ANNEXE D

Rapport de l'étude géotechnique

Saint-Rémi, June 11, 2010 O/F : G1-09-1532

Mr. John Olson
TRANSALTA WIND CORPORATE OFFICE
TRANSALTA CORPORATION
110 12th Avenue S.W.
Calgary AB T2P 2M1

Object: **Geotechnical study – Construction of wind energy converters**
Terrains located in the vicinity of the town of Saint-Valentin, Quebec.

Dear Sir,

Following your agreement to our proposal PG1-09-1529-4 dated on April 29, 2010, we herewith transmit to you the geotechnical report of study carried out by our firm for the project quoted in title.

We hope that it will be to your full satisfaction and we thank you for allowing us to take part in the realization of your project.

Do not hesitate to contact us for all additional questions concerning the present study.

Sincerely yours,

Groupe ABS inc.

Ursula Maselbas, Eng., M.A.Sc.
Team leader, geotechnical

Enc. Reports (1 original and 1 copy)

GEOTECHNICAL STUDY
CONSTRUCTION OF WIND ENERGY CONVERTERS

Terrains located in the vicinity of the town of St-Valentin in Quebec

O/F : G1-09-1532
June 11, 2010

Mr. John Olson
TRANSALTA WIND CORPORATE OFFICE
TRANSALTA CORPORATION
110 12th Avenue S.W.
Calgary AB T2P 2M1

Prepared by:

Ibrahim Ja'far, Eng., M.Eng.

Verified by:

Ursula Maselbas, Eng., M.A.Sc.

Distribution :
TransAlta Corporation (1 original & 1 copy)
Groupe ABS inc. (1 copy)

TABLE OF CONTENTS

LISTE OF APPENDICES

1. INTRODUCTION

GROUPE ABS INC. services were retained by the company *TRANSALTA CORPORATION (hereinafter called client)* to conduct a geotechnical subsoil investigation for 31 proposed wind energy converters to be located in the vicinity of the town of Saint-Valentin, about 50 km south of Montreal in Quebec.

This geotechnical study was performed according to our professional proposal dated April 29, 2010 (PG1-09-1529-04).

The subject properties are located within a 5 km radius from the town of St-Valentin. They are located in an agricultural land with flat topography. Satellite photos showing the configuration of each site are attached in appendix A.

Throughout this report, sites are classified in five (5) groups according to their geographical location (refer to Key-Plan in appendix B of this report):

- Group M includes sites 4, 6, 11, 12 and 14 (5 sites)
- Group N includes sites 8 and 13 (2 sites)
- Group O includes sites 25, 27, 28, 28A, 31 and 31A (6 sites)
- Group P includes sites 5, 7, 9, 10, 16, 17, 18, 20, 21, 22, 23 and 37 (12 sites)
- Group Q includes sites 26, 29, 30, 32, 34 and 35 (6 sites)

A Google satellite photos are enclosed in appendix A. The drilling borehole locations are shown in the plan enclosed in appendix B, the borehole logs are attached in appendix C, the geophysical investigation report is attached in appendix D and the results of the laboratory tests are included in appendix E. Photography of rock cores is presented in appendix F. Finally, miscellaneous documents are attached in appendix G.

2. SCOPE OF THE INVESTIGATION

This geotechnical investigation is primarily aimed at determining the profile and the quality of the subsoil strata as well as the ground water condition by means of boreholes and geophysical methods. The methodology used on-site and in laboratory has allowed the verification of subsoil conditions for the subject sites and the formulation of general recommendations for the project, namely:

- The nature of subsurface materials and their stratigraphic sequence;
- The groundwater level;
- The competent soil/rock starta to receive the anticipated loads;
- Bearing capacity of shallow and deep foundation;
- Soils geotechnical properties;
- Slope stability for temporary excavation;
- General recommendations.

3. FIELD EXPLORATION PROCEDURES

3.1 Fieldwork

As per our professional proposal, the subsoil investigation included two parts: the first part, which is the main one, consisted of drilling boreholes from which disturbed soil and rock samples were retrieved following standard procedures in conjunction with the American Society for Testing and Materials standards (ASTM). The second part of the investigation, the complementary part, consisted in carrying out geophysical surveying for the subject sites.

3.1.1. Boreholes

The first part of the investigation program consisted of drilling a total of thirty-one (31) boreholes (one borehole for each site) advanced to a competent soil or the bedrock. The boreholes are named after their respective site numbers (ex. Borehole 10BH-04 represents site 4 and so forth). The field exploration program was carried out between March 08, 2010 and April 26, 2010 under the constant supervision of our geotechnical personnel and in the presence of the client's representatives.

The boreholes were drilled by means of a track-mounted rotary drill rig, property of the subcontractor, *Explora-Sol Inc*. Soil samples were recovered using a 50 mm OD (outside diameter) split-spoon sampler in conjunction with ASTM D-1586 standard penetration test. This test consists of driving the standard sampler into the soil using a 63.5 kg hammer dropped from a height of 76 cm. The number of blows for each 30 centimetres of penetration named "SPT - N Value" can be correlated to the relative density of the sampled soil.

In the majority of boreholes, the bedrock was cored using a NQ tube core barrel. The length of cored rocks is ±3m. In addition, in-situ vane shear test was conducted where clayey soil was encountered.

An observation well was installed on each borehole in order to monitor the groundwater conditions.

3.1.2. Geophysical exploration

The geophysical exploration method used in this project is a seismic method called the Multi-Channel Analysis of surface Waves (MASW). The seismic exploration was carried out by our subcontractor *Geophysics GPR International inc (hereinafter called GPR).* Site works were conducted between March 15 and 27, 2010 and on June 2nd, 2010. A detailed description of this method is included in section 3 of the report entitled " Shear wave velocity sounding results – Wind energy converters project, Saint-Valentin, Quebec" produced by GPR (report no. M09789 dated June 2010 – copy attached in appendix E of this report).

3.2 field survey

The locations of boreholes were determined by the client. During the field investigation work, the borehole locations were identified by a pre-installed wooden stick on which the name of the site was written. All borehole locations were confirmed by the client's representative before the undertaking of the drilling works. The geodesic coordination of boreholes were furnished by the client and they are presented in table 1.

Table 1 : geodesic coordinates

Borehole	Longitude X	Latitude Y	Elevation (m)
Group M			
10BH-04	316203	4994292	41.00
10BH-06	316202	4994943	42.00
10BH-11	316592	4994528	43.00
10BH-12	316596	4994055	42.13
10BH-14	316620	4994936	44.00
Group N			
10BH-08	316248	4998369	51.00
10BH-13	316618	4998175	47.92
Group O			
10BH-25	319312	4997246	38.00
10BH-27	319664	4996999	35.00
10BH-28	319665	4997492	35.00
10BH-28A	319414	4997499	-
10BH-31	320095	4997479	34.00
10BH-31A	319926	4997484	-
Group P			
10BH-05	316239	5001777	50.00
10BH-07	316244	5002438	49.00
10BH-09	316478	5001418	50.00
10BH-10	316497	5002120	
10BH-16	316876	5001955	51.00
10BH-17	317102	5001353	50.00
10BH-18	317273	5002650	50.00
10BH-20	317482	5002277	49.00
10BH-21	318008	5002258	48.00
10BH-22	318187	5001293	46.00
10BH-23	318195	5001745	47.00
10BH-37	318483	5001515	-
Group Q			
10BH-26	319774	5001316	40.84
10BH-29	319828	5002096	45.00
10BH-30	320091	5001646	41.00
10BH-32	320241	5002214	43.00
10BH-34	319415	5002922	-
10BH-35	319169	5002673	-

3.3 Laboratory testing

All samples collected during the fieldwork were transported to our laboratory for the purpose of analysis, identification and classification. They all made the subject of a careful visual inspection by a geotechnical engineer. Grain-size distribution analysis, limits of consistency and natural water content determinations as well as unconfined compression strength of rock were performed on selected representative samples. The results of these tests are presented in detail in appendix D.

All samples taken during fieldworks and on which no laboratory tests were performed will be preserved for a period of six (6) months as from the date of this report, afterward; they will be discarded unless otherwise stated.

4. SOIL PROFILE AND PROPERTIES

The soil profile determined by boring is shown in table 2 presented hereinafter. A brief description of soil profile at each group is included in the following subsection 5.1 to 5.4. For detailed description, refer to borehole loges enclosed in appendix C.

Table 2: Soil / Rock Profile

Borehole	Top soil / fill	sand	Cohesive soil	Till	Bedrock
Group M					
10BH-04	-	-	0.00-4.72	4.72-11.53	11.53-14.99
10BH-06	-	0.00-0.71	0.71-3.35	3.35-12.39	12.39-15.80
10BH-11	-	-	0.00-2.44	2.44-12.47	12.47-15.62
10BH-12	0.00-0.61	-	0.61-3.05	3.05-14.43	14.43-17.83
10BH-14	0.00-1.52	1.52-12.80	-	-	12.80-16.10
Group N					
10BH-08	0.00-0.46	-	-	0.46-22.56	-
10BH-13	0.00-0.61	-	-	0.61-30.48	-
Group O					
10BH-25	0.00-0.61	-	0.61-4.72	4.72-7.59	7.59-11.15
10BH-27	0.00-0.10	-	0.10-4.77	4.77-10.52	10.52-14.15
10BH-28	0.00-0.15	-	0.15-5.33	5.33-10.67	10.67-13.72
10BH-28A	0.00-0.13	-	0.13-4.93	4.93-11.91	11.91-15.22
10BH-31	0.00-0.18	-	0.18-5.18	5.18-11.66	11.66-15.04
10BH-31A	0.00-0.15	-	0.15-2.90	2.90-12.60	12.60-15.57

Borehole	Top soil / fill	sand	Cohesive soil	Till	Bedrock
Group P					
10BH-05	0.00-1.52	-	-	1.52-7.62	7.62-10.82
10BH-07	0.00-0.20	-	-	0.20-11.07	11.07-15.24
10BH-09	0.00-0.61	-	-	0.61-7.01	7.01-10.85
10BH-10	0.00-0.61	-	-	0.61-20.88	-
10BH-16	0.00-1.52	-	-	1.52-8.91	8.91-12.09
10BH-17	0.00-0.74	-	0.74-3.35	3.35-19.94	-
10BH-18	0.00-0.20	-	-	0.20-6.05	6.05-9.58
10BH-20	0.00-1.83	-	-	1.83-20.17	-
10BH-21	0.00-0.51	0.51-0.86	0.86-1.83	1.83-11.18	11.18-14.33
10BH-22	0.00-0.25	-	-	0.25-12.95	12.95-16.26
10BH-23	0.00-0.10	-	-	0.10-10.72	10.72-13.72
10BH-37	0.00-0.10	-	-	0.10-7.77	7.77-10.52
Group Q					
10BH-26	0.00-0.61	-	-	0.61-5.41	5.41-8.53
10BH-29	0.00-1.17	-	-	1.17-4.04	4.04-6.71
10BH-30	0.00-0.61	-	-	0.61-6.48	6.48-13.23
10BH-32	0.00-0.61	-	-	0.61-6.40	6.40-9.53
10BH-34	0.00-0.18	-	-	0.18-5.08	5.08-9.73
10BH-35	0.00-0.25	-	-	0.25-10.85	10.85-14.17

Note: depths are described in meter and “0.00” indicates ground surface.

4.1 Group M (sites 4, 6, 11, 12, 14)

The soil profile underlying all sites in this group, except site 14, consists of a 3 to 5 m thick clayey soil underlain by a 7 to 10 m thick till deposit followed by the bedrock. In the site 14, the soil profile is composed mainly by a 12 m thick sand deposit followed by the bedrock. In sites 12 and 14 a fill layer or a remoulded native soil is found on the surface.

The clay layer is characterized by the presence of a thin firm grey to brown clayey silt (types CL or ML) followed by a soft grey clay of high plasticity (type CH).

The natural water content measured in soft clay varies between 56 to 74%, the liquid limit ranges from 52 to 65% and the plastic limit varies from 17 to 26%. The in-situ un-drained shear strength varies between 19 and 31 kPa.

The till deposit is composed of silty and sandy soils (type ML and SM), becoming gravelly (type SP) in the last 3 to 5 m before the bedrock. The natural water content varies between 6 (for gravelly soil) and 19% (for silty soil). The obtained SPT N values imply that the density of this deposit is compact (ML and SM) to dense (SP).

The sand deposit found at site 14 consist of a dense sand (SP) becoming gravel and sand (GP) at about 8m deep.

The bedrock consists of grey limestone. The recovery values (recovered rock / core length) vary between 86 and 100% and the RQD values range from 37% (borehole 11) and 100%. The unconfined compressive strength of rock varies between 90 and 117 MPa (106 MPa in average). Based on these results the quality of the bedrock ranges from good to excellent. At borehole 10BH-014 the rock is fractured at surface.

4.2 Group M (sites 8, 13)

The soil profile in this group consists primarily of top soil underlain by a sandy silty till deposit (SM and ML). At about 18 to 20 m deep the till deposit is composed of boulders. The two boreholes were terminated in the till deposit. The density of the first 18 to 20 m of this deposit could be qualified as loose to dense.

4.3 Group O (sites 25, 27, 28, 28A, 31, 31A)

The soil profile at these sites consists of top soil underlain by ±5 m thick clayey soil underlain by a ±6 m thick till deposit followed by the bedrock.

The clay layer is composed of a thin stiff grey to brown silty clay (ML-CL) crust followed by a firm grey clay of high plasticity (type CH). The natural water content measured in soft clay varies between 30 to 58%, the liquid limit ranges from 49 to 59% and the plastic limit varies from 15 to 29%. The in-situ un-drained shear strength varies between 22 and 75 kPa.

The till deposit is composed mainly of sand and silt (type ML and SM), becoming gravelly (type SP or GP) with cobbles and boulders in some boreholes. The natural water content varies between 7 to 15%. The density of the till deposit can be qualified as compact to dense.

The bedrock consists of grey to black limestone. The recovery values vary between 69 and 100% and the RQD values range from 13% (borehole 28) and 100%. The unconfined compressive strength of rock varies between 80 and 109 MPa (96 MPa in average). In general, the quality of the bedrock ranges from fair to excellent. At borehole 10BH-28 the rock is fractured through the entire recovered core.

4.4 Group P (sites 5, 7, 9, 10, 16, 17, 18, 20, 21, 22, 23, 37)

The soil profile at the majority of these sites is composed of 6 to 12 m thick till deposit followed by the bedrock. At sites 10, 17 and 20 the boreholes were terminated in the till deposit at about 20 m deep. At sites 17 and 21 the till deposit was overlain by a thin clayey soil layer. In all boreholes top soil/fill layer are topping the soil profile.

The till deposit consists mainly of sand and silt (type ML and SM), becoming gravelly (type SP or GP) with cobbles and boulders in some boreholes. The natural water content of this deposit is ±10%. The density of the till deposit can be qualified as loose to dense.

The bedrock consists of grey to black limestone and shale. The recovery values vary between 41 and 100% and the RQD values range from 20% (borehole 5) and 95%. The unconfined compressive strength of rock varies between 68 and 165 MPa (71 MPa in average). In general, the quality of the bedrock ranges from fair to excellent.

4.5 Group Q (sites 26, 29, 30, 32, 34, 35)

The soil profile at the majority of these sites consists of a till deposit followed by the bedrock. At sites 35 the thickness of till deposit is about 10m while in the remaining sites of this group its thickness is about 5m. In all boreholes top soil/fill layer are topping the soil profile.

The till deposit consists mainly of sand and silt (type ML and SM), becoming gravely with cobbles and boulders in some boreholes. The natural water content of this deposit is ±10%. The density of the till deposit can be qualified as compact to dense.

The bedrock consists of black limestone and shale. The recovery values vary between 0 and 100% and the RQD values range from 0% (borehole 30) and 100%. The unconfined compressive strength of rock varies between 75 and 85 MPa (79 MPa in average). In general, in all boreholes except 10BH-30, the quality of the bedrock ranges from fair to excellent. At site 30 the rock was fractured through the entire recovered core.

5. GROUNDWATER OBSERVATION

The following table resumes the groundwater levels measured in boreholes.

Table 3 : Summary of groundwater level

Borehole	Depth (m)	Elevation (m)	Recording date
Group M			
10BH-04	0.00	41.00	April 12, 2010
10BH-06	1.32	40.68	April 12, 2010
10BH-11	0.74	42.26	April 12, 2010
10BH-12	1.00	41.13	April 12, 2010
10BH-14	1.13	42.87	April 12, 2010
Group N			
10BH-08	5.35	45.65	May 6, 2010

Borehole	Depth (m)	Elevation (m)	Recording date
10BH-13	2.55	45.37	May 6, 2010
Group O			
10BH-25	0.92	37.08	April 26, 2010
10BH-27	1.28	33.72	April 26, 2010
10BH-28	0.87	34.13	April 26, 2010
10BH-28A	1.30	-	April 26, 2010
10BH-31	0.26	33.74	April 26, 2010
10BH-31A	0.78	-	April 26, 2010
Group P			
10BH-05	0.00	50.00	April 26, 2010
10BH-07	0.30	48.70	April 26, 2010
10BH-09	0.60	49.40	April 26, 2010
10BH-10	0.00	50.00	April 26, 2010
10BH-16	1.45	49.55	April 26, 2010
10BH-17	0.75	49.25	April 26, 2010
10BH-18	0.00	50.00	April 26, 2010
10BH-20	0.00	49.00	April 26, 2010
10BH-21	0.51	47.49	April 26, 2010
10BH-22	0.80	45.20	April 26, 2010
10BH-23	0.25	46.75	April 26, 2010
10BH-37	0.68	-	April 26, 2010
Group Q			
10BH-26	2.46	38.38	April 26, 2010
10BH-29	1.00	44.00	April 26, 2010
10BH-30	1.65	39.35	April 26, 2010
10BH-32	1.57	41.43	April 26, 2010
10BH-34	0.72	-	April 26, 2010
10BH-35	0.64	-	April 26, 2010

The groundwater conditions depend on different factors, such as seasonal fluctuations, precipitations and modifications made to the physical environment. Therefore, during the excavation works, water inflow could be encountered at levels different from those mentioned in table 3.

6. CONCLUSIONS AND RECOMMANDATIONS

6.1 General comments

It is our understanding that the project includes the construction of 31 energy wind converters. According to the foundation data sheets furnished by the client (copy attached in appendix G), a ring footing is to be used to transmit the converter's loads onto soil mass. The minimum required soil bearing pressure is 242 kPa for a ring foundation of 16.8 m in diameter with buoyancy, and 412 kPa for a ring foundation of 14.2 m in diameter without buoyancy. The differential settlement should not exceed 40 mm.

The depth of groundwater level measured in the majority of boreholes ranges from 0.0 to 2.5 m. These measurement were conducted at spring time (April and May 2010) where the water table is on its highest level (snow melting, precipitation) therefore, it is possible that the water level will drop beneath the footing base (2.85 m according to data sheets) during dry seasons. As a result, the "without buoyancy" load case is considered in the shallow foundation design.

In general, the seismic investigation carried out on the subject sites (MASW tests) yields the same results as the conventional borehole investigation.

Based upon the information gathered from boreholes and seismic investigations, the geotechnical recommendations for the proposed construction are presented in the following sections.

6.2 Foundation design

Based on the geotechnical properties of soil and rock underlying the proposed constructions, the depth of the competent soil is determined for each site. The depth of the competent soil is defined as the depth, measured from the ground surface, at which the anticipated pressure (412 kPa) can be transferred to the soil mass/rock without causing a shear failure in the soil mass or/and excessive settlement caused by static or dynamic loads (<40 mm). A factor of safety of 3 (FS = 3) is considered against shear failure. The type of foundation (shallow or deep) is determined based on the depth of the competent strata.

Table 4 : Depth of competent soil and type of foundation

Site	Competent soil / rock		Foundation type
	Type	Depth (m)	
Group M			
4	Bedrock	±13	Deep foundation
6	Bedrock	±13	Deep foundation
11	Bedrock	±13	Deep foundation
12	Bedrock	±15	Deep foundation
14	Bedrock	±13	Deep foundation
Group N			
8	Till deposit	±17	Deep foundation
13	Till deposit	±17	Deep foundation

Site	Competent soil / rock		Foundation type
	Type	Depth (m)	
Group O			
25	Bedrock	±8	Deep foundation
27	Bedrock	±11	Deep foundation
28	Bedrock	±11	Deep foundation
28a	Bedrock	±12	Deep foundation
31	Bedrock	±12	Deep foundation
31a	Bedrock	±13	Deep foundation
Group P			
5	Bedrock	±10	Deep foundation
7	Bedrock	±13	Deep foundation
9	Bedrock	±8	Deep foundation
10	Till deposit	±12	Deep foundation
16	Bedrock	±12	Deep foundation
17	Till deposit	±10	Deep foundation
18	Till deposit	±5	Shallow foundation
20	Till deposit	±15	Deep foundation
21	Bedrock	±11	Deep foundation
22	Bedrock	±13	Deep foundation
23	Till deposit	±5	Shallow foundation
37	Till deposit	±5	Shallow foundation
Group Q			
26	Bedrock	±5	Shallow foundation
29	Till deposit	±3	Shallow foundation
30	Till deposit	±3	Shallow foundation
32	Till deposit	±5	Shallow foundation
34	Bedrock	±5	Shallow foundation
35	Bedrock	±12	Deep foundation

6.2.1 Shallow foundation

All compressible soils (CH or CL), organic soil and fill must be removed from within the footprints of proposed footings. The foundations must be placed under a minimum of 1.5 m earth cover in order to be adequately protected against frost effects.

For some sites the depth of competent soil/rock is located at about 5m. For these sites, it is possible to elevate the competent soil surface level to the desired elevation.
This should be carried out using a well graded granular materials complying with the grain size distribution given in table 5, compacted to 98% of Standard Proctor maximum dry density and placed in 300 mm lift thickness.

Table 5 : Grain size distribution

Grain size (mm)	% passing
31.5	100
20	90 -100
14	68 - 93
5	35 – 60
1.25	19 – 38
0.315	9 – 17
0.080	2 – 7

6.2.2 Deep foundation

As illustrated in table 5, twenty-three (23) out of thirty-one (31) wind energy converters are to be supported by a deep foundation system. Based on the geotechnical properties of subsoil encountered at these sites, driven steel H-piles end-bearing on the surface of good quality bedrock or into a very dense till deposit could be used for this purpose. A cast steel drive shoes should be used to protect the toe of pile when driving through boulders.

For sites where piles are to be driven to bedrock. The ultimate axial capacity of bedrock is estimated at 5000 kPa. The estimated capacity includes a factor of safety of 3. The settlement for pile driven into sound bedrock is normally negligible providing that the contact between pile toe and rock is assured.

For sites 8, 13, 10, 17 and 20 the anticipated load will be transferred by means of end-bearing piles driven into the till deposit. The values of estimated ultimate axial capacity of till deposit at the piles toe level is shown in table 6.

Table 6 : Allowable bearing capacity of pile toe end-bearing on till deposit

Site	Estimated depth of competent soil (till deposit)	Allowable bearing pressure of pile toe (kPa)
8	±17	3000
13	±17	3000
10	±12	2000
17	±10	1750
20	±15	2600

The toe of pile should be driven at least six (6) times its diameter into the competent soil in order to mobilize the full axial end-bearing capacity mentioned in the table 6. The estimated capacity includes a factor of safety of 3.

The lateral capacity of piles can be determined using Broms' method. This method is presented in section 18.4.1 of the Canadian Foundation Engineering Manual. The Borms' method estimates the ultimate lateral resistance of piles using graphical charts (copies are enclosed in appendix G). The soil parameters mentioned in tables 8 to 12 could be used for this matter. A reduction factor should be applied for pile group.

Table 7 : Reduction factor for lateral resistance

Pile spacing (center to center)	Reduction factor
8b	1,0
6b	0,8
4b	0,5
3b	0,4

b = pile diameter

The ultimate loads capacity of piles must be verified by means of static and dynamic load tests as per ASTM procedures.

6.3 soils geotechnical properties

The geotechnical properties for subsoil underlying the subject sites are determined based on the information obtained from boreholes and seismic investigations. They are presented in the following tables.

Table 8 : Soil properties – Group M (Sites 4, 6, 11, 12 and 14)

Parameter/soil	Clay	Till	Sand
Total unit weight ***γ*** (kN/m3)	18	18	18
Submerged unit weight ***γ'*** (kN/m3)	8	8	8
Effective friction angle ***Φ' (º)***	25	28	30
Effective cohesion ***C'*** (kPa)	5	0	0
Un-drained shear strength ***Cu*** **(**kPa)	See logs	0	0
Poisson`s ratio ***v***	0.35	0.25	0.25
Elastic stiffness modulus ***E*** (MPa)	10	15	20
Shear modulus ***G*** (MPa)	3.7	6	8

Table 9 : Soil properties – Group N (Sites 8 and 13)

Parameter/soil	Clay	Till From 0 to 17m	Till >17m
Total unit weight ***γ*** (kN/m3)	-	18	20
Submerged unit weight ***γ'*** (kN/m3)	-	8	10
Effective friction angle ***Φ' (º)***	-	28	34
Effective cohesion ***C'*** (kPa)	-	0	0
Un-drained shear strength ***Cu*** **(**kPa)	-	0	0
Poisson`s ratio ***v***	-	0.25	0.25
Elastic stiffness modulus ***E*** (MPa)	-	15	100
Shear modulus ***G*** (MPa)	-	6	40

Table 10 : Soil properties – Group O (Sites 25, 27, 28, 28A, 31 and 31A)

Parameter/soil	Clay	Till	Sand
Total unit weight ***γ*** (kN/m3)	18	18	
Submerged unit weight ***γ'*** (kN/m3)	8	8	-
Effective friction angle ***Φ' (º)***	25	30	-
Effective cohesion ***C'*** (kPa)	5	0	-
Un-drained shear strength ***Cu*** **(**kPa)	See logs	0	-
Poisson`s ratio ***v***	0.35	0.25	-
Elastic stiffness modulus ***E*** (MPa)	10	35	-
Shear modulus ***G*** (MPa)	3.7	14	-

Table 11: Soil properties – Group P (Sites 5, 7, 9, 10, 16, 17, 18, 20, 21, 22, 23 and 37)

Parameter/soil	Clay	Till From 0 to ±5 m	Till >5m
Total unit weight ***γ*** (kN/m3)	18	18	18
Submerged unit weight ***γ'*** (kN/m3)	8	8	8
Effective friction angle ***Φ' (º)***	25	28	32
Effective cohesion ***C'*** (kPa)	5	0	0

Parameter/soil	Clay	Till From 0 to ±5 m	Till >5m
Un-drained shear strength ***Cu*** **(**kPa)	See logs	0	0
Poisson`s ratio ***v***	0.35	0.25	0.25
Elastic stiffness modulus ***E*** (MPa)	10	15	40
Shear modulus ***G*** (MPa)	3.7	6	16

Table 12 : Soil properties – Group Q (Sites 26, 29, 30, 32, 34 and 35)

Parameter/soil	Clay	Till	Sand
Total unit weight ***γ*** (kN/m3)	-	18	-
Submerged unit weight ***γ'*** (kN/m3)	-	8	-
Effective friction angle ***Φ' (º)***	-	32	-
Effective cohesion ***C'*** (kPa)	-	0	-
Un-drained shear strength ***Cu*** **(**kPa)	-	0	-
Poisson`s ratio ***v***	-	0.25	-
Elastic stiffness modulus ***E*** (MPa)	-	40	-
Shear modulus ***G*** (MPa)	-	16	-

6.4 Temporary excavation and drainage

According to the stratigraphy identified in the boreholes carried out at subject sites, for an excavation of about 3 to 5 m in depth, the excavation will take place mainly in the soft clay layer or the loose to compact till or sand layers. Therefore, temporary slopes must be shaped with inclinations of 1.0 vertically to 3.0 horizontally (1V : 3H) or flatter, depending on density and/or consistency of materials to be encountered.

Moreover, based on measured water level (see table 3) groundwater will seep into the excavations. In addition, the bottom and slopes of excavation in the majority of subject sites is composed of a loose saturated fine silty soil. This type of soil is very sensitive against remoulding and it could loose significant amount of its strength if remoulded. Therefore, in order to maintain a stable bottom and slope of the excavation, water level must be lowered to at least **0.60 m** below the bottom of excavation grade. The contractor must consider the use of a proper pumping system in order to eliminate the surface and seepage water to avoid its accumulation at the bottom of excavation; allowing working in a dry environment.

It is very important to underline that the contractor is **solely responsible** for the design of such pumping system that is capable of maintaining a dry bottom excavation as described in the aforementioned paragraph.

6.5 site classification for seismic site response

Based on the seismic investigation carried at the subject sites (see appendix E), the majority of sites is classified as class C. The following table summarises sites classes.

Table 13 : Site classification for seismic site response

Sites	Class
29, 30, 32, 34 and 37	B
All remaining sites	C
6	D

7. LIMITATIONS OF THE STUDY

Soil description and properties presented in the preceding sections and boreholes log reports, are valid only where the boreholes were performed. Therefore, it is very possible that soil found during execution of work may vary from those studied; any notable variation or discrepancy between descriptions provided in this report and those found must be reported to Groupe ABS Inc. promptly.

Prepared by : Ibrahim Ja'far, Eng., M.Eng.

Verified by: Ursula Maselbas, Eng., M.A.Sc.

IJ/UM//sm

Appendix A

Google satellite photos

Figure 1 : Satellite photo – Group M

Figure 1 : Satellite photo – Group N

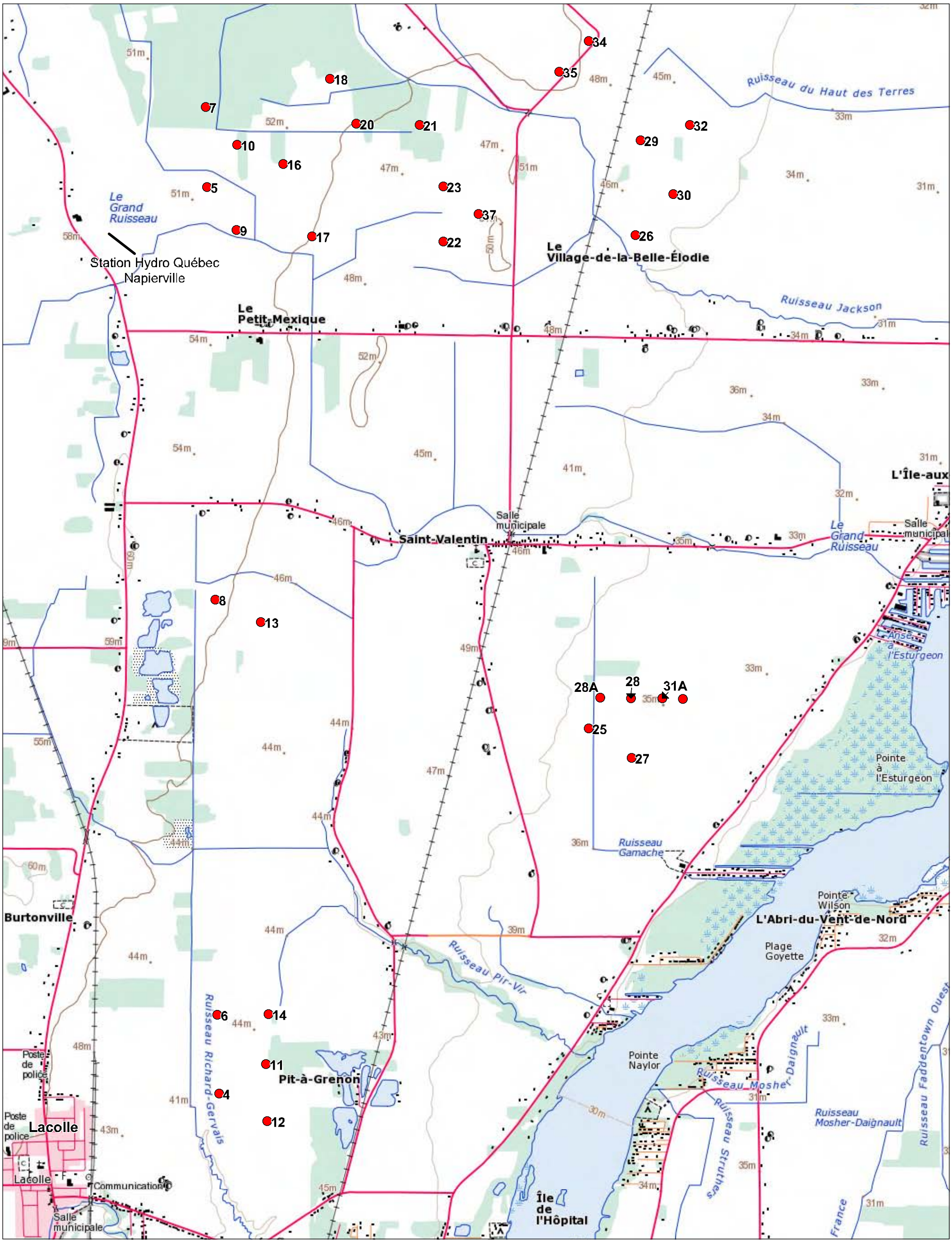
Figure 1 : Satellite photo – Group O

Figure 1 : Satellite photo – Group P

Figure 1 : Satellite photo – Group Q

Appendix B

Key-Plan



VENTERRE

Parc Éolien Saint-Valentin
Québec
MRC Haut-Richelieu

Geo Technical Study

Légende

- Drill locations

Échelle:
1:40 000
(sur 11 x 17)

UTM NAD 83 Zone 18
STV_M136_CPK 14/06/2010

Appendix C

Borehole logs

BOREHOLE REPORT

Borehole N°
10BH-07

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **316244** Y: **5002438**

Date of drilling : **2010-04-01**

Drilling depth (m) : **15.24**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.30
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		49.00											
		48.80	Brown top soil										
			Compact brown **SILT** and **SAND**, trace to some **Gravel (ML)** (Till)		SS-1		71	4	0-1-3-6				
1	5				SS-2		96	21	7-9-12-22				G W= 11%
		47.17			SS-3		83	20	9-10-10-12				
2			Compact to dense grey **Gravelly Silty SAND (ML-SM)** (Till)										
					SS-4		67	10	5-5-5-7				
3	10												
					SS-5		0	28	11-12-16-23				
4													
	15				SS-6		4	16	6-8-8-14				
5													
					SS-7		71	24	9-11-13-15				G W= 8%
6	20												
					SS-8		67	29	8-15-14-16				
7													
					SS-9		63	49	11-28-21-42				G W= 8%
	25												
8					SS-10		50	41	12-20-21-24				

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-07

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35	37.93			SS-11		80	84	-34-50 / 10 cm		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
11					SS-12		100	83	-33-50 / 10 cm				
12	40		Bedrock: Black **LIMESTONE**, poor to excellent quality		RC-13		41	*35*					
13					RC-14		60	*61*					Qu= 165
14	45				RC-15		98	*94*					
15		33.76											
50			END OF BOREHOLE										
16													
17	55												
18													
60													
19													
20	65												
21													
70													
22													
23	75												
24													
80													
25													

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BOREHOLE REPORT

Borehole N° 10BH-04

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Bernard Huppé, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **316203** Y: **4994292**

Date of drilling : **2010-03-10**

Drilling depth (m) : **14.99**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-12 Depth: 0.00
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ N standard penetration, △ Ndc dynamic penetration)	WATER LEVEL	LABORATORY TESTS
		41.00	Firm brown to grey **Silty CLAY (CL)**, some roots		SS-1		92	2	1-1-1-2			2010-04-12	
1					SS-2		83	2	2-1-1-1				
	5	39.48	Soft grey **CLAY (CH)**		SS-3		33	0	1-0-0-0	15			
2					SS-4		100	0	0-0-0-0				W= 64% W_l= 53% W_p= 22%
3	10				SS-5		100	0	0-0-0-0	29			
4										19			
	15	36.28	Soft grey **SILT**, some **Clay**, trace **Gravel (ML)** (Till)		SS-6		100	1	0-0-1-3				
5					SS-7		50	3	3-2-1-4				
6	20				SS-8		67	10	3-6-4-6				
7		33.99	Loose grey **SILT** and **SAND**, trace **Gravel (SM)** (Till)		SS-9		71	7	4-3-4-2				
	25	33.08											
8			**Sandy Silty GRAVEL (SP)** (Till)		SS-10		17	42	5-13-29-12				G, w= 6%

PENETRATION TEST scale: 20 40 60 80

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-04

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35				SS-11		29	62	-43-19-50 / 13 cm		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
11					SS-12		54	40	22-20-20-27				
					SS-13		75	69	-19-50				
		29.47											
12	40		Bedrock: Grey **LIMESTONE**, good to excellent quality		RC-14		100	*93*					Qu= 113
13													
14	45				RC-15		100	*79*					
		26.01											
15	50		END OF BOREHOLE										
16													
17	55												
18													
19	60												
20													
21	65												
22													
23	70												
24													
25	75												
	80												

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BOREHOLE REPORT

Borehole N° 10BH-05

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Rock Samson, tech.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **316239** Y: **5001777**

Date of drilling : **2010-03-31**

Drilling depth (m) : **10.82**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.00
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		50.00	Brown **Silty SAND**, roots (Fill)		SS-1		63	5	1-2-3-6				
1					SS-2		79	19	7-9-10-15				
	5	48.48	Compact grey **SAND** and **SILT**, trace to some **Clay**, trace **Gravel (ML-SM)** (Till)		SS-3		4	9	3-4-5-6				
2					SS-4		46	9	3-3-6-8				G W= 10%
3	10				SS-5		42	25	11-13-12-8				
4					SS-6		0	26	10-11-15-11				
	15												
5		44.82	Firm to stiff **Clayey SILT (CL)** (Till)		SS-7		67	14	4-6-8-8				
6	20				SS-8		54	5	1-2-3-4				G W= 32%
7		42.99											
			Dense grey **Gravelly SAND**, some **Silt (SG)** (Till)		SS-9		42	25	-12-13-50 / 5 cm				
	25	42.38											
8			Bedrock: Light grey **LIMESTONE** and **SHALE**, very poor to good quality		RC-10		90	62					
					RC-11		100	20					
					RC-12		100	68					

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-05

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35	39.18	END OF BOREHOLE		RC-13		100	*83*			▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		Qu= 86
11													
12	40												
13													
14	45												
15	50												
16													
17	55												
18	60												
19													
20	65												
21	70												
22													
23	75												
24													
25	80												

LABORATORY TESTS

G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-06

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 m**
Field technician :	**Bernard Huppé, géo.**
Prepared by :	Sébastian Veillette, dess.
O/F :	**G1-09-1532**
Geodesic coordinates (NAD-1983)	X: **316202** Y: **4994943**
Date of drilling :	**2010-03-11**
Drilling depth (m) :	**15.80**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-12 Depth: 1.32
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		42.00											
		41.29	Brown **SAND**, trace **Silt (SP)**		SS-1		75	24	1-7-17-9			2010-04-12	
1	5		Soft grey **CLAY (CH)**		SS-2		79	5	3-2-3-3				
2					SS-3		100	0	0-0-0-1	31			W= 56% W_l= 52% W_p= 17%
3	10	38.65			SS-4		100	0	0-0-0-0	23			
4			Compact grey **SILT**, trace to some **Sand (ML)** (Till)		SS-5		75	9	2-4-5-7				
5	15				SS-6		71	14	6-7-7-11				G, w= 19%
6	20				SS-7		67	15	6-7-8-10				
7					SS-8		75	13	6-5-8-9				
8	25				SS-9		75	10	5-5-5-5				
					SS-10		58	28	6-9-19-36				
		33.16											

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-06

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	SAMPLES STATE	SAMPLES RECOVERY (%)	SAMPLES N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
			Compact grey **SILT**, some **Gravel** and **Sand (ML)** (Till)		SS-11		4	19	7-8-11-10		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G, w= 15%
10	35				SS-12		4	11	6-6-5-10				
11					SS-13		4	17	12-10-7-10				
12	40	29.61											
			Bedrock: Grey **LIMESTONE**, fair to excellent quality		RC-14		100	*100*					
13													
	45				RC-15		86	*70*					Qu= 106
14													
15					RC-16		100	*90*					
	50	26.20											
16			END OF BOREHOLE										
	55												
17													
18	60												
19													
	65												
20													
21	70												
22													
	75												
23													
24													
	80												
25													

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-08

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Bernard Huppé, géo.**
Prepared by :	Sébastian Veillette, dess.
O/F :	**G1-09-1532**
Geodesic coordinates (NAD-1983)	X: **316248** Y: **4998369**
Date of drilling :	**2010-03-17**
Drilling depth (m) :	**22.56**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-05-06 Depth: 5.35
Date: Depth:
Water infiltration
Groundwater table

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		51.00											
		50.54	Brown **Silty SAND**, trace **Gravel**l and organic soil		SS-1		67	4	1-1-3-6				
			Compact brown **SILT**, some **Sand**, trace **Gravel (ML)** (Till)		SS-2		75	26	7-10-16-27				
1	5	49.81	Loose to compact grey **SILT** and **SAND**, trace to some **Gravel** and **Clay** (Till). **(ML)**		SS-3		75	21	8-11-10-12				
2					SS-4		75	11	5-5-6-9				G W= 4%
3	10				SS-5		75	9	3-3-6-6				
4					SS-6		79	6	3-3-3-6			2010-05-06	
5	15				SS-7		0	7	3-2-5-8				
6	20				SS-8		79	8	3-4-4-7				
7					SS-9		0	15	5-6-9-17				G W= 13%
8	25				SS-10		46	40	9-11-29-33				
		42.47	Compact grey **SILT**, trace to some **Sand**										

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-11

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BOREHOLE REPORT

Borehole N°

10BH-08

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
											▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
10	35	39.88	Loose to compact grey **Sandy SILT**, some **Gravel** and **Clay (SM)** (Till)		SS-11		75	27	11-12-15-19				
					SS-12		79	23	8-10-13-17				G W= 16%
11					SS-13		63	13	6-7-6-20				
12	40				SS-14		71	33	14-15-18-19				
13													
14	45				SS-15		58	3	5-1-2-5				
15	50				SS-16		79	21	13-9-12-24				G W= 8%
16		34.24											
17	55		Very dense grey **SILT**, some **Sand**. Presence of **Cobbles (ML)**		SS-17		80	50	/ 13 cm				
18	60				SS-18		40	50	/ 13 cm				
19		31.62											
20	65		**BOULDERS**: Over consolodated till		RC-19		100	*61*					
					RC-20		100	*82*					
21	70												
22					RC-21		100	*90*					
		28.45	END OF BOREHOLE										
23	75												
24													
25	80												

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BOREHOLE REPORT

Borehole N°
10BH-09

Project : **Wind Energy Converters (WEC)**
Client : **TRANSALTA**
Location : **Saint-Valentin, Québec**
Drilling contractor : **Explora-sol inc.**
Drilling type : **Casing**
Diameter : **76,2 mm**
Field technician : **Rock Samson, tech.**
Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**
Geodesic coordinates (NAD-1983) X: **316478** Y: **5001418**
Date of drilling : **2010-03-29**
Drilling depth (m) : **10.85**

SOIL STATE
Disturbed
Intact
Lost
Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.60
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		50.00											
		49.39	Brown **Sandy SILT**, roots (Fill)		SS-1		25	7	1-2-5-3				
1	5		Compact brown **SILT** and **SAND**, trace **Gravel (ML)** (Till)		SS-2		96	14	3-7-7-20				
					SS-3		50	35	13-17-18-16				G W= 11%
2		47.56			SS-4		38	30	4-13-17-14				
			Dense grey **Sandy SILT**, trace to some **Gravel**. Presence of **Cobbles (ML)** (Till)										
3	10				SS-5		33	44	11-22-22-34				
4					SS-6		50	59	22-34-25-26				
	15				SS-7		58	71	-22-49-50 / 15 cm				G W= 10%
5													
6	20				SS-8		21	50	/ 10 cm				
					SS-9			40	-40 / 3 cm				
7		42.99											
	25		Bedrock: Light grey **LIMESTONE** and **SHALE**, good quality		RC-10		100	*74*					
8					RC-11		90	*85*					Qu= 89

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.
Approved by : Ursula Maselbas, ing.M.Sc.A.
Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-09

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL
10	35	39.15	END OF BOREHOLE		RC-12		90	*86*			▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80	
11												
12	40											
13												
14	45											
15	50											
16												
17	55											
18	60											
19												
20	65											
21	70											
22												
23	75											
24	80											
25												

LABORATORY TESTS

G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N° 10BH-10

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Karim Boudalia, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **316497** Y: **5002120**

Date of drilling : **2010-03-30**

Drilling depth (m) : **20.88**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.00
Date: Depth:
Water infiltration
Groundwater table

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		50.00											
		49.39	Brown **SILT** and **SAND**, organic matter (Fill)		SS-1		83	7	2-3-4-10				
1	5		Loose to compact brown **SILT** and **SAND**, trace **Gravel (ML)** (Till)		SS-2		83	28	16-11-17-36				G W= 10%
2		47.56			SS-3		83	22	16-13-9-12				
3	10		Compact grey **SILT** and **SAND**, trace to some **Gravel (ML-SM)** (Till)		SS-4		71	6	2-3-3-6				G W= 9%
4					SS-5		71	8	3-3-5-9				
	15				SS-6		75	27	5-17-10-16				
5		44.69			SS-7		20	50	/ 13 cm				
6	20		Dense to very dense grey to brown **Sandy SILT**, some **Gravel**. Presence of **Cobbles** and **Boulders (ML-SM)** (Till)		SS-8		71	31	10-15-16-35				G W= 8%
7					SS-9		88	78	26-32-46-50 / 15 cm				
8	25				SS-10		91	82	-32-50 / 15 cm				

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

WATER LEVEL: 2010-04-26

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-10

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35				SS-11		100	86	-36-50 / 10 cm		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
11					SS-12		70	90	-40-50 / 10 cm				
12	40				SS-13		100	85	-35-50 / 13 cm				
13					SS-14		100	83	-33-50 / 13 cm				
14	45												
15	50				SS-15		80	50	/ 10 cm				
16													
17	55				SS-16		88	46	-16-30-50 / 13 cm				G W= 8%
18													
19	60	30.82	**BOULDERS**		SS-17		0	50	/ 8 cm				
20	65				SS-18		0	50	/ 5 cm				
21		29.12	END OF BOREHOLE		RC-19		42	*31*					
22	70												
23													
24	75												
25	80												

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BOREHOLE REPORT

Borehole N° 10BH-11

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Bernard Huppé, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **316592** Y: **4994528**

Date of drilling : **2010-03-08**

Drilling depth (m) : **15.62**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-12 Depth: 0.74
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ N standard penetration, △ Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		43.00											
			Stiff brown **Silty CLAY**, trace **Sand** and roots **(ML)**		SS-1		96	11	4-7-4-3				
					SS-2		83	6	3-3-3-3				
1		41.78											
	5		Soft grey **CLAY (CH)**										
					SS-3		92	0	1-0-0-0	23		2010-04-12	W= 74% W_l= 53% W_p= 25%
2		40.56											
			Compact grey **SILT**, trace fine [Sand (ML)]"/b" (Till)		SS-4		75	4	1-0-4-7				
3	10				SS-5		79	11	6-6-5-7				G, w= 12%
4					SS-6		75	9	4-4-5-5				
	15	38.12											
5			Soft grey **SILT**, some **Clay**, trace **Sand** and **Gravel (ML)** (Till)		SS-7		75	1	3-1-0-6				
		37.21											
6	20		Loose grey **SILT**, trace to some **Sand (ML)** (Till)		SS-8		71	9	5-4-5-5				
7					SS-9		71	10	4-5-5-5				
	25												
8		34.77			SS-10		71	8	4-4-4-7				
			Loose grey **SILT (ML)**										
					SS-11		75	8	3-3-5-3				G, w= 18%

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-11

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35	32.33			SS-12		71	9	3-2-7-13				
11			Compact grey **Sandy GRAVEL**, some **Silt** and **Cobbles (SP)** (Till)		SS-13		21	25	19-15-10-15				G, w= 6%
12	40	30.53			SS-14		73		-12-50 / 13 cm				
13			Bedrock: Grey **LIMESTONE**, poor to excellent quality		RC-15		100	*66*					Qu= 117
14	45				RC-16		100	*37*					
15					RC-17		100	*100*					
16	50	27.38	END OF BOREHOLE										
17	55												
18													
19	60												
20													
21	65												
22	70												
23													
24	75												
25	80												

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

LABORATORY TESTS:
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-12

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Bernard Huppé, géo.**
Prepared by :	Sébastian Veillette, dess.
O/F :	**G1-09-1532**
Geodesic coordinates (NAD-1983)	X: **316596** Y: **4994055**
Date of drilling :	**2010-03-09**
Drilling depth (m) :	**17.83**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-12 Depth: 1.00
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration, △ : Ndc dynamic penetration)	WATER LEVEL	LABORATORY TESTS
		42.13											
		41.52	Brown to grey **SILT** and **SAND**, some roots **(SM)** (Fill)		SS-1		58	6	5-5-1-2				
			Soft grey **CLAY (CH)**										
1	5				SS-2		58	2	1-1-1-2				
2					SS-3		100	0	1-0-0-0	21			W= 57% W_l= 65% W_p= 26%
3	10	39.08	Compact grey **SILT**, trace fine **Sand (ML)** (Till)		SS-4		83	3	1-1-2-4				
4					SS-5		75	9	5-4-5-6				
	15												
5					SS-6		83	11	5-5-6-5				
6	20				SS-7		83	13	3-6-7-4				
7		34.81			SS-8		96	6	1-2-4-4				
	25		Compact grey **Gravelly Silty SAND**, trace **Cobbles (SM)** (Till)		SS-9		52	14	10-4-10-50 / 8 cm				
8					SS-10		4	22	7-10-12-16				G, w= 9%

2010-04-12

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-12

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
											▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
10	35				SS-11		0	21	12-11-10-14				
11					SS-12		63	13	5-4-9-13				
12	40				SS-13		82	25	15-11-14-50 / 10 cm				
13													
14	45				SS-14		73	68	25-24-44-50 / 10 cm				
		27.70											
15	50		Bedrock: Grey **LIMESTONE**, good to excellent quality		RC-15		100	*82*					Qu= 90
16					RC-16		98	*83*					
17	55				RC-17		100	*90*					
		24.29											
18	60		END OF BOREHOLE										
19													
20	65												
21													
22	70												
23													
24	75												
25													
	80												

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BOREHOLE REPORT

Borehole N°
10BH-13

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Bernard Huppé, géo.**
Rock Samson, tech.

