze Wind Farms Project. The MOE requested that confirmation be provided to show that water taking activities will be less than 50,000 L/day. As stated in *Technical Bulletin 2: Guidance for preparing the Design and Operations Report* (Section 6.1) and *Technical Bulletin 3: Guidance for Preparing the Construction Plan Report* (Section 2.3) as part of Ontario Regulation 359/09, a Permit to Take Water (PTTW) is not required under the *Ontario Water Resources Act*. However, upon construction, Suncor Energy Products Inc. (Suncor) will follow the guidance for application for a PTTW as published in the *Permit to Take Water Manual* (2005, publication 4932e), as necessary.

Potential Effects of Water Takings

In addition, the MOE requested that potential environmental effects of water takings and mitigation measures be addressed.

Where required, dewatering for turbine foundation construction has the potential to temporarily alter shallow groundwater flow to waterbodies, watercourses and wetlands. Although dewatering activities would only occur until foundations are completed (approximately 4 months) or until groundwater levels receded to a suitable depth, a measurable change in local well levels and groundwater flow in the immediate vicinity of excavations and potentially for a period of 7 months afterward (4 months of drawdown from dewatering plus 3 months of water level recovery) could occur.

Subsequent release of pumped water from foundation dewatering to discharge areas can cause overland sediment transport to waterbodies, while direct discharge to waterbodies could introduce suspended sediments, resuspend bedload materials, and affect watercourse hydrology and water temperature near the point of discharge.

Mitigation Measures

All reasonable and practical measures will be used to manage takings efficiently to maximize the availability of water for existing or potential uses and to sustain ecosystem integrity. Natural functions of the local ecosystem

will be protected by monitoring local groundwater levels, and utilizing pumping systems and pipelines to minimize erosion, sedimentation, flooding and surface water quality impacts.

If possible, the initial discharge point will be a constructed sump area or a vegetated buffer or woodlot with a low slope to reduce flow rates and minimize erosion of the soil surface.

We trust that the above meets your expectations. However, please do not hesitate to contact the above with any questions.

References

Ministry of the Environment (MOE). 2010. Technical Bulletin 2: Guidance for preparing the Design and Operations Report. March 1, 2010. PIBS 7437e.

Ministry of the Environment (MOE). 2010. Technical Bulletin 3: Guidance for preparing the Construction Plan Report. March 1, 2010. PIBS 7438e.

AE/Dd/ae

n:\active\2010\1151\10-1151-0123 suncor - kent solar - peer review\kent breeze eis\water assessment\dewatering\response to moe_water takings 10oct18.docx