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **316618** Y: **4998175**

Date of drilling : **2010-03-18**

Drilling depth (m) : **30.48**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-05-06 Depth: 2.55
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		47.92											
		47.31	Brown **SAND**, some **Silt** and organic matter		SS-1		71	7	1-2-5-7				
1	5		Compact brown **Silty SAND**, some **Gravel (ML)** (Till)		SS-2		100	30	9-12-18-27				
		46.09										2010-05-06	
2			Loose grey **Sandy SILT**, trace to some **Gravel (ML)** (Till)		SS-3		92	19	10-10-9-11				
					SS-4		83	10	8-5-5-10				
3	10				SS-5		79	11	3-4-7-7				G W= 10%
4													
	15				SS-6		88	4	1-2-2-5				
5					SS-7		46	4	1-2-2-5				
6	20				SS-8		58	5	1-2-3-5				
7					SS-9		75	7	3-3-4-7				G W= 13%
	25												
8					SS-10		88	7	3-3-4-6				

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maslebas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-13

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
											▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
10	35	37.26	Compact grey **SILT**, trace **Sand (ML)** (Till)		SS-11		100	9	2-3-6-10				
					SS-12		0	5	2-2-3-6				
11					SS-13		0	19	6-9-10-13				
12	40				SS-14		92	9	4-5-4-8				
13		34.21											
14	45		Compact grey **Silty SAND**, some **Gravel (SM)** (Till)		SS-15		33	50	/ 8 cm				
15	50				SS-16		71	33	7-13-20-37				G W= 16%
16													
17	55				SS-17		50	50	/ 15 cm				
18	60	30.25	**BOULDERS**: Over consolodated till.		RC-18		100	*86*					
19					RC-19		100	*90*					
20	65				RC-20		100	*85*					
21													
22	70				RC-21		100	*86*					
23	75				RC-22		100	*52*					
24													
25	80				RC-23		100	*0*					
					RC-24		0	*0*					

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BOREHOLE REPORT

Borehole N°

10BH-13

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL
26	85				RC-25		100	*79*			▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80	
27	90				RC-26		100	*56*				
28												
29	95				RC-27		100	*91*				
30		17.44										
100			END OF BOREHOLE									
31												
32	105											
33												
	110											
34												
35	115											
36												
	120											
37												
38	125											
39												
	130											
40												
41	135											

LABORATORY TESTS

G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N° 10BH-14

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Bernard Huppé, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **316620** Y: **4994936**

Date of drilling : **2010-03-12**

Drilling depth (m) : **16.10**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-12 Depth: 1.13
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration, △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		44.00	Brown **SAND**, trace **Silt (SP)** (Fill)		SS-1		71	6	2-2-4-6				
1					SS-2		83	10	4-4-6-4				
	5	42.48	Compact to dense grey medium to fine **SAND**, trace to some **Gravel (SP)**		SS-3		83	2	1-1-1-12				
2					SS-4		75	35	12-16-19-24				
3	10				SS-5		75	29	10-12-17-22				G W= 17%
4													
	15				SS-6		67	22	5-10-12-17				
5					SS-7		75	26	9-12-14-18				
6	20				SS-8		0	29	12-13-16-18				
7					SS-9		54	15	8-6-9-12				
	25												
8			Increasing gravel content with depth		SS-10		21	19	10-8-11-14				
		35.47	Dense grey **GRAVEL** and **SAND (GP)**		SS-11		8	28	9-15-13-13				

2010-04-12

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-14

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	SAMPLES STATE	SAMPLES RECOVERY (%)	SAMPLES N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35				SS-12		4	33	15-15-18-23		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G W= 10%
11					SS-13		21	37	16-17-20-24				
12	40	31.20			SS-14		29	21	8-8-13-10				
13			Bedrock: Grey **LIMESTONE**, excellent quality		RC-15		100	*100*					
14	45				RC-16		100	*100*					Qu= 105
15													
16	50				RC-17		100	*94*					
		27.90	END OF BOREHOLE										
17	55												
18													
19	60												
20													
21	65												
22	70												
23													
24	75												
25	80												

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N° 10BH-16

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Karim Boudalia, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **316876** Y: **5001955**

Date of drilling : **2010-03-29**

Drilling depth (m) : **12.09**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 1.45
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		51.00											
1	5	49.48	Brown **Sandy SILT**, some **Gravel**, organic matters and roots (Fill)		SS-1		75	4	1-2-2-5			2010-04-26	
					SS-2		75	24	11-11-13-14				
2		48.56	Dense brown **SILT** and **SAND**, trace of **Gravel (ML-SM)** (Till)		SS-3		96	55	11-16-39-31				G W= 11%
3	10		Compact to loose grey **SILT** and **SAND**, trace to some **Gravel**. Presence of **Cobbles (ML-SM)** (Till)		SS-4		71	16	5-7-9-17				
4					SS-5		63	24	13-11-13-11				
5	15				SS-6		71	13	6-6-7-9				
6	20				SS-7		0	9	5-3-6-6				
7					SS-8		67	5	4-1-4-5				G W= 9%
8	25				SS-9		8	9	4-3-6-17				
					SS-10		11	61	-11-50 / 8 cm				
		42.09											

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-16

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	SAMPLES STATE	SAMPLES RECOVERY (%)	SAMPLES N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
			Bedrock: Black **LIMESTONE**, good quality		SS-11		0	50	-50 / 8 cm				
10					RC-12		97	*86*					Qu= 55
	35												
11					RC-13		97	*90*					
12		38.91											
	40		END OF BOREHOLE										
13													
	45												
14													
15	50												
16													
	55												
17													
18	60												
19													
	65												
20													
21	70												
22													
	75												
23													
24													
	80												
25													

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

LABORATORY TESTS: G : grain size analysis; CA : chemical analysis; Wl : liquid limit; Wp : plastic limit; w : water content; Qu : unconfined compressive strenght of rock (MPa); Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N° 10BH-17A

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Rock Samson, tech.**
Prepared by :	Sébastian Veillette, dess.
O/F :	**G1-09-1532**
Geodesic coordinates (NAD-1983)	X: **317102** Y: **5001353**
Date of drilling :	**2010-03-25**
Drilling depth (m) :	**19.94**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.75
Date: Depth:
Water infiltration
Groundwater table

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		50.00	Brown **Silty SAND** (Fill)		SS-1		0	8	2-4-4-8				
		49.26	Soft grey **Silty CLAY (CL)**		SS-2		67	3	3-1-2-3			2010-04-26	W= 52% Wl= 28% Wp= 13%
1	5				SS-3		75	1	1-0-1-0				
2					SS-4		46	1	1-0-1-2				
3	10	46.65	Loose to compact grey **SILT** and **SAND**, trace **Gravel (ML-SM)** (Till)		SS-5		63	9	1-4-5-7				
4	15				SS-6		42	23	6-11-12-15				
5					SS-7		83	4	1-2-2-3				G W= 10%
6	20				SS-8		50	6	2-3-3-4				
7					SS-9		50	20	2-5-15-14				
8	25	42.08	Compact grey **SILT** and **SAND**, trace **Gravel (ML-SM)** (Till)		SS-10		75	29	10-15-14-10				G W= 9%

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-17A

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		40.25			SS-11		100	50	-50 / 10 cm		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		
10			Very dense grey **Sandy SILT**, trace **Gravel**. Presence **Cobbles (ML)** (Till)		SS-12		100	73	-35-38-50 / 10 cm				G W= 9%
	35				SS-13		100	84	-34-50 / 25 cm				
11													
					SS-14		50	67	-27-40-50 / 10 cm				
12	40				SS-15		100	50	/ 10 cm				
13													
					SS-16		100	90	-40-50 / 13 cm				
14	45				SS-17		80	50	/ 13 cm				
15													
	50				SS-18		25	50	/ 10 cm				
16													
					SS-19		100	50	/ 13 cm				
17	55												
18													
	60				SS-20		13	50	/ 13 cm				
19					RC-21								
		30.06	**BOULDERS** and **COBBLES**										
20	65		END OF BOREHOLE										
21	70												
22													
	75												
23													
24													
	80												
25													

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-18

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **317273** Y: **5002650**

Date of drilling : **2010-04-02**

Drilling depth (m) : **9.58**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.00
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		50.00											
		49.80	Black top soil										
			Compact to loose brown **SILT** and **SAND**, trace to some **Gravel (ML-SM)** (Till)		SS-1		92	5	2-2-3-8				
1	5				SS-2		100	24	7-10-14-14				G W= 10%
2					SS-3		0	9	6-5-4-8				
					SS-4		4	5	2-2-3-4				
3	10	46.65											
			Very dense grey **SILT** and **SAND**, trace to some **Gravel (ML)** (Till)		SS-5		63	67	44-37-30-50 / 8 cm				G W= 10%
4	15				SS-6		91	98	-48-50 / 13 cm				
5			Gravelly		SS-7		60	69	15-32-37-50 / 10 cm				G W= 7%
6	20	43.95											
			Bedrock: Grey **LIMESTONE**, fractured on surface, good quality		RC-8		57	*0*					
7					RC-9		86	*78*					Qu= 68
	25												
8					RC-10		96	*88*					

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

WATER LEVEL: 2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-18

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		40.42	END OF BOREHOLE								▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
10	35												
11													
12	40												
13													
14	45												
15	50												
16													
17	55												
18	60												
19													
20	65												
21	70												
22													
23	75												
24													
25	80												

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BOREHOLE REPORT

Borehole N° 10BH-20

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Karim Boudalia, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **317482** Y: **5002277**

Date of drilling : **2010-04-02**

Drilling depth (m) : **20.17**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.00
Date: Depth:
Water infiltration
Groundwater table

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		49.00	Top soil.		SS-1		58	3	1-2-1-2			2010-04-26	
		48.39	Grey **SAND** and **CLAY**. Presence of pieces of wood (Fill)		SS-2		17	3	2-1-2-1				
1	5	47.17	Loose to compact grey **SILT** and **SAND**, trace of **Gravel** to **Gravelly (ML)** (Till)		SS-3		17	5	1-2-3-2				
2					SS-4		63	5	1-2-3-4				G W= 12%
3	10				SS-5		33	13	1-3-10-4				
4					SS-6		33	4	1-2-2-3				
5	15				SS-7		13	5	1-2-3-5				G W= 7%
6	20				SS-8		88	7	3-3-4-6				
7					SS-9		0	11	3-6-5-8				
8	25	41.08	Dense to very dense grey **Sandy SILT**, some **Gravel (ML)** (Till)		SS-10		63	75	32-45-30-25				G W= 15%

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-20

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL
10	35	39.25	Zone of **COBBLES** and **BOULDERS**		SS-11		63	39	17-25-14-15			
11												
12	40	36.81	Compact to very dense **Gravelly SAND**, trace of **Silt**. Presence of **Cobbles** and **Boulders (SP)**		SS-12		50	11	7-6-5-11			
13												
14	45				SS-13		100	65	-15-50 / 10 cm			
15												
16	50				SS-14		100	50	/ 13 cm			
17	55	32.74	**BOULDERS**.		RC-15		37	*0*				
18												
19	60				RC-16		32	*0*				
20	65				RC-17		34	*0*				
21		28.83	END OF BOREHOLE									
22	70											
23												
24	75											
25	80											

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-21

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **318008** Y: **5002258**

Date of drilling : **2010-04-07**

Drilling depth (m) : **14.33**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.51
Date: Depth:

Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration, △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		48.00											
		47.49	Top soil		SS-1		75	1	0-0-1-2				
		47.14	Grey **SAND**, some **Silt (SM)**										
1			Soft grey **CLAY**, trace of **Silt (CL)**		SS-2		50	5	3-3-2-1				
	5	46.17			SS-3		96	3	0-1-2-1				
2			Loose grey **SILT**, some **Sand (ML)** (Till)										
					SS-4		8	7	5-4-3-2				
3	10	44.65											
			Loose to compact grey **SILT** and **SAND**, trace **Gravel** and **Clay**. Presence of **Cobbles (ML)** (Till)		SS-5		33	4	2-2-2-3				G W= 14%
4													
	15				SS-6		29	11	2-5-6-4				
5					SS-7		83	5	1-2-3-3				G W= 11%
6	20				SS-8		4	4	2-2-2-3				
7					SS-9		0	25	5-13-12-3				
	25												
8					SS-10		96	4	0-1-3-6				G W= 13%
			Becomes **Gravelly**										

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-21

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35				SS-11		29	25	8-13-12-20		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G W= 10%
11		36.82			SS-12		92	65	-23-42-50 / 3 cm				
			Bedrock: Black and grey **LIMESTONE**, excellent quality										
12	40				RC-13		90	*93*					Qu= 79
13													
	45				RC-14		98	*95*					
14		33.67	END OF BOREHOLE										
15	50												
16													
	55												
17													
18	60												
19													
	65												
20													
21	70												
22													
	75												
23													
24													
	80												
25													

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-22

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Karim Boudalia, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **318187** Y: **5001293**

Date of drilling : **2010-04-13**

Drilling depth (m) : **16.26**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.80
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		46.00											
		45.75	Topsoil										
			Compact brown **Sandy SILT**, trace **Gravel (ML)** (Till)		SS-1		63	6	2-3-3-6				
1	5				SS-2		100	17	8-8-9-15				G W= 12%
2					SS-3		67	14	7-6-8-9				
		43.56											
			Loose to compact grey **Sandy SILT**, trace **Gravel (ML)** (Till)		SS-4		79	5	1-2-3-6				G W= 15%
3	10				SS-5		63	23	-6-17-50 /10 cm				
		42.24											
4			Very dense grey **GRAVEL** and **SAND**, some **Silt**. Presence of **Cobbles (GM)** (Till)		SS-6		0	58	27-23-35-46				
5	15				SS-7		0		-47-50 /8 cm				
6	20				SS-8		50	62	33-39-23-21				G W= 6%
7					SS-9		9		-21-50 /13 cm				
	25												
8		37.82			SS-10		80		-33-50 /10 cm				
			COBBLES and **BOULDERS**		RC-11		38						

Penetration test: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-22

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
					SS-12		67		-50 /8 cm		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
10					RC-13		42						
					RC-14		5						
11	35												
					RC-15		62						
12	40												
					RC-16		57						
		33.05											
13			Bedrock: Black **LIMESTONE**, good quality		RC-17		97	*88*					
	45												
14					RC-18		97	*84*					Qu= 123
15	50												
					RC-19		83	*75*					
16		29.74											
			END OF BOREHOLE										
17	55												
18													
	60												
19													
20	65												
21													
	70												
22													
23	75												
24													
	80												
25													

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BOREHOLE REPORT

Borehole N°
10BH-23

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Rock Samson, tech.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **318195** Y: **5001745**

Date of drilling : **2010-04-13**

Drilling depth (m) : **13.72**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.25
Date: Depth:
Water infiltration
Groundwater table

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration, △ : Ndc dynamic penetration)	WATER LEVEL	LABORATORY TESTS
		47.00									20 40 60 80		
		46.90	Topsoil										
			Loose brown **Sandy SILT**, trace gravel **(ML)** (Till)		SS-1		75	9	3-3-6-8				
1	5				SS-2		100	21	6-9-12-11				G W= 13%
		45.17											
2			Loose grey **SILT** and **SAND**, trace **Gravel (ML)** (Till)		SS-3		79	8	7-5-3-3				
					SS-4		83	4	2-2-2-3				
3	10				SS-5		88	4	1-2-2-3				G W= 12%
4		42.73											
	15		Compact to dense grey **Sandy SILT**, trace to some **Gravel**. Presence of **Cobbles (ML)** (Till)		SS-6		8	36	3-12-24-12				
5					SS-7		17	50	/ 13 cm				
6	20				SS-8		58	69	-22-47-50 / 8 cm				
7					SS-9		54	77	-29-48-50 / 8 cm				
8	25												

2010-04-26

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-23

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35	36.28	Bedrock: Grey **LIMESTONE** with **SHALE**, fair to good quality		SS-10		75	41	10-20-21-41		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G W= 14%
11													
12	40				RC-11		100	*63*					Qu= 73
13					RC-12		100	*90*					
14	45	33.28	END OF BOREHOLE										
15	50												
16													
17	55												
18													
19	60												
20													
21	65												
22	70												
23													
24	75												
25	80												

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N° 10BH-25

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Bernard Huppé, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **319312** Y: **4997246**

Date of drilling : **2010-03-16**

Drilling depth (m) : **11.15**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.92
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (N / Ndc)	WATER LEVEL	LABORATORY TESTS
		38.00											
		37.39	Brown **SILT**, some **Sand**, trace organic soil and matters (Fill) **(ML)**		SS-1		75	9	2-2-7-9				
1		36.63	Stiff grey **Silty CLAY**, some roots **(CL)**		SS-2		92	12	4-5-7-9				
	5		Firm grey **CLAY (CH)**		SS-3		96	2	1-1-1-2	48			
2													
					SS-4		100	1	1-0-1-1	41			W= 34% Wl= 54% Wp= 28%
3	10												
					SS-5		100	1	0-1-0-1	22			
4													
	15	33.28			SS-6		67	32	7-10-22-36				G W= 8%
5			Very dense grey **Gravelly Silty SAND**, trace **Cobbles (SM)** (Till)										
					SS-7		75	53	26-27-26-34				
6	20												
					SS-8		71	81	26-45-36-43				
7													
		30.41			SS-9		91	69	-19-50 / 13 cm				
	25		Bedrock: Grey **LIMESTONE**, poor to good quality										
8					RC-10		100	*78*					Qu= 106

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-25

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL
					RC-11		100	*39*			▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80	
10												
	35				RC-12		100	*79*				
11		26.85	END OF BOREHOLE									
12	40											
13												
	45											
14												
15	50											
16												
	55											
17												
18	60											
19												
	65											
20												
21	70											
22												
	75											
23												
24	80											
25												

LABORATORY TESTS

G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-26

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.
O/F :	**G1-09-1532**
Geodesic coordinates (NAD-1983)	X: **319774** Y: **5001316**
Date of drilling :	**2010-03-25**
Drilling depth (m) :	**8.53**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 2.46
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		40.84											
		40.23	Brown **SILT**, trace **Sand** and **Gravel**. Presence of organic matter (Fill)		SS-1		67	4	1-2-2-6				
1	5	39.32	Compact brown **SAND**, some **Silt (SM)** (Till)		SS-2		21	20	10-10-10-29				
2			Compact grey **SILT** and **SAND**, trace **Gravel (ML)** (Till)		SS-3		83	23	11-12-11-12			2010-04-26	G W= 11%
3	10				SS-4		42	19	6-8-11-8				
4					SS-5		0	22	8-11-11-13				
5	15				SS-6		50	14	9-5-9-18				
		35.43			SS-7		78	67	-17-50 / 8 cm				
6	20		Bedrock: Black **LIMESTONE** and **SHALE**, fair to excellent quality		RC-8		96	*74*					
7					RC-9		95	*96*					Qu= 79
8	25				RC-10		100	*100*					
		32.31	END OF BOREHOLE										

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.
Approved by : Ursula Maselbas, ing.M.Sc.A.
Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°
10BH-27

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **319664** Y: **4996999**

Date of drilling : **2010-04-19**

Drilling depth (m) : **14.15**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 1.28
Date: Depth:

Water infiltration
Groundwater table

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		35.00											
		34.90	Topsoil										
			Stiff grey-brown **SILT**, trace of **Clay (ML)**		SS-1		33	4	0-1-3-5				
1					SS-2		83	10	4-5-5-7				
	5	33.48											
			Firm reddish brown **CLAY (CH)**		SS-3		96	1	1-0-1-1	75			
2													
					SS-4		92	0	0-0-0-1				W= 44% Wl= 55% Wp= 17%
3	10									30			
4													
	15	30.23								31			
			Compact grey **SAND** and **SILT**, some **Gravel (ML)** (Till)		SS-5		88	3	0-1-2-1				
5													G W= 11%
					SS-6		67	19	8-10-9-9				
6	20												
					SS-7		4	8	9-5-3-9				
7													
					SS-8		54	21	13-11-10-10				
	25	27.07											
8			Dense to very dense grey **SAND** and **GRAVEL**, some **Silt (SP)** (Till)		SS-9		71	32	8-14-18-30				G W= 9%

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

WATER LEVEL: 2010-04-26

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-27

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10					SS-10		83	97	26-49-48-50 / 13 cm		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		
		24.48			SS-11		75		-50 / 10 cm				
35			Bedrock: Black **LIMESTONE**, fair to excellent quality		RC-12		92	*56*					
11													
12	40				RC-13		100	*100*					Qu= 109
13													
					RC-14		97	*70*					
45													
14		20.85	END OF BOREHOLE										
15	50												
16													
55													
17													
18	60												
19													
65													
20													
21	70												
22													
75													
23													
24													
80													
25													

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-28

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Rock Samson, tech.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **319665** Y: **4997492**

Date of drilling : **2010-04-15**

Drilling depth (m) : **13.72**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.87
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ N standard penetration, △ Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		35.00											
		34.85	Topsoil										
			Loose light brown **Sandy SILT**, trace		SS-1		50	8	2-4-4-8				
		34.31	**Clay (ML)**										
1			Stiff to firm reddish brown **CLAY (CH)**		SS-2		92	16	5-7-9-14				W= 20%
	5												
2					SS-3		100	4	1-2-2-3	62			W= 46% Wl= 59% Wp= 15%
					SS-4		92	3	1-1-2-1				
3	10									39			
					SS-5		100	2	-1-1-1				W= 56%
4										36			
	15				SS-6		100	2	-1-1-1				
5													
		29.67											
			Compact grey **SILT** and **SAND**, trace **Gravel (ML)** (Till)		SS-7		75	23	2-10-13-18				
6	20												
					SS-8		58	51	25-24-27-35				
7													
	25				SS-9		33	36	15-17-19-13				G W= 15%
8													
					SS-10		54	29	10-16-13-22				

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-28

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		25.78	**Cobbles** and **Boulders**		SS-11		13		-50 /8 cm		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
10					RC-12		30						
		24.33	Bedrock: Black **LIMESTONE**, poor quality										
11	35				RC-13		100	*13*					
12	40												
13					RC-14		100	*35*					Qu= 80
		21.28	END OF BOREHOLE										
14	45												
15	50												
16													
	55												
17													
18	60												
19													
	65												
20													
21	70												
22													
	75												
23													
24	80												
25													

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BOREHOLE REPORT

Borehole N° 10BH-28A

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Karim Boudalia, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **319414** Y: **4997499**

Date of drilling : **2010-04-15**

Drilling depth (m) : **15.22**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.78
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration; △ : Ndc dynamic penetration)	WATER LEVEL	LABORATORY TESTS
		0.00									20 40 60 80		
		-0.13	Topsoil										
			Stiff grey-brown **SILT**, trace of **Clay (ML)**		SS-1		33	7	1-3-4-5				
1					SS-2		83	16	6-7-9-11				
	5	-1.52	Stiff to firme reddish brown **CLAY (CH)**		SS-3		83	4	1-2-2-2				
2					SS-4		100	1	0-0-1-1				
3	10				SS-5		100	0	0-0-0-1	63			W= 49% Wl= 49% Wp= 22%
4					SS-6		91	23	0-11-12-50 / 13 cm	23			
	15	-4.93											
5			Compact grey **Sandy GRAVEL**, trace **Silt**. Presence of **Cobbles** and **Boulders (GP)** (Till)							32			
6	20				RC-7		20			40			
7					SS-8		63	24	7-12-12-10				G W= 7%
	25	-7.92			RC-9		0						
8			Very dense grey **SILT** and **SAND**, trace **Gravel (ML)** (Till)		SS-10		58	53	18-22-31-37				

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-28A

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	SAMPLES STATE	SAMPLES RECOVERY (%)	SAMPLES N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35				SS-11		67	62	15-32-30-31		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G W= 14%
11					SS-12		96	58	15-24-34-44				
12	40	-11.91	Bedrock: Black **LIMESTONE**, poor to excellent quality		SS-13		0		-50 / 3 cm				
					RC-14		88	*43*					
13					RC-15		100	*60*					Qu= 103
14	45				RC-16		94	*91*					
15		-15.22	FIN DU FORAGE										
16	50												
17	55												
18	60												
19													
20	65												
21	70												
22													
23	75												
24													
25	80												

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-29

Project : **Wind Energy Converters (WEC)**
Client : **TRANSALTA**
Location : **Saint-Valentin, Québec**
Drilling contractor : **Explora-sol inc.**
Drilling type : **Casing**
Diameter : **76,2 mm**
Field technician : **Karim Boudalia, géo.**
Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**
Geodesic coordinates (NAD-1983) X: **319828** Y: **5002096**
Date of drilling : **2010-03-25**
Drilling depth (m) : **6.71**

SOIL STATE
Disturbed
Intact
Lost
Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 1.00
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		45.00											
			Brown **SILT**, trace **Sand** and **Gravel**. Presence of organic matter (Fill)		SS-1		83	4	2-1-3-6				
1		43.83			SS-2		23	83	22-33-50-50 / 10 cm				
	5		Dense grey **SILT** and **SAND**, trace to some **Gravel**. Presence of cobbles **(ML-SM)** (Till)		SS-3		96	39	18-21-18-20				G W= 11%
2					SS-4		73	54	-4-50 / 13 cm				
3	10				SS-5		70	38	13-16-22-50 / 5 cm				G W= 10%
4		40.96	Bedrock: Black **LIMESTONE** and **SHALE**, fair to excellent quality		RC-6		57	*0*					
	15				RC-7		56	*0*					
5					RC-8		84	*63*					Qu= 85
6	20				RC-9		89	*91*					
		38.29	END OF BOREHOLE										
7													
	25												
8													

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.
Approved by : Ursula Maselbas, ing.M.Sc.A.
Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°
10BH-30

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **320091** Y: **5001646**

Date of drilling : **2010-03-22**

Drilling depth (m) : **13.23**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 1.65
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		41.00											
		40.39	Brown **Sandy SILT**. Presence of organic matter (Fill)		SS-1		75	7	2-3-4-6				
1	5		Compact to dense brown **Silty Gravelly SAND (SM)** (Till)		SS-2		96	20	4-8-12-20				
2		38.87			SS-3		25	47	16-20-27-38			2010-04-26	G W= 11%
			Compact to dense grey **SILT** and **SAND**, some **Gravel (SM-SP)** (Till)		SS-4		75	31	18-19-12-26				
3	10				SS-5		0	98	-48-50 / 13 cm				
4													
	15				SS-6		50	20	5-11-9-12				G W= 10%
5													
6	20	34.52			SS-7		67	35	10-10-25-33				
			Fractured rock: Black **LIMESTONE** and **SHALE**, very poor quality		RC-8		53	0					
7					RC-9		35	10					
	25												
8					RC-10		33	0					

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-30

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	SAMPLES STATE	SAMPLES RECOVERY (%)	SAMPLES N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL
					RC-11		60	0				
10					RC-12		61	0				
	35				RC-13		43	0				
11					RC-14		55	0				
					RC-15		75	0				
12	40											
					RC-16		71	10				
13		27.77	END OF BOREHOLE									
	45											
14												
15	50											
16												
	55											
17												
18												
	60											
19												
	65											
20												
21												
	70											
22												
23	75											
24												
	80											
25												

PENETRATION TEST

▲ : N standard penetration

△ : Ndc dynamic penetration

20 40 60 80

LABORATORY TESTS

G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N°
10BH-31

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **320095** Y: **4997479**

Date of drilling : **2010-04-14**

Drilling depth (m) : **15.04**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.26
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ N standard penetration, △ Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		34.00											
		33.82	Topsoil										
			Loose to compact light brown **Sandy SILT**, trace **Clay (ML)**		SS-1		42	7	1-3-4-3				
1					SS-2		96	10	4-5-5-4				
	5	32.48	Stiff to firm reddish brown **CLAY**		SS-3		100	0	1-0-0-1				W= 57%
2										26			
					SS-4		100	0	0-0-0-1				W= 58% Wl= 56% Wp= 18%
3	10				SS-5		100	0	0-0-0-1				
4													
	15									32			
5		28.82			SS-6		100	1	0-0-1-1				
			Compact grey **Silty SAND**, some **Gravel (SM)** (Till)										
6	20				SS-7		50	22	3-7-15-9				
7													
					SS-8		50	18	11-11-7-6				G W= 9%
	25												
8													
					SS-9		58	15	6-6-9-8				

2010-04-26

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-31

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		24.55											
10			Very dense grey **Gravelly SAND**, trace **Silt**. Presence of **Cobbles (SP)** (Till)		SS-10		83	59	26-30-29-32				
	35												
11					SS-11		50		-50 /15 cm				
		22.34											
12	40		Bedrock: Black **LIMESTONE**, fair to excellent quality		RC-12		82	*60*					
13					RC-13		69	*51*					Qu= 82
	45												
14					RC-14		95	*97*					
		18.96											
15	50		FIN DU FORAGE										
16													
	55												
17													
18	60												
19													
	65												
20													
21	70												
22													
	75												
23													
24													
	80												
25													

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

LABORATORY TESTS: G : grain size analysis; CA : chemical analysis; Wl : liquid limit; Wp : plastic limit; w : water content; Qu : unconfined compressive strenght of rock (MPa); Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N° 10BH-31A

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Karim Boudalia, géo.** Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **319926** Y: **4997484**

Date of drilling : **2010-04-14**

Drilling depth (m) : **15.57**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 1.30
Date: Depth:

▽ Water infiltration
▽ Groundwater table

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		0.00											
		-0.15	Topsoil										
			Compact light brown **Sandy SILT**, trace **Clay (ML)**		SS-1		33	7	1-3-4-5				
1					SS-2		83	15	6-7-8-8				W= 30%
	5	-1.52	Stiff reddish brown **CLAY (CH)**		SS-3		96	2	1-1-1-2	57		2010-04-26	W= 36% W_l= 55% W_p= 29%
2					SS-4		100	2	0-0-2-5				
		-2.90											
3	10		Compact grey **SILT** and **SAND**, some **Gravel** to **Gravelly (SM)** (Till)		SS-5		0	18	10-9-9-10				
4													
	15				SS-6		50	14	8-8-6-7				
5					SS-7		0	20	8-9-11-12				
6	20				SS-8		71	23	10-14-9-8				G W= 9%
7					SS-9		71	23	4-9-14-16				
	25												
8		-8.18	**COBBLES** and **BOULDERS**		RC-10		25						

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-31A

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
10	35				RC-11		17				▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
11													
12	40				RC-12		14						
		-12.60	Bedrock: Black **LIMESTONE**, good to excellent quality										
13	45				RC-13		88	*83*					Qu= 95
14													
15	50				RC-14		100	*97*					
		-15.57	FIN DU FORAGE										
16													
17	55												
18													
19	60												
20													
21	65												
22													
23	70												
24													
25	75												
	80												

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BOREHOLE REPORT

Borehole N° 10BH-32

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.
O/F :	**G1-09-1532**
Geodesic coordinates (NAD-1983)	X: **320241** Y: **5002214**
Date of drilling :	**2010-03-24**
Drilling depth (m) :	**9.53**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 1.57
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		43.00	Beige **Sandy SILT**. Presence of organic matter (Fill)		SS-1		75	6	2-3-3-4				
		42.39	Compact beige **SILT** and **SAND**, trace **Gravel (ML)** (Till)		SS-2		96	19	5-0-19-22			2010-04-26	G W= 6%
1	5				SS-3		88	26	-11-15-50 / 10 cm				
2		40.69	Grey **BOULDERS**		RC-4								
3	10	40.00	Compact grey **Sandy SILT**, some **Gravel**. Presence of **Cobbles (ML)** (Till)		SS-5		80	32	5-11-21-50 / 5 cm				
4					SS-6		92	31	12-12-19-26				
5	15				SS-7		83	25	10-9-16-23				G W= 12%
6	20	36.60	Bedrock: Black **LIMESTONE** and **SHALE**, fair to good quality		SS-8		88	29	-13-16-50 / 13 cm				
					SS-9		60	50	-50 / 13 cm				
7					RC-10		78	*53*					Qu= 79
8	25				RC-11		86	*85*					
					RC-12		81	*68*					

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

Remark(s):

Verified by: IObrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-32

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		33.48	END OF BOREHOLE								▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght
10	35												
11													
12	40												
13													
	45												
14													
15	50												
16													
	55												
17													
18	60												
19													
	65												
20													
21	70												
22													
	75												
23													
24	80												
25													

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BOREHOLE REPORT

Borehole N° 10BH-34

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76.2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **319415** Y: **5002922**

Date of drilling : **2010-04-08**

Drilling depth (m) : **9.73**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D $\frac{\Sigma \text{ Length of sound pieces} > 100 \text{ mm}}{\text{Total core run length}}$

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.72
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration, △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		0.00											
		-0.18	Topsoil										
			Compact to dense brown **SILT** and **SAND**, some **Gravel (ML-SM)** (Till)		SS-1		75	6	2-2-4-4				
1	5				SS-2		100	27	7-11-16-16				G W= 12%
2					SS-3		96	31	8-13-18-16				
					SS-4		50	39	10-18-21-50 / 15 cm				G W= 9%
3	10				SS-5		67	26	-13-13-50 / 15 cm				
		-3.96											
4			**BOULDERS** and **COBBLES**		RC-6		24						
	15												
5		-5.08											
			Bedrock: Black **LIMESTONE**, fractured on surface, good to excellent quality		RC-7		25	*10*					
6	20												
7					RC-8		88	*92*					Qu= 75
	25												
8					RC-9		81	*77*					

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-34

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		-9.73	END OF BOREHOLE								▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		G : grain size analysis CA : chemical analysis Wl : liquid limit Wp : plastic limit w : water content Qu : unconfined compressive strenght of rock (MPa) Cur : shear strenght: disturbed undrained shear strenght

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

35 40 45 50 55 60 65 70 75 80

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BOREHOLE REPORT

Borehole N°
10BH-35

Project :	**Wind Energy Converters (WEC)**
Client :	**TRANSALTA**
Location :	**Saint-Valentin, Québec**
Drilling contractor :	**Explora-sol inc.**
Drilling type :	**Casing**
Diameter :	**76,2 mm**
Field technician :	**Karim Boudalia, géo.**
Prepared by :	Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **319169** Y: **5002673**

Date of drilling : **2010-04-08**

Drilling depth (m) : **14.17**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.64
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
		0.00											
		-0.25	Topsoil										
1	5		Compact to dense brown **SILT** and **SAND**, some **Gravel (ML-SM)** (Till)		SS-1		83	5	1-2-3-5				
					SS-2		88	33	9-14-19-25				G W= 10%
		-1.75											
2			Compact to very dense grey **SILT** and **SAND**, some **Gravel**. Presence of **Boulders** and **Cobbles (ML-SM)** (Till)		SS-3		75	25	16-10-15-19				
					SS-4		50	31	9-9-22-22				G W= 8%
3	10												
4					RC-5		20						
	15												
5													
6	20				RC-6		26						
7													
	25				RC-7		60						
8					SS-8		0	15	8-8-7-3				

PENETRATION TEST: ▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-35

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	SAMPLES STATE	SAMPLES RECOVERY (%)	SAMPLES N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL	LABORATORY TESTS
					SS-9		88	77	22-38-39-37		▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80		
10	35	-10.85			SS-10		86	78	-28-50 / 3 cm				
11			Bedrock: Black **LIMESTONE**, fair to excellent quality		RC-11		77	*55*					Qu= 76
12	40				RC-12		97	*100*					
13					RC-13		94	*93*					
14	45	-14.17	END OF BOREHOLE										
15	50												
16													
17	55												
18													
19	60												
20													
21	65												
22													
23	70												
24													
25	75												
	80												

LABORATORY TESTS

- G : grain size analysis
- CA : chemical analysis
- Wl : liquid limit
- Wp : plastic limit
- w : water content
- Qu : unconfined compressive strenght of rock (MPa)
- Cur : shear strenght: disturbed undrained shear strenght

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BOREHOLE REPORT

Borehole N° 10BH-37

Project : **Wind Energy Converters (WEC)**

Client : **TRANSALTA**

Location : **Saint-Valentin, Québec**

Drilling contractor : **Explora-sol inc.**

Drilling type : **Casing**

Diameter : **76,2 mm**

Field technician : **Karim Boudalia, géo.**

Prepared by : Sébastian Veillette, dess.

O/F : **G1-09-1532**

Geodesic coordinates (NAD-1983) X: **318483** Y: **5001515**

Date of drilling : **2010-04-23**

Drilling depth (m) : **10.52**

SOIL STATE
- Disturbed
- Intact
- Lost
- Core sample

TYPE OF SAMPLES
SS Split Spoon
ST Shelby tube
HA Helical auger
RC Roc core barrel
CA Casing
MA Manual

TERMINOLOGY

"traces"	1-10%
"some"	10-20%
adjective (sandy...)	20-35%
"and"	35-50%

SYMBOLS
N N-value (Standard penetration test)
R Refusal
R.Q.D Rock Quality Designation
% R.Q.D = Σ Length of sound pieces > 100 mm / Total core run length

ROCK QUALITY DESIGNATION

% RQD	QUALITATIVE
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

CLASSIFICATION

Clay	< 0,002 mm
Silt	0,002 à 0,08 mm
Sand	0,08 à 5 mm
Gravel	5 à 80 mm
Cobbles	80 à 300 mm
Boulders	> 300 mm

COMPACTION

	INDEX "N"
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

COHESIVE SOILS CONSISTENCY

	SHEAR STRENGHT (Cu)
Very soft	<12 kPa
Soft	12-25 kPa
Firm	25-50 kPa
Stiff	50-100 kPa
Very stiff	100-200 kPa
Hard	>200 kPa

WATER LEVEL (m)
Date: 2010-04-26 Depth: 0.68
Date: Depth:
Water infiltration
Groundwater table

LABORATORY TESTS
G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES TYPE & NO	STATE	RECOVERY (%)	N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST (▲ : N standard penetration; △ : Ndc dynamic penetration; 20 40 60 80)	WATER LEVEL	LABORATORY TESTS
		0.00											
		-0.10	Topsoil										
1	5		Loose brown **SILT** and **SAND**, trace to some **Gravel**. Presence of **Cobbles** between 5' to 7' depth **(ML)** (Till)		SS-1		63	6	0-2-4-3				
					SS-2		100	13	3-6-7-8				
2					SS-3		67	49	4-26-23-14			2010-04-26	G W= 13%
		-2.44											
3	10		Compact to loose grey **SAND**, some **Silt** and **Gravel**. Presence of **Cobbles (ML)** (Till)		SS-4		46	9	3-3-6-6				
					SS-5		92	11	3-5-6-8				
4													
	15				SS-6		0	5	2-2-3-6				
		-4.88											
5			Dense grey **Sandy GRAVEL (SP)** (Till)		SS-7		50	37	13-18-19-22				G W= 7%
6	20				SS-8		78	74	23-30-44-50 / 13 cm				
		-6.68											
7			Zone of **COBBLES** and **BOULDERS** (Till)		SS-9		0		-50 / 10 cm				
	25				RC-10		25						
		-7.77											
8			Bedrock: Black **LIMESTONE**, good quality		RC-11		86	*85*					Qu= 117

Remark(s):

Verified by: Ibrahim Ja'far, ing.M.Ing.

Approved by : Ursula Maselbas, ing.M.Sc.A.

Date of report 2010-06-09

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BOREHOLE REPORT

Borehole N°

10BH-37

DEPTH (m)	DEPTH - ft	ELEVATION (m)	STRATIGRAPHIC DESCRIPTION	SYMBOLS	SAMPLES: TYPE & NO	SAMPLES: STATE	SAMPLES: RECOVERY (%)	SAMPLES: N, Ndc or RQD	BLOW COUNTS/150mm	VANE TEST (KPa)	PENETRATION TEST	WATER LEVEL
10					RC-12		92	*87*			▲ : N standard penetration △ : Ndc dynamic penetration 20 40 60 80	
		-10.52	END OF BOREHOLE									
35												
11												
12	40											
13												
45												
14												
15	50											
16												
55												
17												
18	60											
19												
65												
20												
21	70											
22												
75												
23												
24												
80												
25												

LABORATORY TESTS

G : grain size analysis
CA : chemical analysis
Wl : liquid limit
Wp : plastic limit
w : water content
Qu : unconfined compressive strenght of rock (MPa)
Cur : shear strenght: disturbed undrained shear strenght

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Appendix D

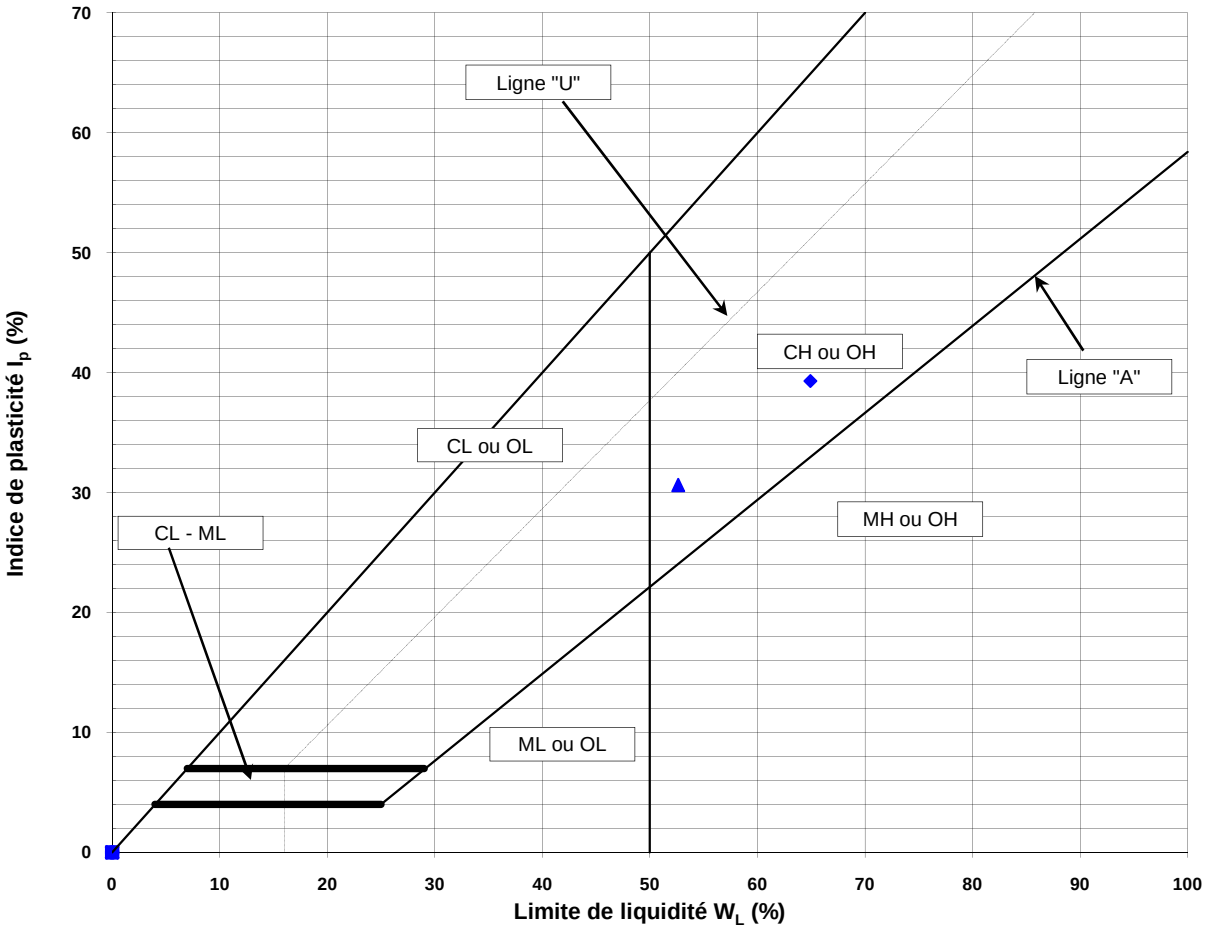
Laboratory tests

SOIL PLASTICITY CHART

CLIENT TransAlta **N/D:** G1-09-1532

PROJECT Geotechnical study - wind energy converters (WEC)

LOCATION St-Valentin, Québec **PAGE** 1 **de** 1



Selon ASTM D-2487

RÉSULTATS

Legend	Boring	Simple n°	Depth (m)	W_n	W_L	W_p	I_p	I_L	Classification
▲	**10BH-04**	**SS-04**	**2,44 - 3,05**	**64%**	**53%**	**22%**	**31%**	**1,4**	**CH**
◆	**10BH-12**	**SS-03**	**2,13 - 2,74**	**57%**	**65%**	**26%**	**39%**	**0,8**	**CH**

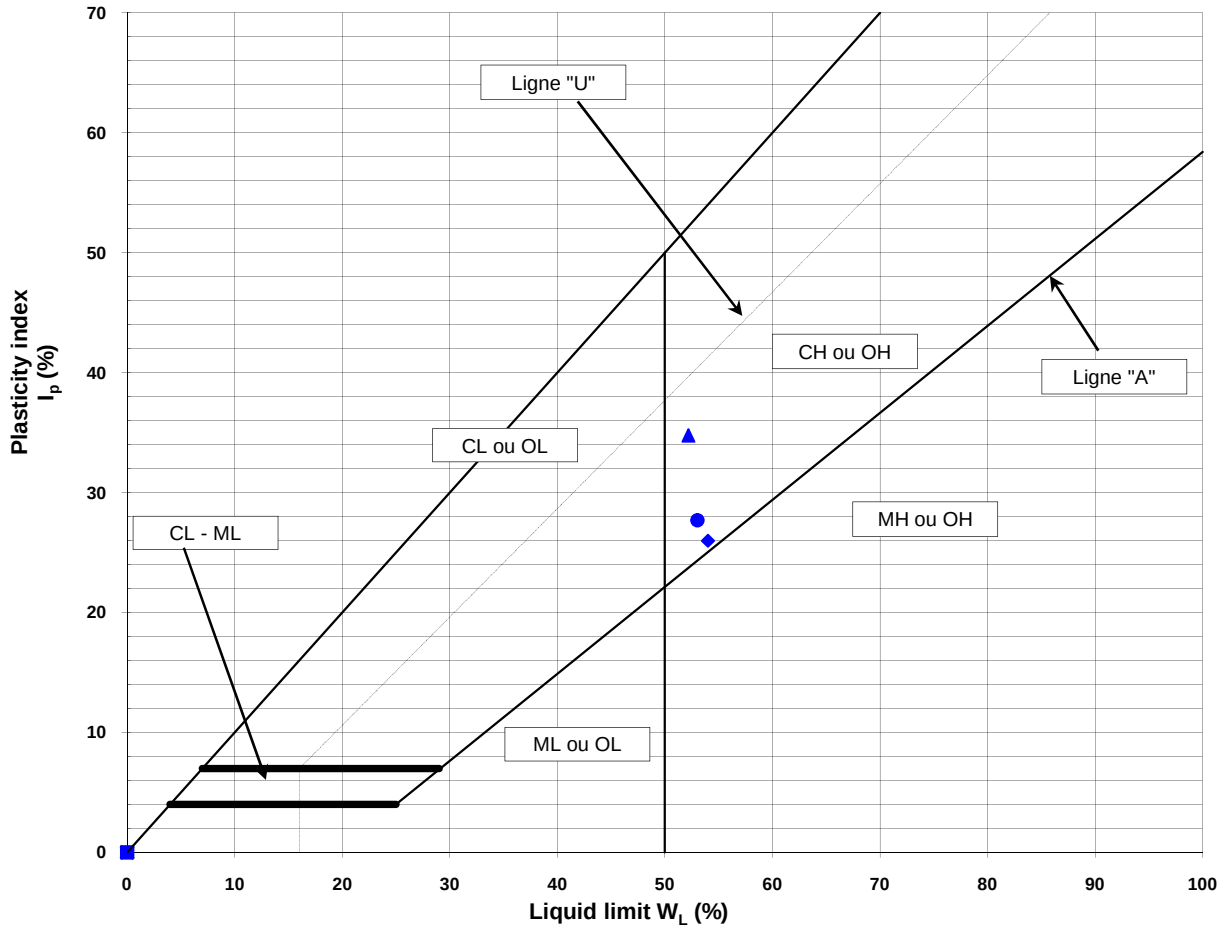
Préparé par Benoit St-Pierre, tech. **Approuvé par** Ibrahim Ja'far, ing. **Date** 2010-04-01

SOIL PLASTICITY CHART

CLIENT TransAlta **N/D:** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **PAGE** 1 **de** 1



according to ASTM D-2487

RESULTS INTERPRETATION

Legend	Boring	Sample n°	Depth (m)	W_n	W_L	W_p	I_p	I_L	Classification
▲	**10BH-06**	**SS-03**	**1,52 - 2,13**	**56%**	**52%**	**17%**	**35%**	**1,1**	**CH**
◆	**10BH-25**	**SS-04**	**2,44 - 3,05**	**34%**	**54%**	**28%**	**26%**	**0,2**	**CH**
●	**10BH-11**	**SS-03**	**1,52 - 2,13**	**74%**	**53%**	**25%**	**28%**	**1,8**	**CH**

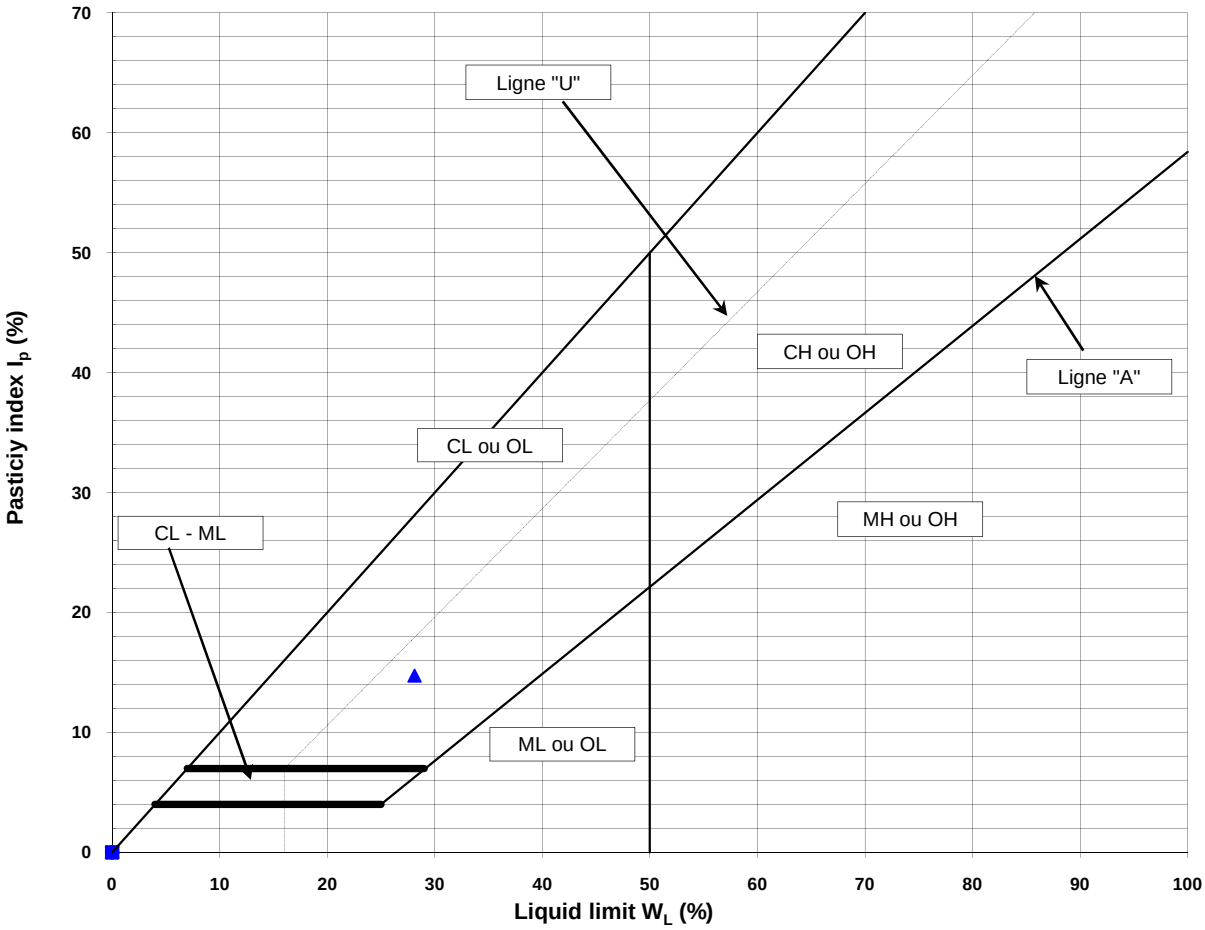
Prepared by Daniel Fleury, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

SOIL PLASTICITY CHART

CLIENT TransAlta **N/D:** G1-09-1532

PROJECT Geotechnical study - wind energy converters (WEC)

LOCATION St-Valentin (Québec) **PAGE** 1 **de** 1



ACCORDIING TO ASTM D-2487

RESULTS INTERPRETATION

Legend	Boring	Sample n°	Dept (m)	W_n	W_L	W_p	I_p	I_L	Classification
▲	**10BH-17A**	**SS-03**	**1,52 - 2,13 m**	**52%**	**28%**	**13%**	**15%**	**2,6**	**CL**

Prepared By Benoit St-Pierre,tech **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-13

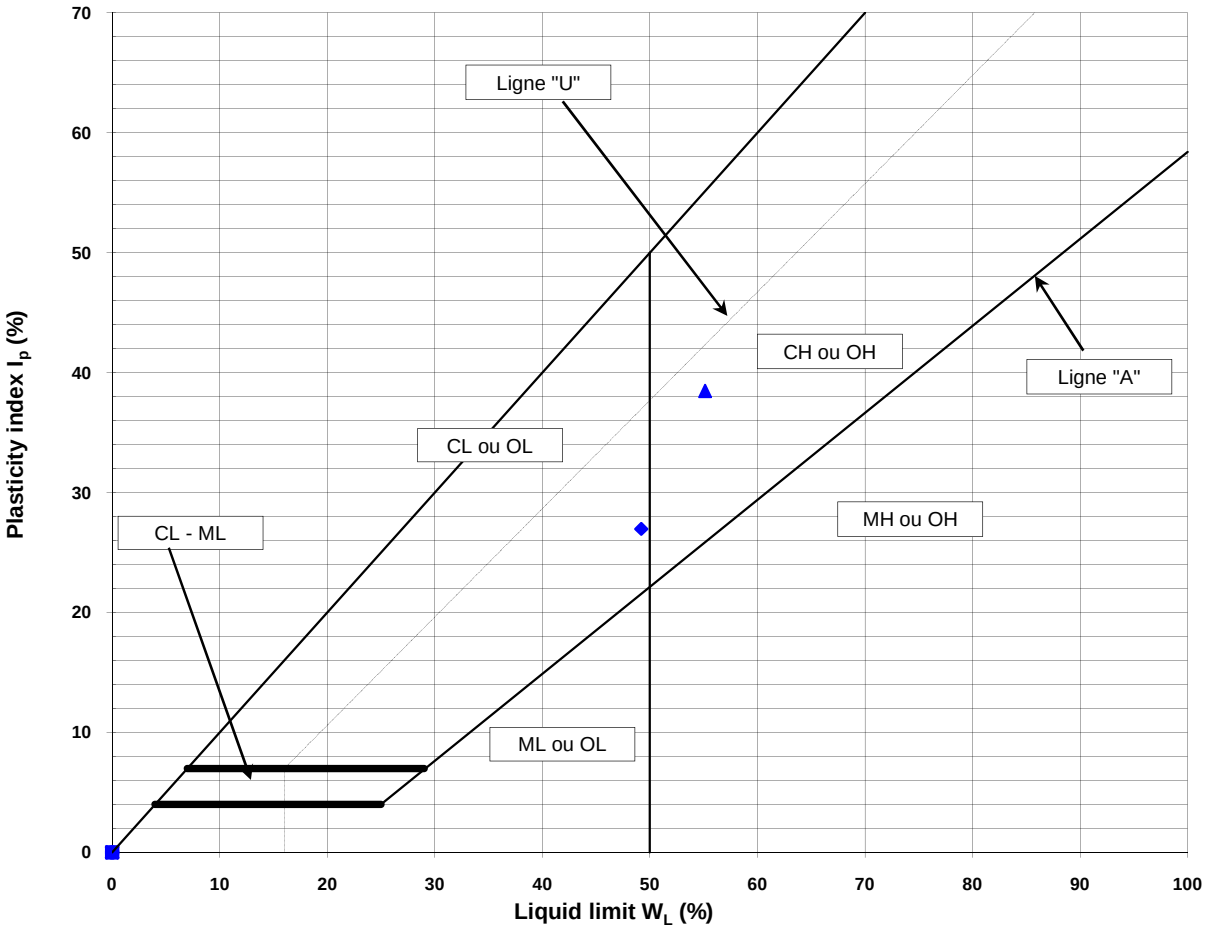
Groupe ABS

SOIL PLASTICITY CHART

CLIENT TransAlta **N/D:** G1-09-1532

PROJET Geotechnical study - Wind energy converters (WEC)

ENDROIT St-Valentin (Québec) **PAGE** 1 **de** 1



according to ASTM D-2487

RESULTS INTERPRETATION

Legend	Boring	Sample n°	Depth (m)	W_n	W_L	W_p	I_p	I_L	Classification
▲	**10BH-27**	**SS-04**	**2,44 - 3,05**	**44%**	**55%**	**17%**	**38%**	**0,7**	**CH**
◆	**10BH-28A**	**SS-05**	**3,35 - 3,96**	**49%**	**49%**	**22%**	**27%**	**1,0**	**CH**

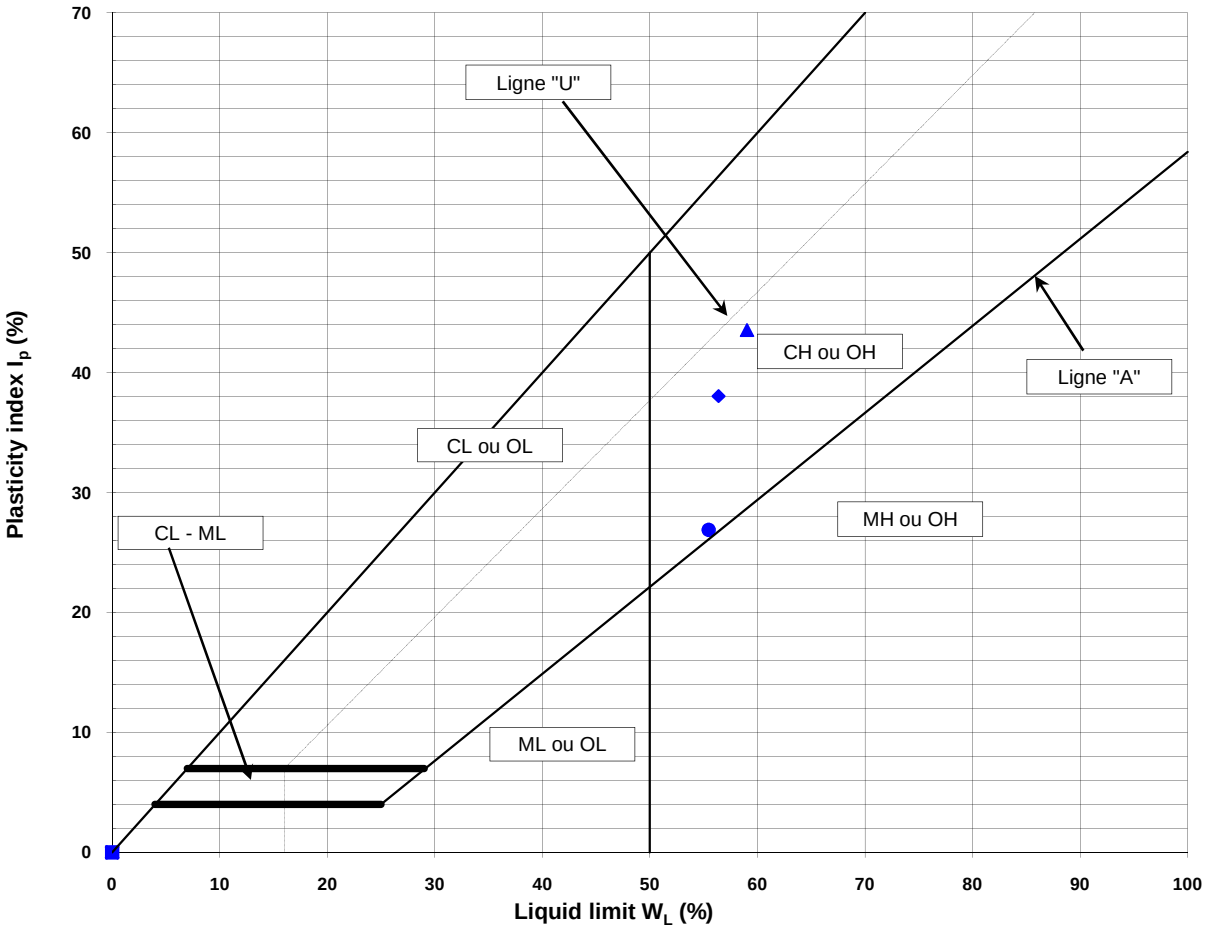
Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-05

SOIL PLASTICITY CHART

CLIENT TransAlta **N/D:** G1-09-1532

PROJECT Geotechnical study - Wind energy convertrs (WEC)

LOCATION St-valentin (Québec) **PAGE** 1 **de** 1



ACCORDING TOASTM D-2487

RESULTS INTERPRETATION

Legend	Boring	Simple n°	Depth (m)	W_n	W_L	W_p	I_p	I_L	Classification
▲	**10BH-28**	**SS-3**	**1,52 - 2,13**	**46%**	**59%**	**15%**	**44%**	**0,7**	**CH**
◆	**10BH-31**	**SS-04**	**2,44 - 3,05**	**58%**	**56%**	**18%**	**38%**	**1,0**	**CH**
●	**10BH-31A**	**SS-03**	**1,52 - 2,13**	**36%**	**55%**	**29%**	**27%**	**0,3**	**CH**

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

Groupe ABS

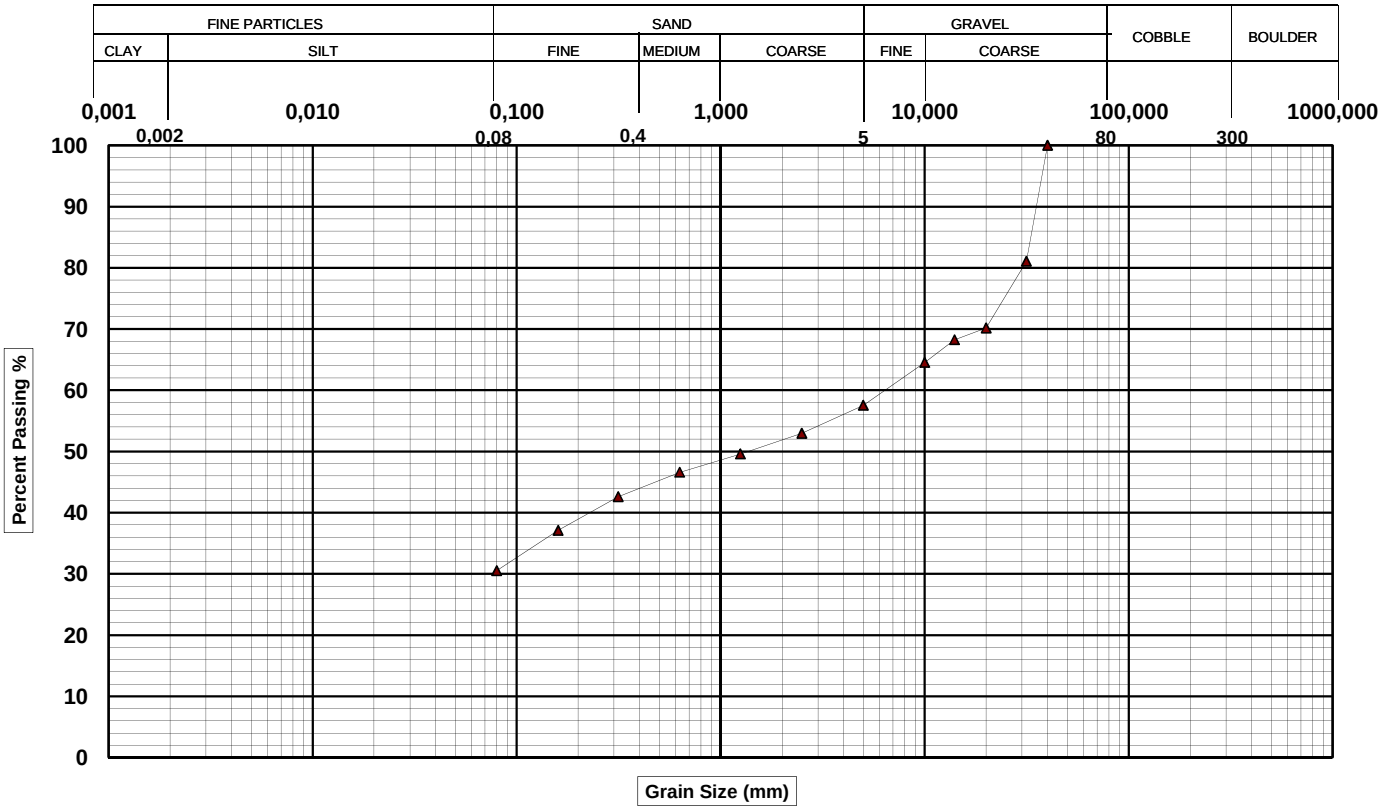
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin, Québec **NO. LAB.** 36370



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	30,5	27,0	42,5	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	6,50	N/A	N/A	6

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	53		
56,00	100	1,250	50		
40,00	100	0,630	47		
31,50	81	0,315	43		
20,00	70	0,160	37		
14,00	68	0,080	30,5		
10,00	65				
5,00	58				

SAMBLE IDENTIFICATION

Sample	10BH-04 (SS-10)
Depth	7,92 - 8,53 m

Soil Description

Sandy silty gravel

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-01

Groupe ABS

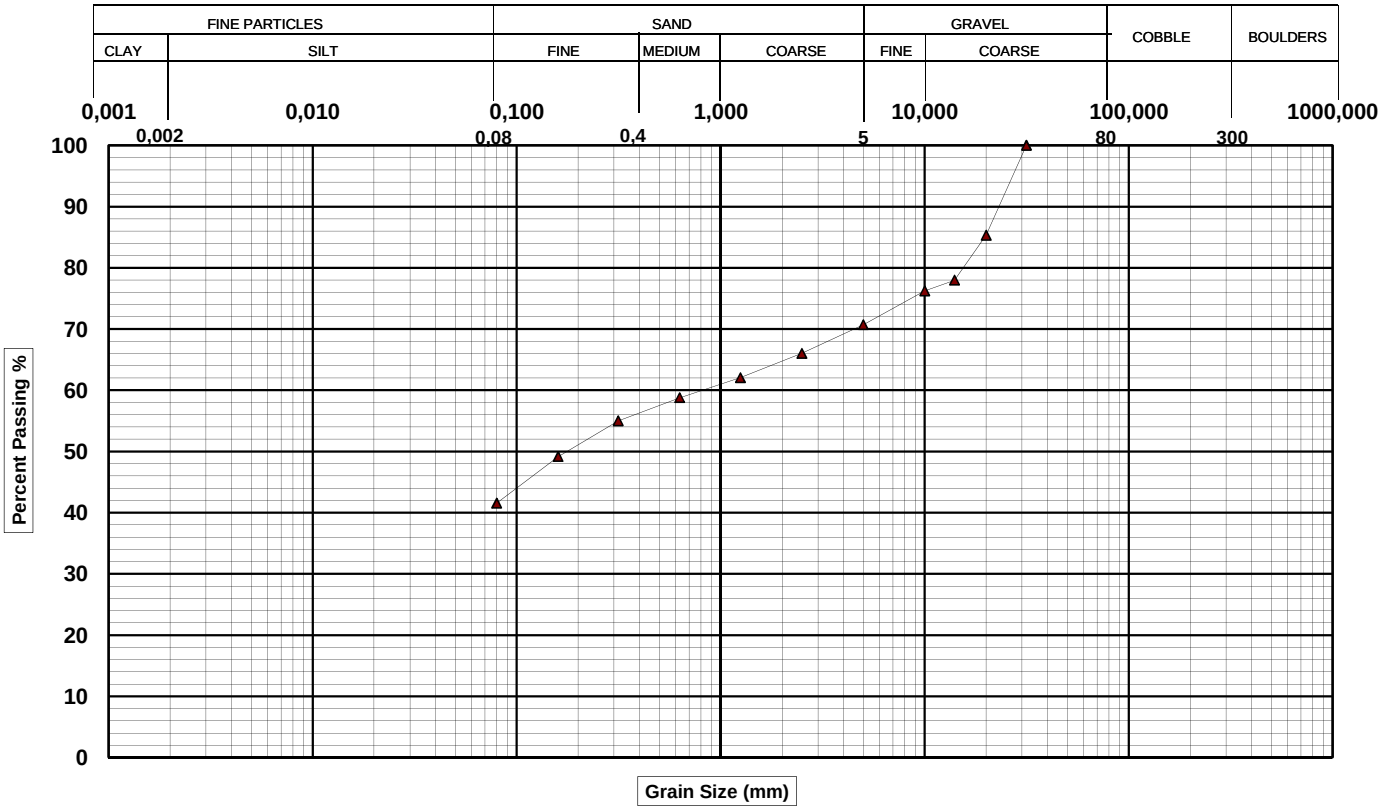
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin, Québec **NO. LAB.** 36373



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	41,6	29,1	29,3	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,84	N/A	N/A	9

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	66		
56,00	100	1,250	62		
40,00	100	0,630	59		
31,50	100	0,315	55		
20,00	85	0,160	49		
14,00	78	0,080	41,6		
10,00	76				
5,00	71				

SAMBLE IDENTIFICATION

Sample	10BH-12 (SS-10)
Depth	8,53 - 9,14 m

Soil Description

Gravelly sandy Silt

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-01

Groupe ABS

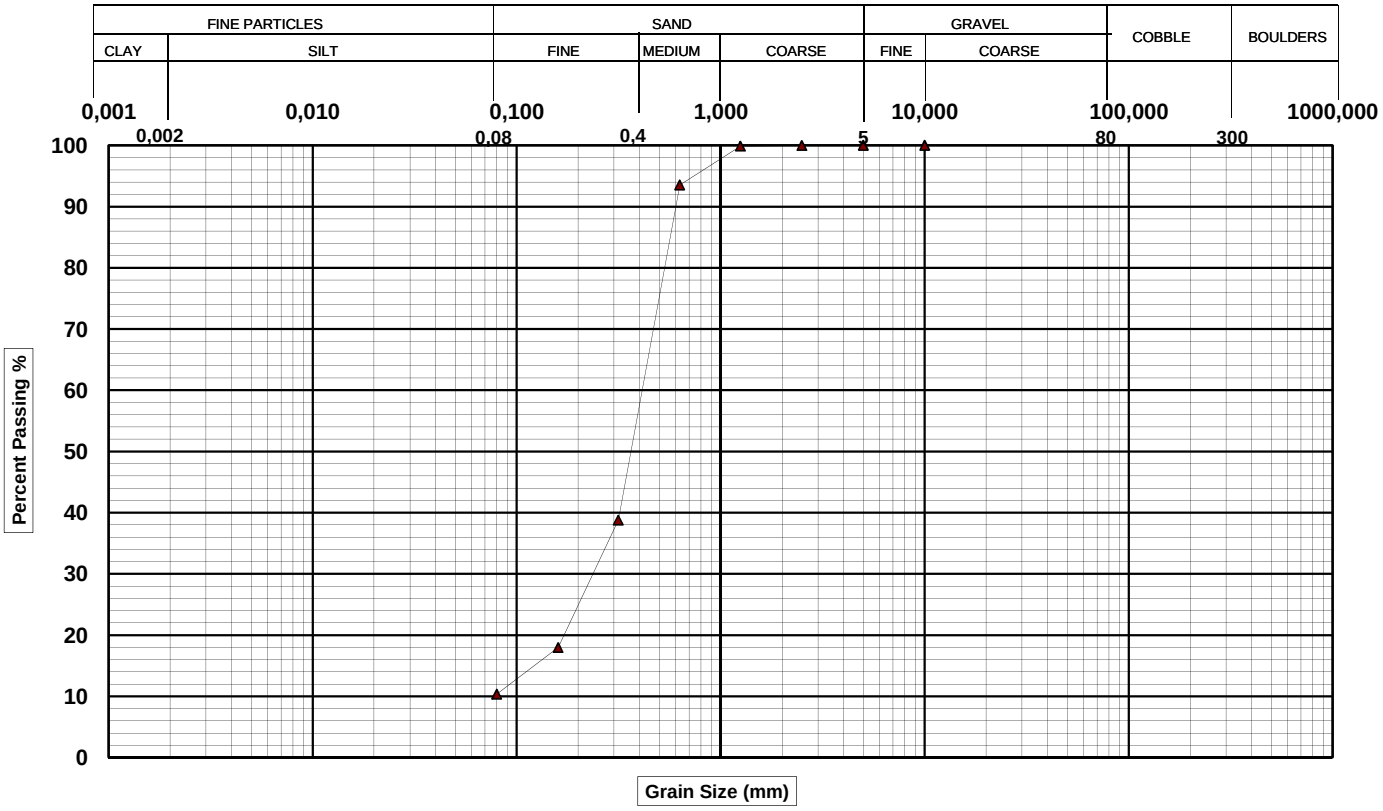
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin, Québec **NO. LAB.** 36375



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	10,4	89,6	0,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	0,24	0,41	N/A	N/A	17

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	100		
56,00	100	1,250	100		
40,00	100	0,630	94		
31,50	100	0,315	39		
20,00	100	0,160	18		
14,00	100	0,080	10,4		
10,00	100				
5,00	100				

SAMBLE IDENTIFICATION

Sample	10BH-14 (SS-05)
Depth	3,35 - 3,96 m

Soil Description

Sand, some of silt

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-01

Groupe ABS

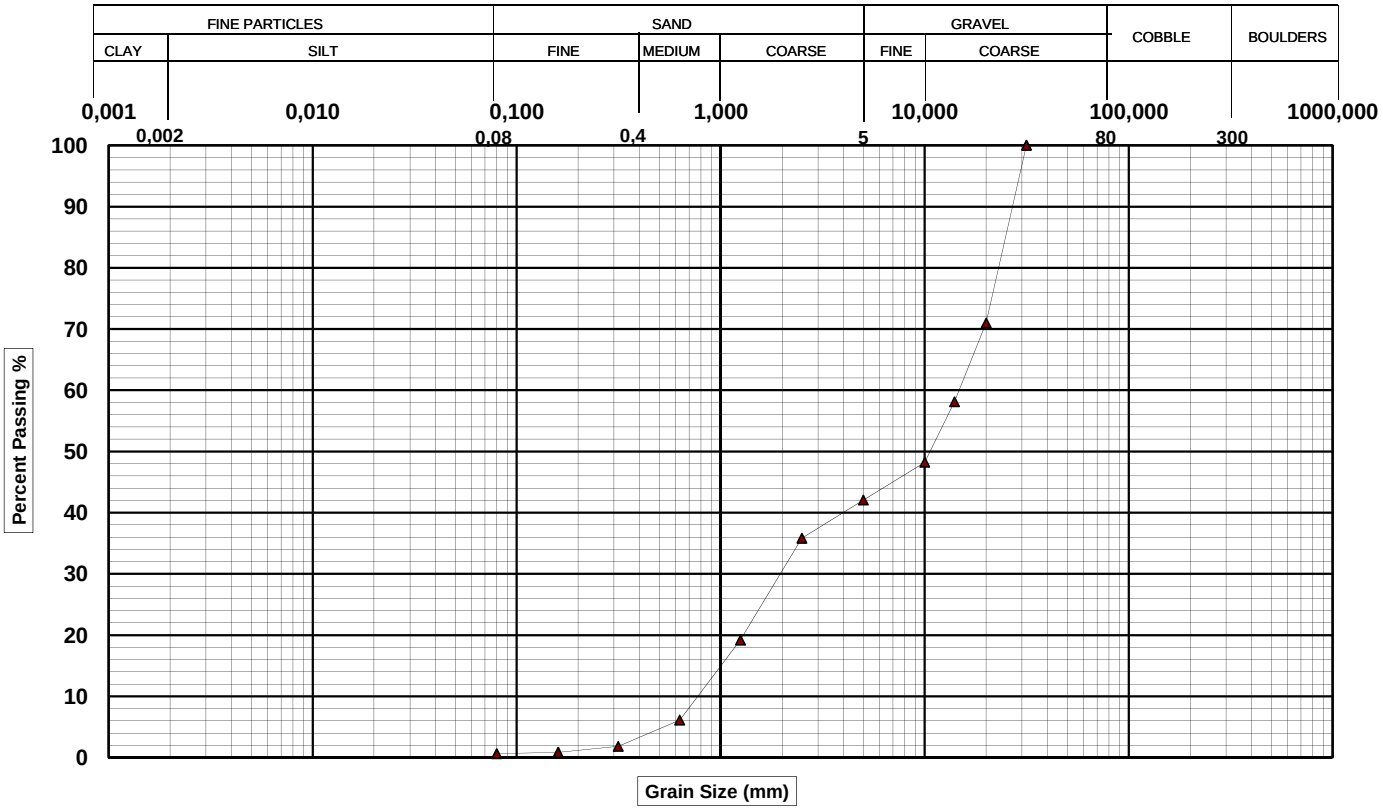
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin, Québec **NO. LAB.** 36376



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	0,6	41,4	57,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
0,800	2,00	16,00	20,00	0,31	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	36		
56,00	100	1,250	19		
40,00	100	0,630	6		
31,50	100	0,315	2		
20,00	71	0,160	1		
14,00	58	0,080	0,6		
10,00	48				
5,00	42				

SAMBLE IDENTIFICATION

Sample	10BH-14 (SS-11)
Depth	8,53 - 9,14 m

Soil Description

Gravel and sand

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-01

F104/970307(0)

Groupe ABS

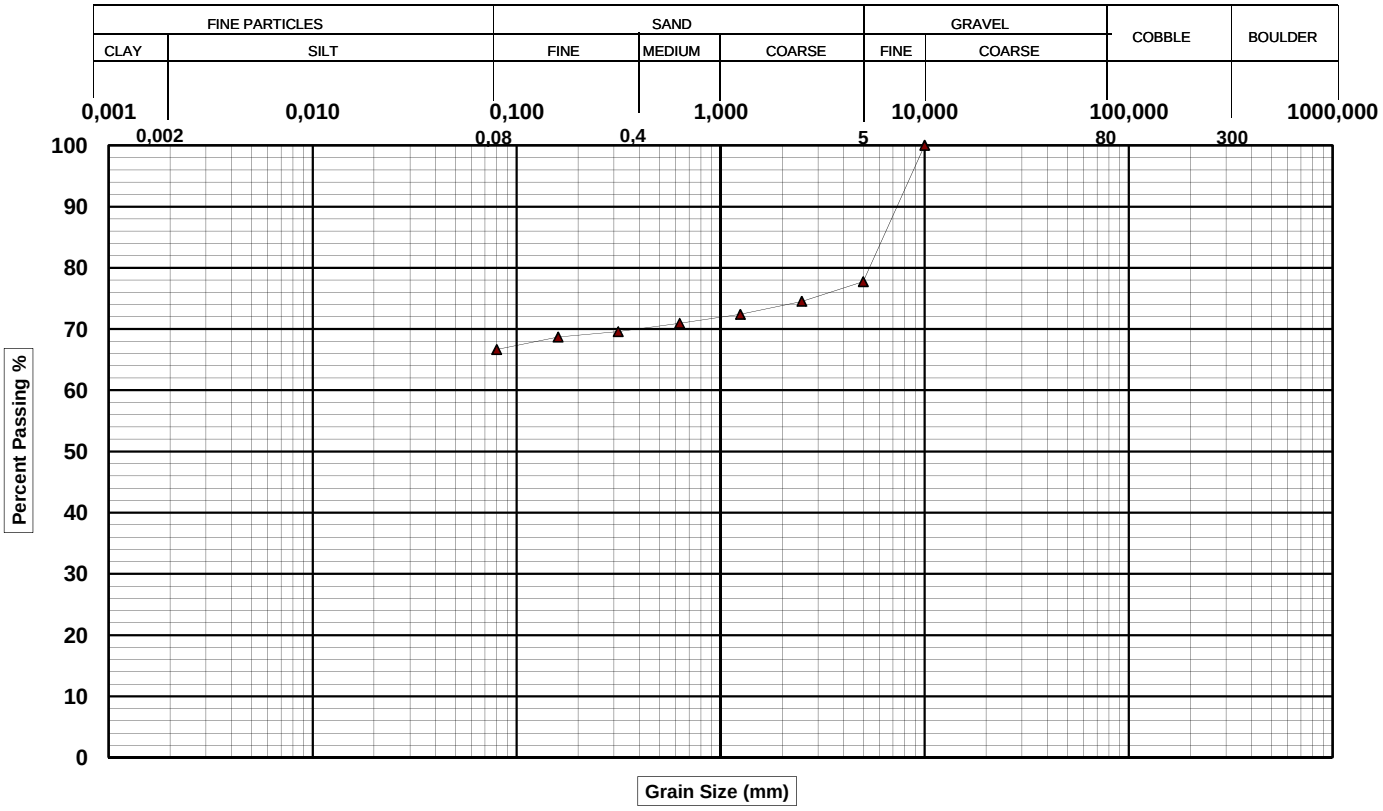
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36422



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	66,7	11,1	22,3	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	15

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	75		
56,00	100	1,250	72		
40,00	100	0,630	71		
31,50	100	0,315	70		
20,00	100	0,160	69		
14,00	100	0,080	66,7		
10,00	100				
5,00	78				

SAMBLE IDENTIFICATION

Sample	10BH-06 (SS-11)
Depth	8,84 - 9,45 m

Soil Description

Silt, some gravel and sand

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

Groupe ABS

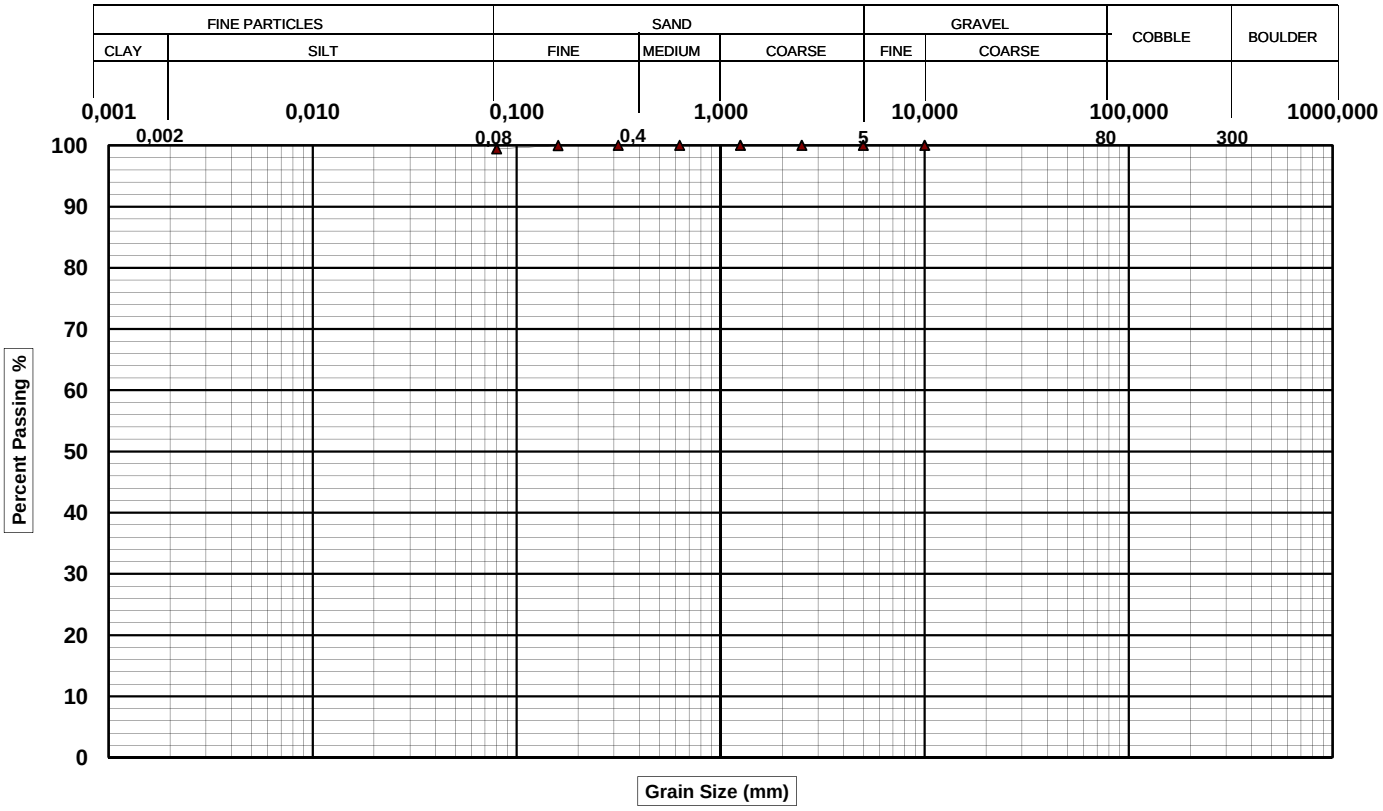
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36426



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	99,4	0,6	0,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	12

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	100		
56,00	100	1,250	100		
40,00	100	0,630	100		
31,50	100	0,315	100		
20,00	100	0,160	100		
14,00	100	0,080	99,4		
10,00	100				
5,00	100				

SAMBLE IDENTIFICATION

Sample	10BH-11 (SS-05)
Depth	3,05 - 3,66 m
Soil Description	
Silt	

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

F104/970307(0)

Groupe ABS

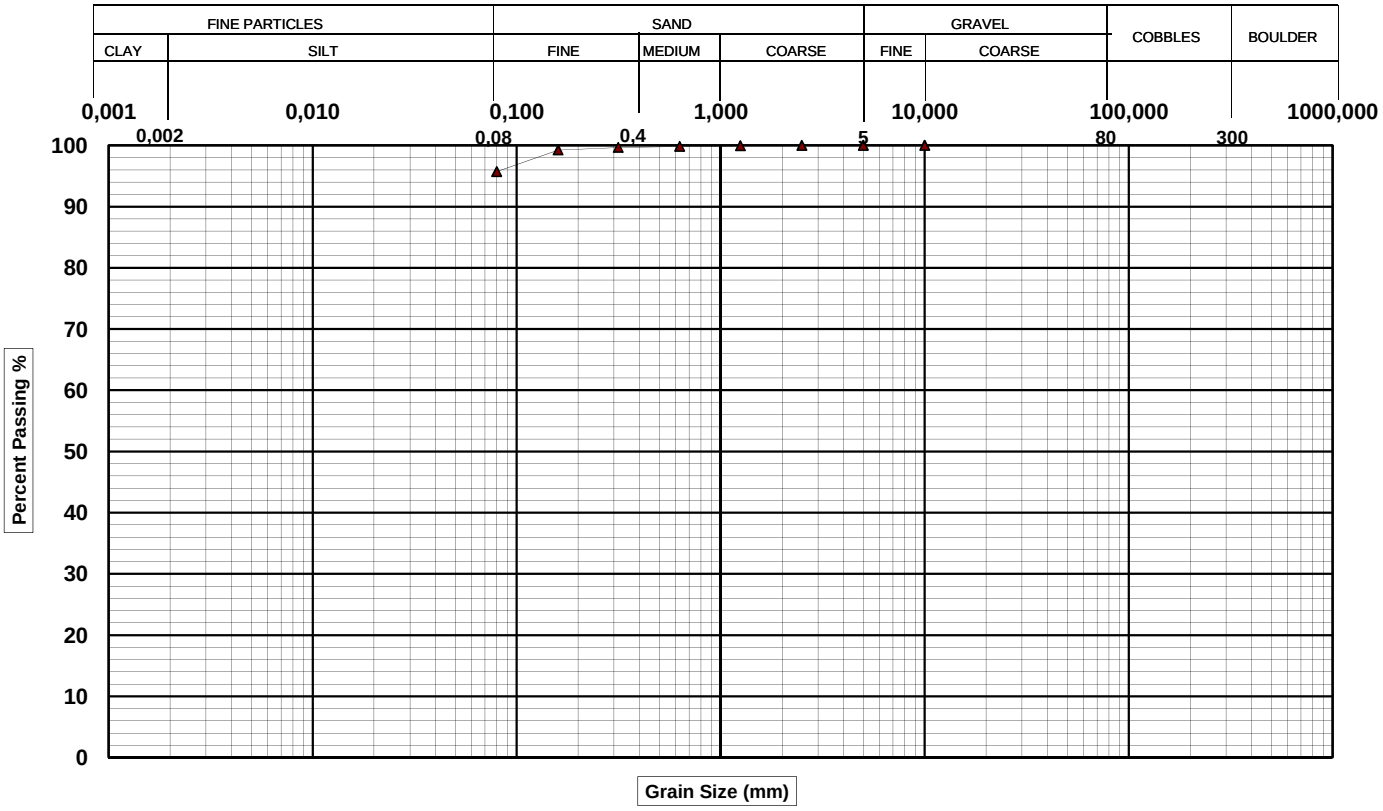
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36427



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	95,7	4,3	0,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	18

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	100		
56,00	100	1,250	100		
40,00	100	0,630	100		
31,50	100	0,315	100		
20,00	100	0,160	99		
14,00	100	0,080	95,7		
10,00	100				
5,00	100				

SAMBLE IDENTIFICATION

Sample	10BH-11 (SS-11)
Depth	8,53 - 9,14 m

Soil Description

Silt, traces of sand

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

F104/970307(0)

Groupe ABS

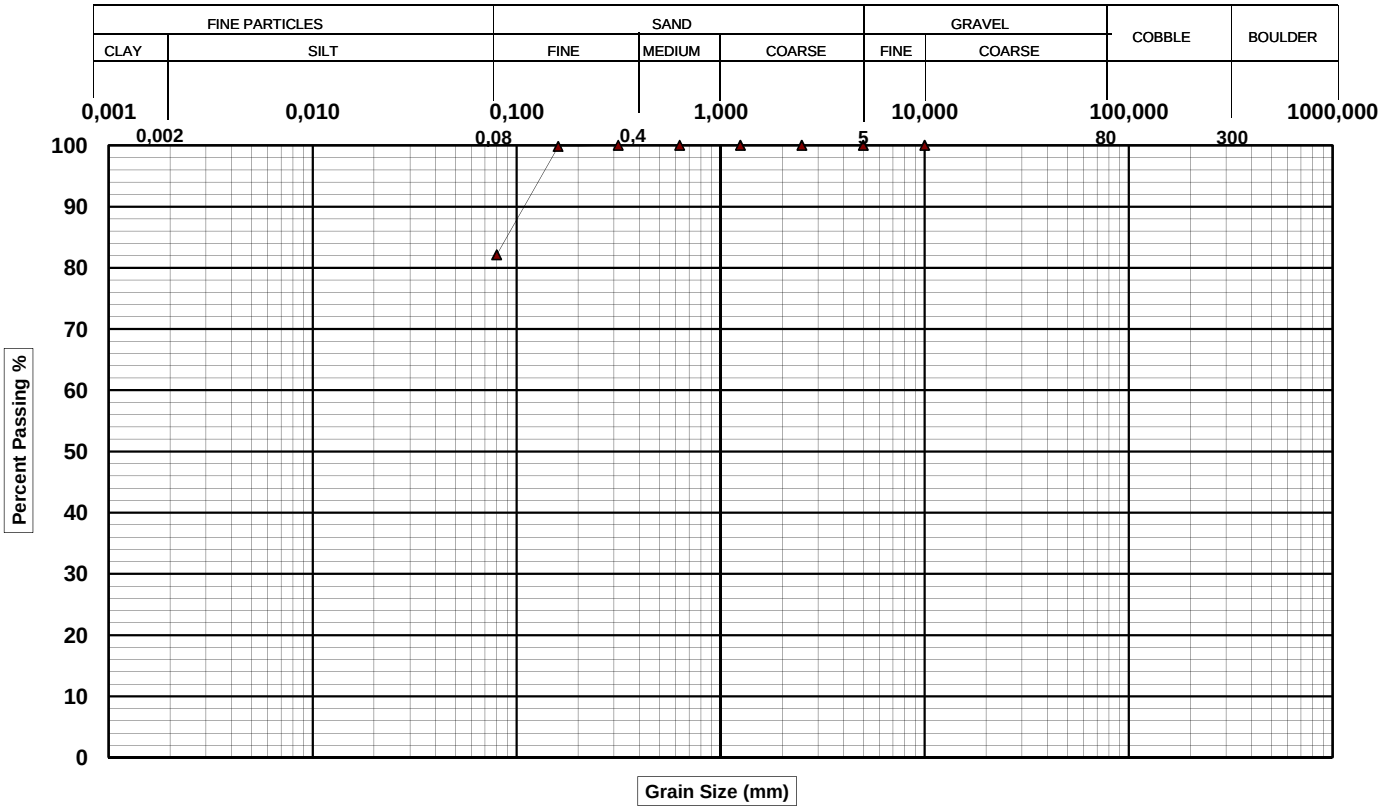
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36421



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	82,1	17,9	0,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	19

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	100		
56,00	100	1,250	100		
40,00	100	0,630	100		
31,50	100	0,315	100		
20,00	100	0,160	100		
14,00	100	0,080	82,1		
10,00	100				
5,00	100				

SAMBLE IDENTIFICATION

Sample	10BH-06 (SS-06)
Depth	4,27 - 4,88 m

Soil Description

Silt, some sand

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

F104/970307(0)

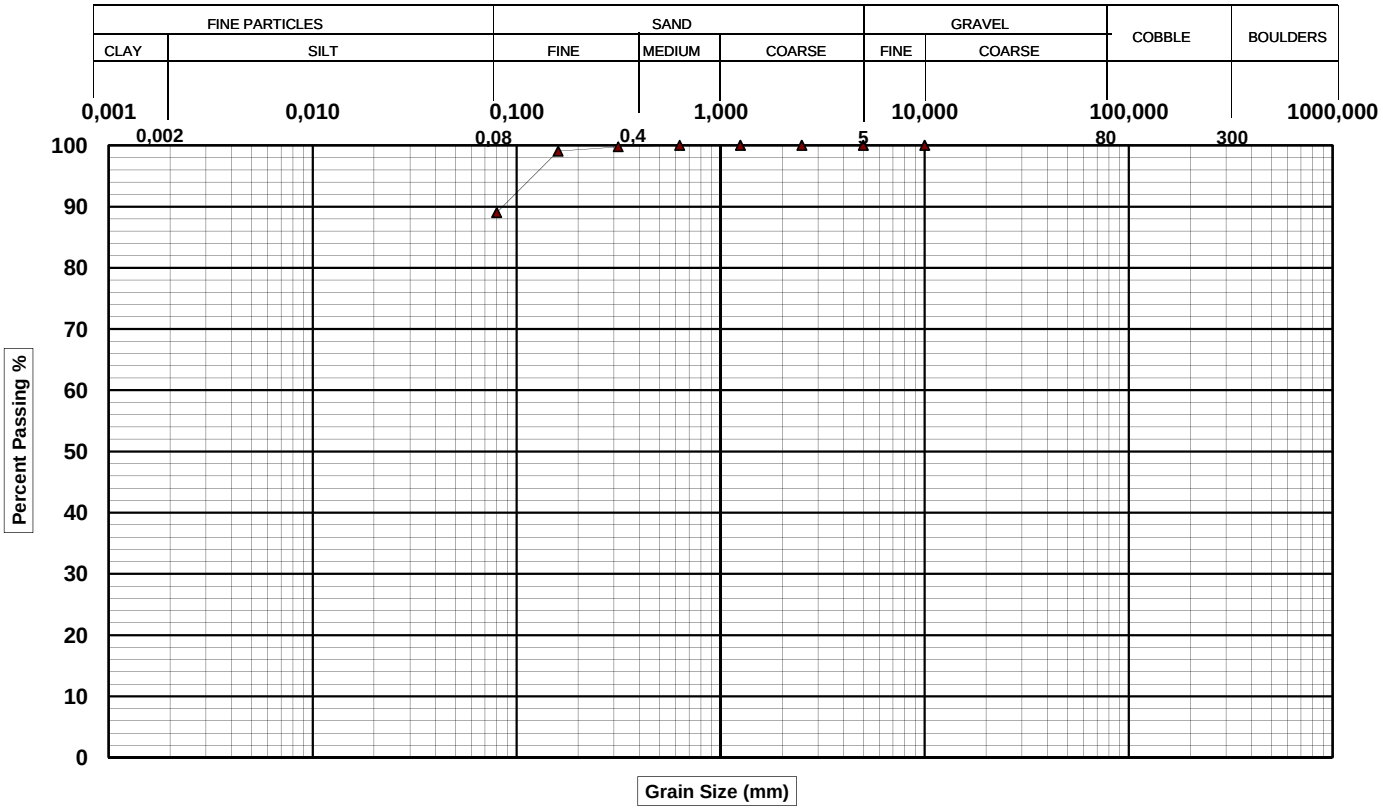
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36431



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	89,0	11,0	0,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	16

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	100		
56,00	100	1,250	100		
40,00	100	0,630	100		
31,50	100	0,315	100		
20,00	100	0,160	99		
14,00	100	0,080	89,0		
10,00	100				
5,00	100				

SAMBLE IDENTIFICATION

Sample	10BH-08 (SS-12)
Depth	9,75 - 10,36 m

Soil Description

Silt, some sand

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

Groupe ABS

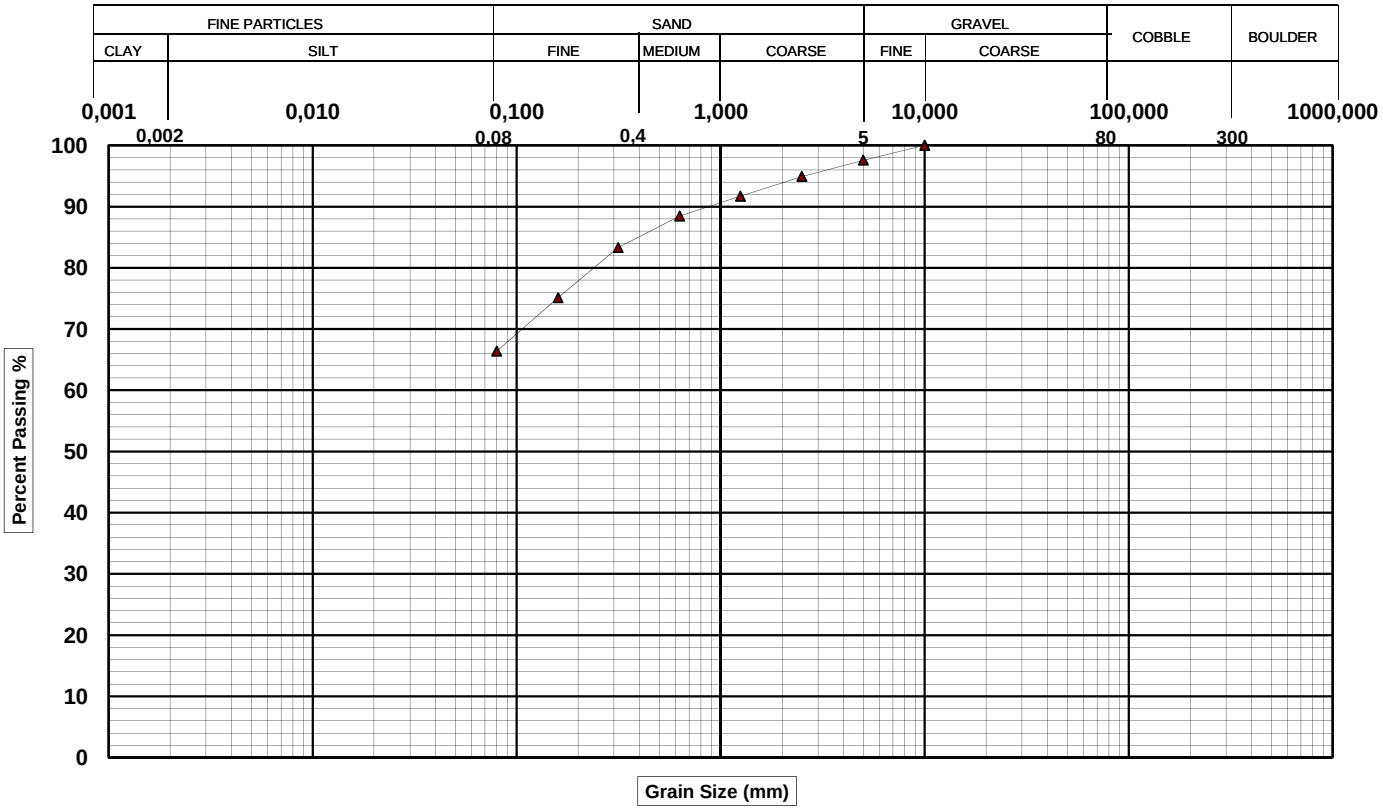
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36434



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	66,4	31,2	2,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	13

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	95		
56,00	100	1,250	92		
40,00	100	0,630	88		
31,50	100	0,315	83		
20,00	100	0,160	75		
14,00	100	0,080	66,4		
10,00	100				
5,00	98				

SAMBLE IDENTIFICATION

Sample	10BH-13 (SS-09)
Depth	7,01 - 7,62 m

Soil Description

Sandy silt, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

Groupe ABS

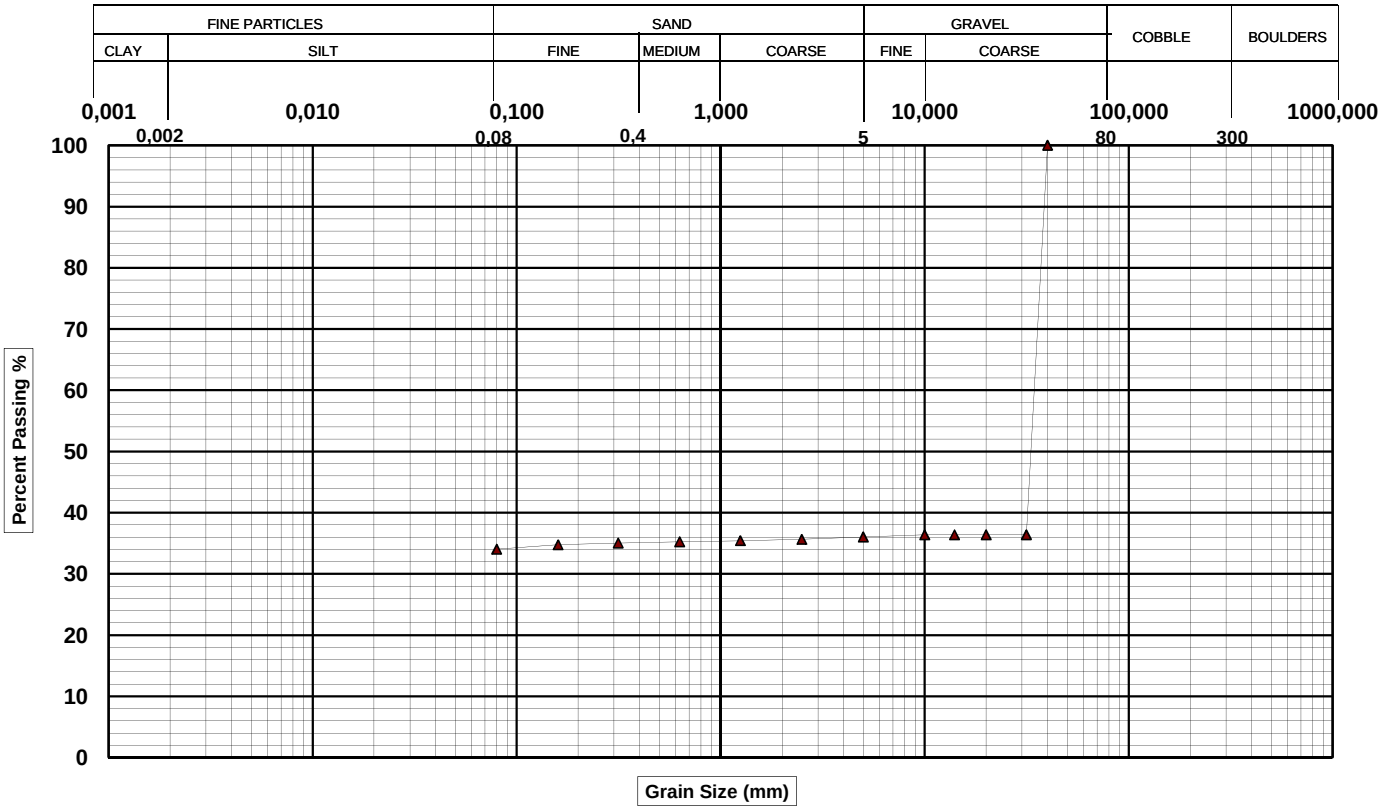
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36435



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	34,0	2,0	64,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	7

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	36		
56,00	100	1,250	35		
40,00	100	0,630	35		
31,50	36	0,315	35		
20,00	36	0,160	35		
14,00	36	0,080	34,0		
10,00	36				
5,00	36				

SAMBLE IDENTIFICATION

Sample	10F-13 (CF-13)
Depth	10,67 - 11,28 m

Soil Description

Gravel silteux, traces of sand

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

Groupe ABS

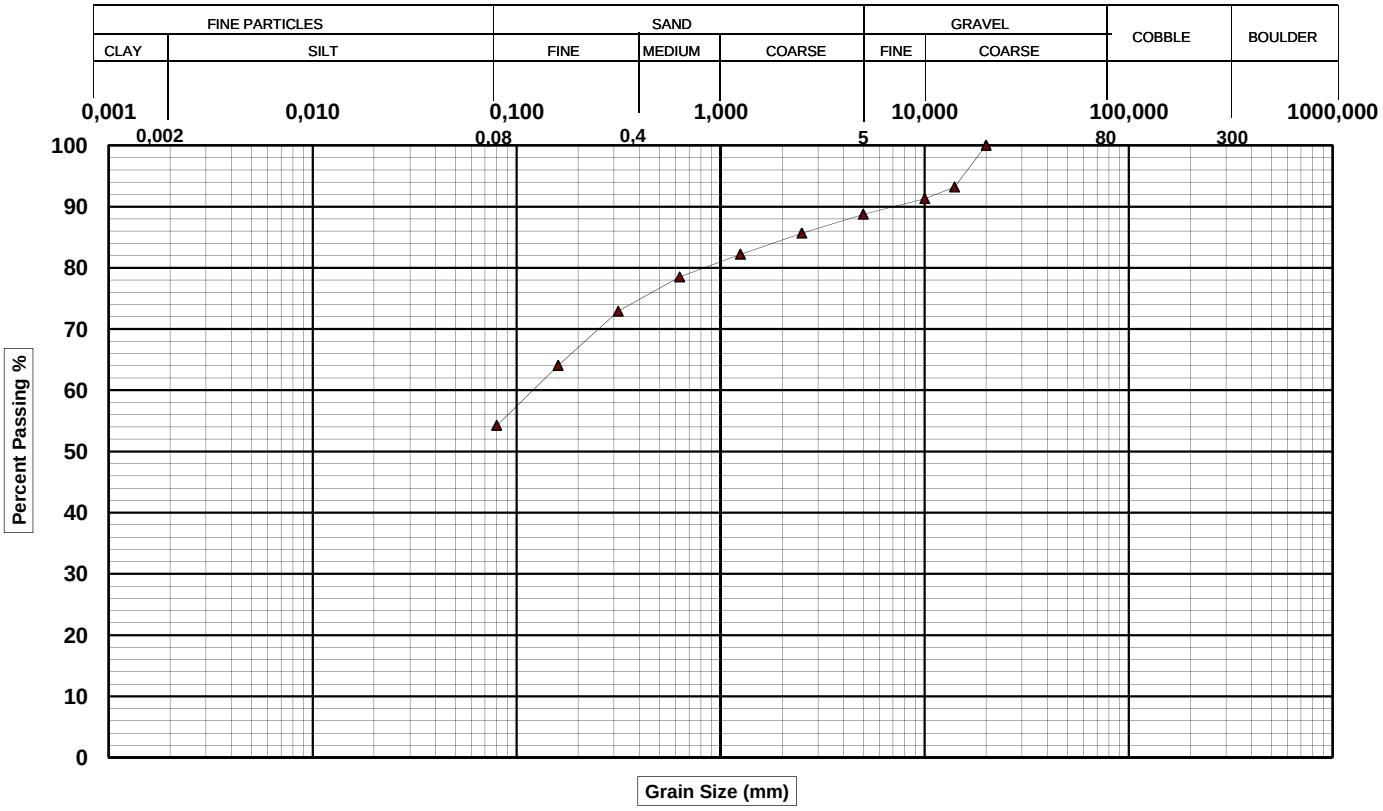
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 34633



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	54,2	34,5	11,3	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,12	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	86		
56,00	100	1,250	82		
40,00	100	0,630	79		
31,50	100	0,315	73		
20,00	100	0,160	64		
14,00	93	0,080	54,2		
10,00	91				
5,00	89				

SAMBLE IDENTIFICATION

Sample	10BH-13 (SS-05)
Depth	3,35 - 3, 96 m

Soil Description

Sandy silt, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

F104/970307(0)

Groupe ABS

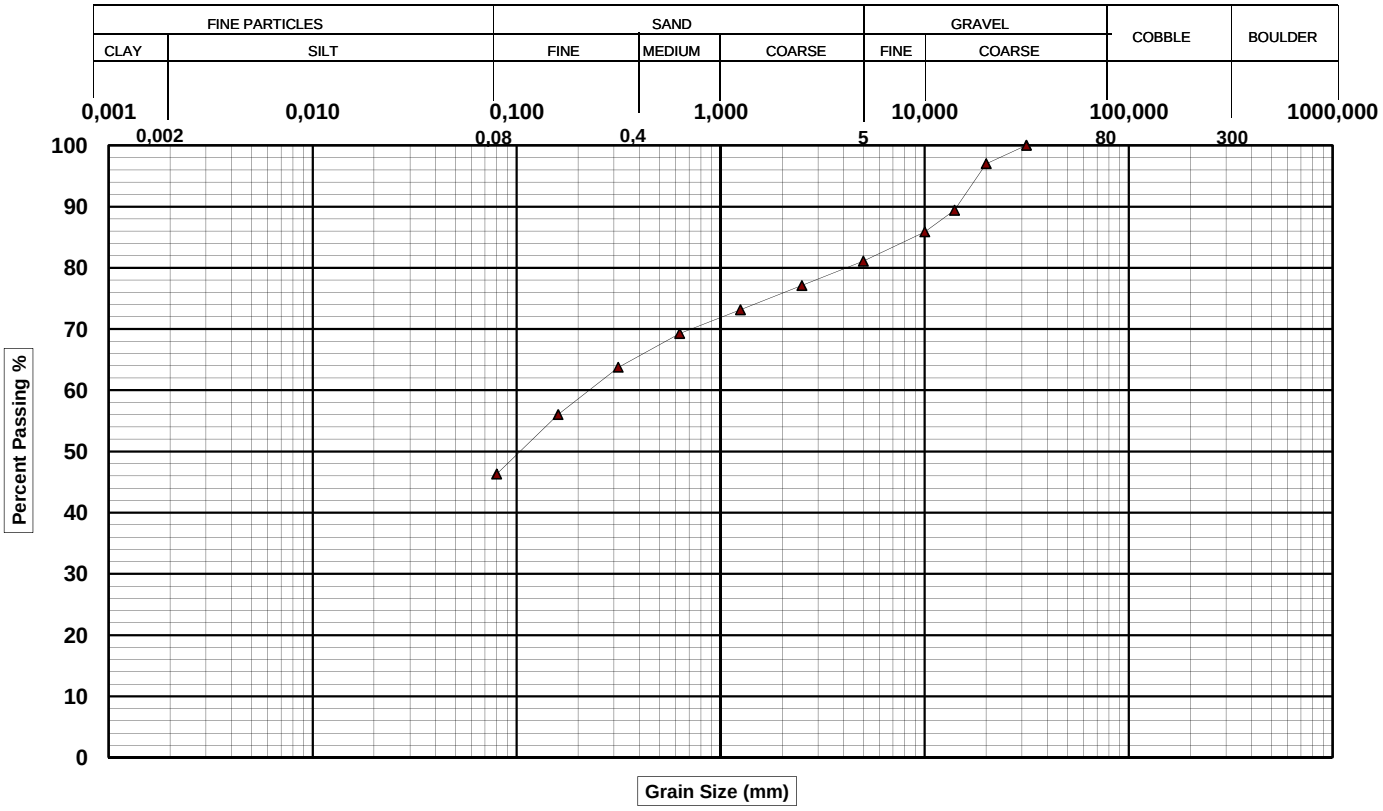
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36432



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	46,3	34,8	18,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,23	N/A	N/A	8

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	77		
56,00	100	1,250	73		
40,00	100	0,630	69		
31,50	100	0,315	64		
20,00	97	0,160	56		
14,00	89	0,080	46,3		
10,00	86				
5,00	81				

SAMBLE IDENTIFICATION

Sample	10BH-08 (SS-16)
Depth	15,00 - 15,61 m

Soil Description

Sandy silt, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

F104/970307(0)

Groupe ABS

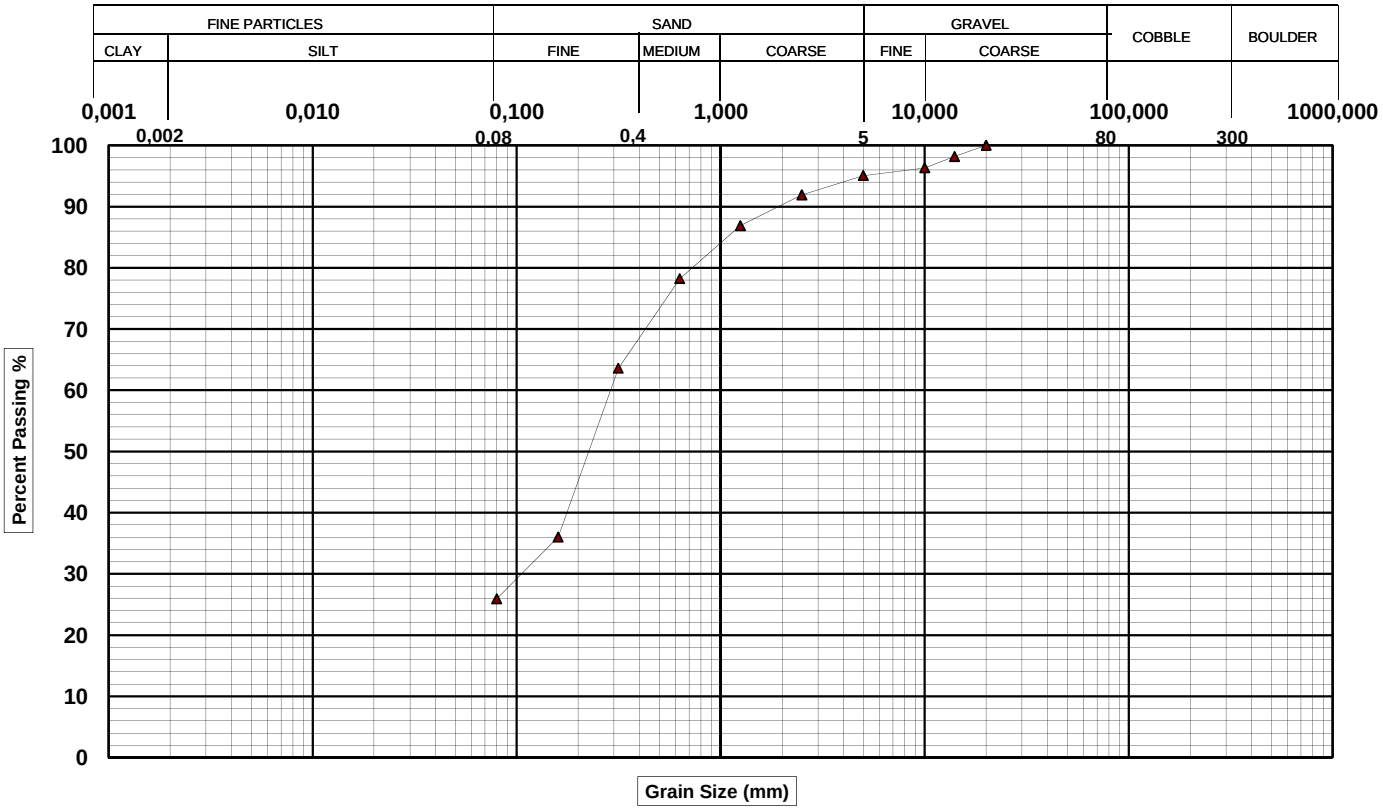
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36436



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	25,9	69,1	4,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	0,10	0,30	N/A	N/A	16

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	92		
56,00	100	1,250	87		
40,00	100	0,630	78		
31,50	100	0,315	64		
20,00	100	0,160	36		
14,00	98	0,080	25,9		
10,00	96				
5,00	95				

SAMBLE IDENTIFICATION

Sample	10BH-13 (SS-16)
Depth	15,24 - 15,85 m

Soil Description

Silty sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

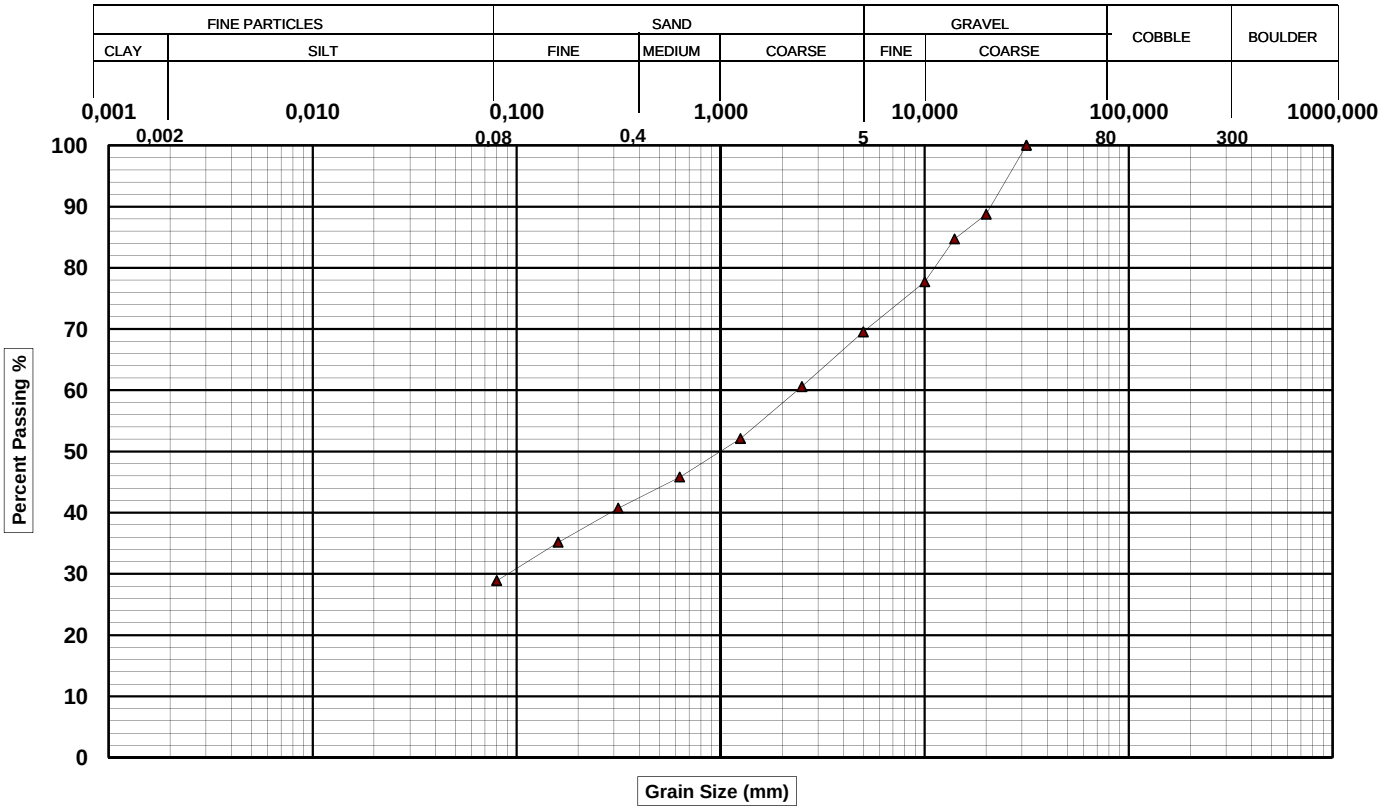
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36424



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	28,9	40,6	30,5	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	0,09	0,25	N/A	N/A	8

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	61		
56,00	100	1,250	52		
40,00	100	0,630	46		
31,50	100	0,315	41		
20,00	89	0,160	35		
14,00	85	0,080	28,9		
10,00	78				
5,00	70				

SAMBLE IDENTIFICATION

Sample	10BH-07 (SS-07)
Depth	5,18 - 5,79 m
Soil Description	
Silty gravelly sand	

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

Groupe ABS

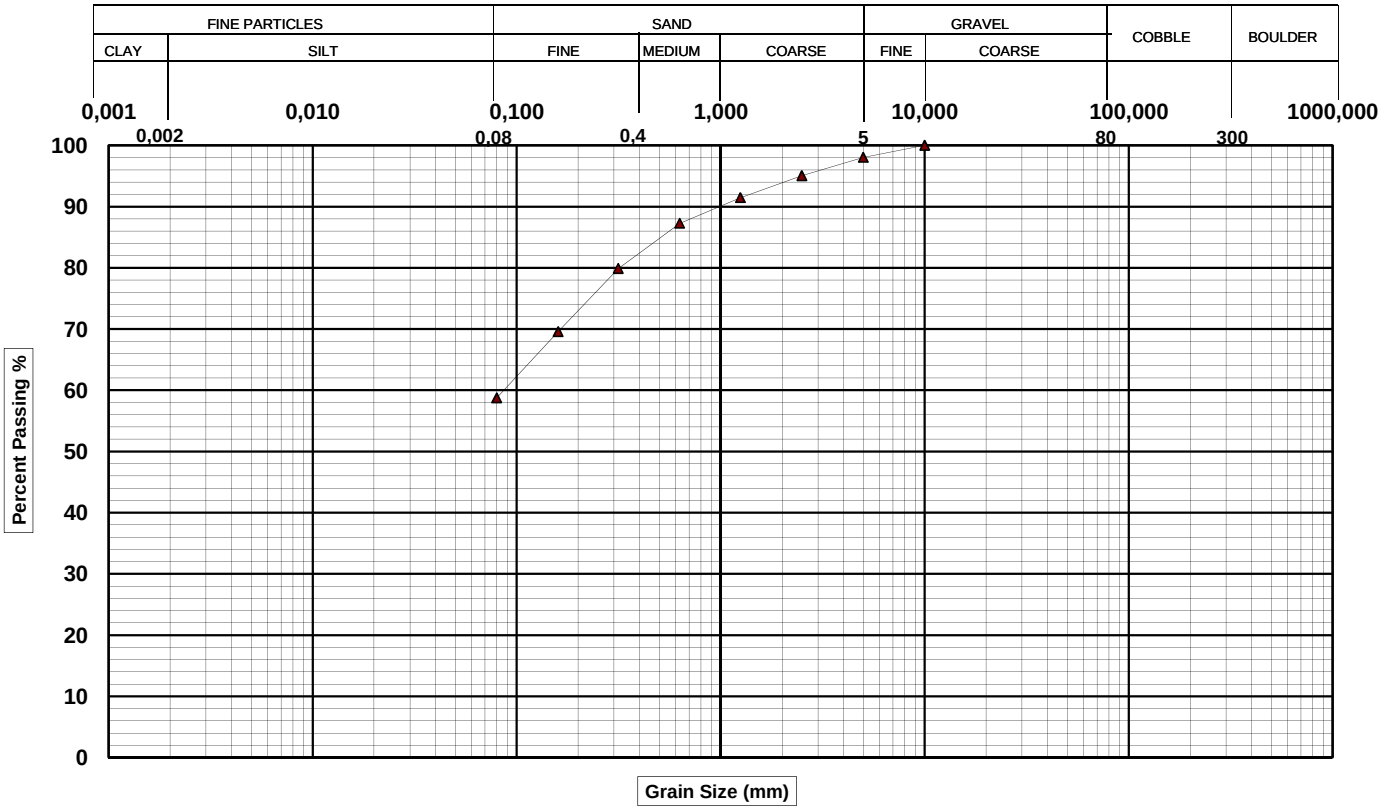
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36429



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	58,7	39,3	2,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,09	N/A	N/A	4

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	95		
56,00	100	1,250	91		
40,00	100	0,630	87		
31,50	100	0,315	80		
20,00	100	0,160	70		
14,00	100	0,080	58,7		
10,00	100				
5,00	98				

SAMBLE IDENTIFICATION

Sample	10BH-08 (SS-04)
Depth	2,44 - 3,05 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

Groupe ABS

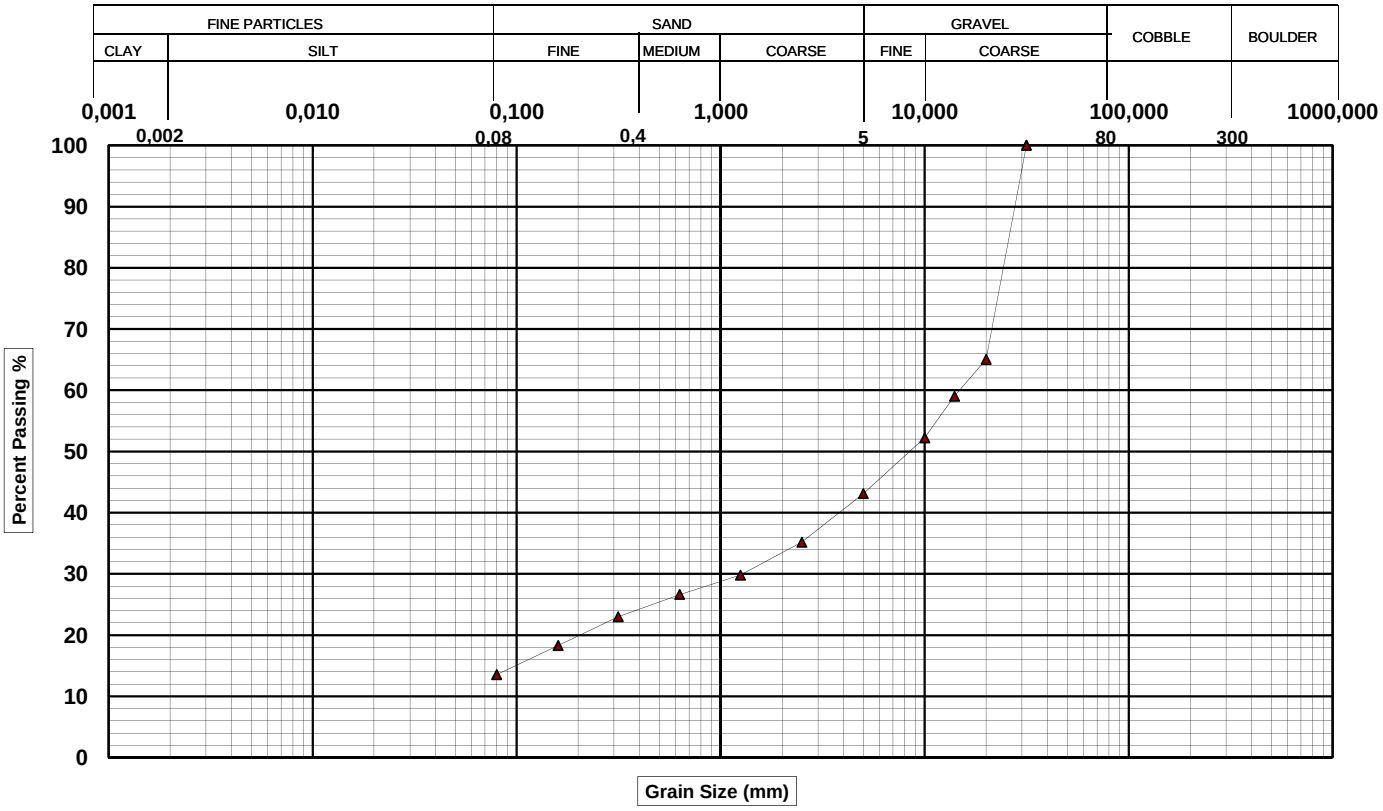
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36428



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	13,5	29,6	56,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	1,40	N/A	N/A	N/A	6

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	35		
56,00	100	1,250	30		
40,00	100	0,630	27		
31,50	100	0,315	23		
20,00	65	0,160	18		
14,00	59	0,080	13,5		
10,00	52				
5,00	43				

SAMBLE IDENTIFICATION

Sample	10BH-11 (SS-13)
Depth	10,67 - 11,28 m

Soil Description

Sandy gravel, some silt

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

Groupe ABS

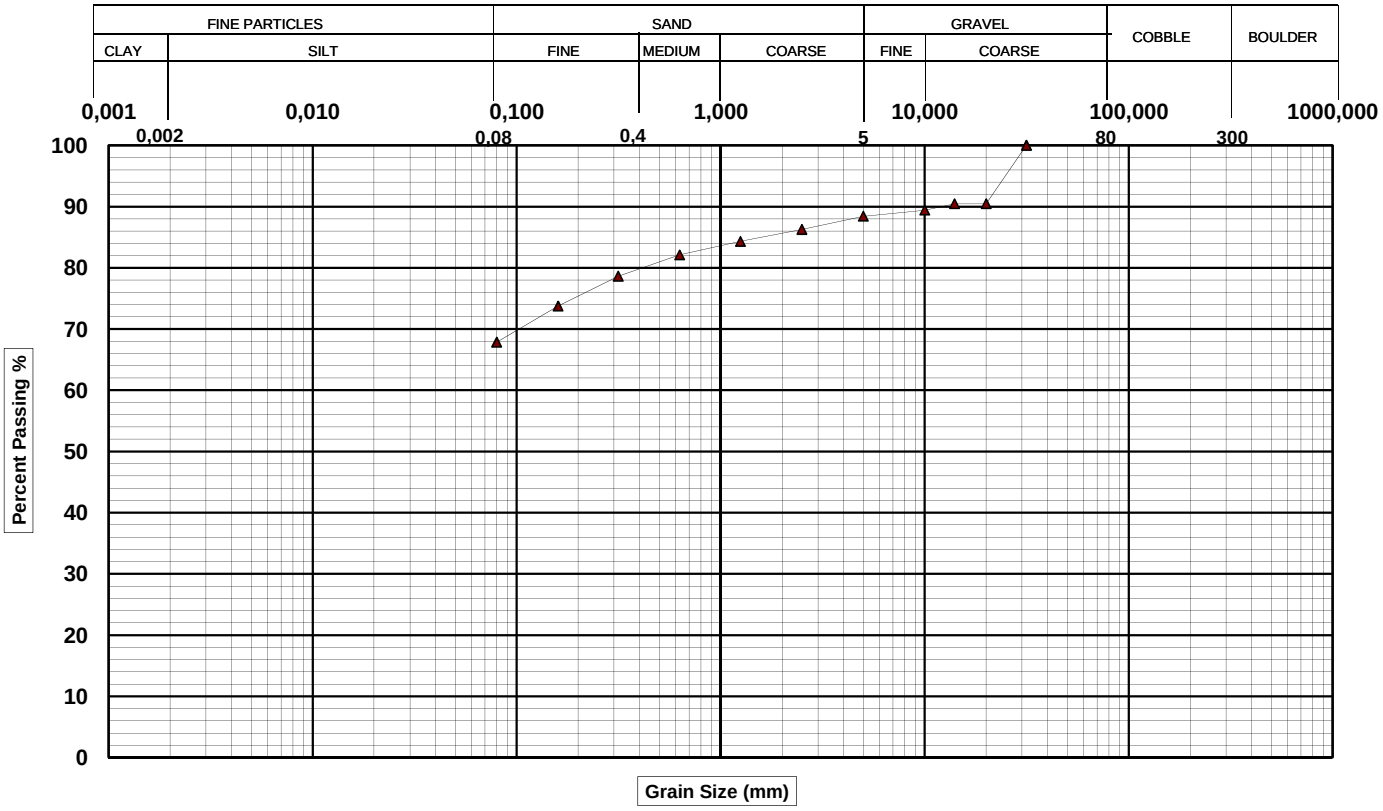
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36430



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	67,9	20,6	11,6	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	13

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	86		
56,00	100	1,250	84		
40,00	100	0,630	82		
31,50	100	0,315	79		
20,00	90	0,160	74		
14,00	90	0,080	67,9		
10,00	89				
5,00	88				

SAMBLE IDENTIFICATION

Sample	10BH-08 (SS-09)
Depth	7,01 - 7,62 m

Soil Description

Sandy silt, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-08

F104/970307(0)

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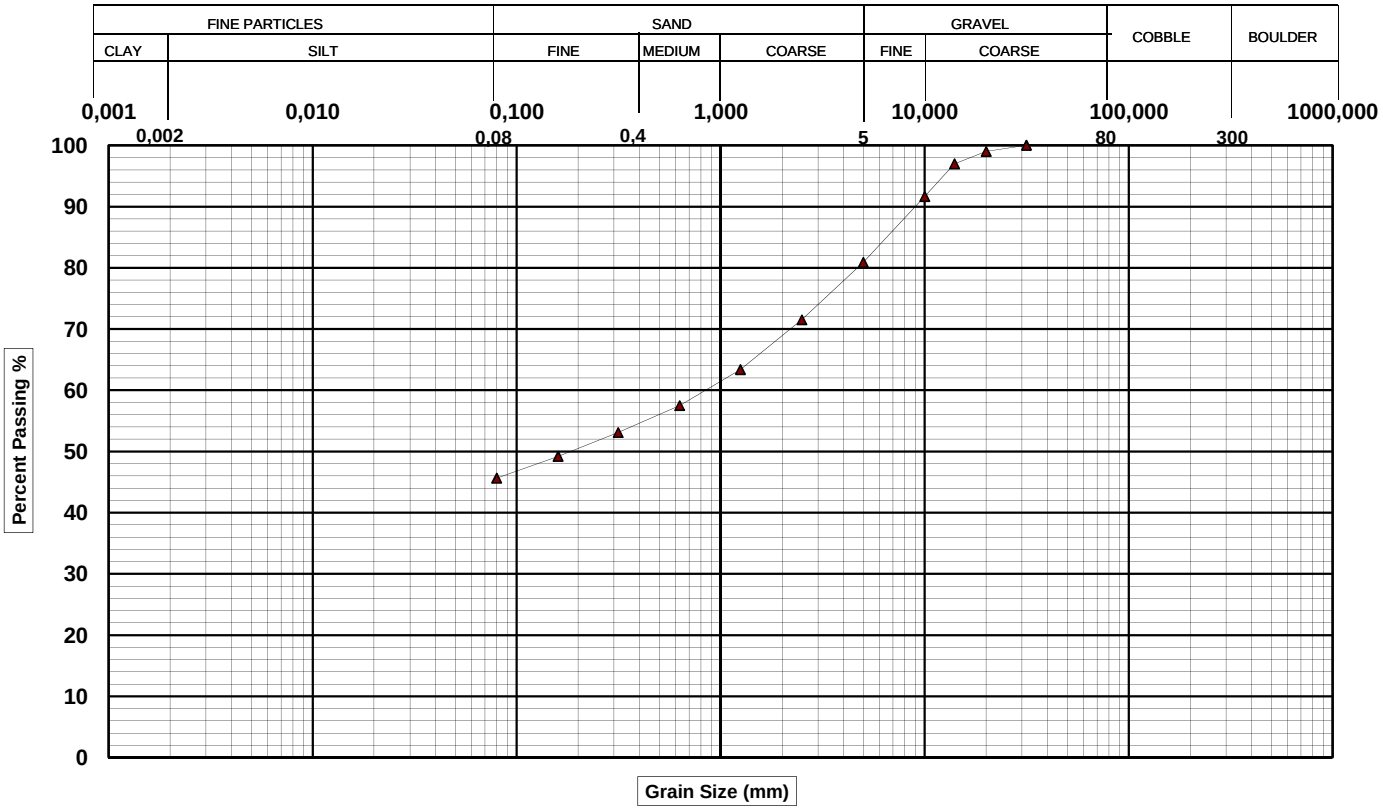
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36525



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	45,7	35,2	19,1	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,86	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	72		
56,00	100	1,250	63		
40,00	100	0,630	58		
31,50	100	0,315	53		
20,00	99	0,160	49		
14,00	97	0,080	45,7		
10,00	92				
5,00	81				

SAMBLE IDENTIFICATION

Sample	10BH-29 (SS-05)
Depth	3,35 - 3,86 m

Soil Description

Silt and sand, a little gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-12

Groupe ABS

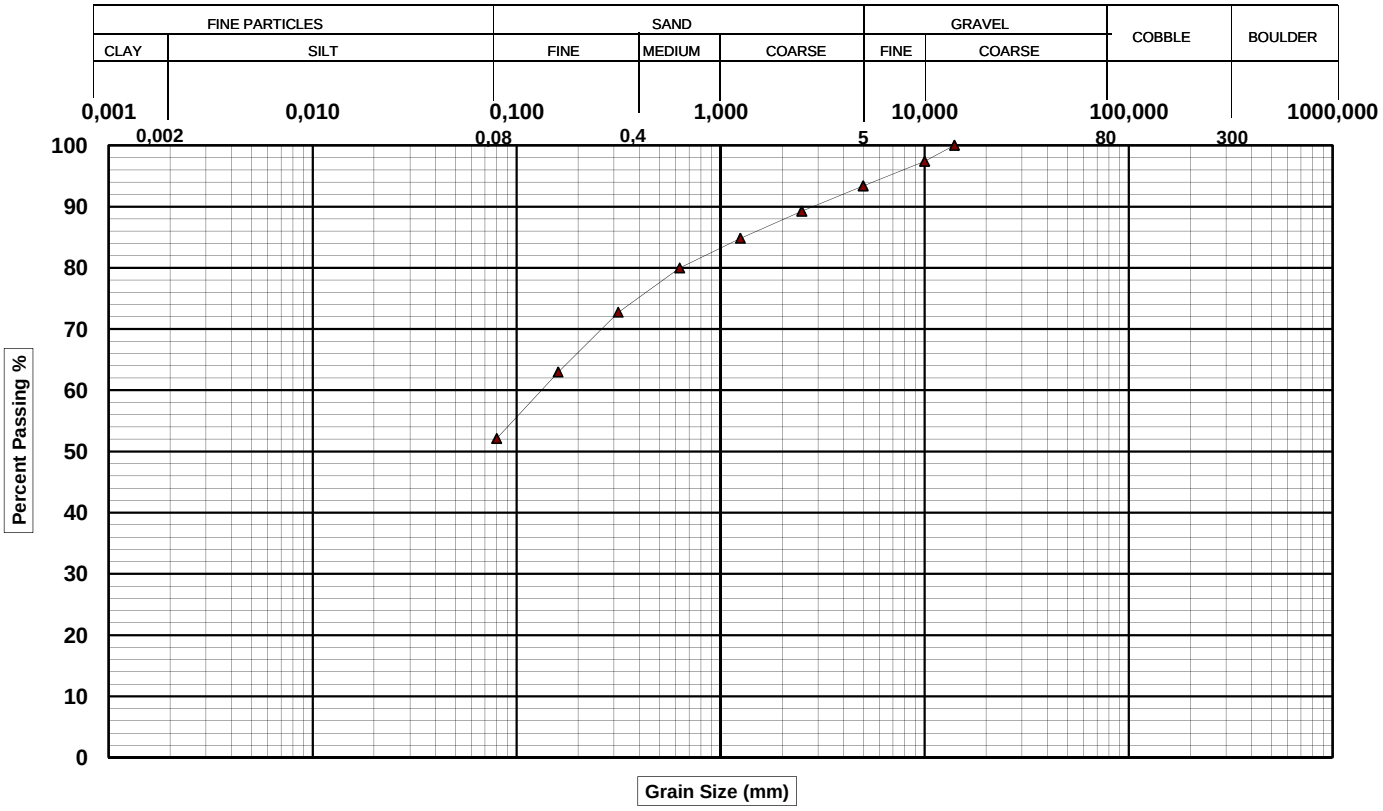
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36524



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	52,1	41,2	6,6	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,15	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	89		
56,00	100	1,250	85		
40,00	100	0,630	80		
31,50	100	0,315	73		
20,00	100	0,160	63		
14,00	100	0,080	52,1		
10,00	97				
5,00	93				

SAMBLE IDENTIFICATION

Sample	10BH-29 (SS-03)
Depth	1,52 - 2,13 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-12

Groupe ABS

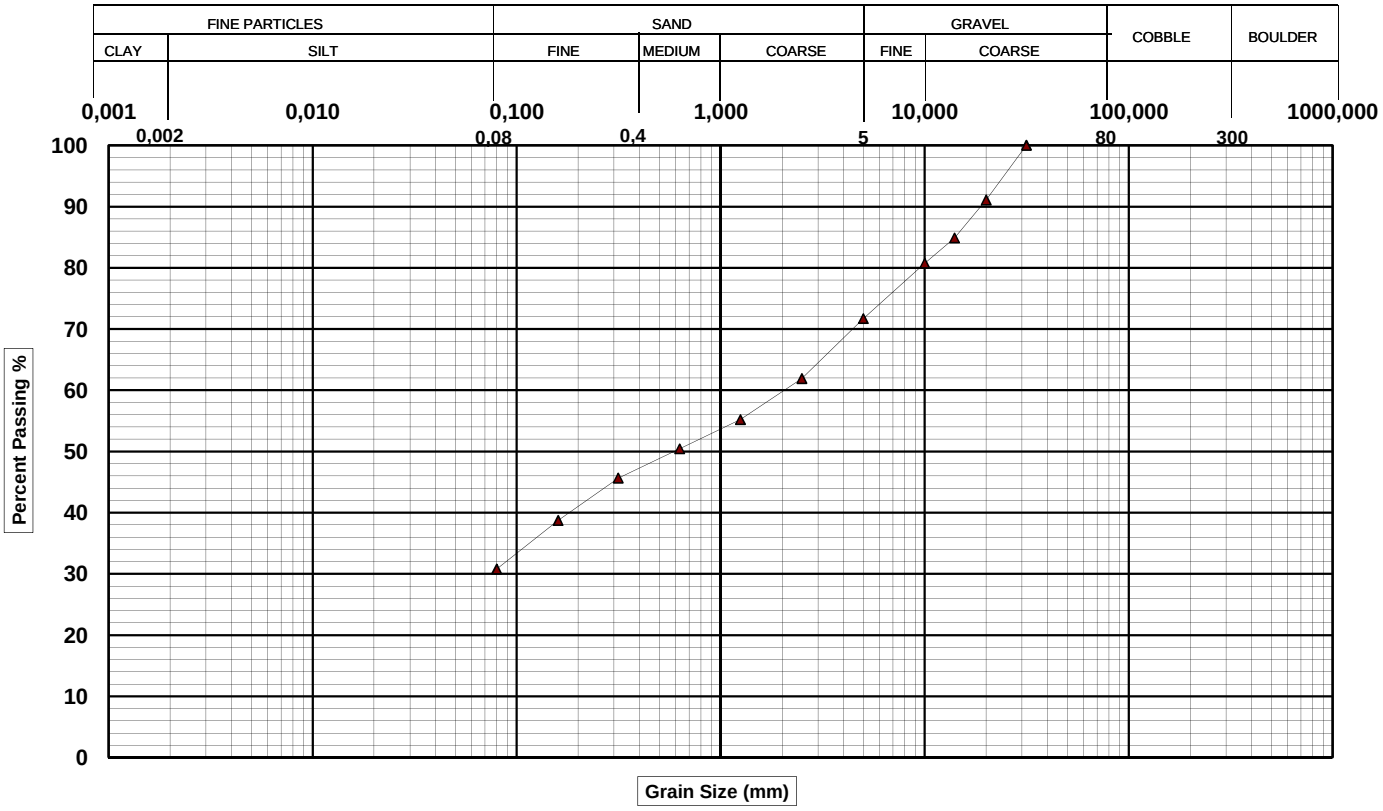
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36527



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	30,8	40,9	28,3	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	2,00	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	62		
56,00	100	1,250	55		
40,00	100	0,630	50		
31,50	100	0,315	46		
20,00	91	0,160	39		
14,00	85	0,080	30,8		
10,00	81				
5,00	72				

SAMBLE IDENTIFICATION

Sample	10BH-30 (SS-03)
Depth	1,52 - 2,13 m

Soil Description

Silty gravelly sand

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-12

F104/970307(0)

Groupe ABS

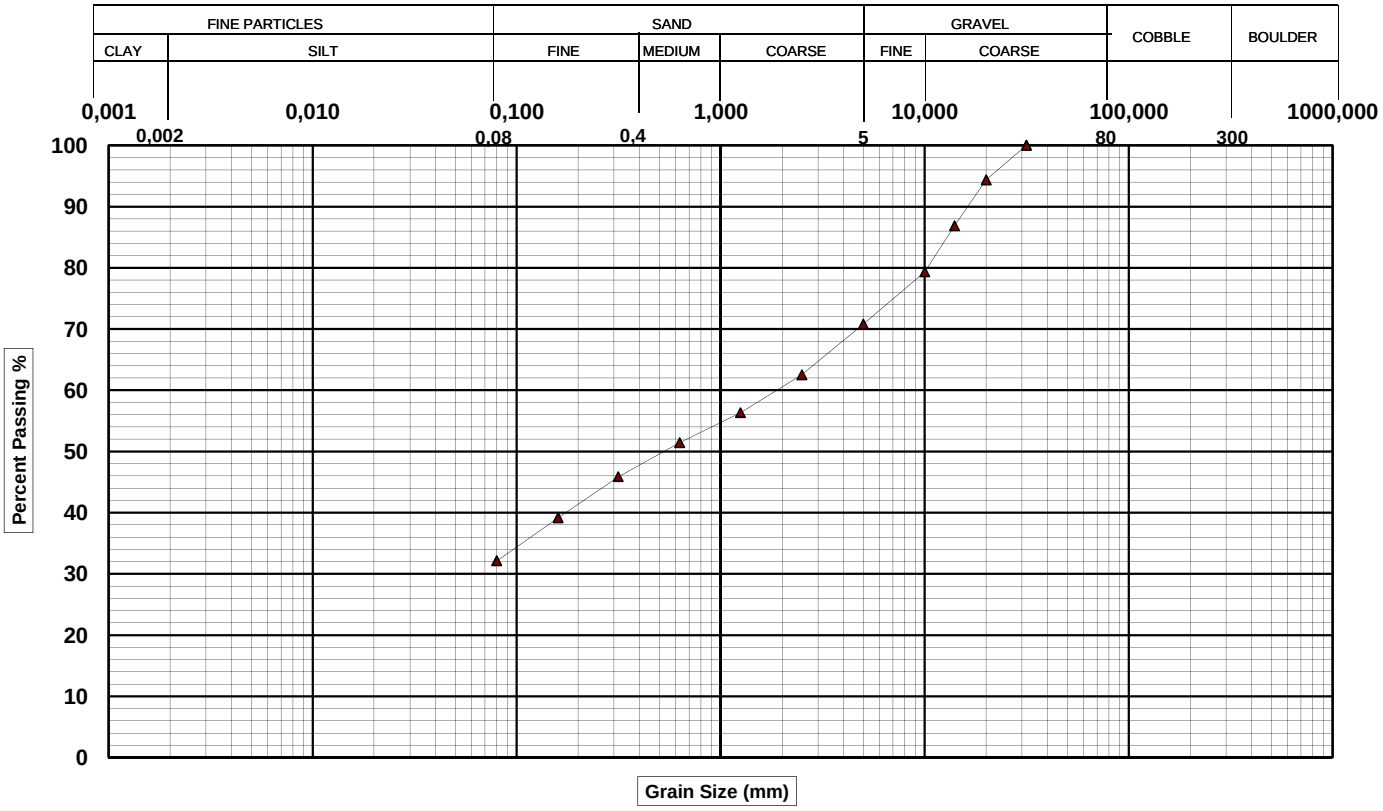
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36522



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	32,1	38,7	29,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	2,00	N/A	N/A	8

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	63		
56,00	100	1,250	56		
40,00	100	0,630	51		
31,50	100	0,315	46		
20,00	94	0,160	39		
14,00	87	0,080	32,1		
10,00	79				
5,00	71				

SAMBLE IDENTIFICATION

Sample	10BH-25 (SS-06)
Depth	4,27 - 4,88 m
Soil Description	
Gravelly silty sand	

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-12

F104/970307(0)

Groupe ABS

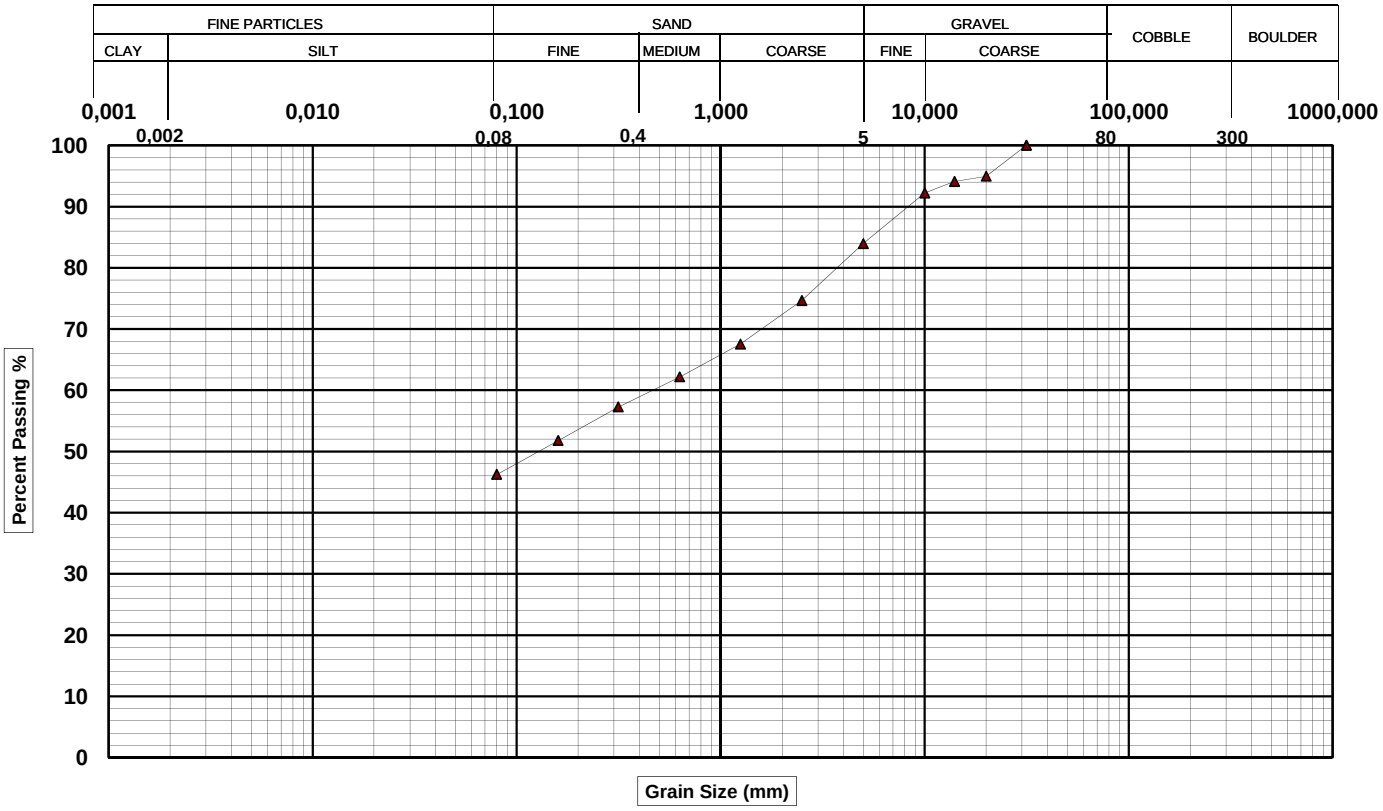
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36528



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	46,2	37,7	16,1	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,49	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	75		
56,00	100	1,250	68		
40,00	100	0,630	62		
31,50	100	0,315	57		
20,00	95	0,160	52		
14,00	94	0,080	46,2		
10,00	92				
5,00	84				

SAMBLE IDENTIFICATION

Sample	10BH-30 (SS-06)
Depth	4,57 - 5,18 m

Soil Description

Silt and sand, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-12

Groupe ABS

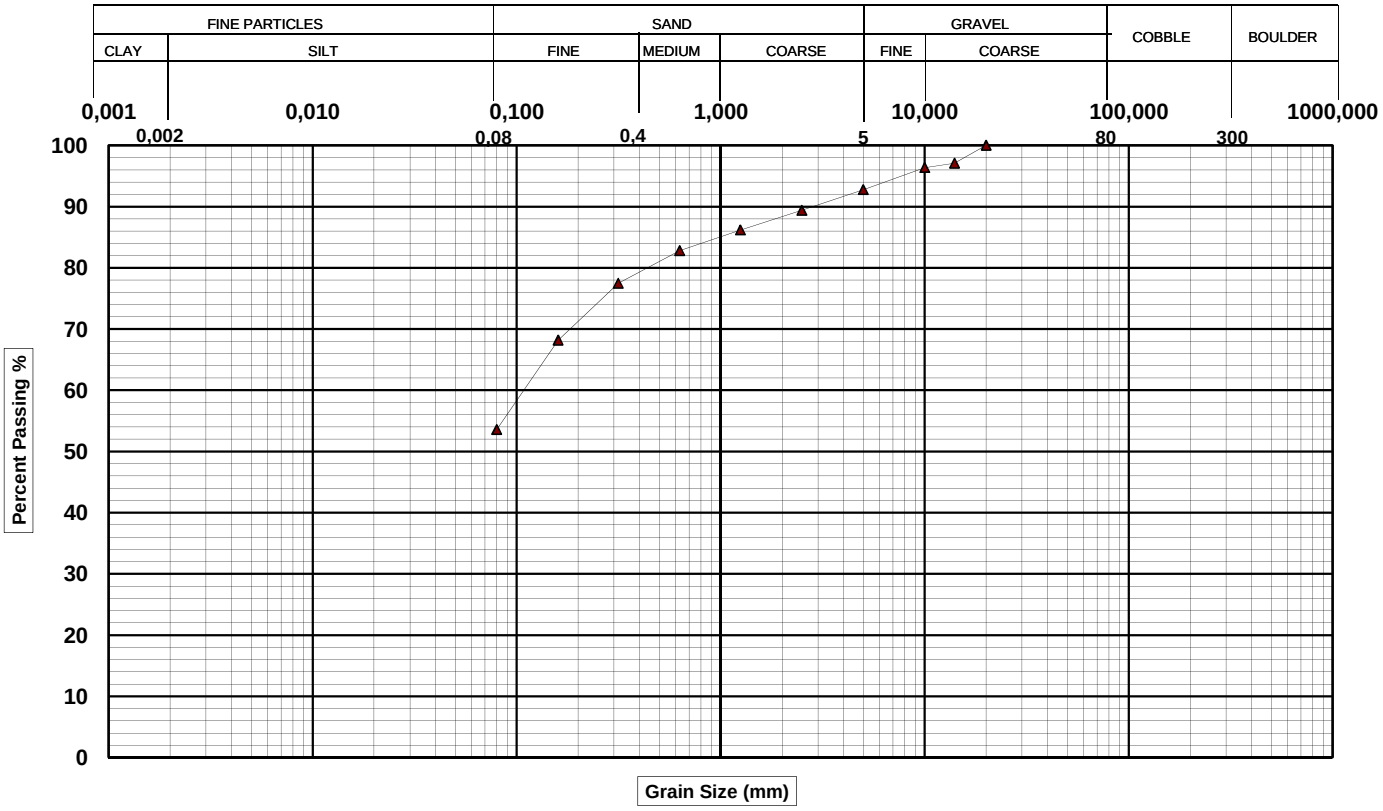
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36521



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	53,6	39,2	7,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,11	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	89		
56,00	100	1,250	86		
40,00	100	0,630	83		
31,50	100	0,315	77		
20,00	100	0,160	68		
14,00	97	0,080	53,6		
10,00	96				
5,00	93				

SAMBLE IDENTIFICATION

Sample	10BH-26 (SS-03)
Depth	1,52 - 2,13 m

Soil Description

Silt and sand, taces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-12

Groupe ABS

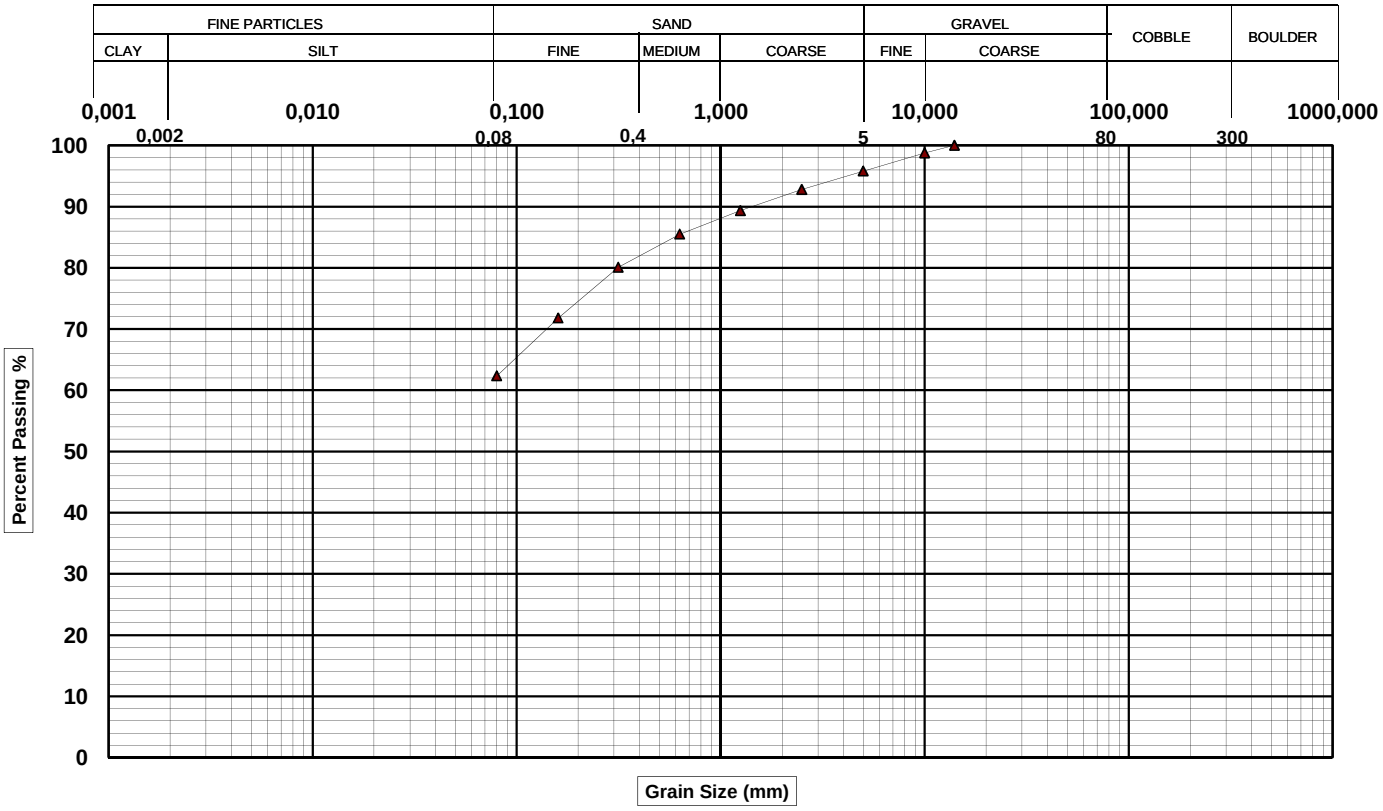
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36529



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	62,3	33,4	4,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	6

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	93		
56,00	100	1,250	89		
40,00	100	0,630	86		
31,50	100	0,315	80		
20,00	100	0,160	72		
14,00	100	0,080	62,3		
10,00	99				
5,00	96				

SAMBLE IDENTIFICATION

Sample	10BH-32 (SS-02)
Depth	0,61 - 1,22

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-12

Groupe ABS

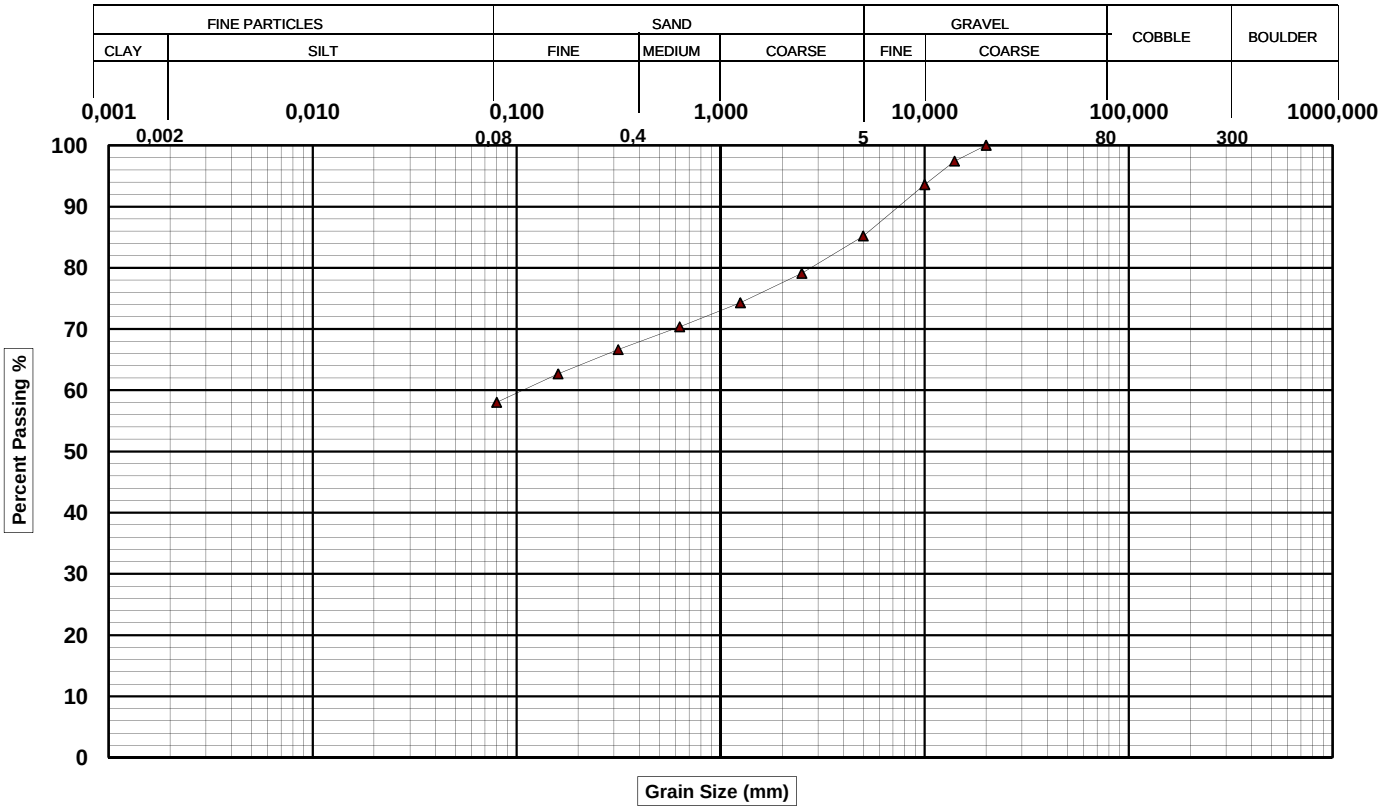
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36530



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	58,1	27,1	14,8	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,11	N/A	N/A	12

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	79		
56,00	100	1,250	74		
40,00	100	0,630	70		
31,50	100	0,315	67		
20,00	100	0,160	63		
14,00	97	0,080	58,1		
10,00	94				
5,00	85				

SAMBLE IDENTIFICATION

Sample	10BH-32 (SS-07)
Depth	4,57 - 5,18 m

Soil Description

Sandy silt, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-12

F104/970307(0)

Groupe ABS

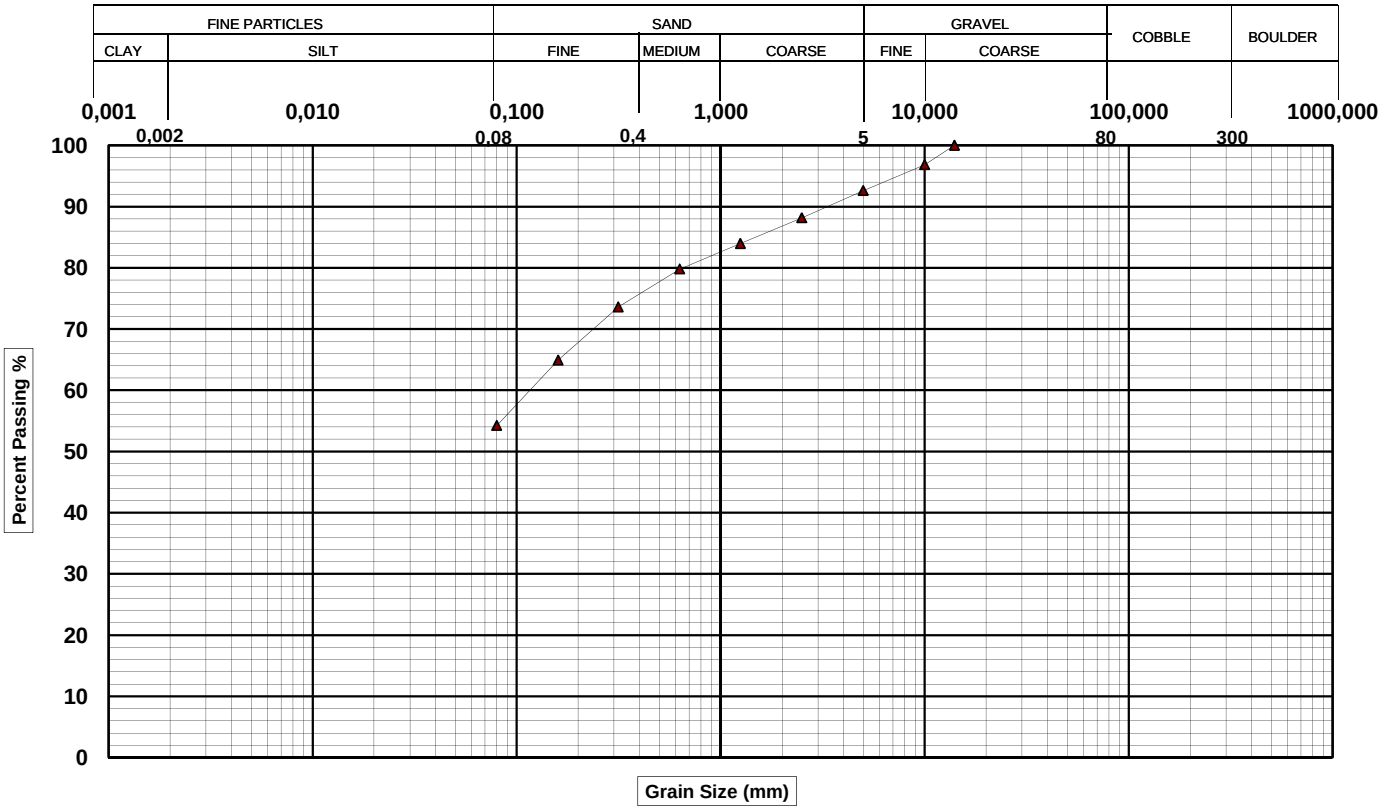
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36545



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	54,2	38,4	7,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,12	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	88		
56,00	100	1,250	84		
40,00	100	0,630	80		
31,50	100	0,315	74		
20,00	100	0,160	65		
14,00	100	0,080	54,2		
10,00	97				
5,00	93				

SAMBLE IDENTIFICATION

Sample	10BH-17A (SS-07)
Depth	5,18 - 5,79 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

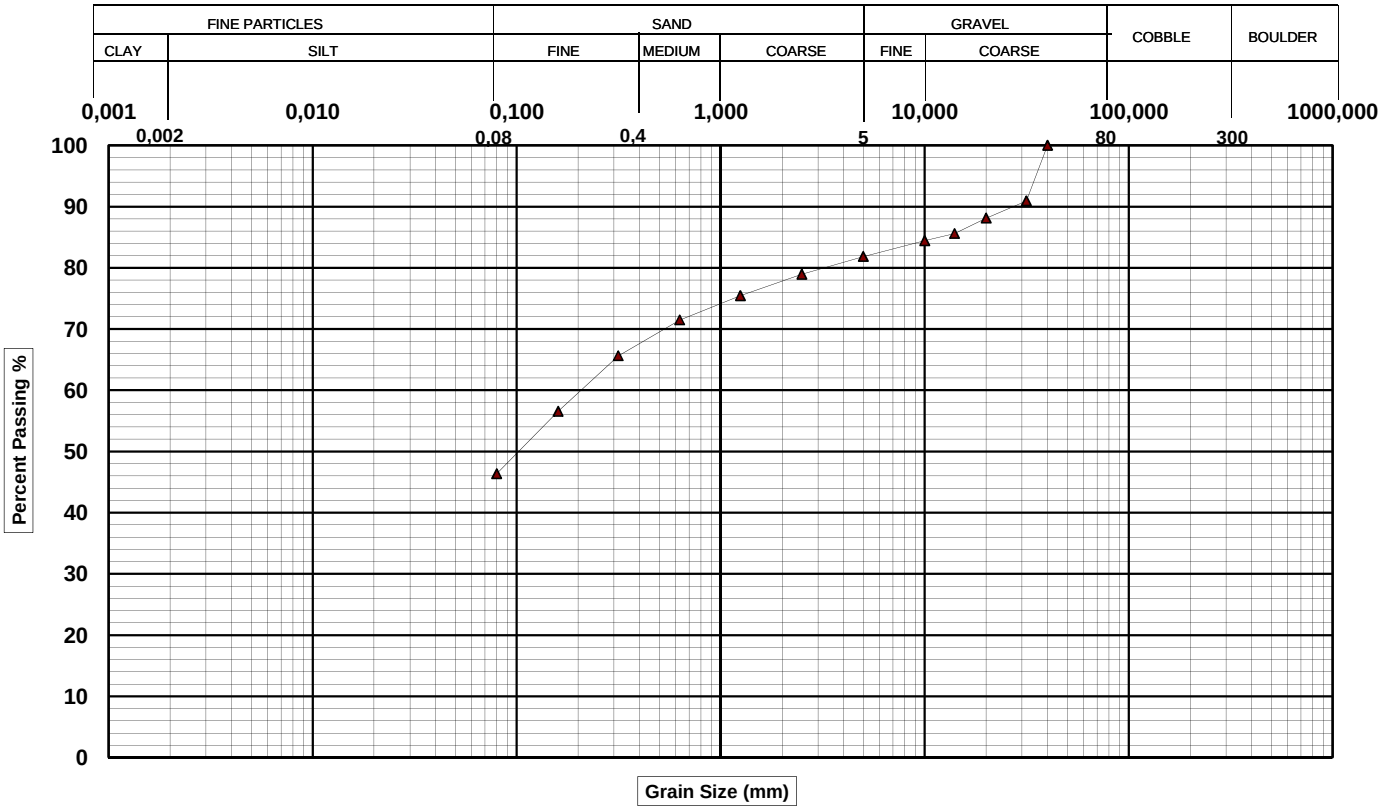
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36535



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	46,4	35,5	18,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,20	N/A	N/A	9

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	79		
56,00	100	1,250	75		
40,00	100	0,630	71		
31,50	91	0,315	66		
20,00	88	0,160	57		
14,00	86	0,080	46,4		
10,00	84				
5,00	82				

SAMBLE IDENTIFICATION

Sample	10BH-10 (SS-04)
Depth	2,44 - 3,05 m

Soil Description

Silt and sand, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

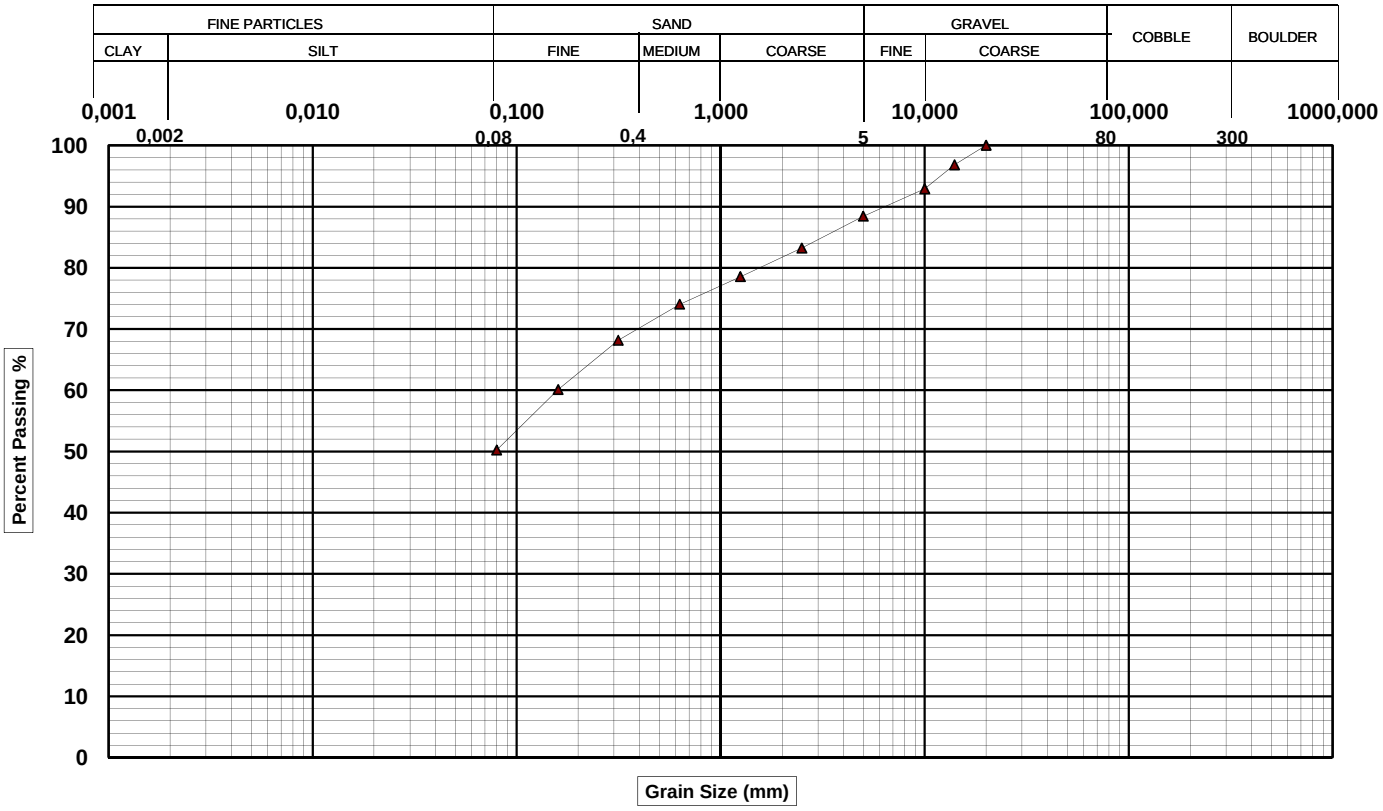
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36536



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	50,2	38,2	11,6	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,17	N/A	N/A	8

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	83		
56,00	100	1,250	79		
40,00	100	0,630	74		
31,50	100	0,315	68		
20,00	100	0,160	60		
14,00	97	0,080	50,2		
10,00	93				
5,00	88				

SAMBLE IDENTIFICATION

Sample	10BH-10 (SS-08)
Depth	6,10 - 6,71 m

Soil Description

Silt and sand, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

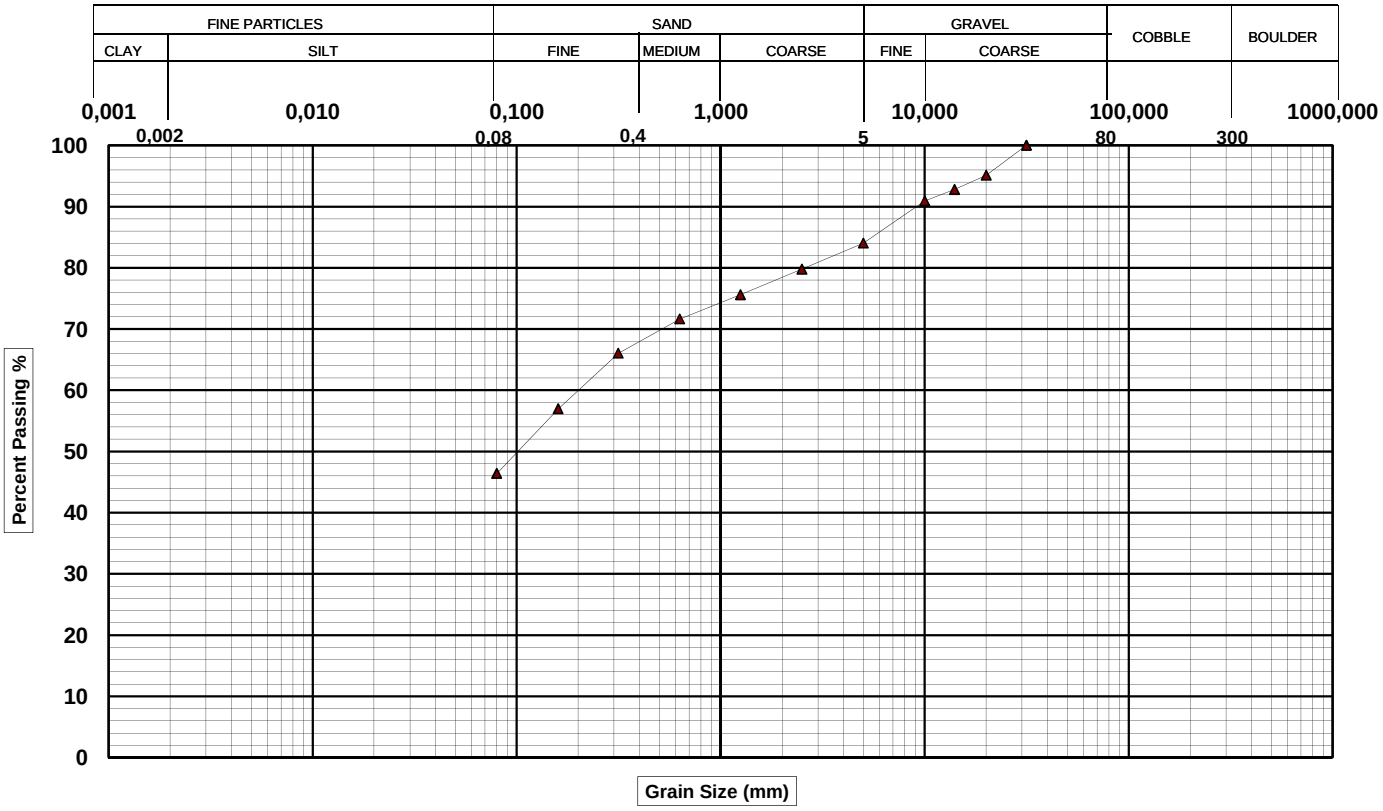
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36539



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	46,4	37,6	16,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,20	N/A	N/A	9

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	80		
56,00	100	1,250	76		
40,00	100	0,630	72		
31,50	100	0,315	66		
20,00	95	0,160	57		
14,00	93	0,080	46,4		
10,00	91				
5,00	84				

SAMBLE IDENTIFICATION

Sample	10BH-16 (SS-08)
Depth	6,10 - 6,71 m

Soil Description

Silt and sand, a little gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

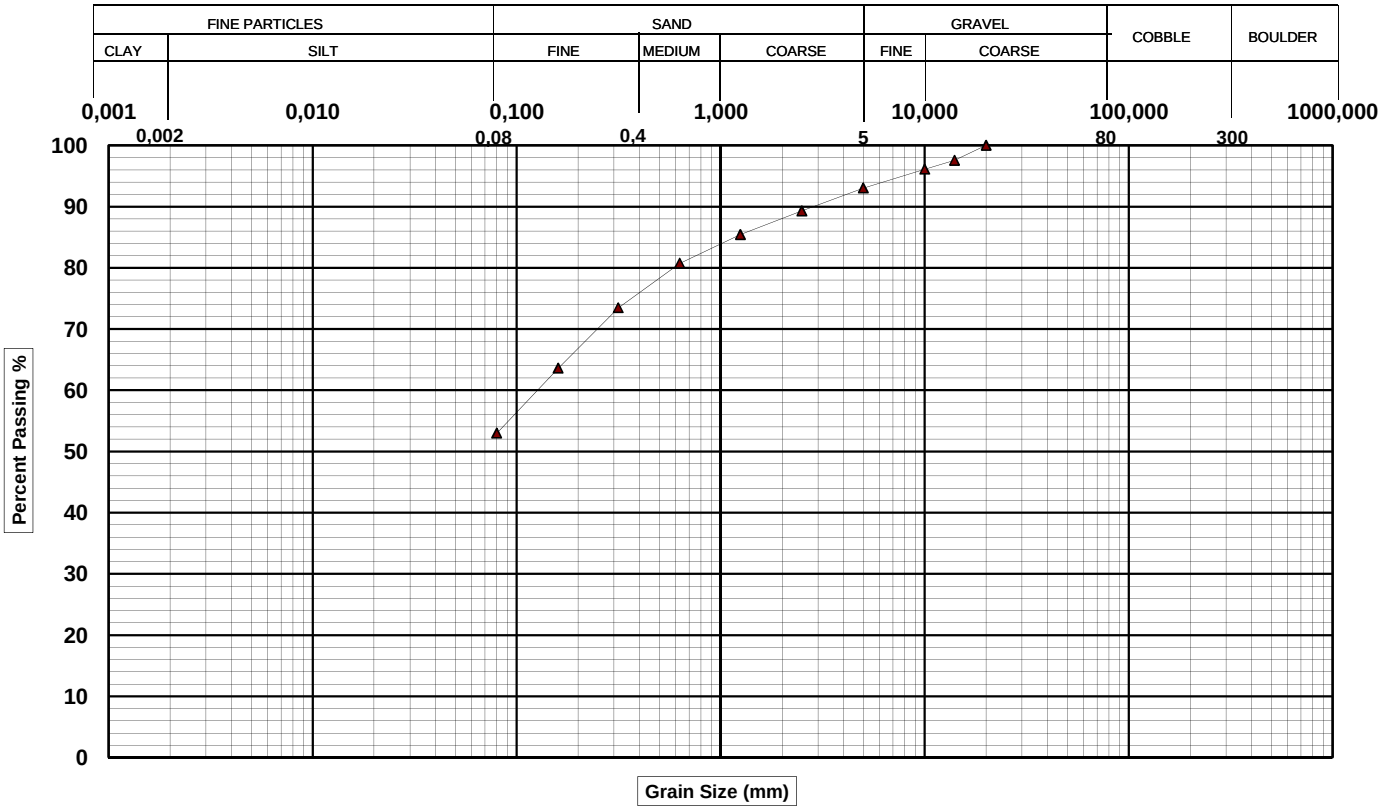
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36534



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	53,0	40,0	7,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,13	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	89		
56,00	100	1,250	85		
40,00	100	0,630	81		
31,50	100	0,315	73		
20,00	100	0,160	64		
14,00	98	0,080	53,0		
10,00	96				
5,00	93				

SAMBLE IDENTIFICATION

Sample	10BH-10 (SS-02)
Depth	0,61 - 1,22 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

F104/970307(0)

Groupe ABS

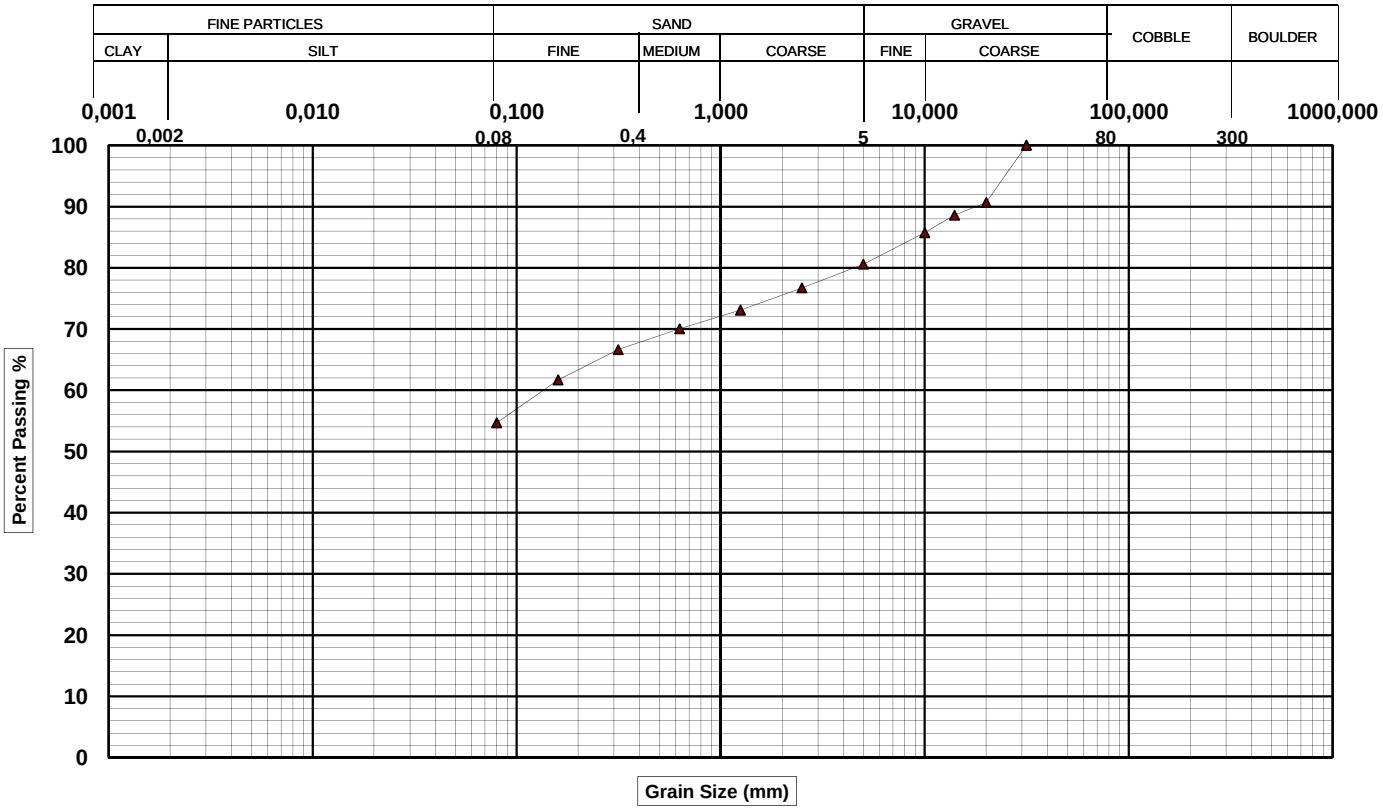
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36537



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	54,7	25,9	19,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,15	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	77		
56,00	100	1,250	73		
40,00	100	0,630	70		
31,50	100	0,315	67		
20,00	91	0,160	62		
14,00	89	0,080	54,7		
10,00	86				
5,00	81				

SAMBLE IDENTIFICATION

Sample	10BH-10 (SS-16)
Depth	16,5 - 16,927 m

Soil Description

Sandy silt, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

F104/970307(0)

Groupe ABS

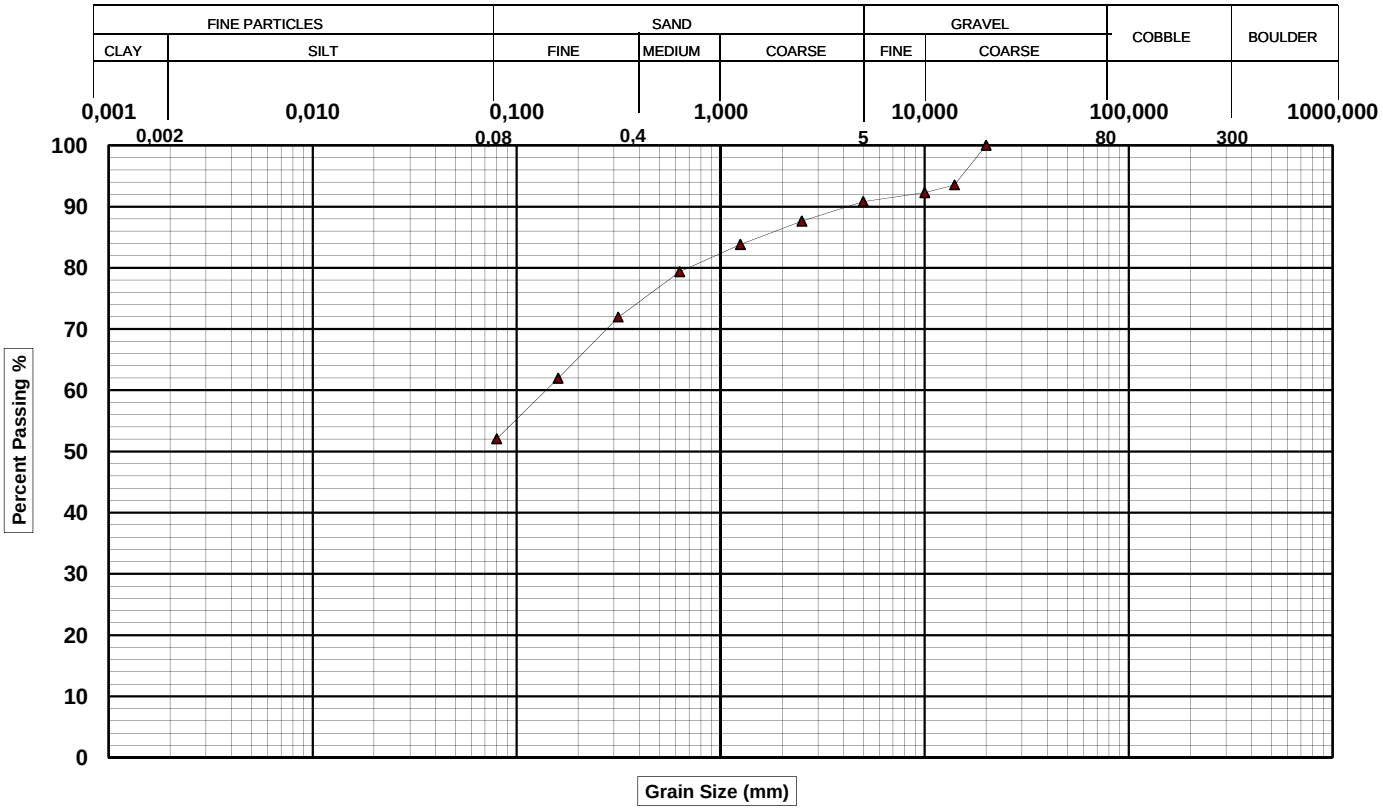
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36542



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	52,1	38,8	9,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,15	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	88		
56,00	100	1,250	84		
40,00	100	0,630	79		
31,50	100	0,315	72		
20,00	100	0,160	62		
14,00	94	0,080	52,1		
10,00	92				
5,00	91				

SAMBLE IDENTIFICATION

Sample	10BH-09 (SS-03)
Depth	1,22 - 1,83 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

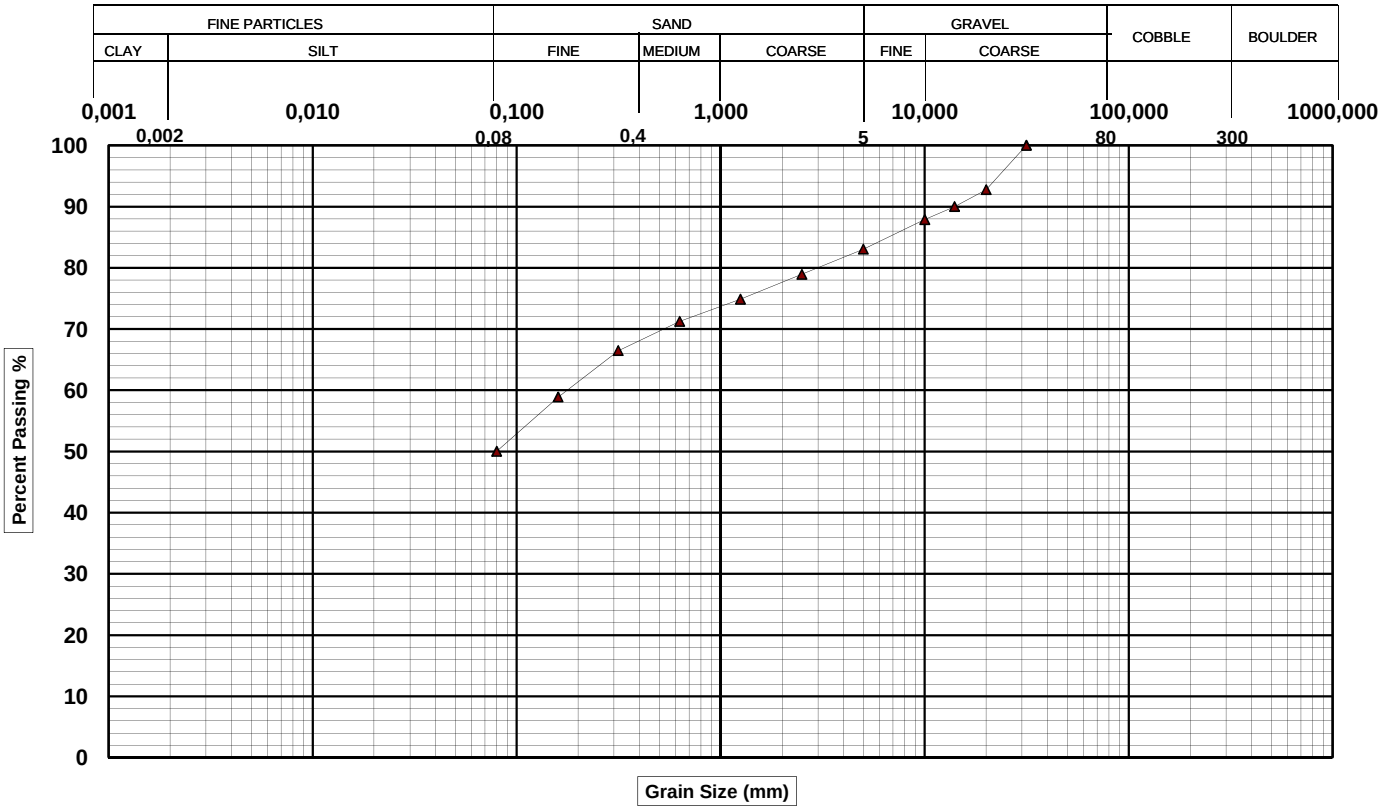
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36543



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	50,0	33,0	17,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,19	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	79		
56,00	100	1,250	75		
40,00	100	0,630	71		
31,50	100	0,315	66		
20,00	93	0,160	59		
14,00	90	0,080	50,0		
10,00	88				
5,00	83				

SAMBLE IDENTIFICATION

Sample	10BH-09 (SS-07)
Depth	4,57 - 5,18 m

Soil Description

Sandy silt, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

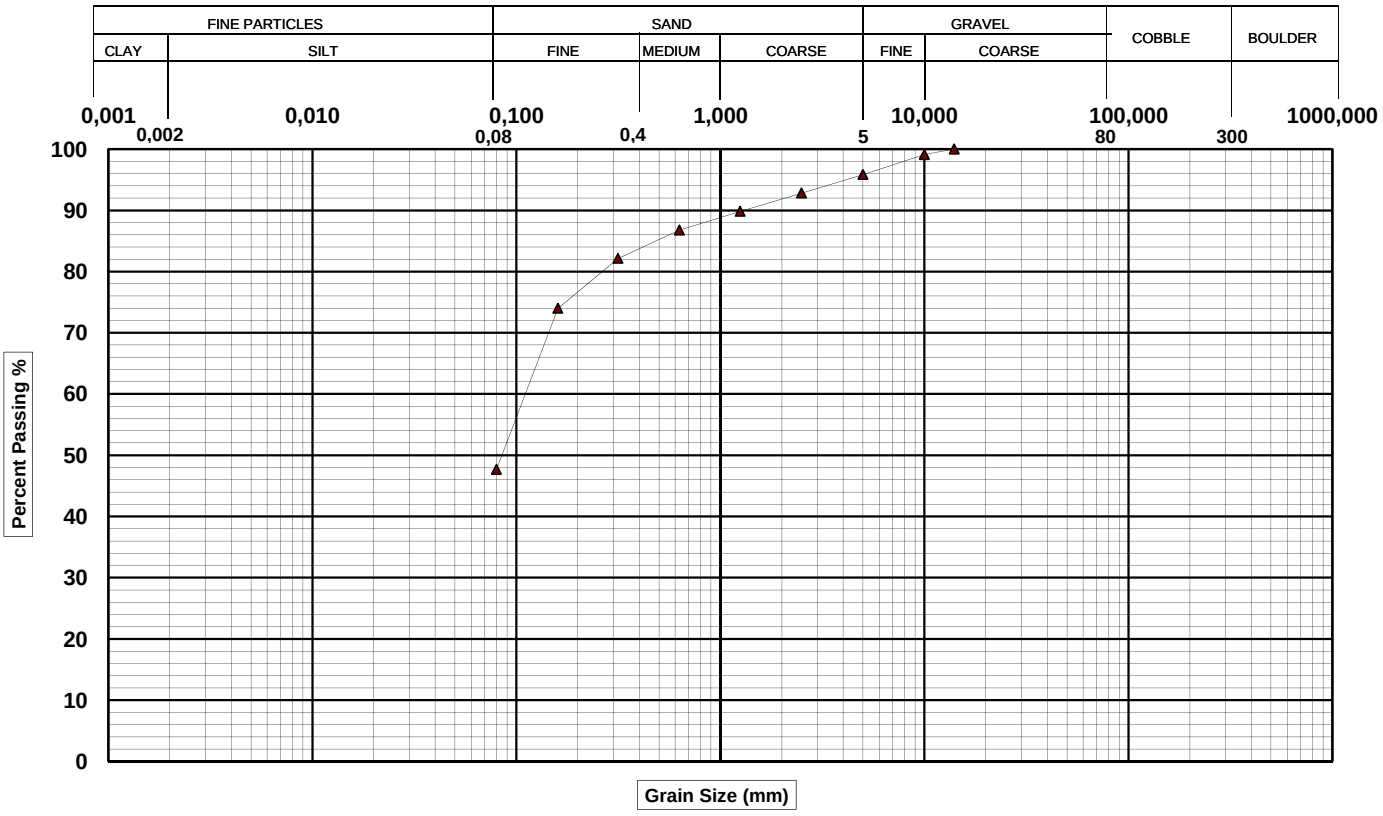
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36547



-	47,7	48,2	4,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,11	N/A	N/A	9

PERCENT PASSING					
(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	93		
56,00	100	1,250	90		
40,00	100	0,630	87		
31,50	100	0,315	82		
20,00	100	0,160	74		
14,00	100	0,080	47,7		
10,00	99				
5,00	96				

SAMBLE IDENTIFICATION	
Sample	10BH-17A (SS-10)
Depth	7,92 - 8,53 m
Soil Description	
Sand and silt, traces of gravel	

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

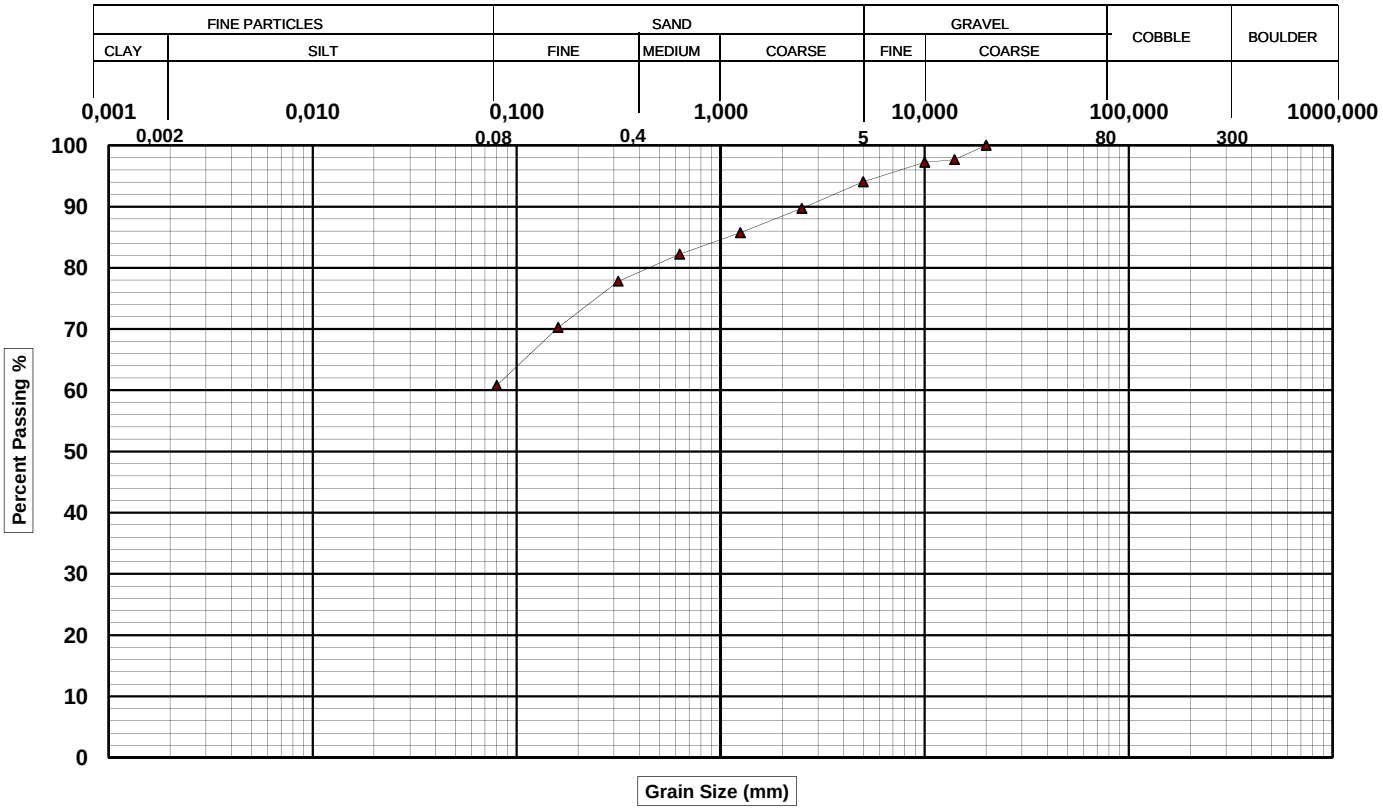
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36546



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	60,8	33,2	6,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	9

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	90		
56,00	100	1,250	86		
40,00	100	0,630	82		
31,50	100	0,315	78		
20,00	100	0,160	70		
14,00	98	0,080	60,8		
10,00	97				
5,00	94				

SAMBLE IDENTIFICATION

Sample	10BH-17A (SS-12)
Depth	9,75 - 10,36 m

Soil Description

Sandy silt, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

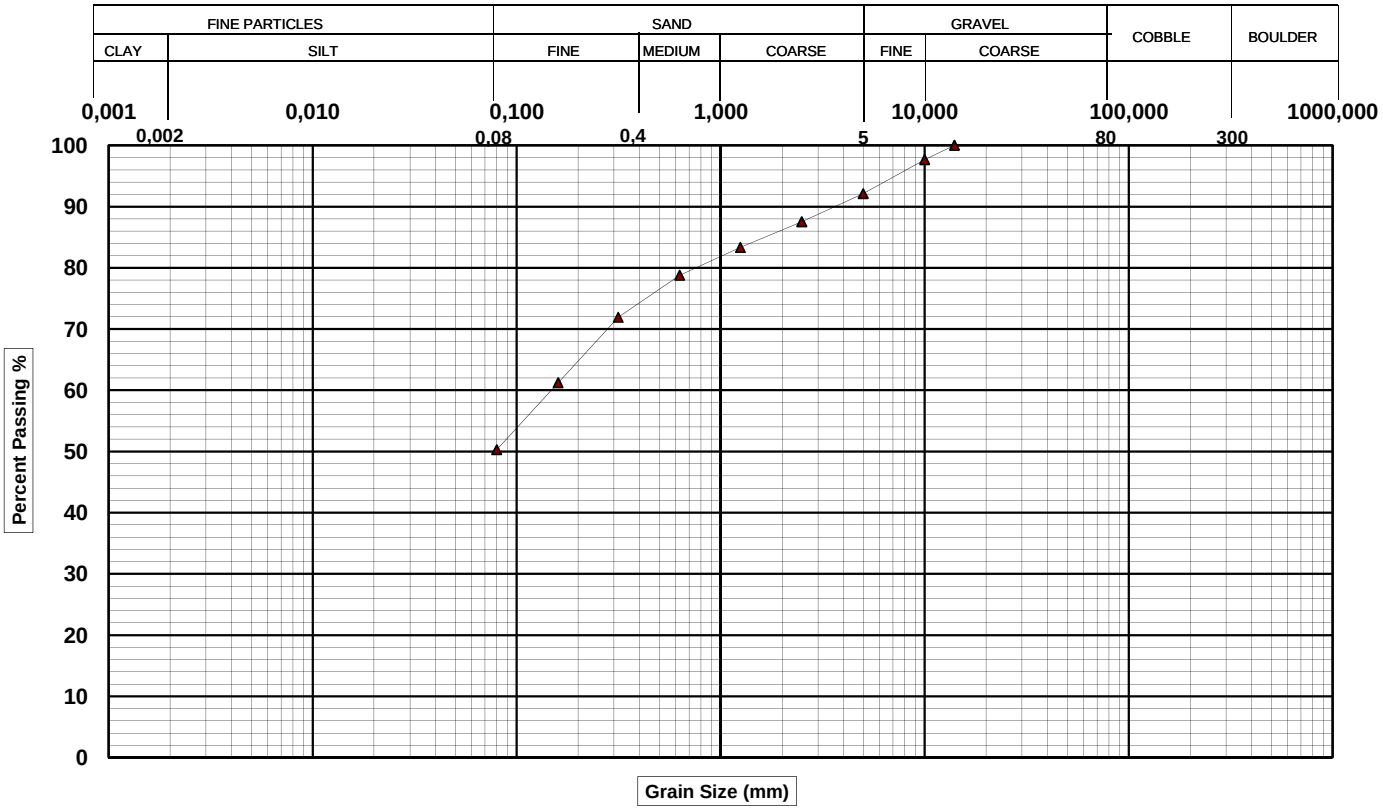
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36538



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	50,3	41,8	7,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,16	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	88		
56,00	100	1,250	83		
40,00	100	0,630	79		
31,50	100	0,315	72		
20,00	100	0,160	61		
14,00	100	0,080	50,3		
10,00	98				
5,00	92				

SAMBLE IDENTIFICATION

Sample	10BH-16 (SS-03)
Depth	1,52 - 2,13 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

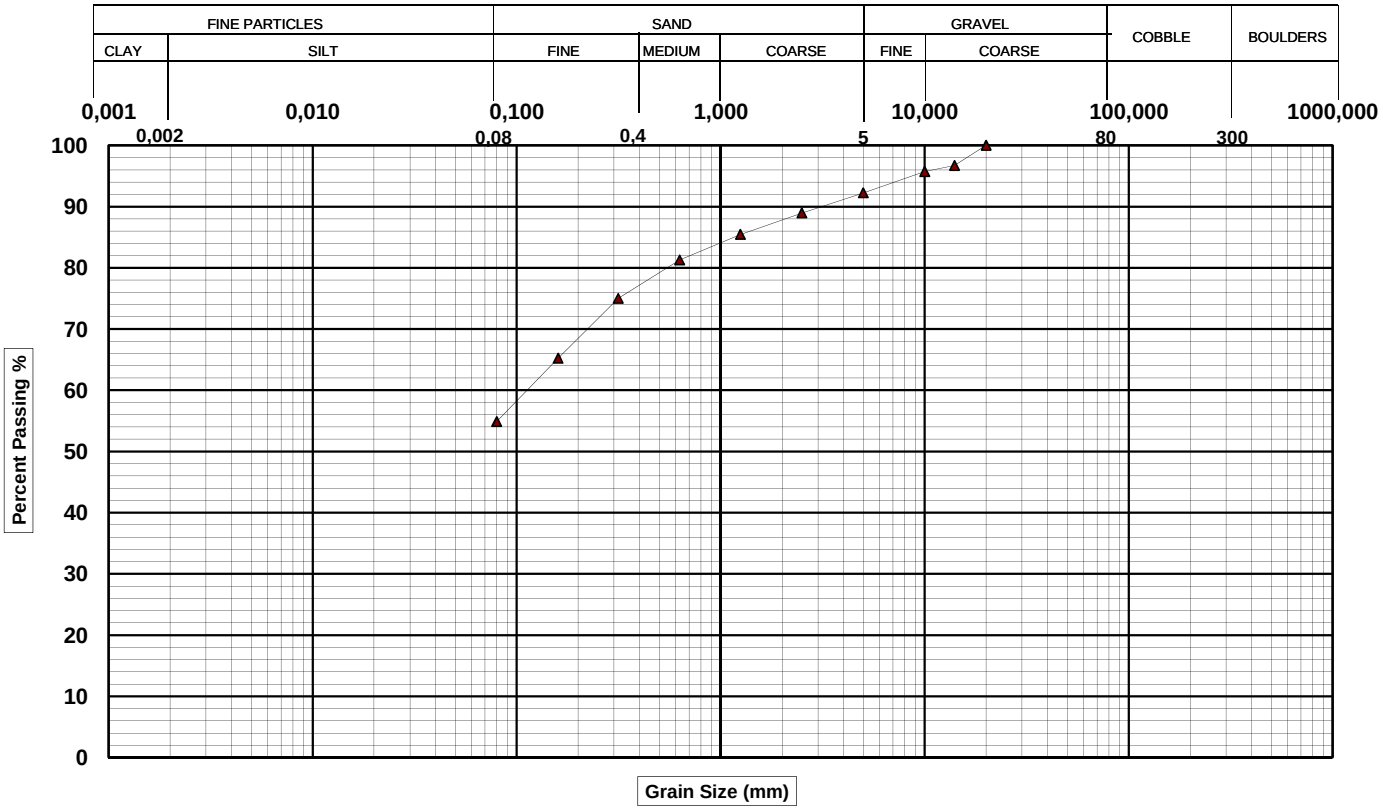
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36553



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	54,9	37,3	7,8	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,12	N/A	N/A	4

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	89		
56,00	100	1,250	85		
40,00	100	0,630	81		
31,50	100	0,315	75		
20,00	100	0,160	65		
14,00	97	0,080	54,9		
10,00	96				
5,00	92				

SAMBLE IDENTIFICATION

Sample	10BH-08 (SS-04)
Depth	2,44 - 3,05 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

F104/970307(0)

Groupe ABS

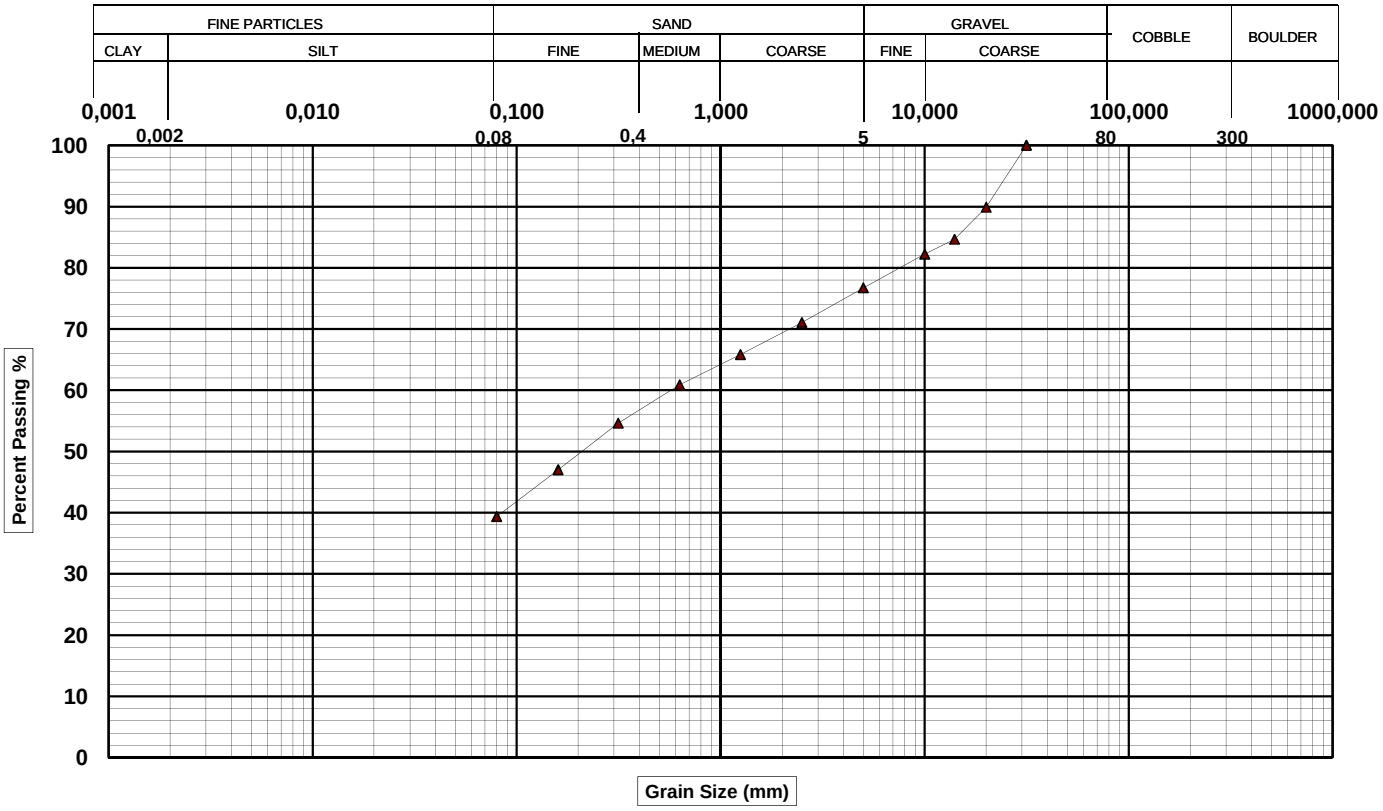
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36554



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	39,4	37,4	23,3	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,60	N/A	N/A	8

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	71		
56,00	100	1,250	66		
40,00	100	0,630	61		
31,50	100	0,315	55		
20,00	90	0,160	47		
14,00	85	0,080	39,4		
10,00	82				
5,00	77				

SAMBLE IDENTIFICATION

Sample	10BH-07 (SS-09)
Depth	7,01 - 7,62 m
Soil Description	
Gravelly silt and sand	

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

F104/970307(0)

Groupe ABS

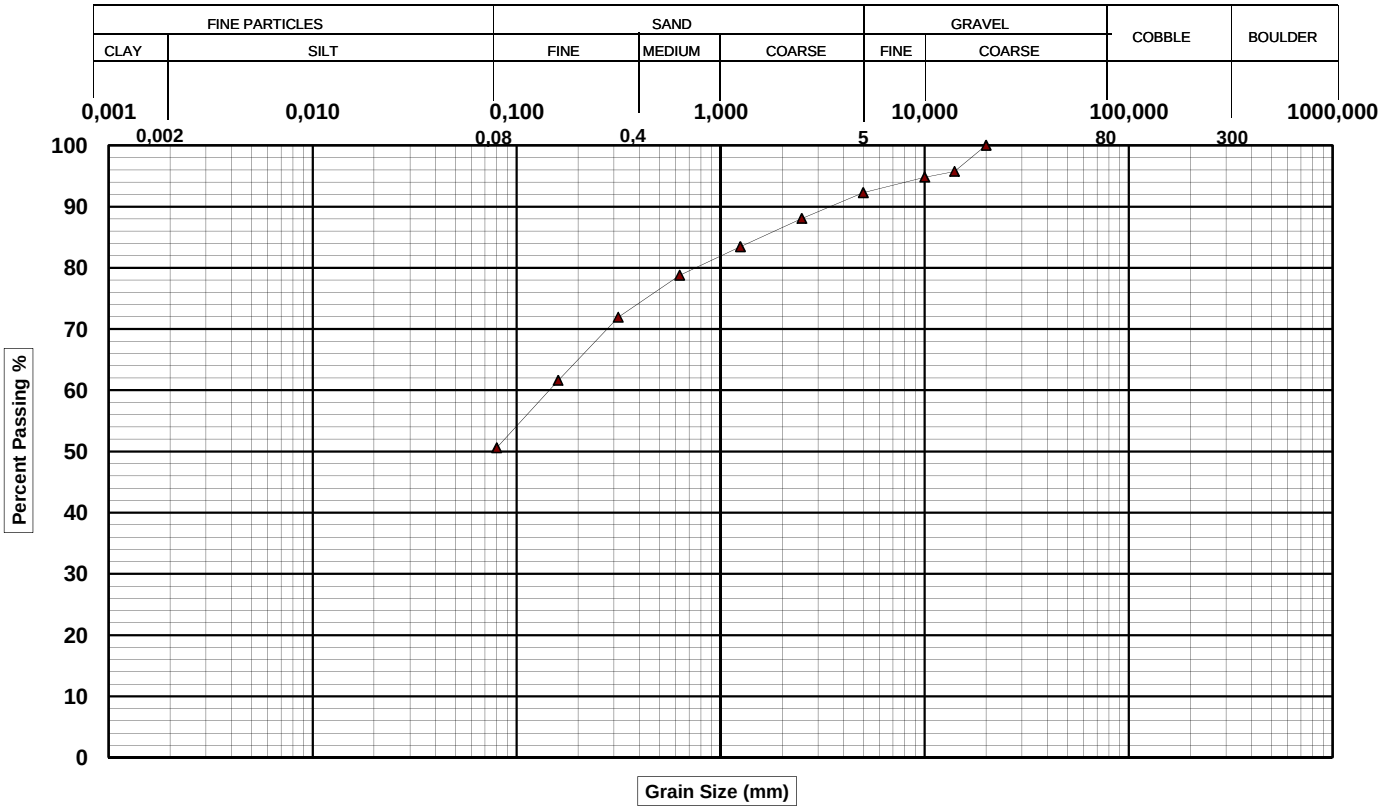
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36552



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	50,6	41,7	7,7	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,15	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	88		
56,00	100	1,250	83		
40,00	100	0,630	79		
31,50	100	0,315	72		
20,00	100	0,160	62		
14,00	96	0,080	50,6		
10,00	95				
5,00	92				

SAMBLE IDENTIFICATION

Sample	10BH-07 (SS-02)
Depth	0,61 - 1,22 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

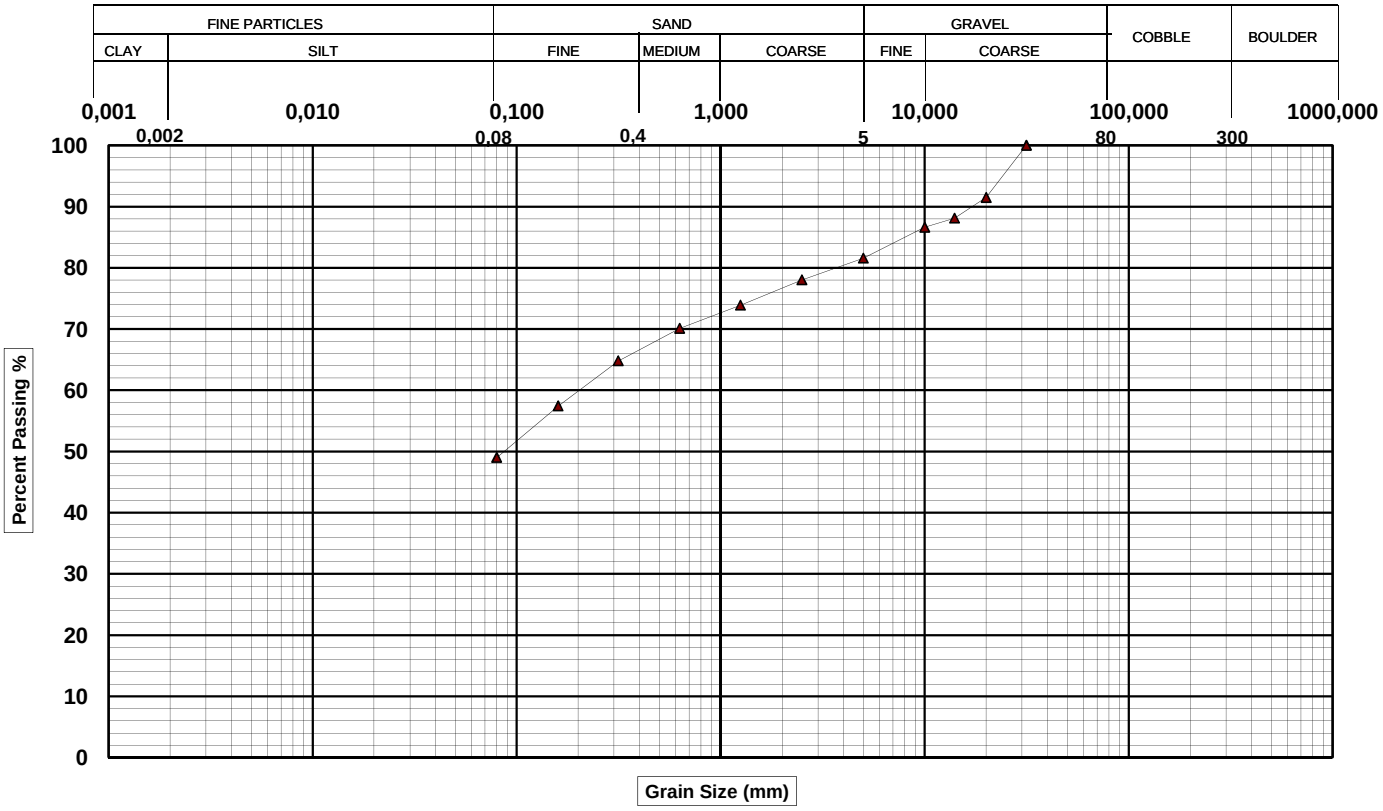
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36550



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	49,0	32,6	18,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,20	N/A	N/A	7

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	78		
56,00	100	1,250	74		
40,00	100	0,630	70		
31,50	100	0,315	65		
20,00	91	0,160	57		
14,00	88	0,080	49,0		
10,00	87				
5,00	82				

SAMBLE IDENTIFICATION

Sample	10BH-18 (SS-07)
Depth	5,18 - 5,74 m

Soil Description

Sandy silt some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

F104/970307(0)

Groupe ABS

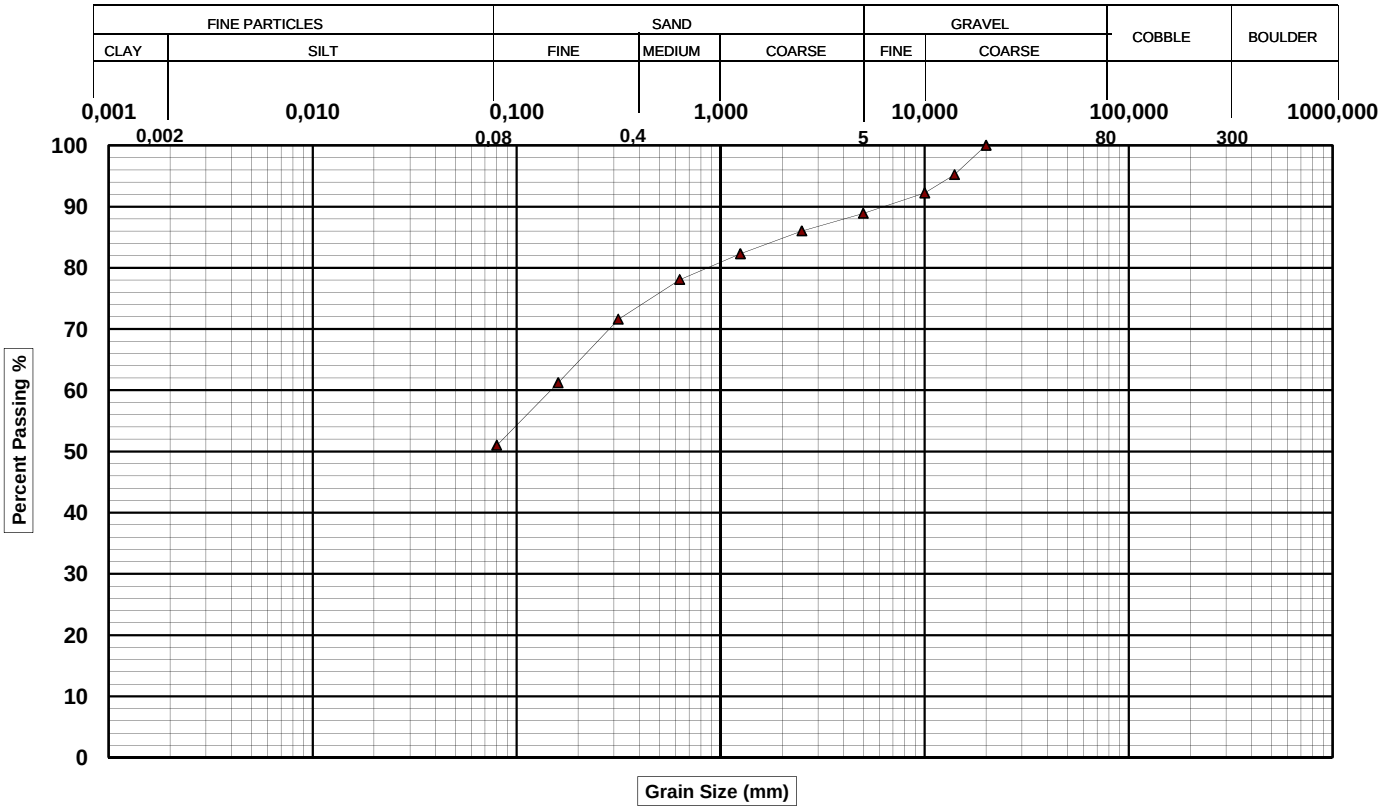
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36548



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	51,0	37,9	11,1	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,15	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	86		
56,00	100	1,250	82		
40,00	100	0,630	78		
31,50	100	0,315	72		
20,00	100	0,160	61		
14,00	95	0,080	51,0		
10,00	92				
5,00	89				

SAMBLE IDENTIFICATION

Sample	10BH-18 (SS-02)
Depth	0,61 - 1,22 m

Soil Description

Silt and sand, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

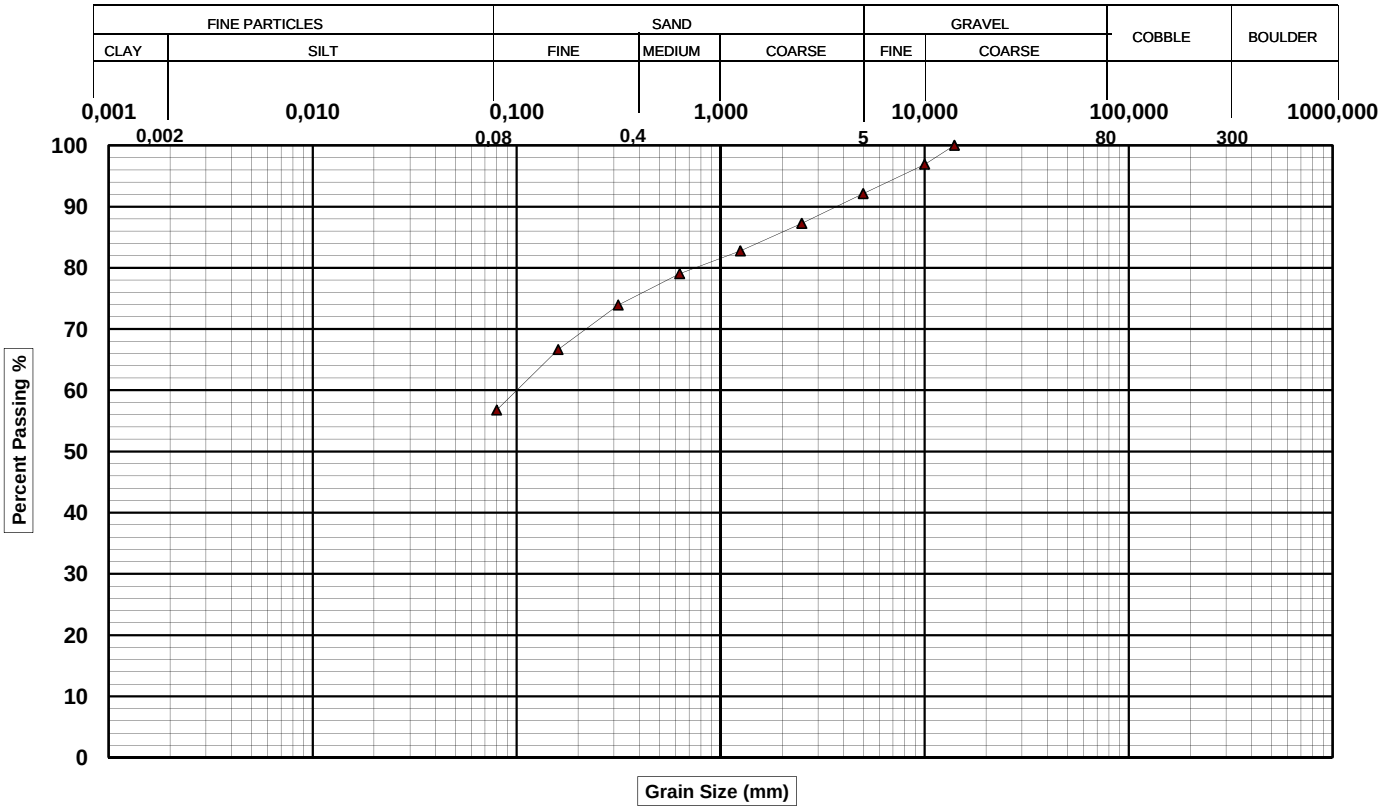
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36549



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	56,8	35,3	7,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,10	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	87		
56,00	100	1,250	83		
40,00	100	0,630	79		
31,50	100	0,315	74		
20,00	100	0,160	67		
14,00	100	0,080	56,8		
10,00	97				
5,00	92				

SAMBLE IDENTIFICATION

Sample	10BH-18 (SS-05)
Depth	3,35 - 3,96 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-14

Groupe ABS

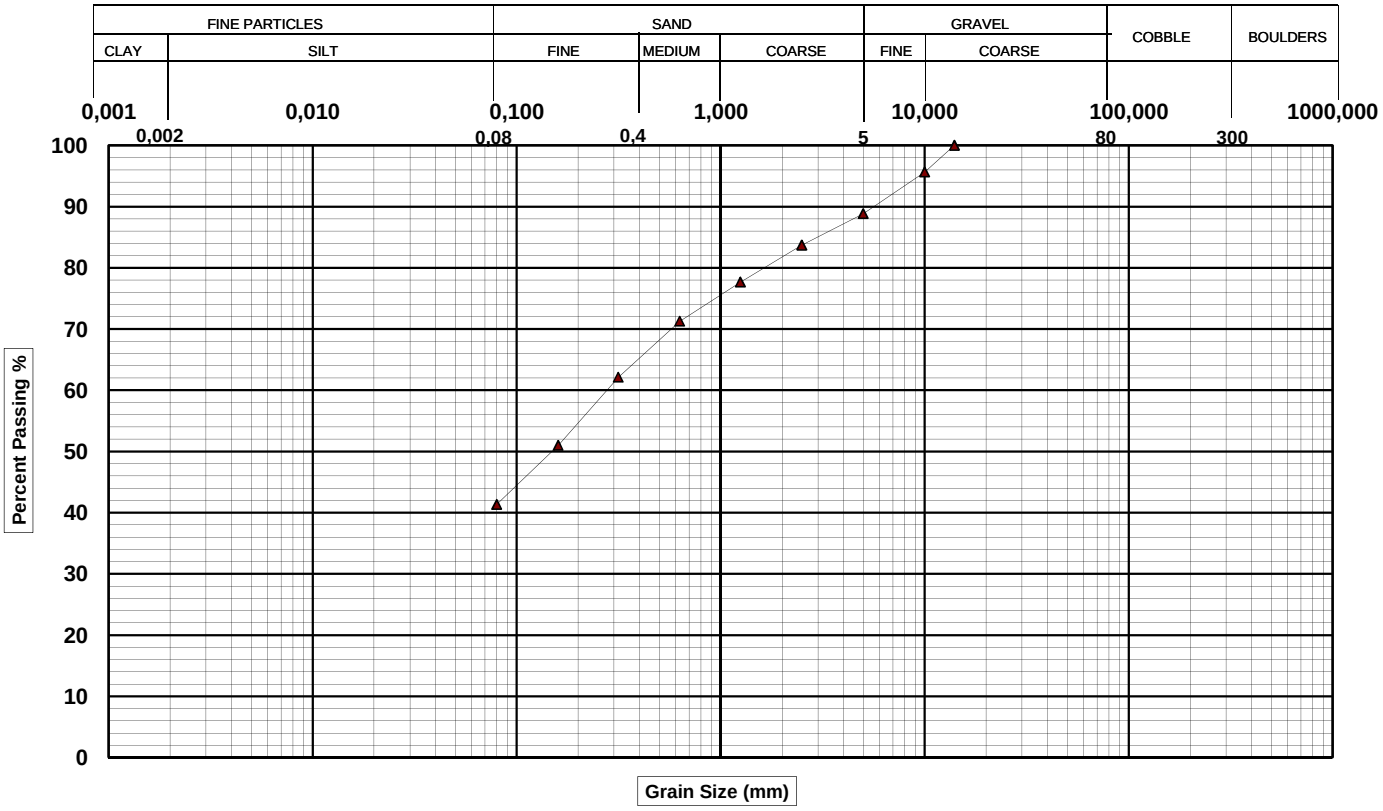
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36887



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	41,3	47,5	11,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,29	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	84		
56,00	100	1,250	78		
40,00	100	0,630	71		
31,50	100	0,315	62		
20,00	100	0,160	51		
14,00	100	0,080	41,3		
10,00	96				
5,00	89				

SAMBLE IDENTIFICATION

Sample	10BH-27 (SS-06)
Depth	5,18 - 5,79 m

Soil Description

Sand and silt, some gravel

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-05

Groupe ABS

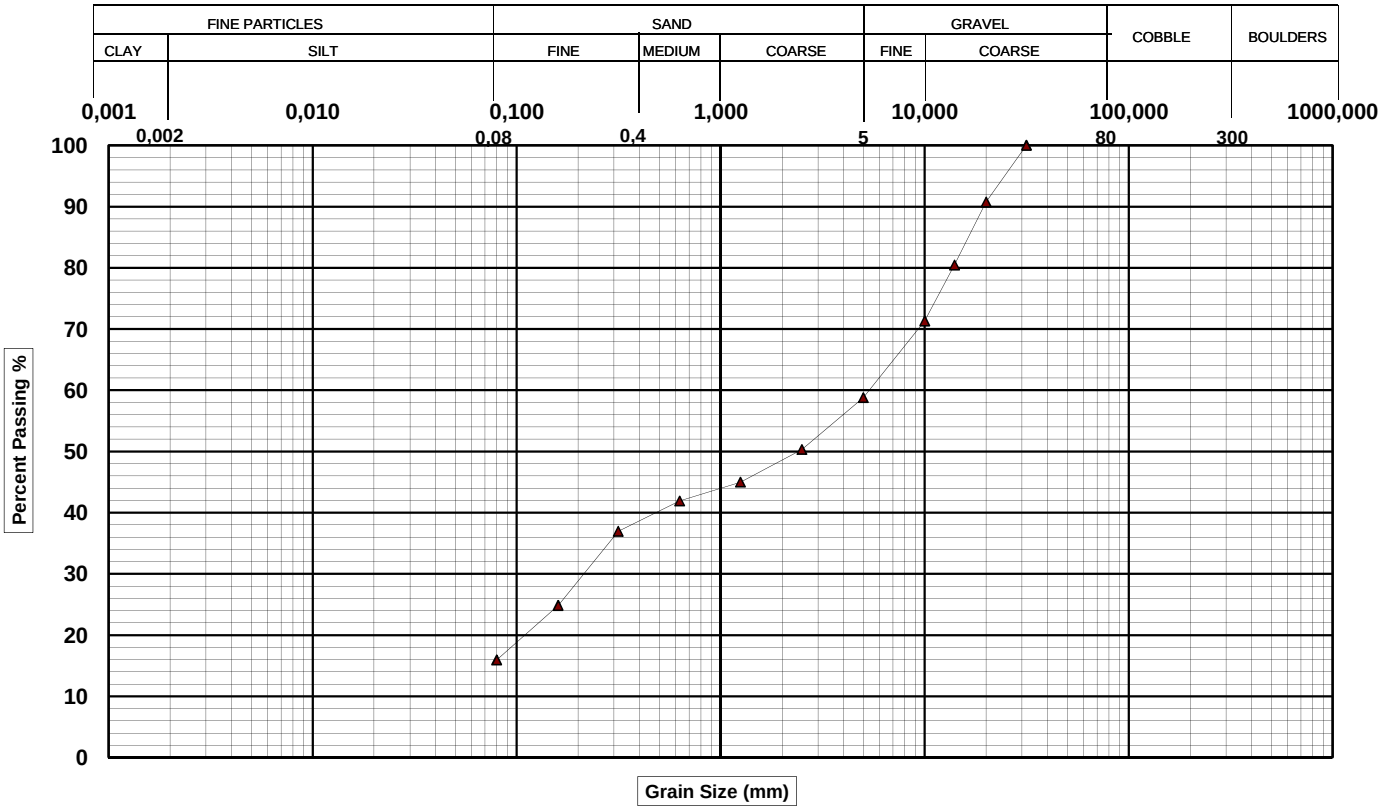
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36888



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	16,0	42,8	41,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	0,22	5,30	N/A	N/A	9

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	50		
56,00	100	1,250	45		
40,00	100	0,630	42		
31,50	100	0,315	37		
20,00	91	0,160	25		
14,00	80	0,080	16,0		
10,00	71				
5,00	59				

SAMBLE IDENTIFICATION

Sample	10BH-27 (SS-10)
Depth	9,14 - 9,75 m

Soil Description

sand and gravel, some silt

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-05

Groupe ABS

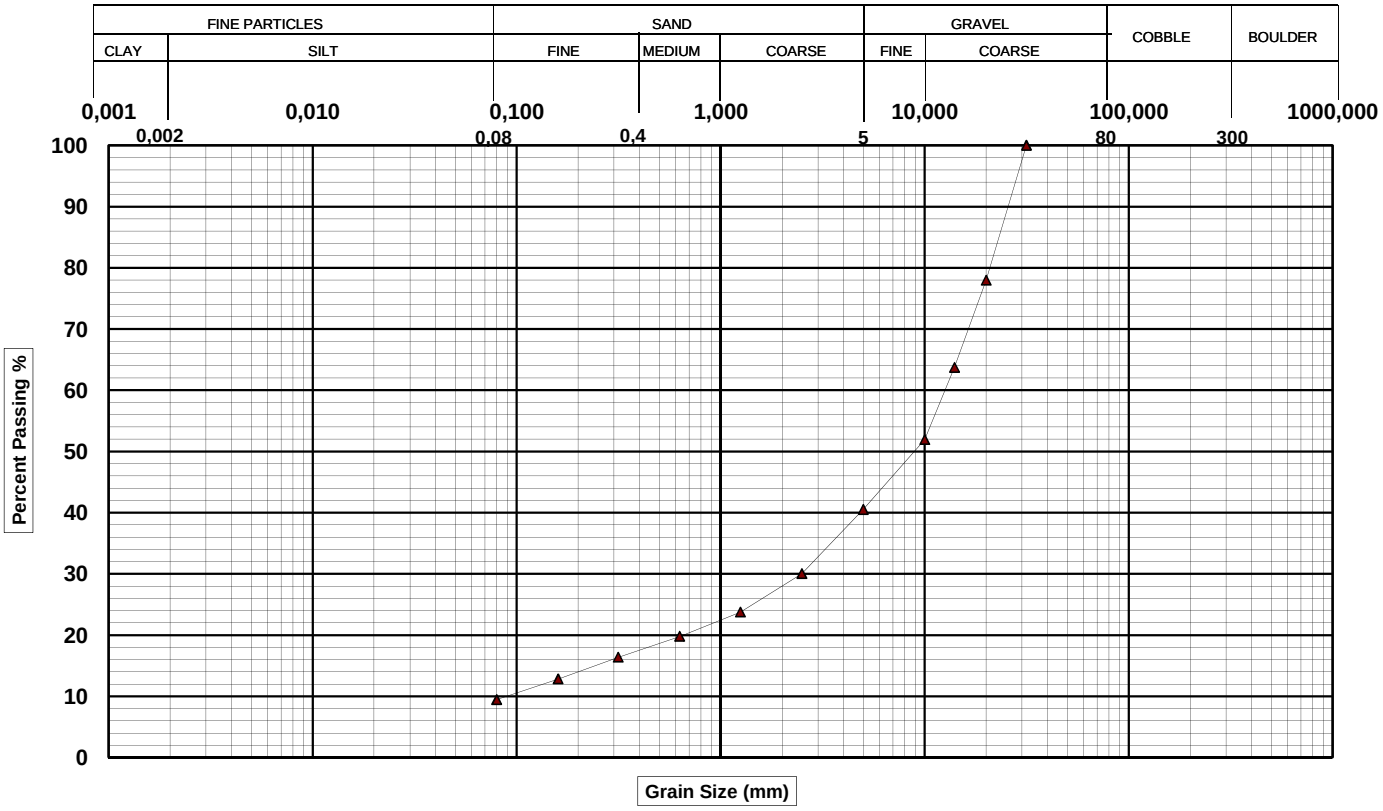
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36891



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	9,4	31,1	59,5	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
0,090	2,50	13,00	144,44	5,34	7

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	30		
56,00	100	1,250	24		
40,00	100	0,630	20		
31,50	100	0,315	16		
20,00	78	0,160	13		
14,00	64	0,080	9,4		
10,00	52				
5,00	41				

SAMBLE IDENTIFICATION

Sample	10BH-28A (SS-08)
Depth	6,48 - 7,09 m

Soil Description

Sandy gravel, traces of silt

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-05

Groupe ABS

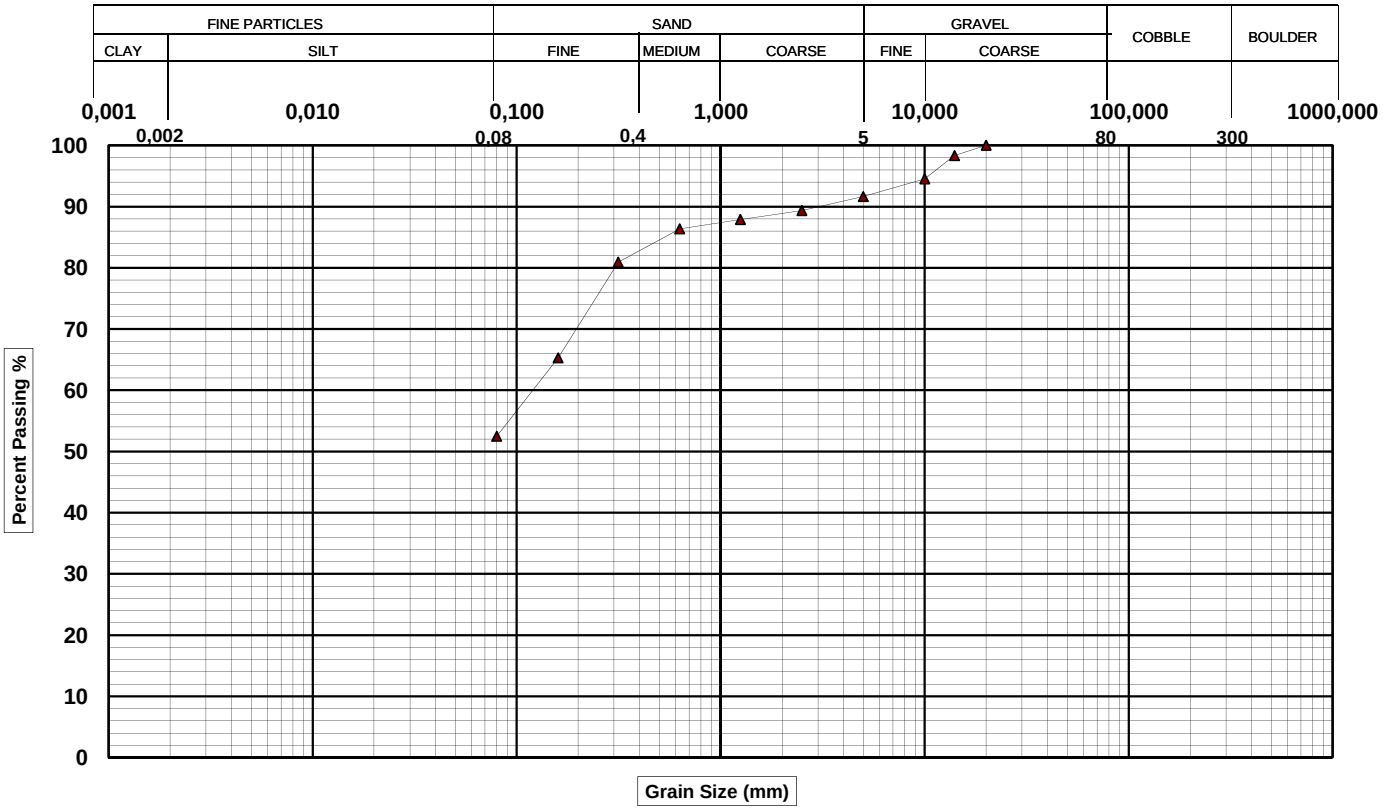
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36892



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	52,5	39,2	8,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,12	N/A	N/A	14

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	89		
56,00	100	1,250	88		
40,00	100	0,630	86		
31,50	100	0,315	81		
20,00	100	0,160	65		
14,00	98	0,080	52,5		
10,00	95				
5,00	92				

SAMBLE IDENTIFICATION

Sample	10BH-28A (SS-11)
Depth	9,14 - 9,75 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-05

Groupe ABS

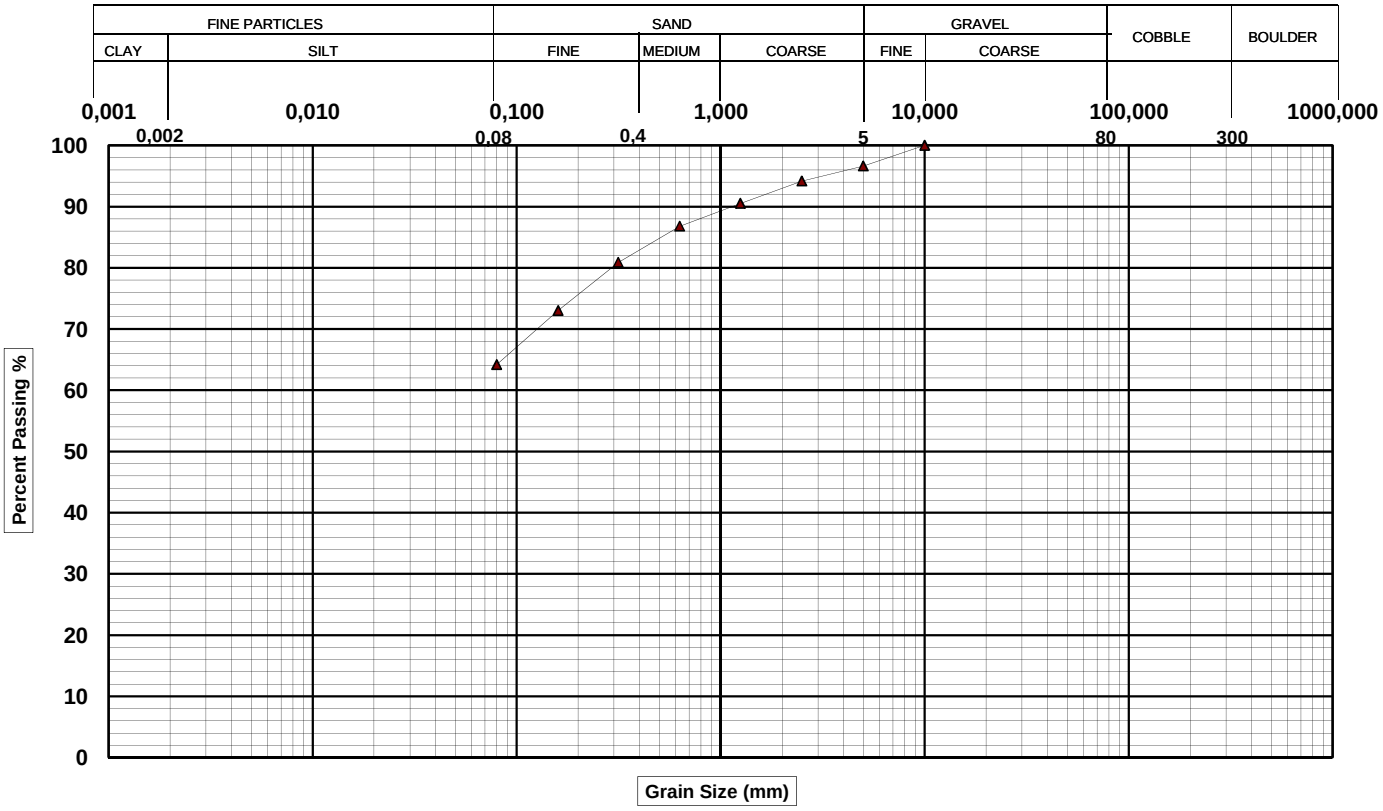
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36867



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	64,2	32,4	3,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	12

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	94		
56,00	100	1,250	91		
40,00	100	0,630	87		
31,50	100	0,315	81		
20,00	100	0,160	73		
14,00	100	0,080	64,2		
10,00	100				
5,00	97				

SAMBLE IDENTIFICATION

Sample	10BH-22 (SS-02)
Depth	0,61 - 1,22 m

Soil Description

Sandy silt, traces of gravel

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

Groupe ABS

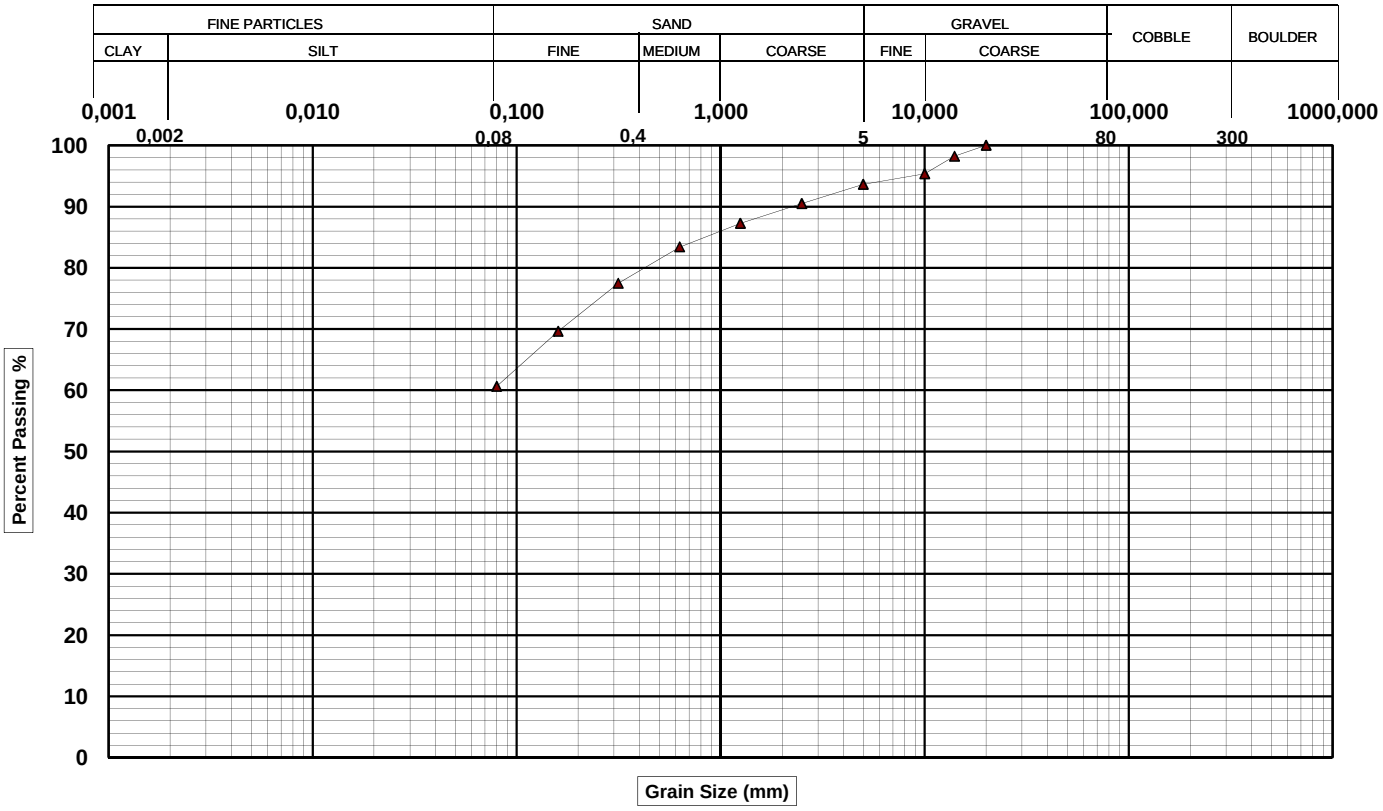
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36868



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	60,6	33,0	6,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	15

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	90		
56,00	100	1,250	87		
40,00	100	0,630	83		
31,50	100	0,315	77		
20,00	100	0,160	70		
14,00	98	0,080	60,6		
10,00	95				
5,00	94				

SAMBLE IDENTIFICATION

Sample	10BH-22 (SS-04)
Depth	2,44 - 3,05 m

Soil Description

Sandy silt, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

Groupe ABS

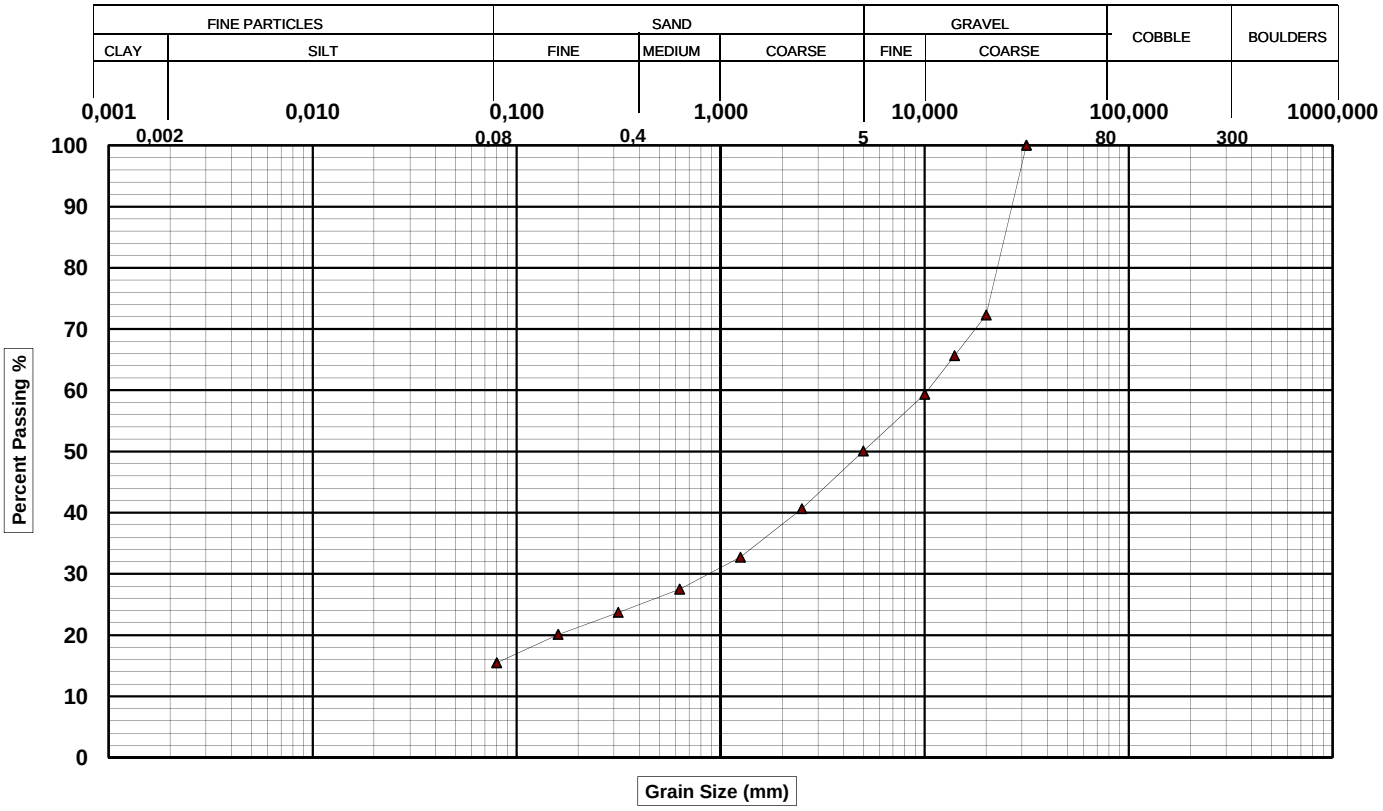
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36869



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	15,5	34,6	49,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	0,90	N/A	N/A	N/A	6

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	41		
56,00	100	1,250	33		
40,00	100	0,630	27		
31,50	100	0,315	24		
20,00	72	0,160	20		
14,00	66	0,080	15,5		
10,00	59				
5,00	50				

SAMBLE IDENTIFICATION

Sample	10BH-22 (SS-08)
Depth	6,10 - 6,71 m

Soil Description

Gravel and sand, some silt

Prepared by Benoit St-pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

F104/970307(0)

Groupe ABS

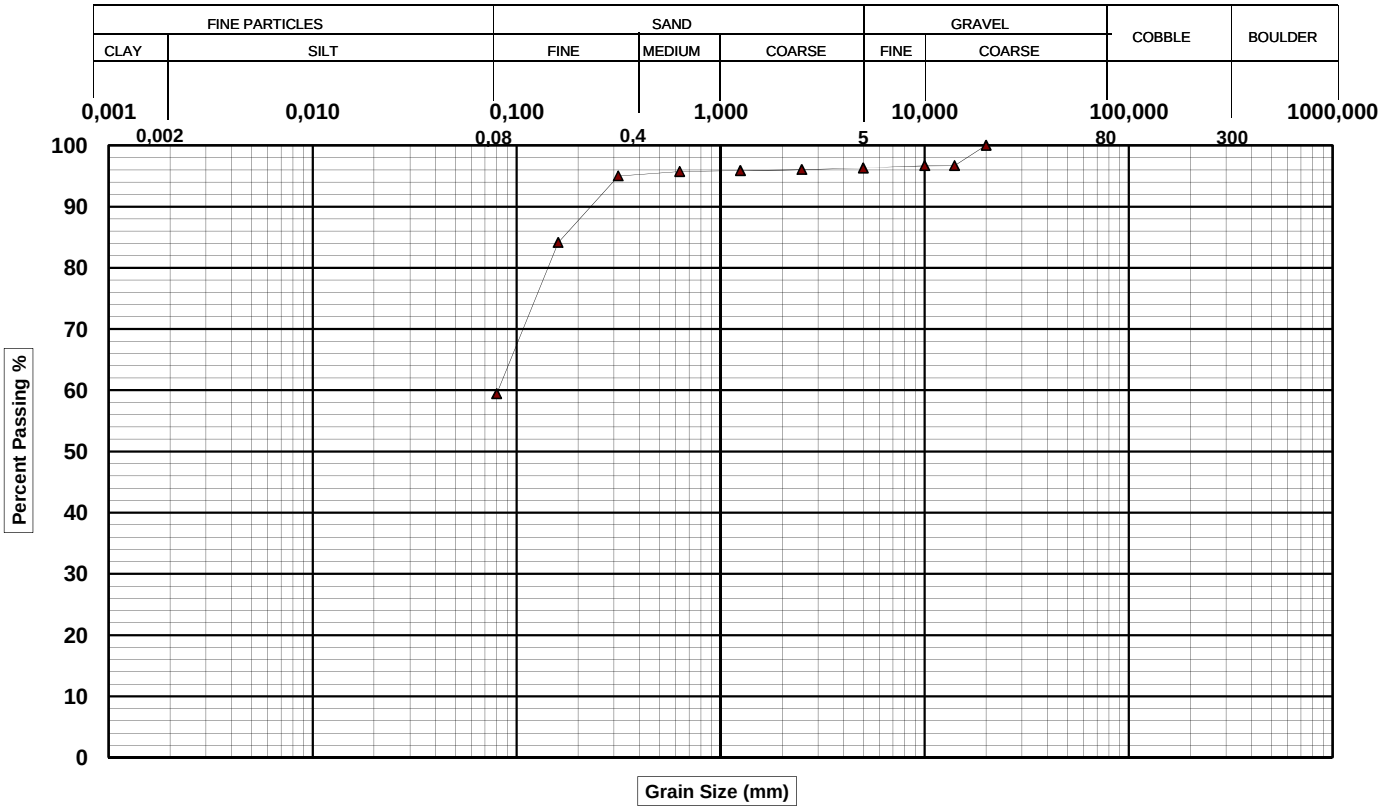
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36873



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	59,4	36,9	3,7	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,08	N/A	N/A	15

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	96		
56,00	100	1,250	96		
40,00	100	0,630	96		
31,50	100	0,315	95		
20,00	100	0,160	84		
14,00	97	0,080	59,4		
10,00	97				
5,00	96				

SAMBLE IDENTIFICATION

Sample	10BH-28 (SS-09)
Depth	7,01 - 7,62 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

F104/970307(0)

Groupe ABS

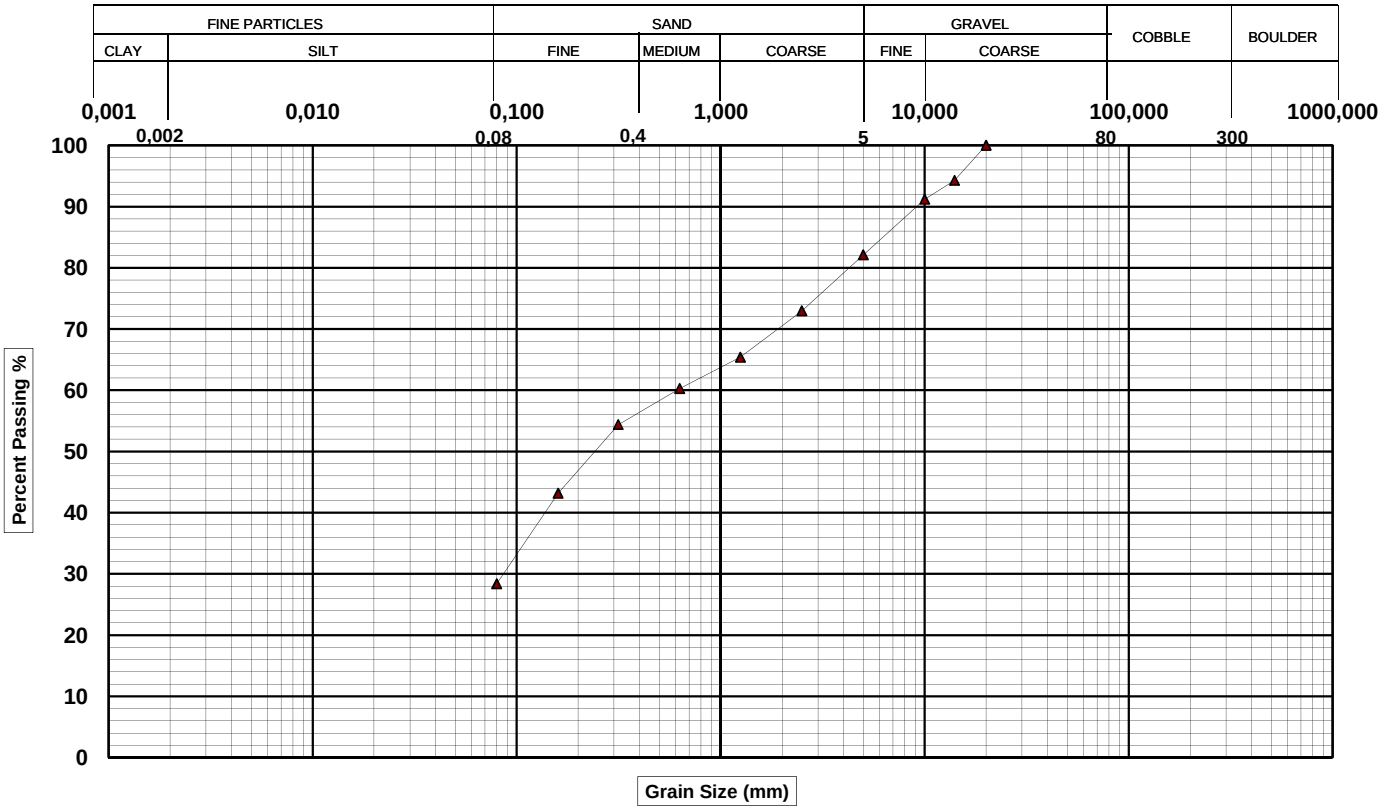
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36880



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	28,4	53,7	17,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	0,09	0,60	N/A	N/A	9

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	73		
56,00	100	1,250	65		
40,00	100	0,630	60		
31,50	100	0,315	54		
20,00	100	0,160	43		
14,00	94	0,080	28,4		
10,00	91				
5,00	82				

SAMBLE IDENTIFICATION

Sample	10BH-31 (SS-08)
Depth	7,09 - 7,70 m

Soil Description

Silty sand, trace of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

Groupe ABS

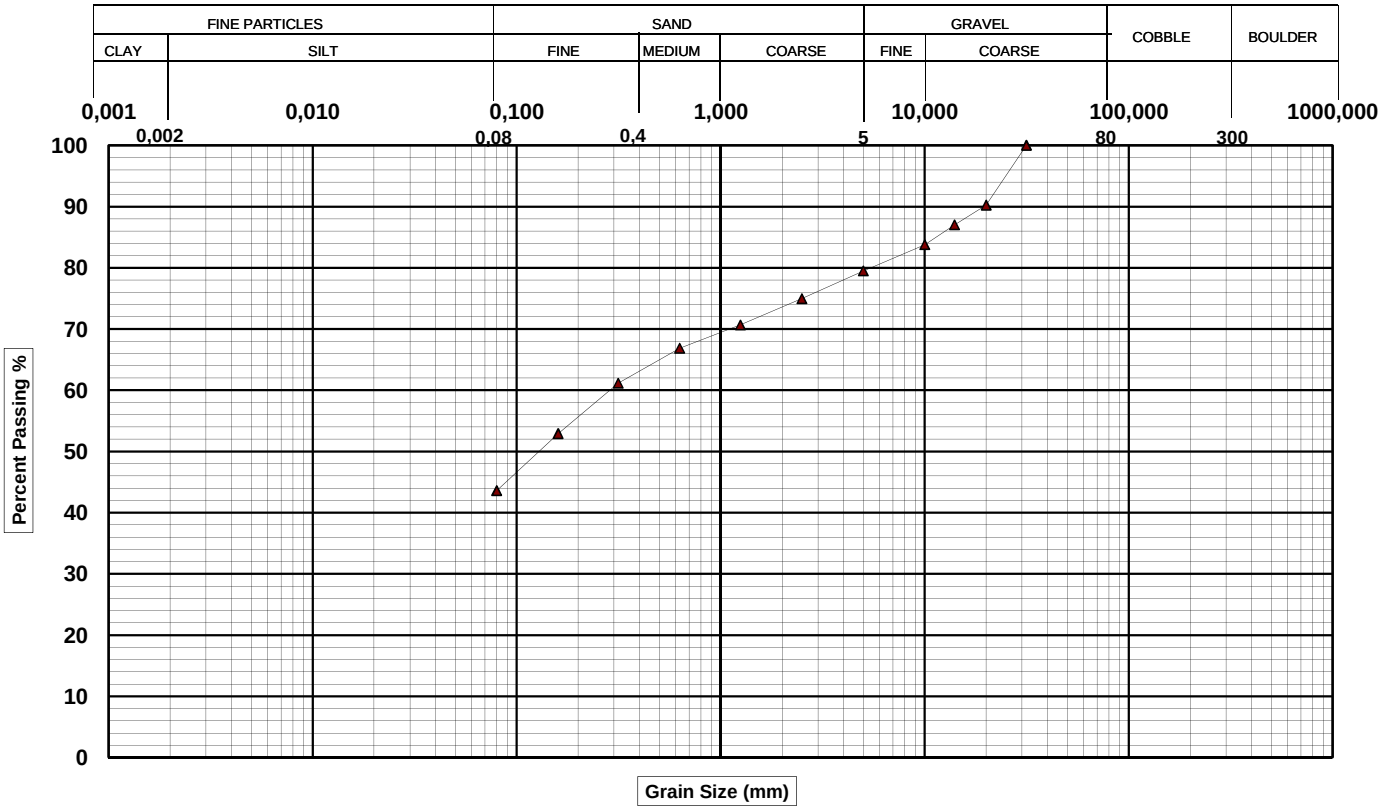
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36884



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	43,6	35,9	20,5	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,30	N/A	N/A	9

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	75		
56,00	100	1,250	71		
40,00	100	0,630	67		
31,50	100	0,315	61		
20,00	90	0,160	53		
14,00	87	0,080	43,6		
10,00	84				
5,00	79				

SAMBLE IDENTIFICATION

Sample	10BH-31A (SS-08)
Depth	6,10 - 6,71 m
Soil Description	
Gravelly silt and sand	

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

F104/970307(0)

Groupe ABS

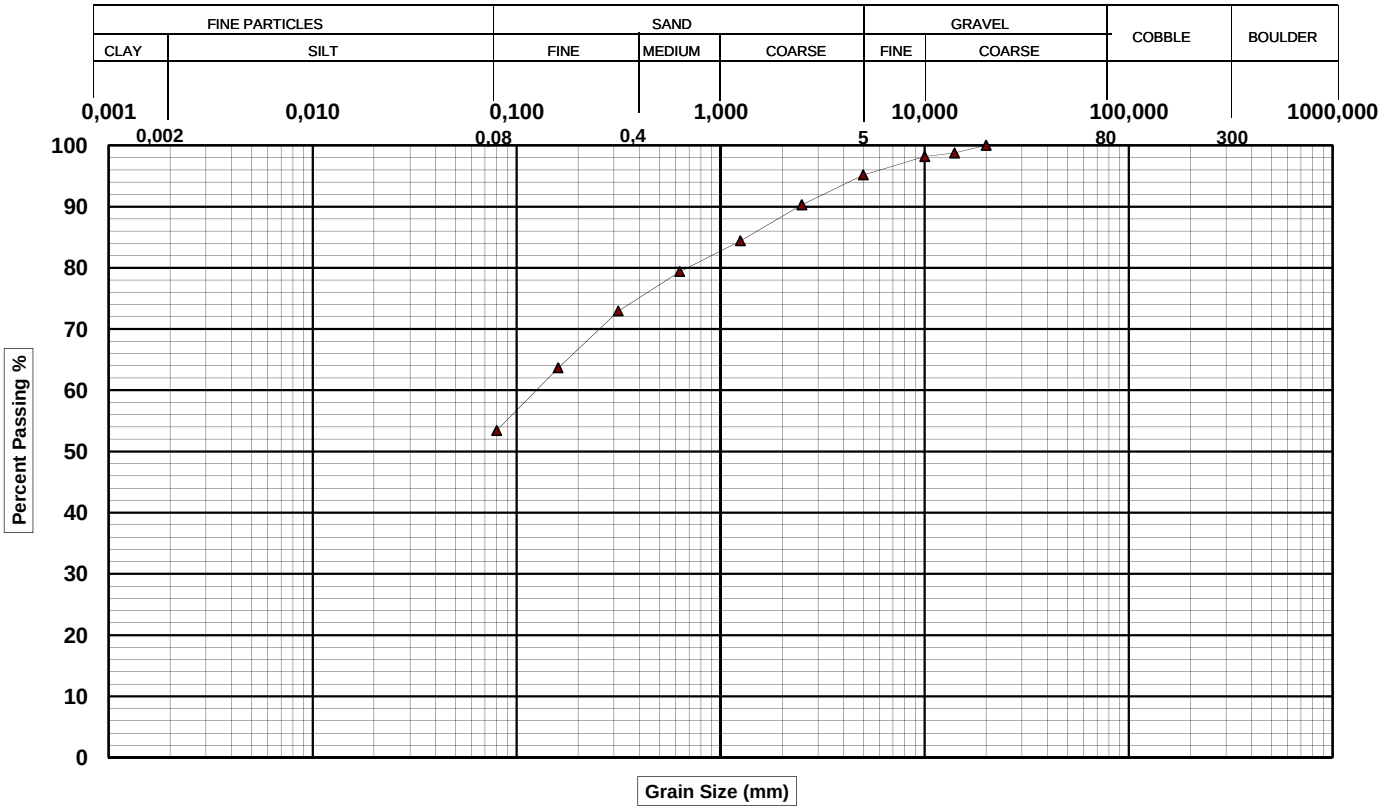
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36929



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	53,4	41,7	4,8	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,13	N/A	N/A	13

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	90		
56,00	100	1,250	84		
40,00	100	0,630	79		
31,50	100	0,315	73		
20,00	100	0,160	64		
14,00	99	0,080	53,4		
10,00	98				
5,00	95				

SAMBLE IDENTIFICATION

Sample	10BH-37 (SS-03)
Depth	1,52 - 2,13 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

Groupe ABS

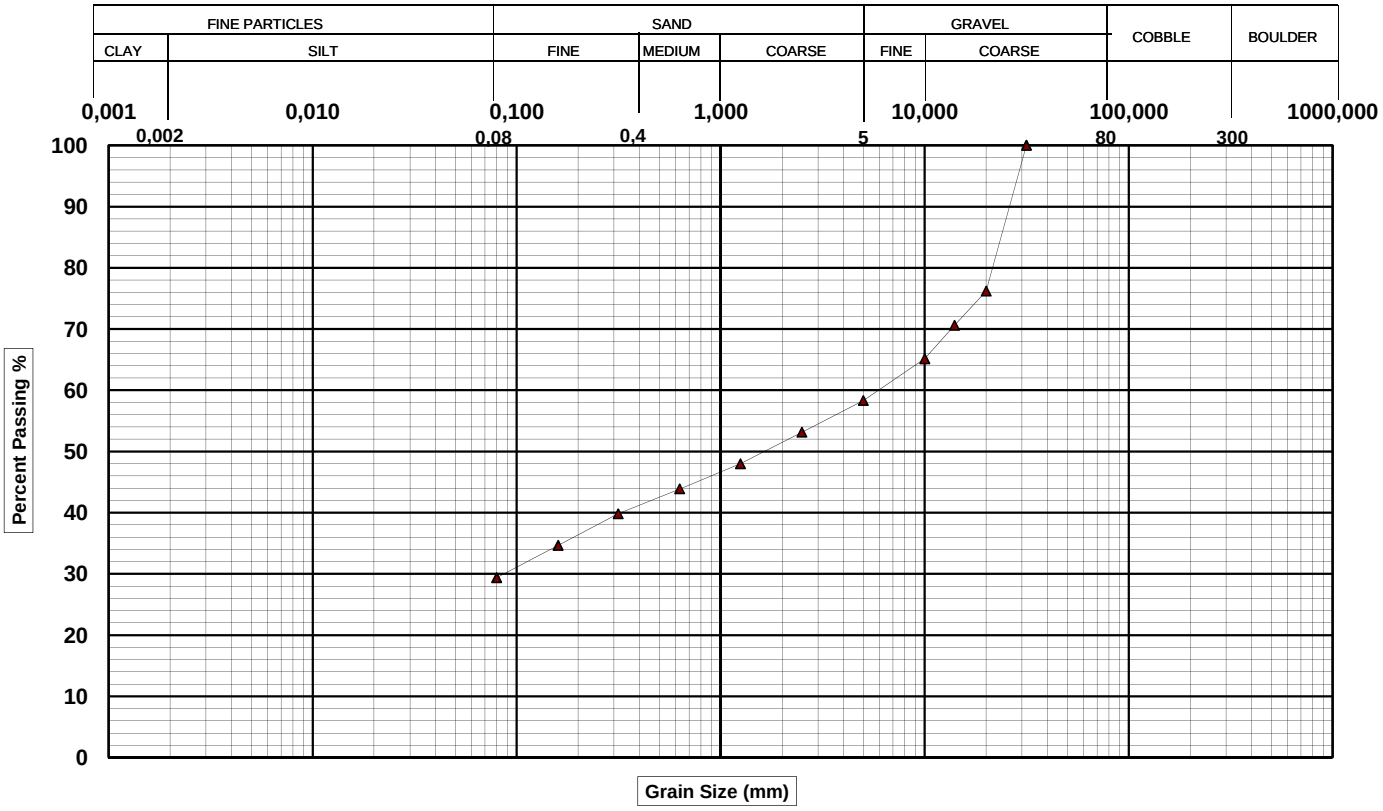
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-10-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36930



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	29,4	28,9	41,7	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	0,09	6,00	N/A	N/A	7

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	53		
56,00	100	1,250	48		
40,00	100	0,630	44		
31,50	100	0,315	40		
20,00	76	0,160	35		
14,00	71	0,080	29,4		
10,00	65				
5,00	58				

SAMBLE IDENTIFICATION

Sample	10BH-37 (SS-07)
Depth	5,18 - 5,79 m
Soil Description	
Sandy silty gravel	

Prepared by Benoit St-Pierre, tech. **Approved by** Ibrahim Ja'far, ing. **Date** 2010-05-04

F104/970307(0)

Groupe ABS

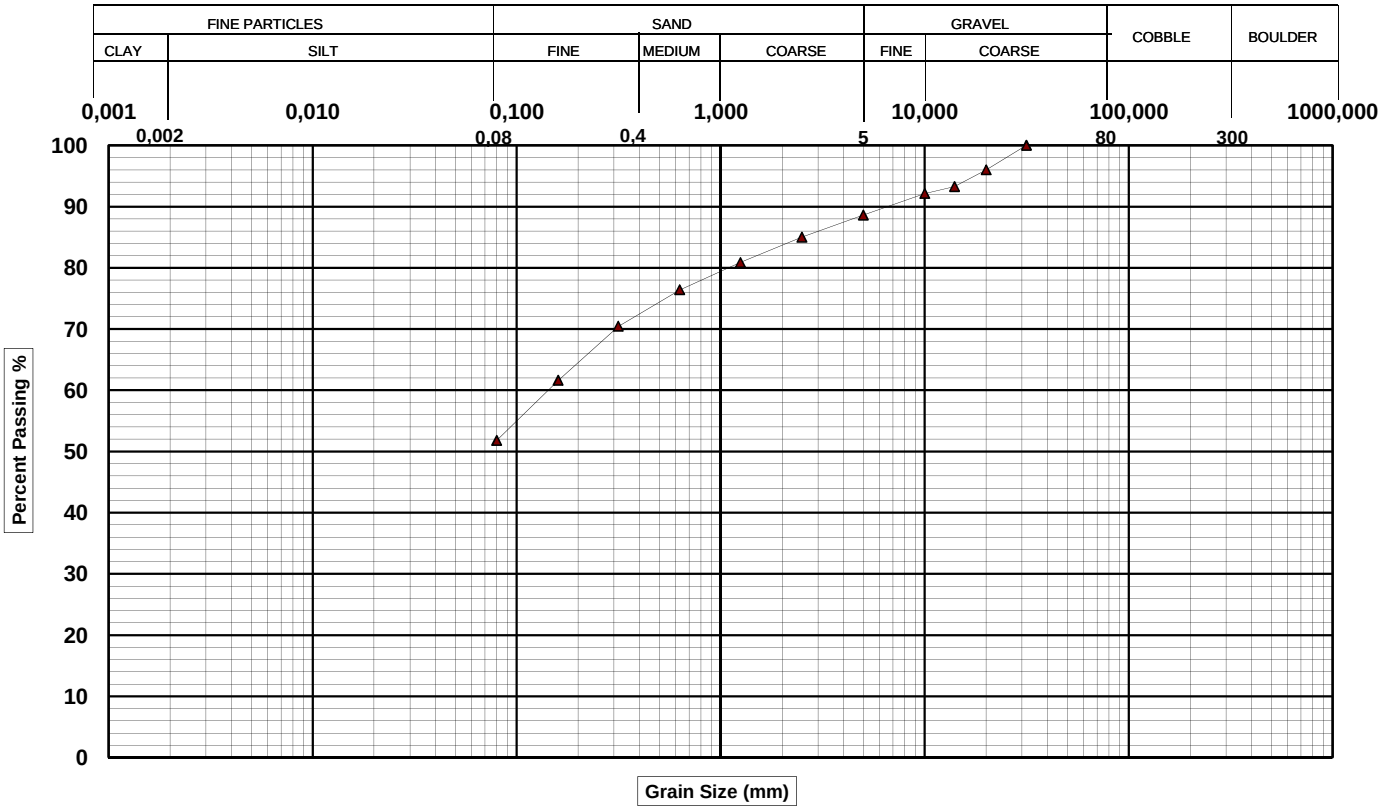
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36671



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
0,0	51,8	36,8	11,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,15	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	85		
56,00	100	1,250	81		
40,00	100	0,630	76		
31,50	100	0,315	70		
20,00	96	0,160	62		
14,00	93	0,080	51,8		
10,00	92				
5,00	89				

SAMBLE IDENTIFICATION

Sample	10BH-35 (SS-02)
Depth	0,61 - 1,22 m

Soil Description

Silt and sand, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-21

Groupe ABS

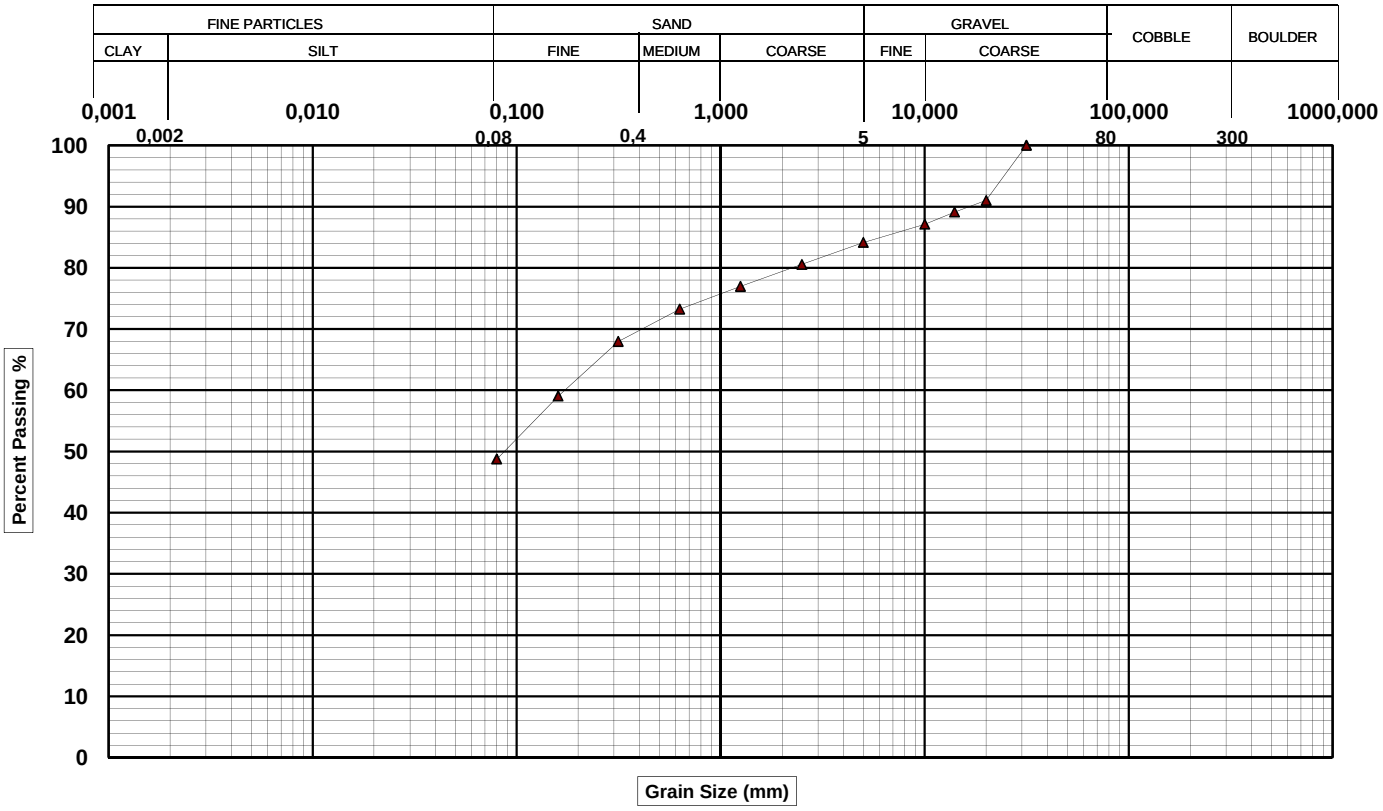
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36772



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	48,8	35,4	15,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,19	N/A	N/A	8

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	81		
56,00	100	1,250	77		
40,00	100	0,630	73		
31,50	100	0,315	68		
20,00	91	0,160	59		
14,00	89	0,080	48,8		
10,00	87				
5,00	84				

SAMBLE IDENTIFICATION

Sample	10BH-35 (SS-04)
Depth	2,44 - 3,05 m

Soil Description

Sand and silt, a little gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-21

F104/970307(0)

Groupe ABS

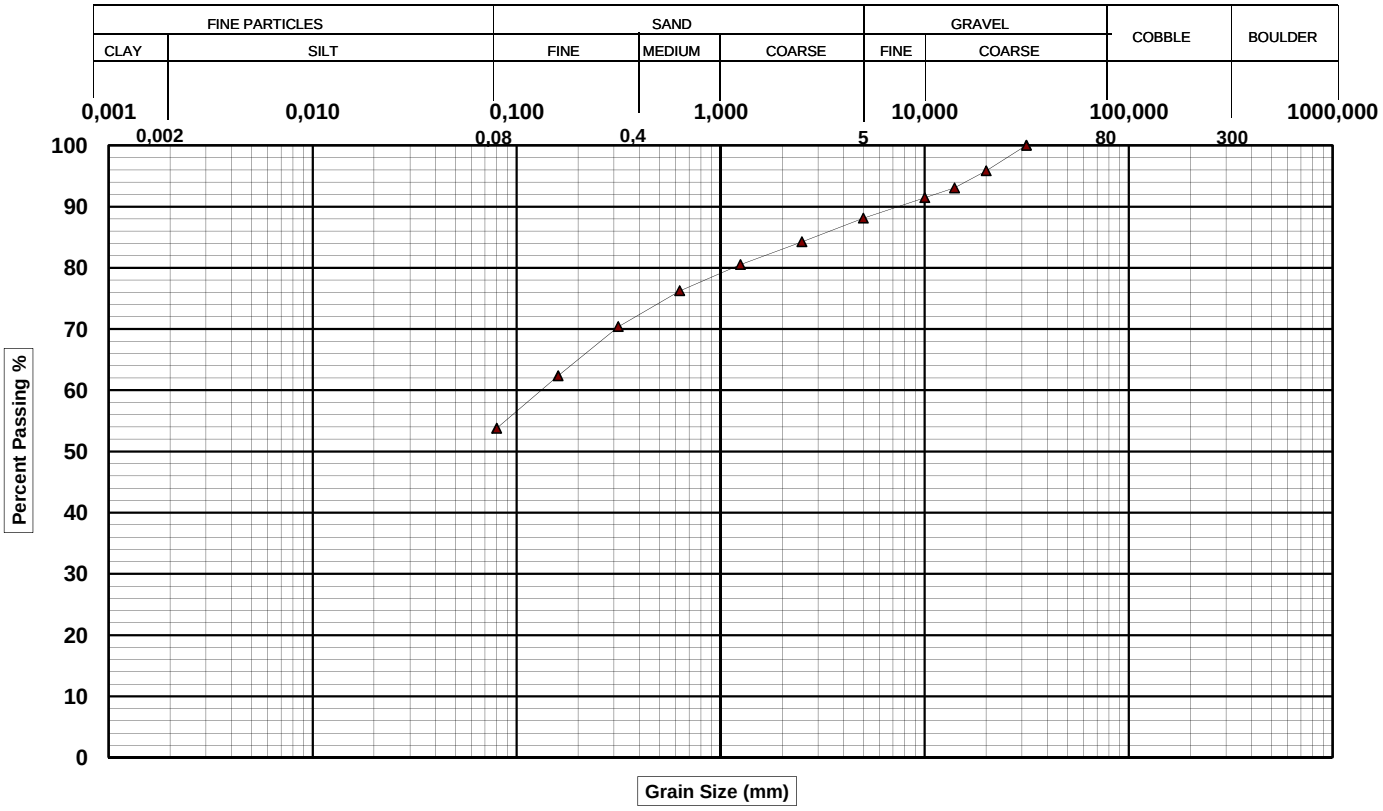
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36674



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	53,8	34,3	11,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,14	N/A	N/A	12

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	84		
56,00	100	1,250	81		
40,00	100	0,630	76		
31,50	100	0,315	70		
20,00	96	0,160	62		
14,00	93	0,080	53,8		
10,00	91				
5,00	88				

SAMBLE IDENTIFICATION

Sample	10BH-34 (SS-02)
Depth	0,61 - 1,22 m

Soil Description

Silt and sand, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-21

Groupe ABS

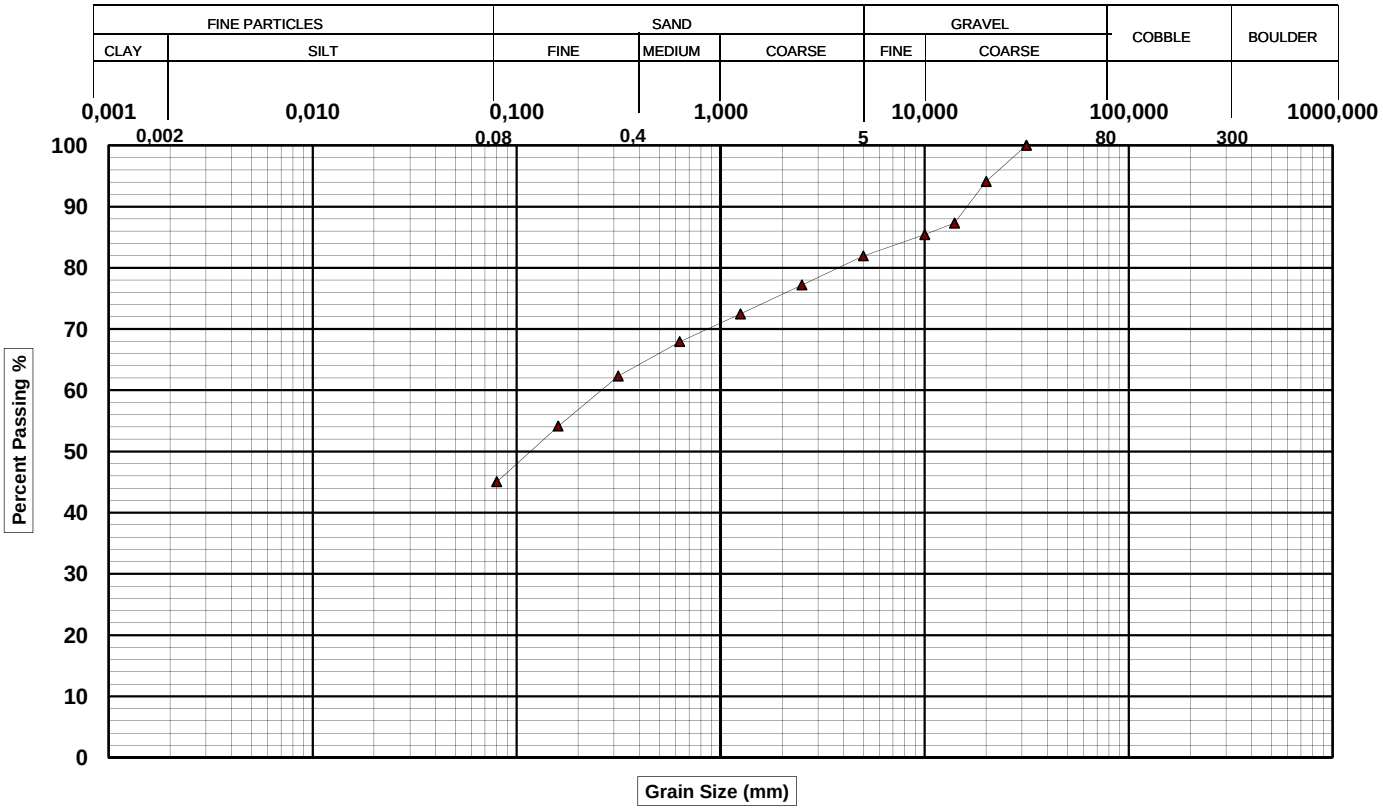
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin **NO. LAB.** 36675



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	45,0	36,9	18,1	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,28	N/A	N/A	9

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	77		
56,00	100	1,250	72		
40,00	100	0,630	68		
31,50	100	0,315	62		
20,00	94	0,160	54		
14,00	87	0,080	45,0		
10,00	85				
5,00	82				

SAMBLE IDENTIFICATION

Sample	10BH-34 (SS-04)
Depth	2,44 - 3,05 m

Soil Description

Silt and sand, some gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-21

Groupe ABS

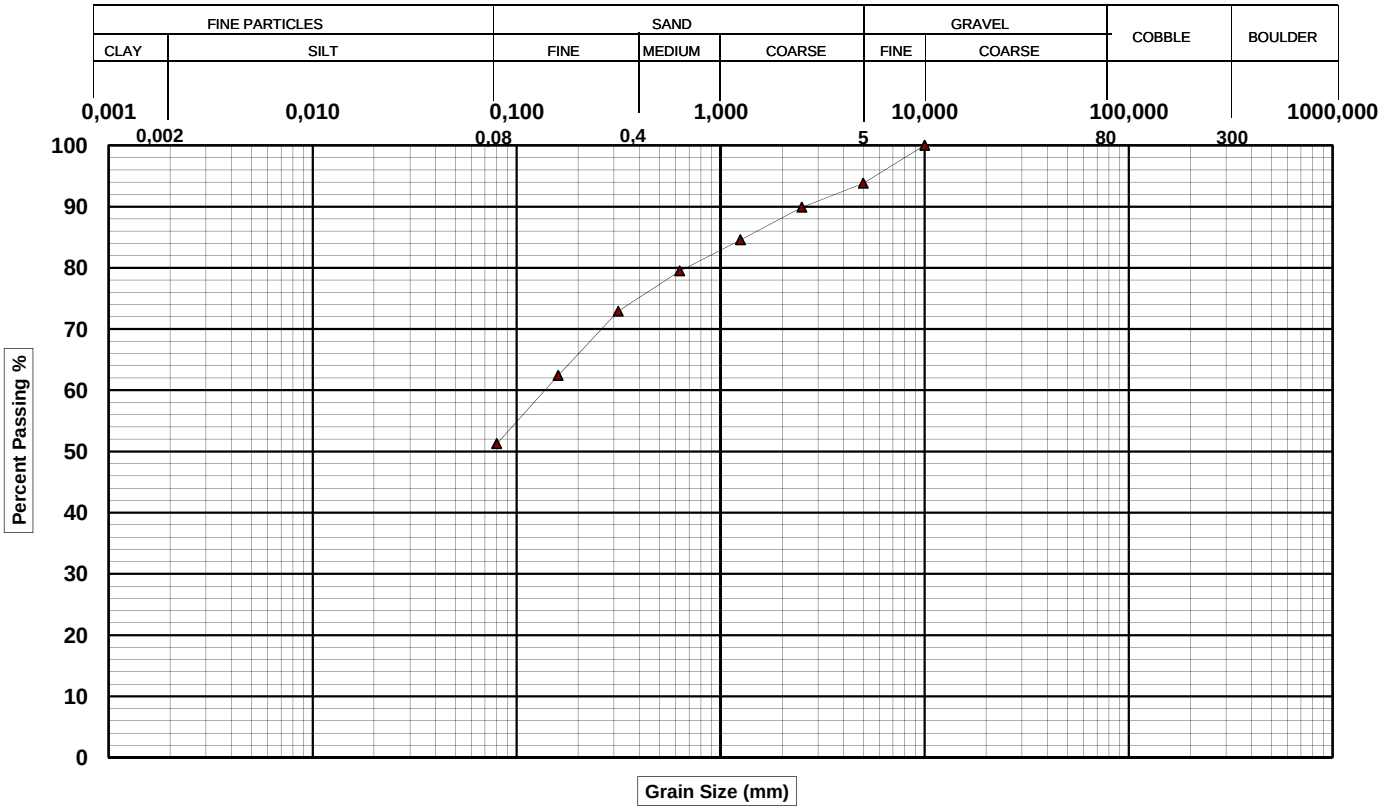
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36604



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	51,3	42,5	6,2	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,14	N/A	N/A	14

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	90		
56,00	100	1,250	85		
40,00	100	0,630	79		
31,50	100	0,315	73		
20,00	100	0,160	62		
14,00	100	0,080	51,3		
10,00	100				
5,00	94				

SAMBLE IDENTIFICATION

Sample	10BH-21 (SS-05)
Depth	3,35 - 3,96 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

Groupe ABS

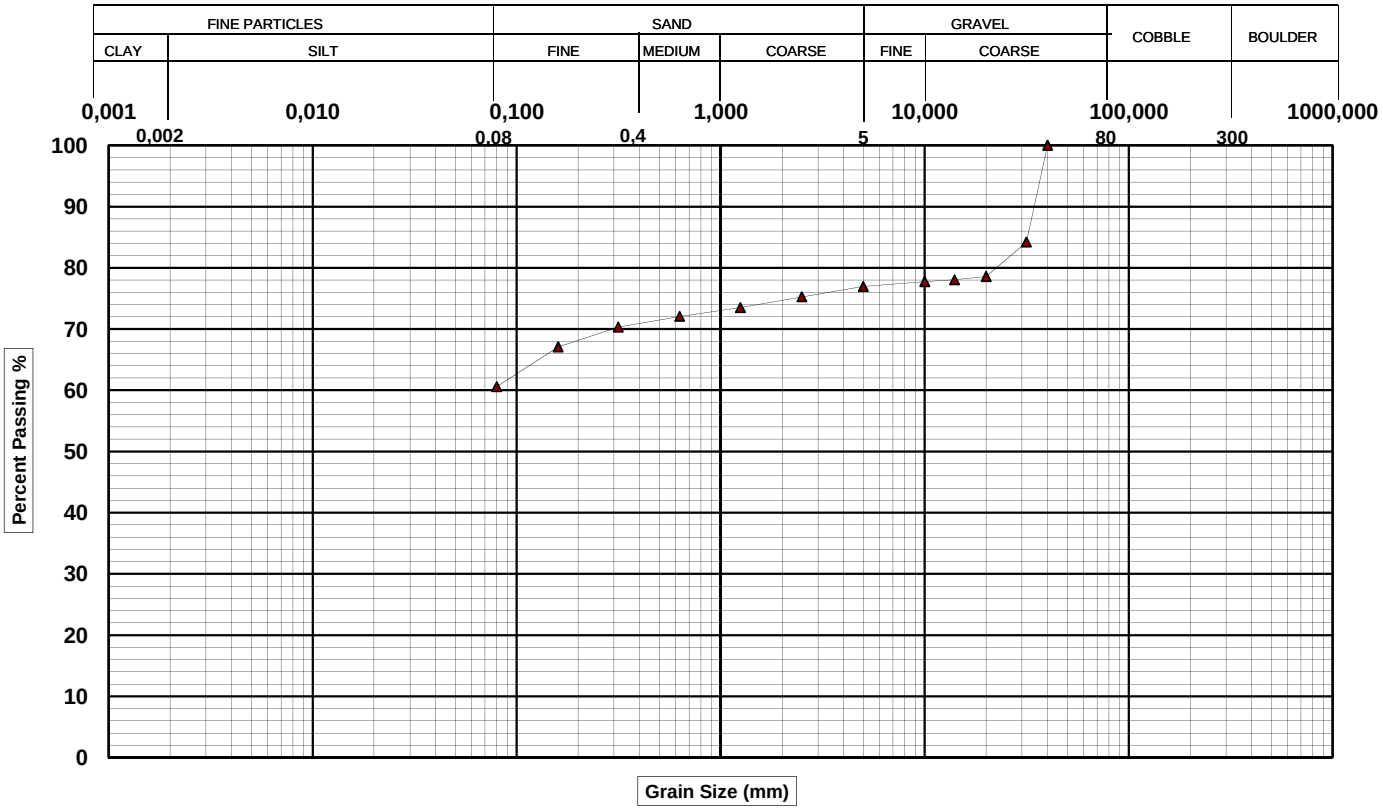
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36607



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	60,6	16,3	23,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	10

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	75		
56,00	100	1,250	73		
40,00	100	0,630	72		
31,50	84	0,315	70		
20,00	79	0,160	67		
14,00	78	0,080	60,6		
10,00	78				
5,00	77				

SAMBLE IDENTIFICATION

Sample	10BH-21 (SS-11)
Depth	9,14 - 9,75 m

Soil Description

Gravelly silt, some sand

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

Groupe ABS

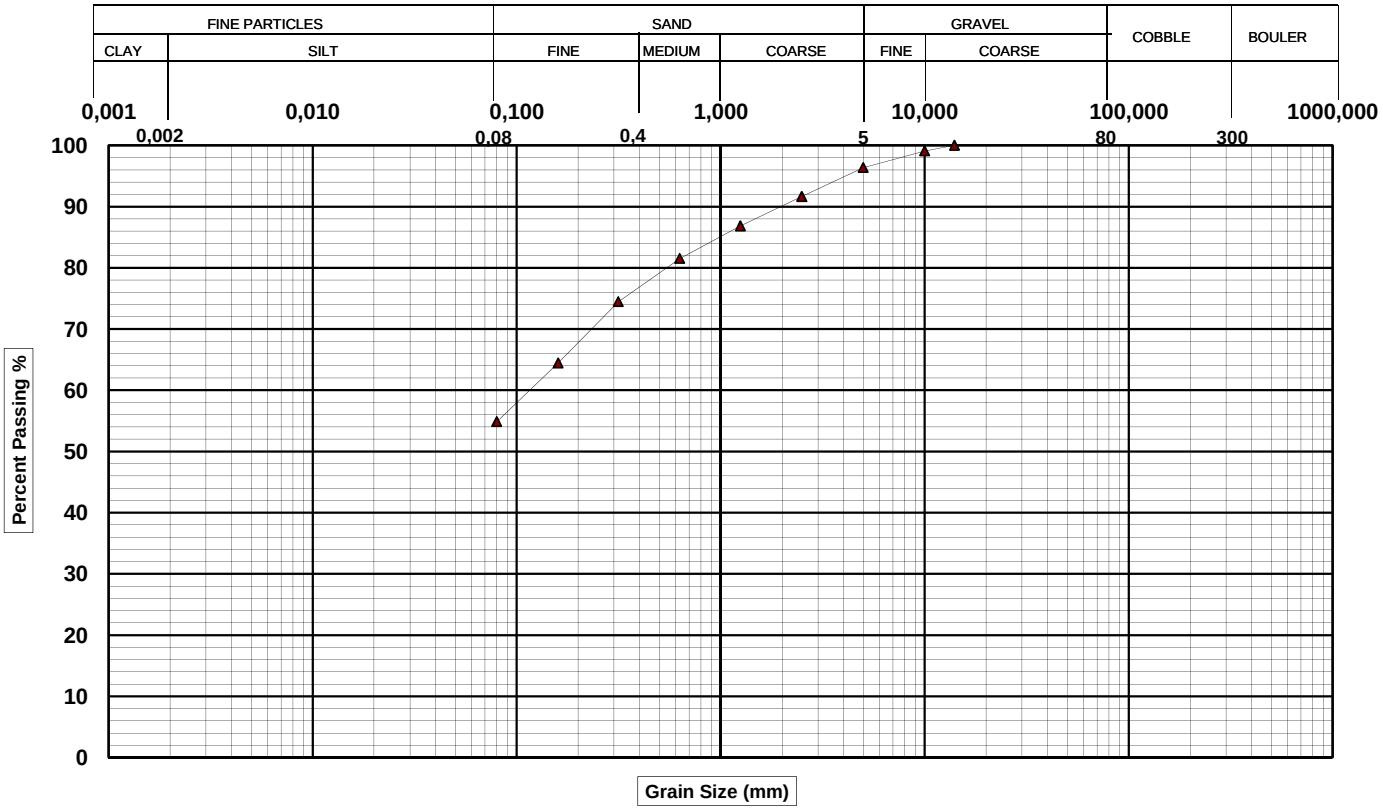
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36601



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	54,9	41,5	3,6	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,12	N/A	N/A	12

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	92		
56,00	100	1,250	87		
40,00	100	0,630	82		
31,50	100	0,315	74		
20,00	100	0,160	64		
14,00	100	0,080	54,9		
10,00	99				
5,00	96				

SAMBLE IDENTIFICATION

Sample	10BH-20 (SS-04)
Depth	2,44 - 3,05 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

Groupe ABS

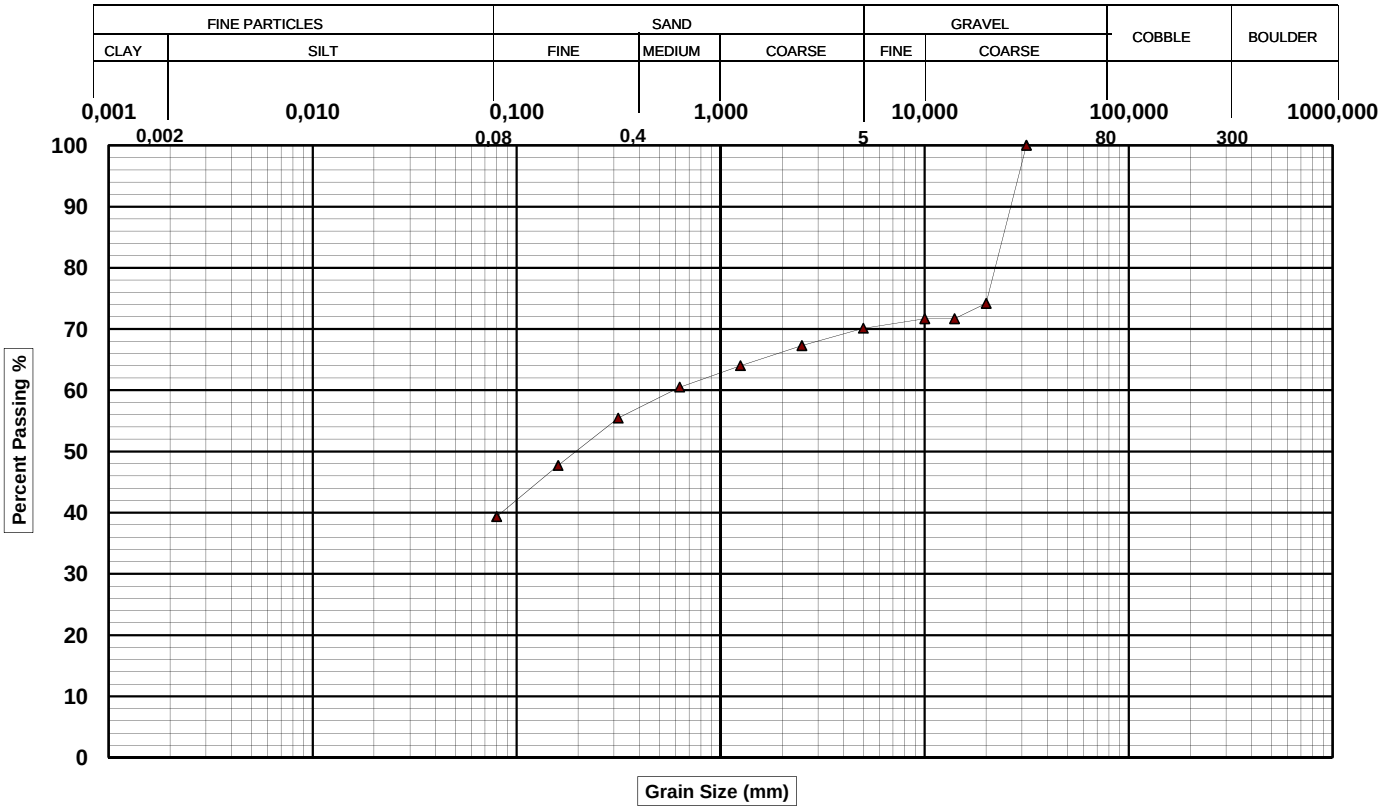
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36602



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	39,4	30,8	29,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,60	N/A	N/A	7

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	67		
56,00	100	1,250	64		
40,00	100	0,630	61		
31,50	100	0,315	55		
20,00	74	0,160	48		
14,00	72	0,080	39,4		
10,00	72				
5,00	70				

SAMBLE IDENTIFICATION

Sample	10BH-20 (SS-07)
Depth	5,18 - 5,79 m
Soil Description	
Gravelly sandy silt	

Prepared by Benoit St-Pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

F104/970307(0)

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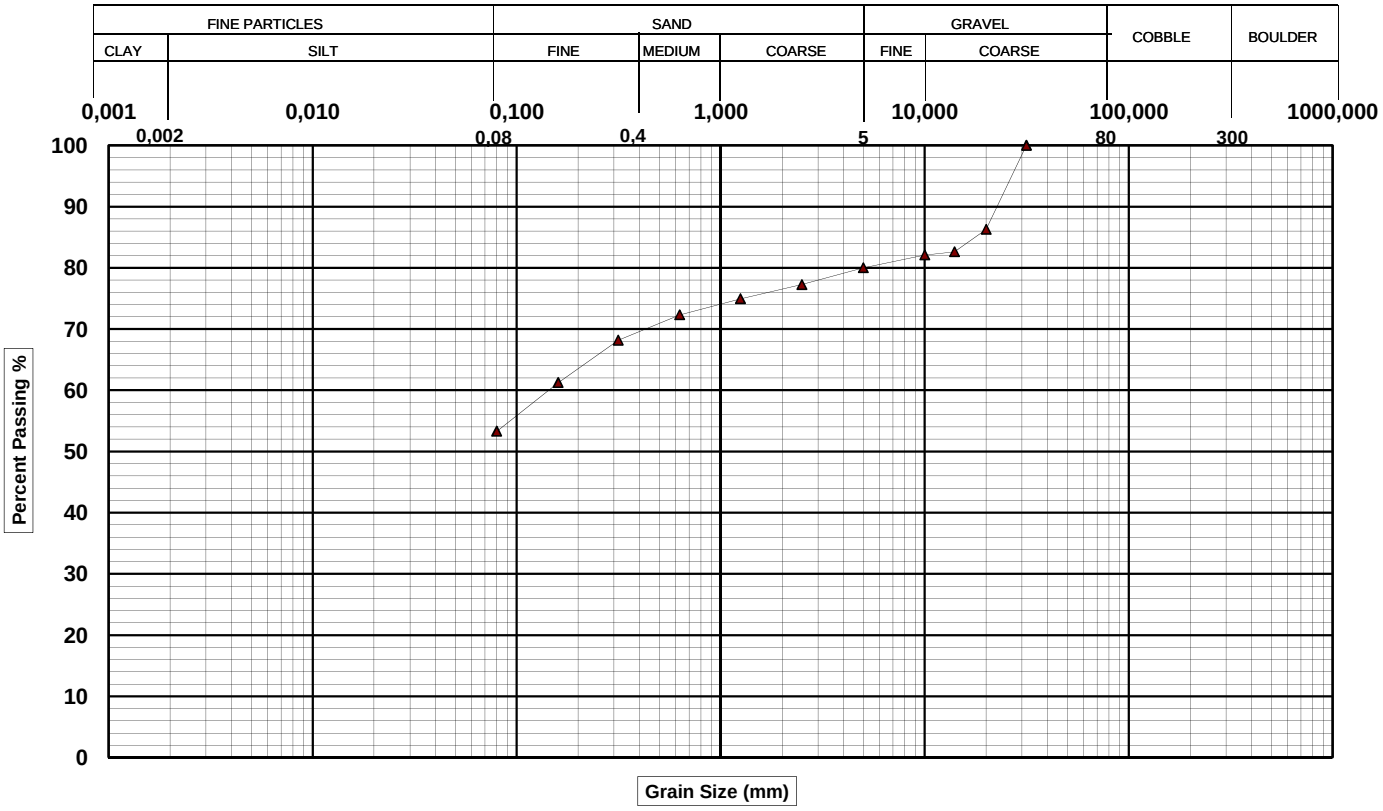
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36603



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	53,3	26,7	20,0	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,15	N/A	N/A	15

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	77		
56,00	100	1,250	75		
40,00	100	0,630	72		
31,50	100	0,315	68		
20,00	86	0,160	61		
14,00	83	0,080	53,3		
10,00	82				
5,00	80				

SAMBLE IDENTIFICATION

Sample	10BH-20 (SS-10)
Depth	7,92 - 8,53 m

Soil Description

Sandy silt, some gravel

Prepared by Benoit St-pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

Groupe ABS

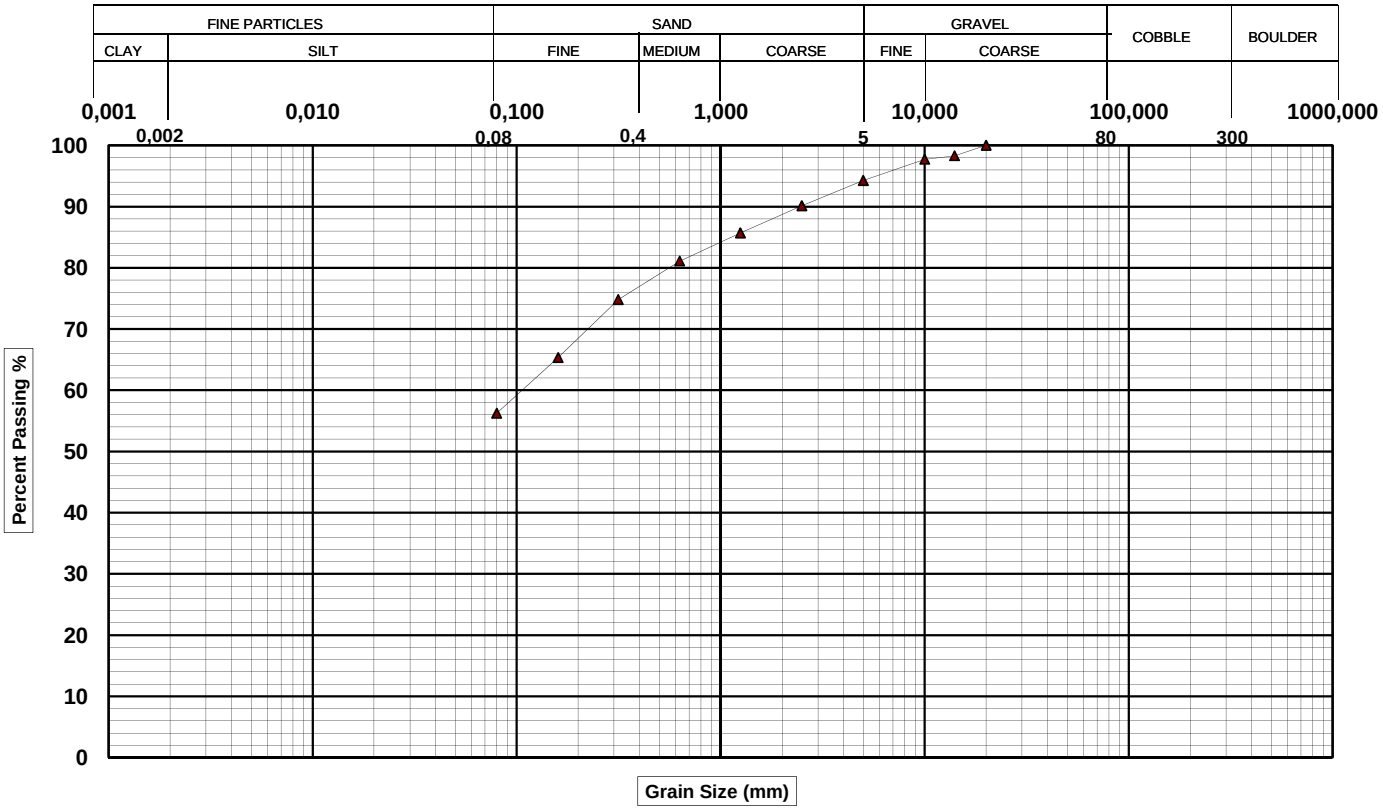
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36605



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	56,2	38,0	5,8	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,10	N/A	N/A	11

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	90		
56,00	100	1,250	86		
40,00	100	0,630	81		
31,50	100	0,315	75		
20,00	100	0,160	65		
14,00	98	0,080	56,2		
10,00	98				
5,00	94				

SAMBLE IDENTIFICATION

Sample	10BH-21 (SS-07)
Depth	5,18 - 5,79 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

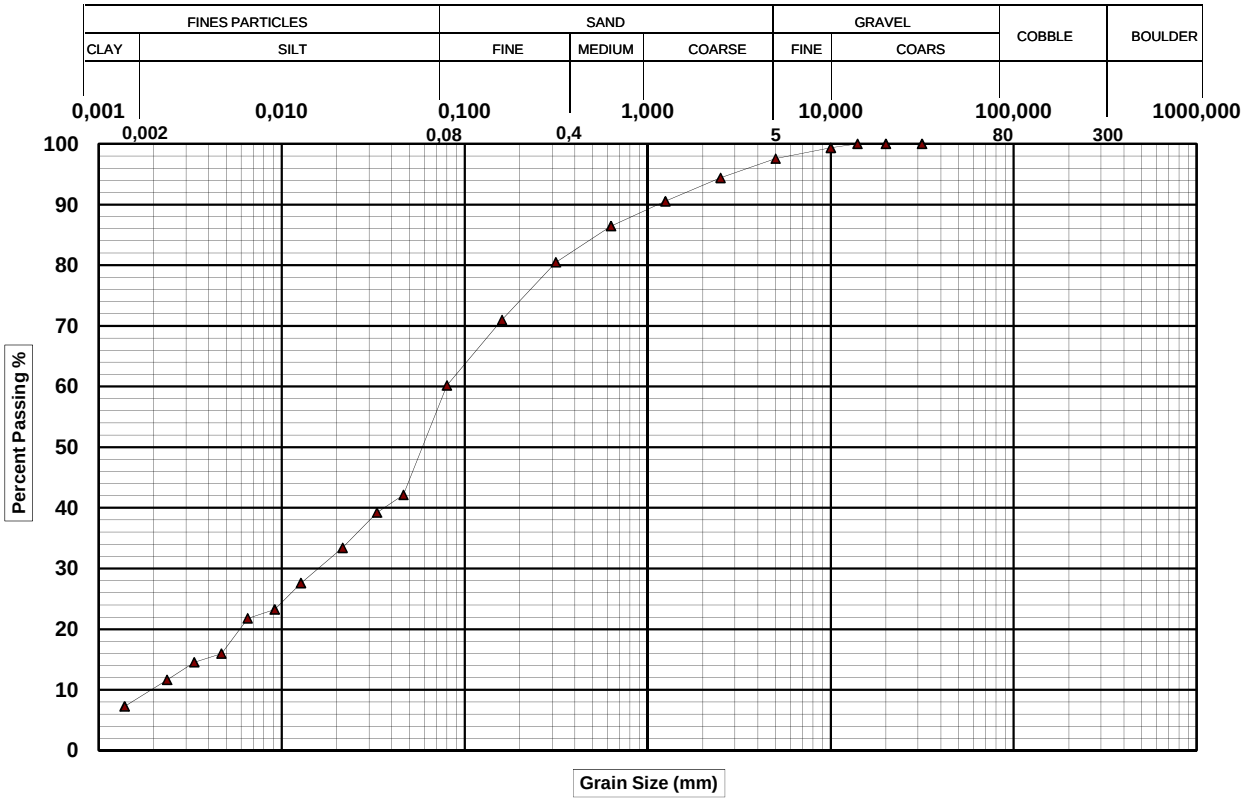
F104/970307(0)

Groupe ABS

GRAIN-SIZE ANALYSIS

LC 21-040 & NQ 2501-025

CLIENT	TranAlta	**N/D** G1-10-1532
PROJCET	Geotechnical study - Wind energy converters (WEC)	
LOCATION	St-Valentin	**NO. LAB.** G1-09-15



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particules			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
10,0	50,2	37,4	2,4	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
0,0020	0,018	0,08	40,00	2,03	13

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	94	0,0215	33
56,00	100	1,250	91	0,0127	28
40,00	100	0,630	86	0,0092	23
31,50	100	0,315	80	0,0065	22
20,00	100	0,160	71	0,0047	16
14,00	100	0,080	60	0,0033	15
10,00	99	0,046	42	0,0024	11,6
5,00	98	0,033	39	0,0014	7,3

SAMBLE IDENTIFICATION

Sample	10BH-21 (SS-10)
Depth	7,92 - 8,53 m

Soil Description

Silt and sand, traces of caly and gravel

Préparé par : Benoit St-Pierre **Approuvé par : Ibrahim Ja'far, ing.** **Date** 2010-04-21

F104/970307(0)

Groupe ABS

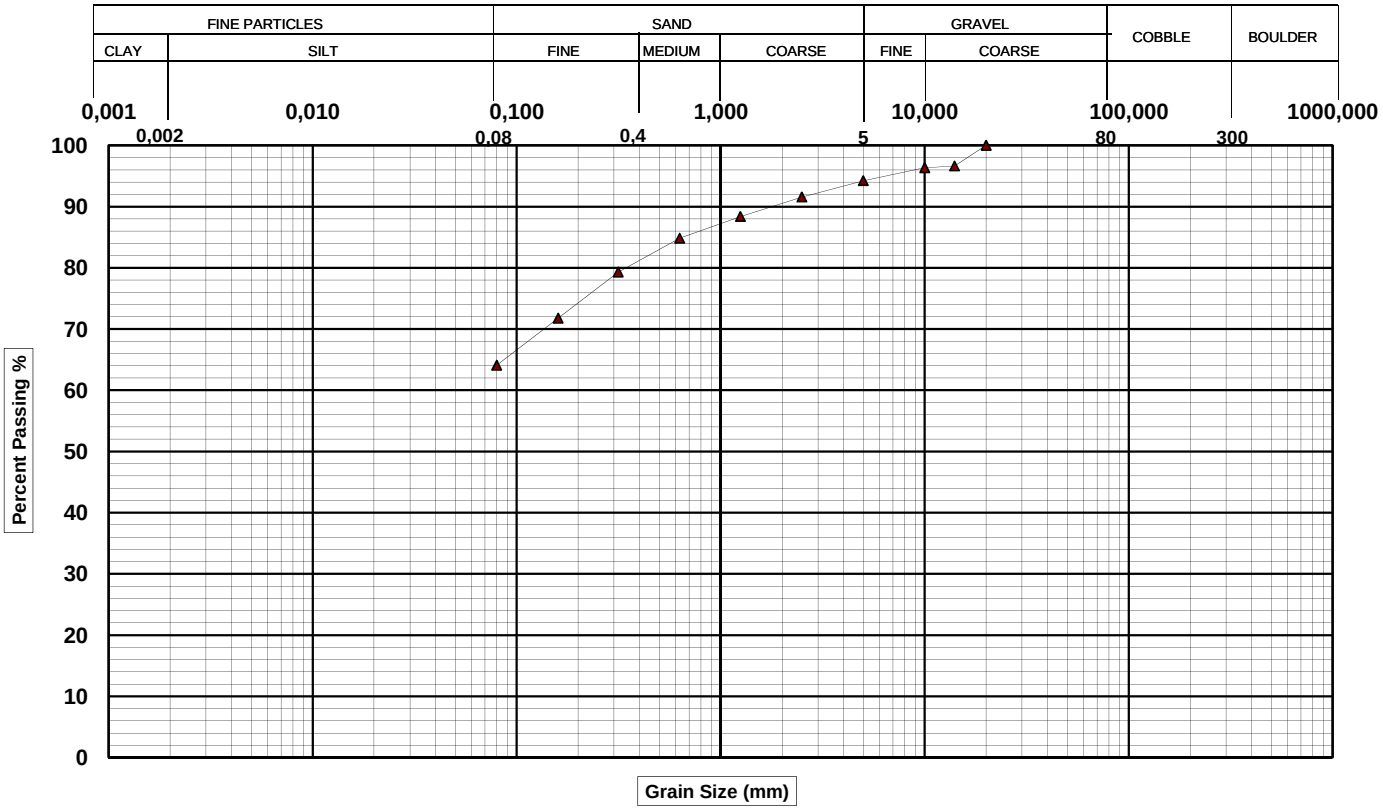
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36713



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	64,1	30,1	5,8	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	13

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	92		
56,00	100	1,250	88		
40,00	100	0,630	85		
31,50	100	0,315	79		
20,00	100	0,160	72		
14,00	97	0,080	64,1		
10,00	96				
5,00	94				

SAMBLE IDENTIFICATION

Sample	10BH-23 (SS-02)
Depth	0,61 - 1,22 m

Soil Description

Sandy silt, traces of gravel

Prepared by Benoit St-pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

Groupe ABS

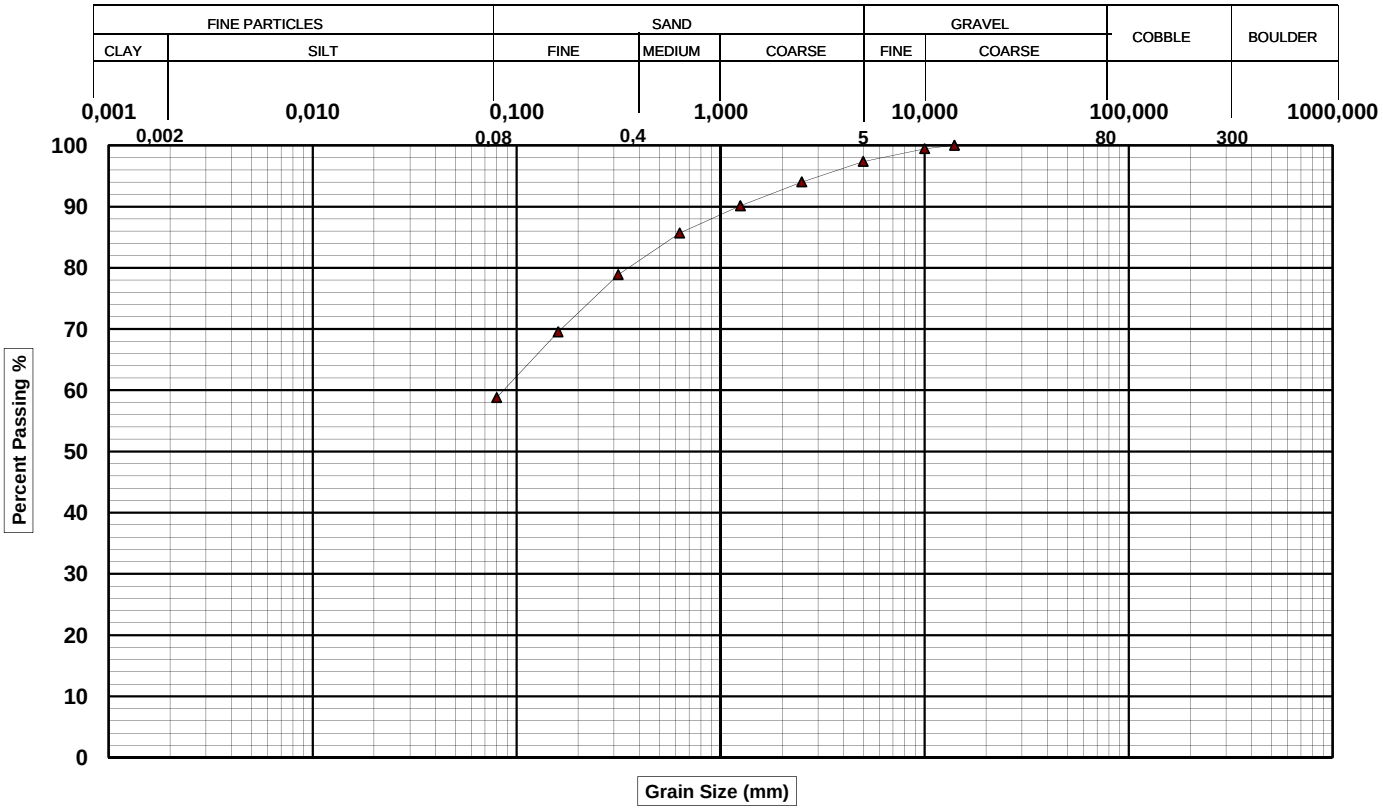
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36714



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	58,8	38,5	2,6	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	0,09	N/A	N/A	12

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	94		
56,00	100	1,250	90		
40,00	100	0,630	86		
31,50	100	0,315	79		
20,00	100	0,160	70		
14,00	100	0,080	58,8		
10,00	99				
5,00	97				

SAMBLE IDENTIFICATION

Sample	10BH-23 (SS-05)
Depth	3,35 - 3,96 m

Soil Description

Silt and sand, traces of gravel

Prepared by Benoit St-pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

Groupe ABS

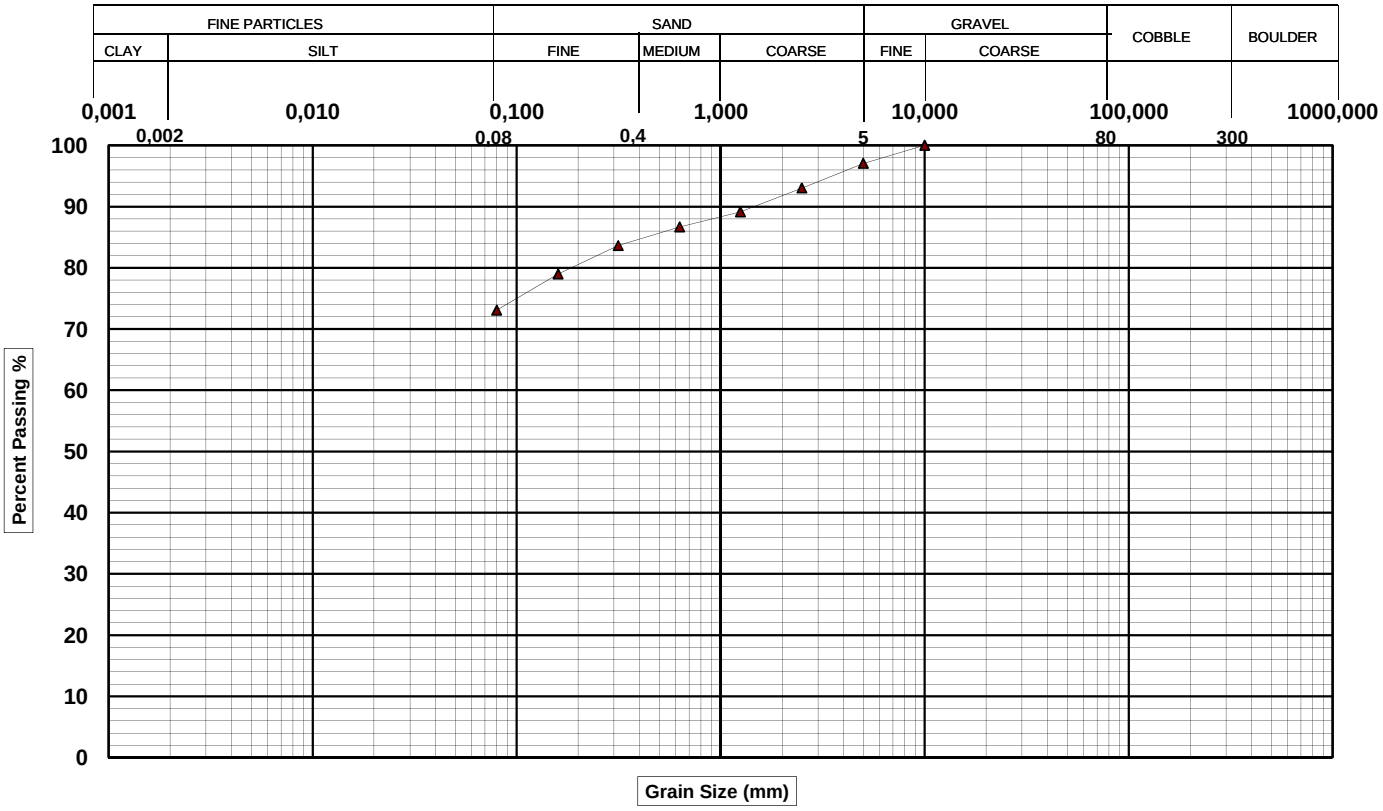
GRAIN-SIZE ANALISYS

LC 21-040 & NQ 2501-025

CLIENT TransAlta **N/D** G1-09-1532

PROJECT Geotechnical study - Wind energy converters (WEC)

LOCATION St-Valentin (Québec) **NO. LAB.** 36715



GRAIN-SIZE DISTRIBUTION

Fine Particles		Coarse Particles			
Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
-	73,1	24,0	2,9	0,0	0,0

D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_u	C_c	W_n (%)
N/A	N/A	N/A	N/A	N/A	14

PERCENT PASSING

(mm)	(%)	(mm)	(%)	(mm)	(%)
80,00	100	2,500	93		
56,00	100	1,250	89		
40,00	100	0,630	87		
31,50	100	0,315	84		
20,00	100	0,160	79		
14,00	100	0,080	73,1		
10,00	100				
5,00	97				

SAMBLE IDENTIFICATION

Sample	10F-23 (CF-10)
Depth	9,14 - 9,75 m

Soil Description

Sandy silt, traces of gravel

Prepared by Benoit St-pierre **Approved by** Ibrahim Ja'far, ing. **Date** 2010-04-22

F104/970307(0)

Appendix E

Geophysical investigation report

SHEAR WAVE VELOCITY SOUNDING RESULTS – WIND ENERGY CONVERTERS PROJECT, SAINT-VALENTIN, QUÉBEC

Presented to :

GROUPE ABS INC.
17, rue de l'Industrie
St-Rémi-de-Napierville (Québec)
J0L 2L0

Presented by :

GEOPHYSICS GPR INTERNATIONAL INC.
100 – 2545, rue Delorimier
Longueuil (Québec)
J4K 3P7

JUNE 2010 **M09789**

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

Geophysics GPR International Inc. has been requested by Groupe ABS Inc. to carry out shear wave velocity soundings at 31 locations in the vicinity of the town of Saint-Valentin, Québec. This work is part of the geotechnical studies for a future wind farm. The geophysical investigations utilized the Multi-channel Analysis of Surface Waves (MASW) method to generate a shear wave velocity depth profile. The study aimed to obtain the average shear wave velocity for the first 30 metres of soil and rock.

The surveys were carried out between March 15 and 27, 2010 and on June 2nd, 2010.

2. SITE LOCATION

The town of Saint-Valentin is located about 60 km South-East of Montréal in the Montérégie administrative region. The soundings are located approximately within a 5 km radius from Saint-Valentin. Figure 1 shows a regional map of the Montérégie region. Figure 2 shows a local map with the position of each sounding site.

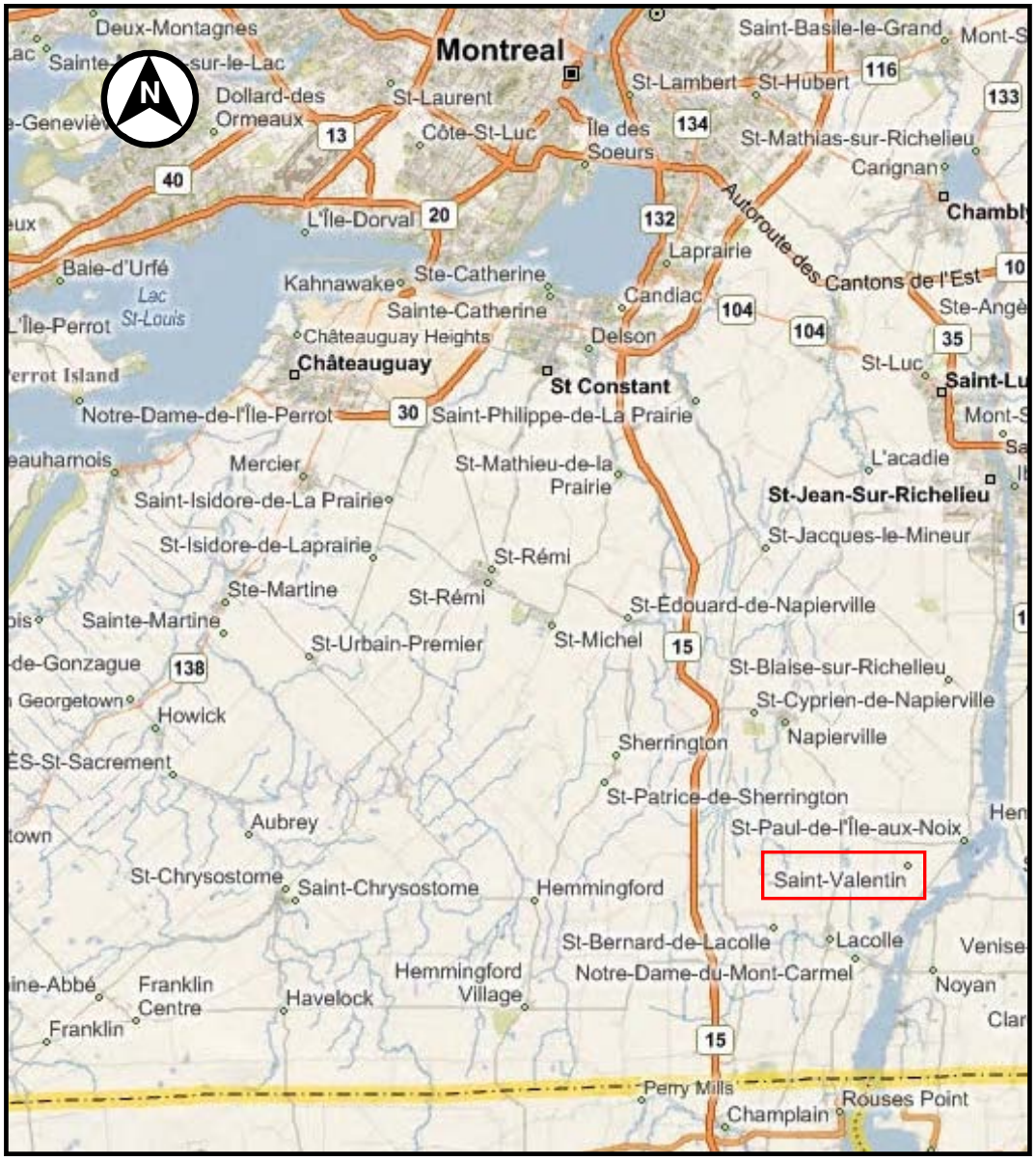
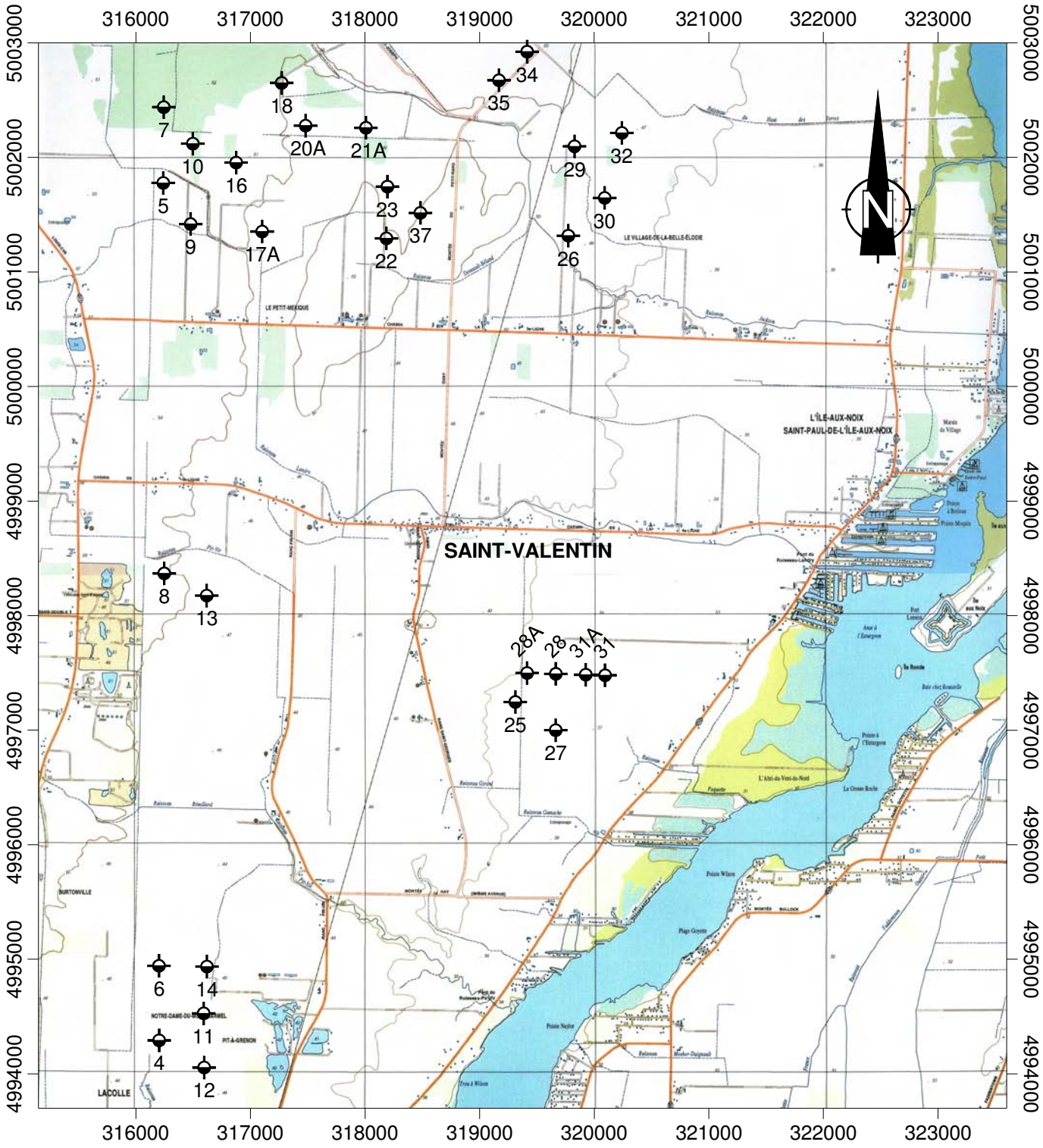


FIGURE 1

Location of Saint-Valentin within the Montérégie region (source: Bing Maps™)



Site coordinates provided by Groupe ABS

Scale 1 : 50 000
MTM NAD83 zone 8

FIGURE 2
MASW sounding locations

3. METHODOLOGY

3.1 Basic Theory

The Multi-channel Analysis of Surface Waves (MASW) and the Extended Spatial Autocorrelation Method (ESPAC) are seismic methods used to evaluate the shear wave velocities of subsurface materials through the analysis of the dispersion properties of Rayleigh surface waves ("ground roll"). The MASW is considered as an "active" method, as the seismic signal is induced at known location and time in the geophones spread axis. Conversely, the ESPAC is considered as a "passive" method, using the low frequency "noises" produced far away.

The dispersion properties are measured as a change in phase velocity with frequency. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. Inversion of the Rayleigh wave dispersion curve yields a shear wave (Vs) velocity depth profile (sounding). Figure 3 outlines the basic operating procedure for the MASW method. Figure 4 is an example image of a typical MASW record and resulting 1D V_S model.

The ESPAC method allows deeper Vs soundings, but with a poor resolution for the surface portion. Its dispersion curve can then be merged with the higher frequency curve from the MASW to allow a more complete inversion of the data. A detailed description of the MASW method can be found in the paper *Multi-channel Analysis of Surface Waves*, Park, C.B., Miller, R.D. and Xia, J. Geophysics, Vol. 64, No. 3 (May-June 1999); P. 800–808. For the SPAC method, one can refer to the paper *Shear Velocity Profiles Obtained from Microtremor Array Data with an Example from Direct Fitting of SPAC Curves*, Asten, M.W., 2007, Proceedings of the 20th SAGEEP Conference, Denver, Environmental and Engineering Geophysical Society.

3.2 Survey Design

The MASW survey utilizes a similar set-up to a seismic refraction investigation (i.e. 24 geophones in a linear array). The principle consists of intentionally generating a seismic wave at the surface and digitally recording the surface waves from the moment of source impact with a linear series of geophones on the surface.

A 12 pound sledgehammer was used as the primary energy source with traces being recorded off both ends of the seismic spread (4 shots per spread). Two geophone spacing values (1m and 3m) were used in order to get good resolution of surface velocities as well as good depth penetration. The total spread length was 23 m for the 1 m spacing and 69m for the 3m spacing. Unlike the refraction method, which produces a data point beneath each geophone, the shear wave depth profile is the average of the bulk area within the geophone spread, especially for its central half-length.

The orientation of the MASW spreads was determined on-site, depending on site access and clearance available.

3.3 Interpretation Method

The main processing sequence involved plotting, picking and 1D inversion of the MASW shot records using the SeisImagerSW™ software package. In theory, all the MASW shot records for a given spread should produce a similar shear wave velocity profile. In practice, however, differences can arise due to energy dissipation, localized surface variations, and/or dipping of overburden layers or rock. In general, the precision of the calculated seismic shear wave velocities (V_S) is of the order of 15% or better. When the penetration of the MASW shots was not sufficient, the same data points were processes using the ESPAC method to obtain greater depth penetration.

The results of the MASW tests are normally presented in chart format. It presents the 1-D shear wave velocity values from the inversion models of dispersion curves of the active MASW.

The V_{S30} value is based on the harmonic mean of the shear wave velocities, from the surface to a depth of 30 metres. The V_{S30} value is calculated by dividing the total depth of interest (e.g. 30m) by the sum of the time spent in each velocity layer from the surface up to that depth. This harmonic mean value reflects an equivalent single layer response.

The V_{S30} is used to determine the Site Classification for Seismic Site Response, as presented in the National Building Code of Canada (NBCC, 2005 ed.), as specified in table 4.1.8.4.A of the mentioned document[1].

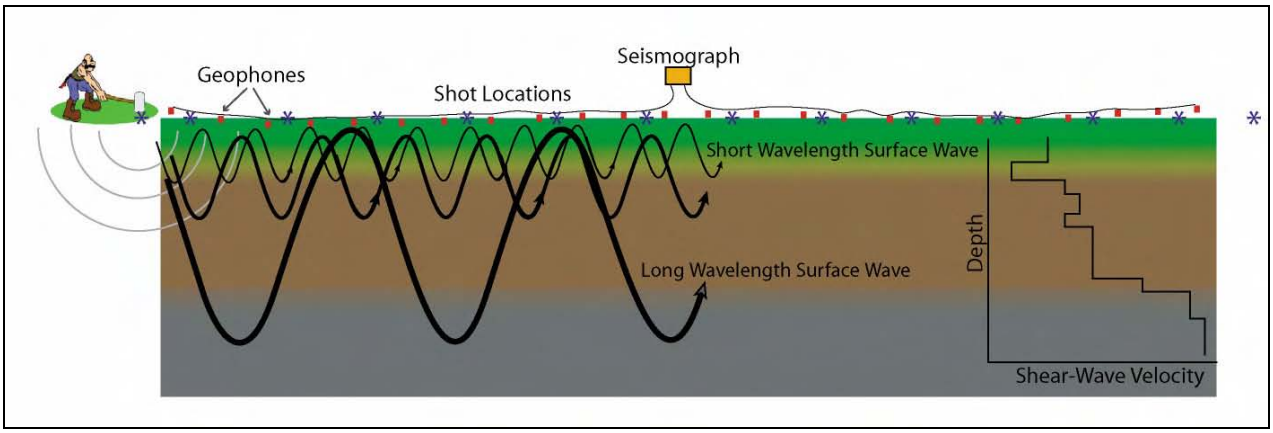


FIGURE 3
MASW Operating Principle

[1] NBCC. 2005. National Building Code of Canada 2005. Institute for Research in Construction, National Research Council of Canada, Ottawa, Ont.

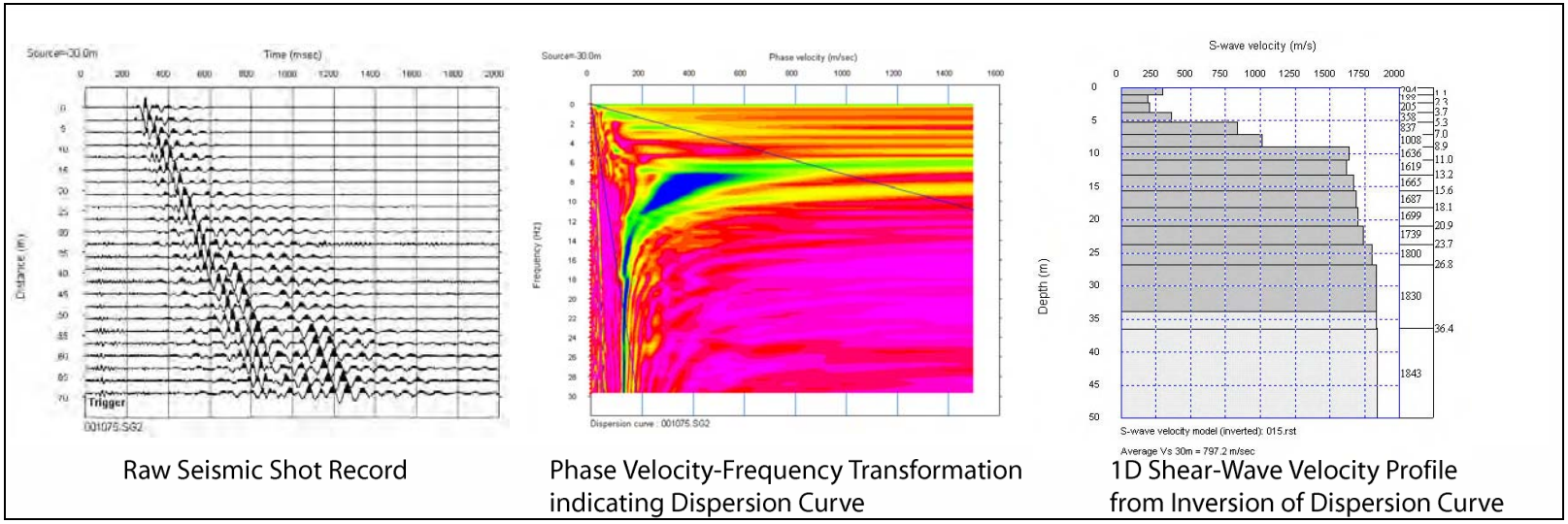


FIGURE 4

Example of a typical MASW shot record, phase velocity/frequency curve and resulting 1D shear wave velocity model

4. RESULTS

The MASW sounding results for each site investigated are presented in Appendix A. For each site, details of the V_{S30} calculations are presented in the table at the left of the 1D sounding profile. Site specific notes are included in each result sheet. As reference, the NBCC site classification is also indicated.

Table 1 shows the site coordinates provided by Groupe ABS.

The majority of the sites investigated show a similar velocity vs. depth distribution. This trend is characterized by a low velocity surface layer of a thickness of about 4 to 10 metres. In most cases, this layer shows abnormally low values that could be associated with a soil with liquefaction potential.

The low velocity layer is followed by an intermediate layer of variable thickness with an increasing V_S velocity in function of depth. Finally, a high velocity layer (bedrock in most cases) is detected beneath the intermediate layer. The high velocity layer is characterized by almost constant V_S. The velocity of this layer increases slightly with depth.

The MASW soundings were divided into five (5) groups in relation to their geographical position within the Saint-Valentin region. Average velocities for the three main layers and the average V_{S30} were computed and are presented in Table 2. These results indicate that the sounding sites within groups M and O show very low V_S velocities within the surface layer. Groups M and O are located to the South and South-East of Saint-Valentin.

In the case of the intermediate layer, it is groups N and O that show the lowest V_S velocities. These groups are located to the East and South of Saint-Valentin.

Group N shows the lowest average velocities for the hard layer. Borehole results indicate that the bedrock is located at depths over 30 metres in this area. Therefore, the measured shear wave velocities are only representative of the overburden in this area. This group also shows the lowest V_{S30} values of all five groups.

Overall, it is the sounding sites within group Q that show the highest shear wave velocities for all three principal layers as well as the average V_{S30} value. Group Q is the only group that does not have one or several sites with abnormally low V_S values for the surface layer that could be associated with a soil with liquefaction potential. Group Q is located at the North-East of Saint-Valentin.

TABLE 1 - MASW sounding site coordinates (MTM, NAD83, zone 8)

Site	Xc_MTM	Yc_MTM
4	316203	4994292
5	316239	5001777
6	316202	4994943
7	316244	5002438
8	316248	4998369
9	316478	5001418
10	316497	5002120
11	316592	4994528
12	316596	4994055
13	316618	4998175
14	316620	4994936
16	316876	5001955
17A	317102	5001353
18	317273	5002650
20A	317482	5002277
21A	318008	5002258
22	318187	5001293
23	318195	5001745
25	319312	4997246
26	319774	5001316
27	319664	4996999
28	319665	4997492
28A	319414	4997499
29	319828	5002096
30	320091	5001646
31	320095	4997479
31A	319926	4997484
32	320241	5002214
34	319415	5002922
35	319169	5002673
37	318483	5001515

coordinates provided by Groupe ABS

TABLE 2 – Average velocities vs. geographical groups

GROUP	SITES	AVERAGE VELOCITIES (m/s)			
		surface layer	intermediate layer	hard layer or bedrock	V_{S30}
M	4, 6, 11, 12, 14	134	742	1426	399
N	8, 13	245	590	1105	386
O	25, 27, 28, 28A, 31, 31A	150	575	1343	480
P	5, 7, 9, 10, 16, 17A, 18, 20A, 21A, 22, 23, 37	207	756	1400	606
Q	26, 29, 30, 32, 34, 35	264	880	1548	802
Average for all 31 sites		**198**	**732**	**1403**	**572**

5. CONCLUSION

Geophysical investigations with the MASW seismic method were carried out on 31 sites in the region of the town of Saint-Valentin, Québec. These surveys were part of the geotechnical studies for a wind farm project in the area.

The surveys allowed calculating the average shear wave velocities from the surface to a depth of 30 metres (V_{S30}). These values can be used to determine the Site Classification for Seismic Site Response, as presented in the National Building Code of Canada.

Results show that the 18 sites located at the north of the town of Saint-Valentin show higher V_{S30} values than the 13 sites located at the south of the town. A high number of the sites investigated show the presence of a surface layer with abnormally low shear wave velocity values that could be associated with a soil with liquefaction potential. Further geotechnical assessments are recommended for these sites.

It must be noted that other geotechnical information gleaned onsite; including the rock depth, the presence of liquefiable soils, soft clays, high moisture content etc. can supersede the site classification provided in this report based on V_{s30} value.

This report has been written by Daniel Campos Halas, Eng., M.A.Sc., with the collaboration of Jean-Luc Arsenault, Eng., M.A.Sc.

Daniel Campos Halas, Eng., M.Sc.A.
Project Manager
(O.I.Q member: 130386)

Jean-Luc Arsenault, Eng., M.Sc.A.
Project Manager
(O.I.Q member: 45316)

APPENDIX A – MASW SOUNDING RESULTS

Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	78.4					
1.07	79.3	1.07	1.07	0.013658	0.013658	78.4
2.31	78.4	1.24	2.31	0.015584	0.029242	78.9
3.71	128.7	1.40	3.71	0.017871	0.047113	78.7
5.27	433.1	1.57	5.27	0.012164	0.059276	89.0
7.01	699.1	1.73	7.01	0.003996	0.063272	110.7
8.90	867.2	1.90	8.90	0.002712	0.065984	134.9
10.96	1599.3	2.06	10.96	0.002376	0.068360	160.4
13.19	1613.4	2.23	13.19	0.001391	0.069751	189.1
15.58	1600.6	2.39	15.58	0.001481	0.071233	218.7
18.13	1582.1	2.55	18.13	0.001596	0.072829	249.0
20.85	1572.5	2.72	20.85	0.001719	0.074548	279.7
23.74	1748.5	2.88	23.74	0.001834	0.076382	310.8
26.79	1801.1	3.05	26.79	0.001744	0.078126	342.9
30.00	1952.1	3.21	30.00	0.001785	0.079911	375.4

Location

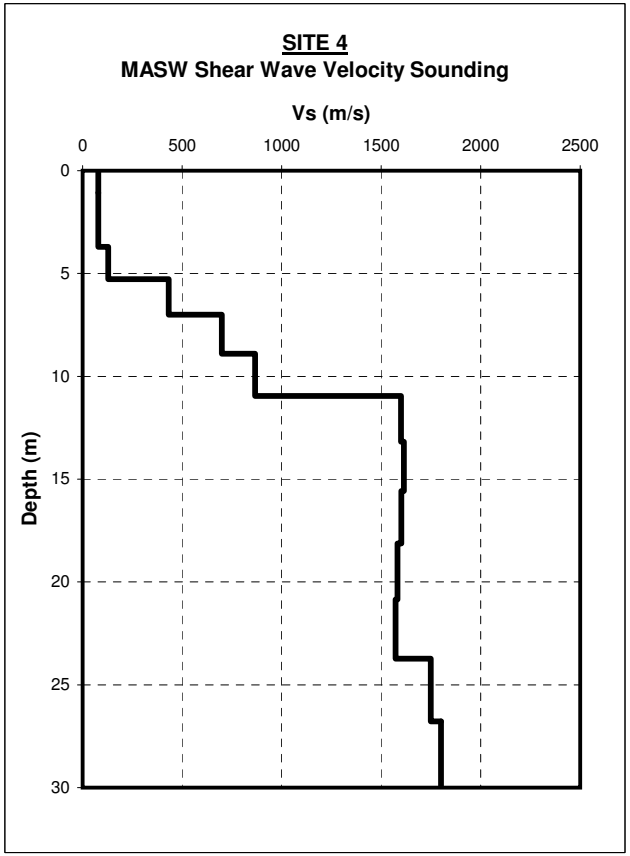
Sounding:	X (m)	Y (m)
MTM/Nad83	316203	4994292

Vs30 (m/s) =	375.4
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	205.9					
1.07	190.3	1.07	1.07	0.005204	0.005204	205.9
2.31	165.8	1.24	2.31	0.006496	0.011701	197.2
3.71	175.9	1.40	3.71	0.008450	0.020151	184.1
5.27	315.4	1.57	5.27	0.008901	0.029051	181.6
7.01	589.9	1.73	7.01	0.005488	0.034539	202.8
8.90	1060.5	1.90	8.90	0.003214	0.037753	235.8
10.96	1267.8	2.06	10.96	0.001943	0.039696	276.1
13.19	1294.8	2.23	13.19	0.001755	0.041451	318.1
15.58	1377.5	2.39	15.58	0.001846	0.043297	359.8
18.13	1444.0	2.55	18.13	0.001855	0.045152	401.6
20.85	1492.5	2.72	20.85	0.001883	0.047035	443.3
23.74	1513.7	2.88	23.74	0.001933	0.048968	484.7
26.79	1528.6	3.05	26.79	0.002015	0.050983	525.4
30.00	1546.9	3.21	30.00	0.002103	0.053085	565.1

Location

Sounding:	X (m)	Y (m)
MTM/Nad83	316239	5001777

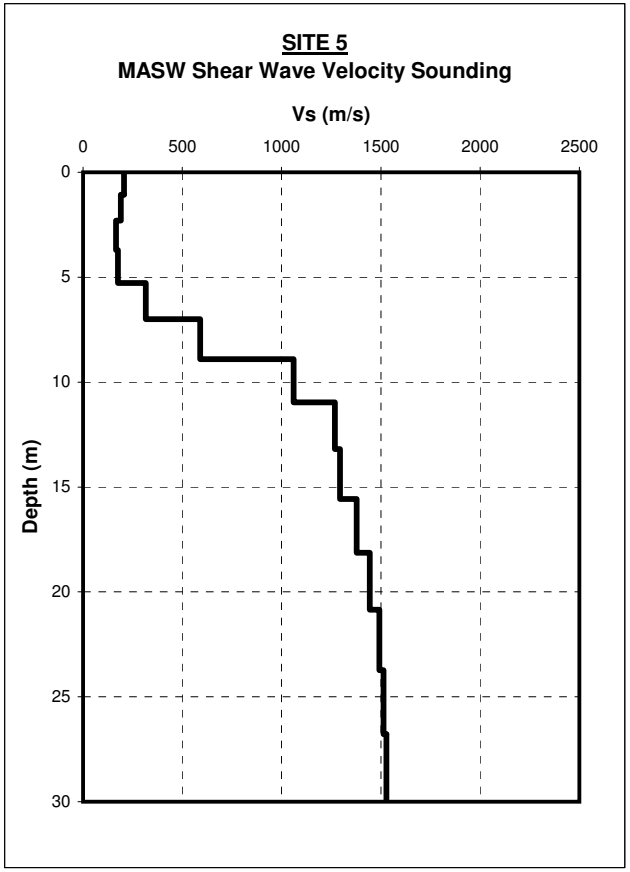
Vs30 (m/s)	565.1
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.

3- The site coordinates were provided by the client.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	136.2726					
1.07	81.73054	1.07	1.07	0.007862	0.007862	136.3
2.31	133.5603	1.24	2.31	0.015126	0.022988	100.4
3.71	129.1482	1.40	3.71	0.010490	0.033479	110.8
5.27	240.9045	1.57	5.27	0.012125	0.045604	115.7
7.01	239.3755	1.73	7.01	0.007184	0.052788	132.7
8.90	259.3235	1.90	8.90	0.007919	0.060707	146.6
10.96	615.7848	2.06	10.96	0.007945	0.068653	159.7
13.19	1085.137	2.23	13.19	0.003614	0.072267	182.5
15.58	1297.528	2.39	15.58	0.002203	0.074469	209.2
18.13	1372.757	2.55	18.13	0.001969	0.076438	237.2
20.85	1371.588	2.72	20.85	0.001981	0.078419	265.9
23.74	1388.833	2.88	23.74	0.002103	0.080523	294.8
26.79	1390.087	3.05	26.79	0.002196	0.082718	323.8
30.00	1641.913	3.21	30.00	0.002312	0.085031	352.8

Location

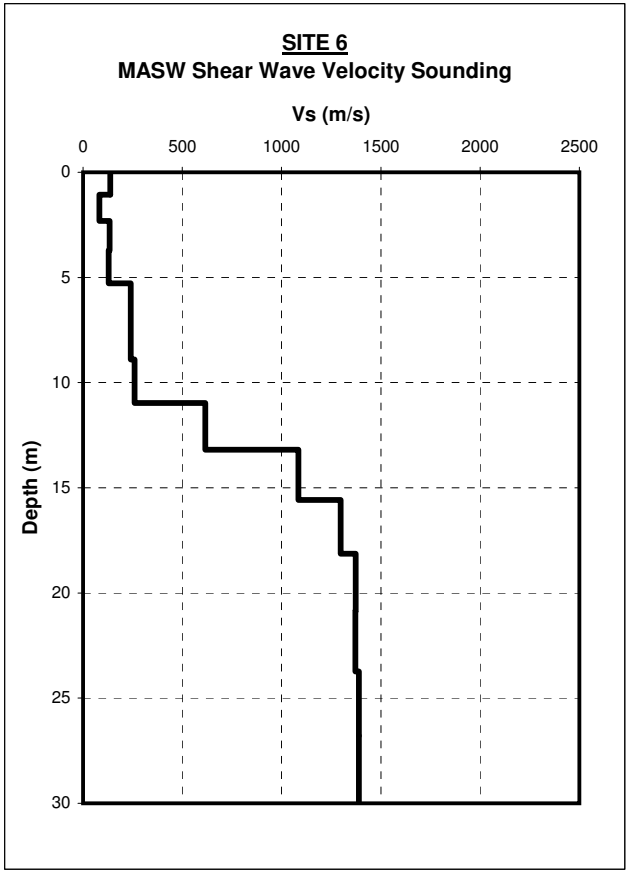
Sounding:	X (m)	Y (m)
MTM/Nad83	316202	4994943

Vs30 (m/s)	352.8
Class :	D

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains D, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	258.6					
1.07	149.0	1.07	1.07	0.004144	0.004144	258.6
2.31	167.1	1.24	2.31	0.008297	0.012441	185.5
3.71	270.7	1.40	3.71	0.008386	0.020827	178.1
5.27	374.1	1.57	5.27	0.005785	0.026612	198.2
7.01	492.8	1.73	7.01	0.004627	0.031238	224.3
8.90	385.9	1.90	8.90	0.003847	0.035085	253.7
10.96	691.3	2.06	10.96	0.005340	0.040425	271.2
13.19	1307.8	2.23	13.19	0.003219	0.043644	302.1
15.58	1401.2	2.39	15.58	0.001828	0.045471	342.6
18.13	1464.8	2.55	18.13	0.001823	0.047295	383.4
20.85	1485.6	2.72	20.85	0.001857	0.049152	424.2
23.74	1490.0	2.88	23.74	0.001942	0.051093	464.6
26.79	1667.5	3.05	26.79	0.002047	0.053140	504.1
30.00	2141.1	3.21	30.00	0.001928	0.055068	544.8

Location

Sounding:	X (m)	Y (m)
MTM/Nad83	316244	5002438

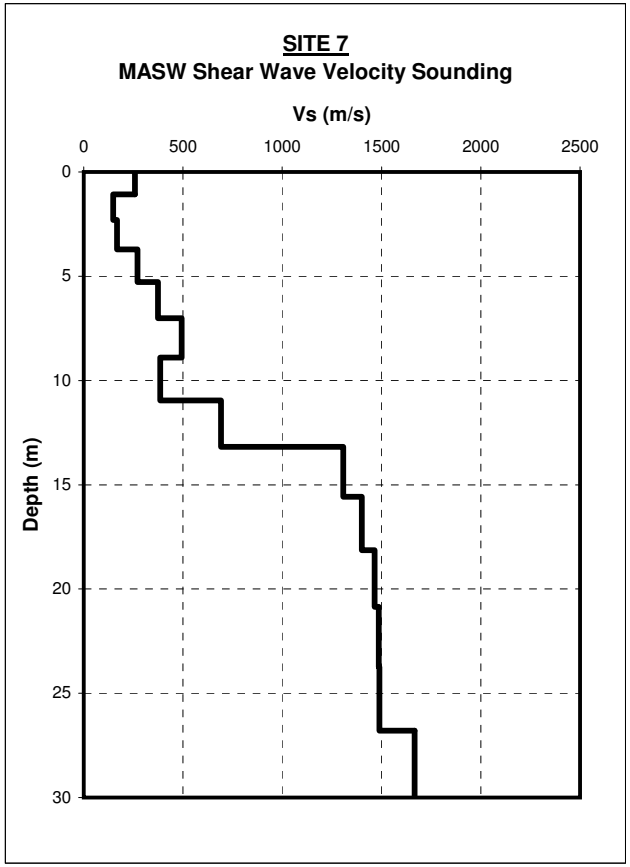
Vs30 (m/s)	544.8
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 3-4 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.

3- The site coordinates were provided by the client.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	153.4					
1.07	194.3	1.07	1.07	0.006984	0.006984	153.4
2.31	229.9	1.24	2.31	0.006362	0.013347	172.9
3.71	258.1	1.40	3.71	0.006095	0.019442	190.8
5.27	246.4	1.57	5.27	0.006067	0.025509	206.8
7.01	261.6	1.73	7.01	0.007024	0.032534	215.3
8.90	346.6	1.90	8.90	0.007245	0.039779	223.8
10.96	480.9	2.06	10.96	0.005944	0.045723	239.7
13.19	501.4	2.23	13.19	0.004627	0.050350	261.9
15.58	518.2	2.39	15.58	0.004767	0.055117	282.6
18.13	546.1	2.55	18.13	0.004931	0.060048	302.0
20.85	649.1	2.72	20.85	0.004980	0.065028	320.7
23.74	974.0	2.88	23.74	0.004444	0.069472	341.7
26.79	1336.1	3.05	26.79	0.003131	0.072603	368.9
30.00	1365.0	3.21	30.00	0.002406	0.075008	400.0

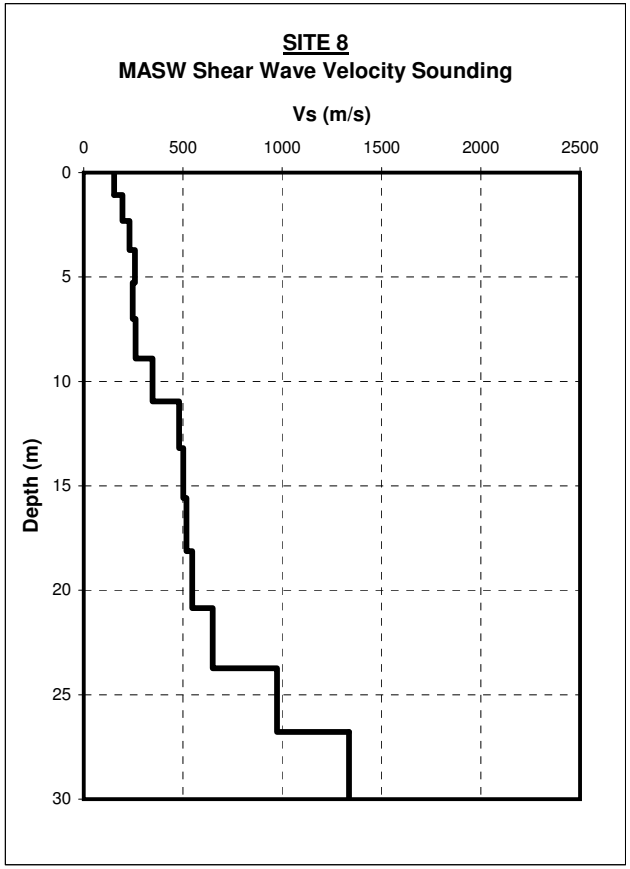
Location

Sounding:	X (m)	Y (m)
MTM/Nad83	316248	4998369

Vs30 (m/s)	400.0
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	277.3					
1.07	156.0	1.07	1.07	0.003864	0.003864	277.3
2.31	172.6	1.24	2.31	0.007924	0.011789	195.8
3.71	438.9	1.40	3.71	0.008118	0.019907	186.3
5.27	242.0	1.57	5.27	0.003568	0.023474	224.7
7.01	579.4	1.73	7.01	0.007153	0.030627	228.7
8.90	989.6	1.90	8.90	0.003272	0.033899	262.6
10.96	1311.4	2.06	10.96	0.002082	0.035981	304.6
13.19	1364.2	2.23	13.19	0.001697	0.037678	350.0
15.58	1602.4	2.39	15.58	0.001752	0.039430	395.1
18.13	1600.3	2.55	18.13	0.001594	0.041024	442.0
20.85	1685.3	2.72	20.85	0.001699	0.042724	488.1
23.74	1601.3	2.88	23.74	0.001712	0.044435	534.2
26.79	1551.2	3.05	26.79	0.001904	0.046340	578.0
30.00	2728.1	3.21	30.00	0.002072	0.048412	619.7

Location

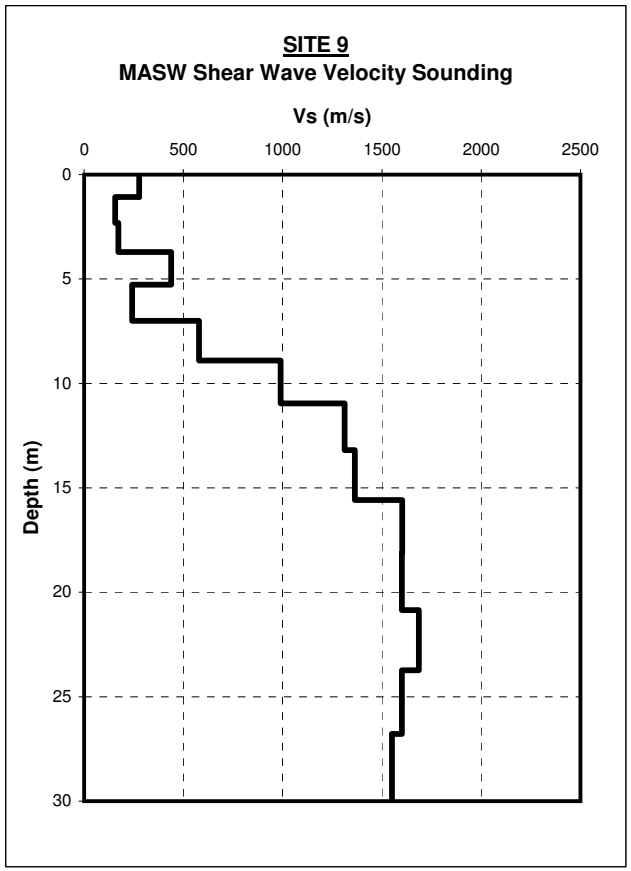
Sounding:	X (m)	Y (m)
MTM/Nad83	316478	5001418

Vs30 (m/s)	619.7
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 2-4 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	310.9					
1.07	140.2	1.07	1.07	0.003446	0.003446	310.9
2.31	341.8	1.24	2.31	0.008818	0.012264	188.2
3.71	297.5	1.40	3.71	0.004099	0.016362	226.7
5.27	400.3	1.57	5.27	0.005264	0.021626	243.9
7.01	501.6	1.73	7.01	0.004324	0.025950	270.0
8.90	545.6	1.90	8.90	0.003779	0.029729	299.4
10.96	679.2	2.06	10.96	0.003776	0.033505	327.2
13.19	778.2	2.23	13.19	0.003276	0.036781	358.5
15.58	827.0	2.39	15.58	0.003071	0.039853	390.9
18.13	853.9	2.55	18.13	0.003090	0.042942	422.2
20.85	826.7	2.72	20.85	0.003185	0.046127	452.0
23.74	840.3	2.88	23.74	0.003489	0.049617	478.4
26.79	1136.0	3.05	26.79	0.003629	0.053246	503.1
30.00	1492.2	3.21	30.00	0.002829	0.056075	535.0

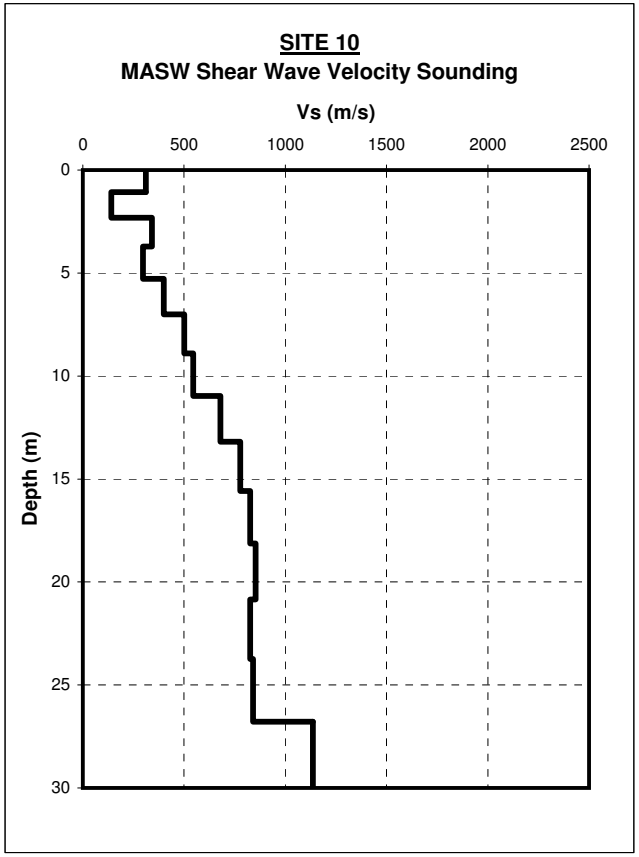
Location

Sounding:	X (m)	Y (m)
MTM/Nad83	316497	5002120

Vs30 (m/s)	535.0
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	98.2					
1.07	111.7	1.07	1.07	0.010915	0.010915	98.2
2.31	108.4	1.24	2.31	0.011066	0.021980	105.0
3.71	170.0	1.40	3.71	0.012924	0.034904	106.3
5.27	203.8	1.57	5.27	0.009212	0.044116	119.6
7.01	226.4	1.73	7.01	0.008492	0.052608	133.2
8.90	621.0	1.90	8.90	0.008374	0.060982	146.0
10.96	833.5	2.06	10.96	0.003318	0.064300	170.5
13.19	1179.2	2.23	13.19	0.002670	0.066970	196.9
15.58	1415.3	2.39	15.58	0.002027	0.068997	225.8
18.13	1435.3	2.55	18.13	0.001805	0.070802	256.1
20.85	1447.4	2.72	20.85	0.001895	0.072697	286.8
23.74	1456.4	2.88	23.74	0.001993	0.074690	317.8
26.79	1471.5	3.05	26.79	0.002094	0.076784	348.8
30.00	1507.5	3.21	30.00	0.002184	0.078968	379.9

Location

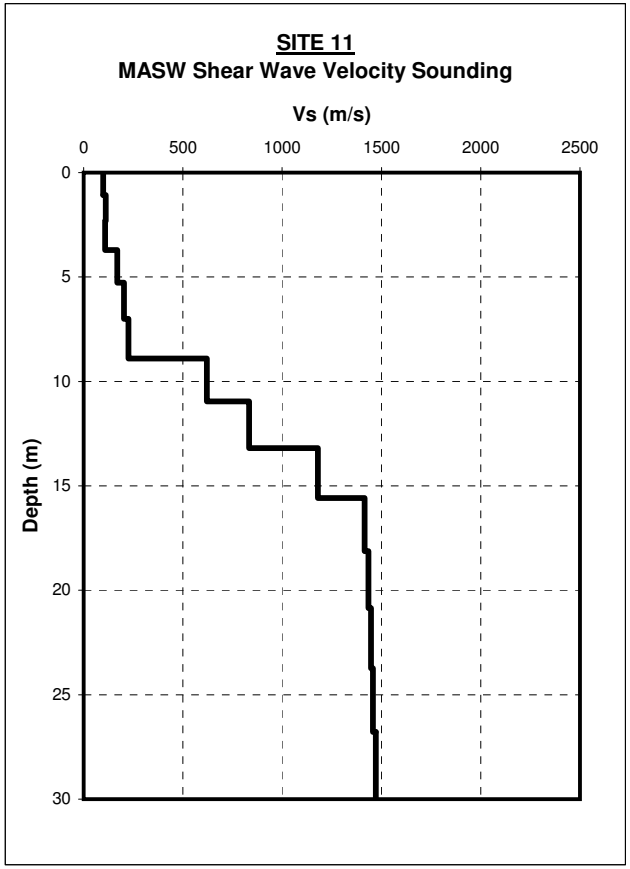
Sounding:	X (m)	Y (m)
MTM/Nad83	316592	4994528

Vs30 (m/s)	379.9
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	129.2					
1.07	96.3	1.07	1.07	0.008291	0.008291	129.2
2.31	111.0	1.24	2.31	0.012842	0.021133	109.2
3.71	223.8	1.40	3.71	0.012621	0.033753	109.9
5.27	236.8	1.57	5.27	0.006998	0.040752	129.4
7.01	728.5	1.73	7.01	0.007310	0.048061	145.8
8.90	753.7	1.90	8.90	0.002602	0.050663	175.7
10.96	764.1	2.06	10.96	0.002734	0.053397	205.3
13.19	774.5	2.23	13.19	0.002912	0.056309	234.2
15.58	1173.5	2.39	15.58	0.003086	0.059395	262.3
18.13	1204.7	2.55	18.13	0.002177	0.061573	294.5
20.85	1237.6	2.72	20.85	0.002258	0.063830	326.7
23.74	1250.7	2.88	23.74	0.002331	0.066161	358.8
26.79	1265.4	3.05	26.79	0.002438	0.068599	390.5
30.00	1284.4	3.21	30.00	0.002540	0.071140	421.7

Location

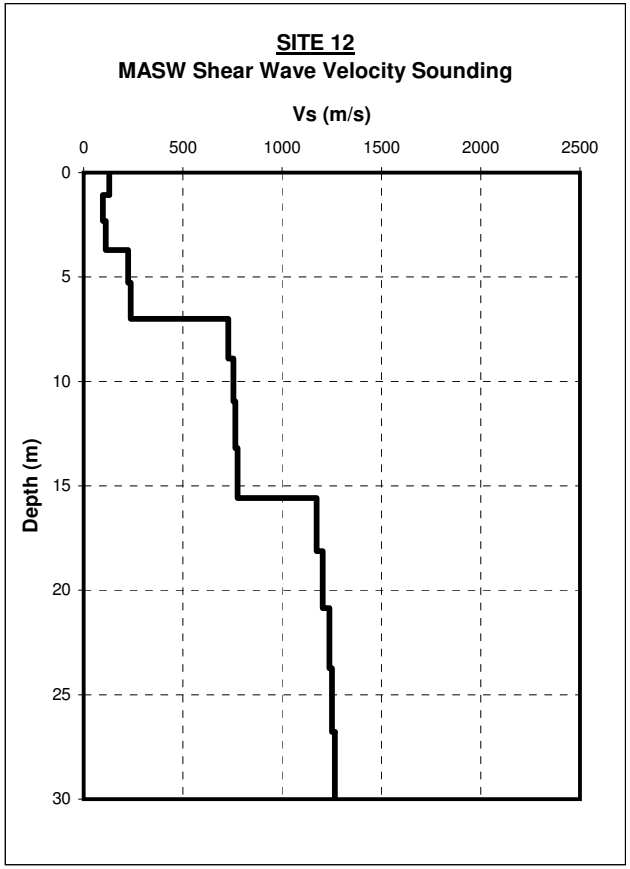
Sounding:	X (m)	Y (m)
MTM/Nad83	316596	4994055

Vs30 (m/s)	421.7
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-7 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	354.5					
1.07	191.0	1.07	1.07	0.003022	0.003022	354.5
2.31	212.2	1.24	2.31	0.006474	0.009496	243.0
3.71	269.7	1.40	3.71	0.006602	0.016098	230.4
5.27	239.4	1.57	5.27	0.005806	0.021904	240.8
7.01	234.2	1.73	7.01	0.007230	0.029134	240.5
8.90	247.2	1.90	8.90	0.008095	0.037229	239.1
10.96	379.9	2.06	10.96	0.008336	0.045565	240.6
13.19	392.9	2.23	13.19	0.005858	0.051423	256.4
15.58	395.5	2.39	15.58	0.006083	0.057506	270.9
18.13	629.8	2.55	18.13	0.006460	0.063966	283.5
20.85	638.3	2.72	20.85	0.004319	0.068285	305.4
23.74	740.7	2.88	23.74	0.004519	0.072804	326.0
26.79	882.0	3.05	26.79	0.004117	0.076921	348.2
30.00	1468.3	3.21	30.00	0.003644	0.080565	372.4

Location

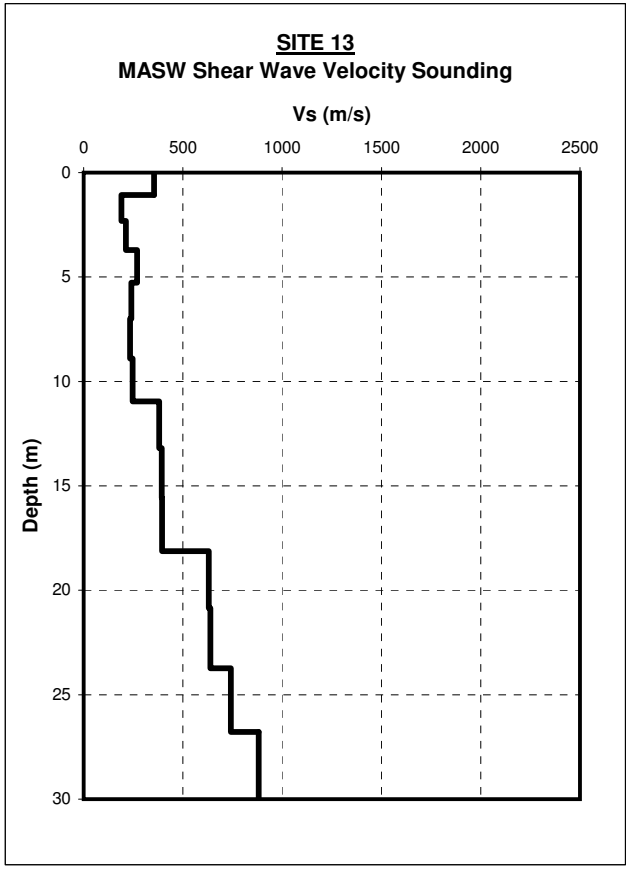
Sounding:	X (m)	Y (m)
MTM/Nad83	316618	4998175

Vs30 (m/s)	372.4
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 2-9 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	131.3					
1.07	167.1	1.07	1.07	0.008159	0.008159	131.3
2.31	179.0	1.24	2.31	0.007398	0.015558	148.3
3.71	199.3	1.40	3.71	0.007825	0.023383	158.6
5.27	247.1	1.57	5.27	0.007858	0.031241	168.8
7.01	296.1	1.73	7.01	0.007003	0.038244	183.2
8.90	391.8	1.90	8.90	0.006402	0.044646	199.4
10.96	821.2	2.06	10.96	0.005258	0.049905	219.7
13.19	1210.4	2.23	13.19	0.002710	0.052614	250.6
15.58	1335.5	2.39	15.58	0.001975	0.054589	285.3
18.13	1398.5	2.55	18.13	0.001913	0.056502	320.9
20.85	1460.2	2.72	20.85	0.001945	0.058447	356.8
23.74	1560.7	2.88	23.74	0.001976	0.060422	392.8
26.79	1594.2	3.05	26.79	0.001954	0.062376	429.4
30.00	1648.6	3.21	30.00	0.002016	0.064392	465.9

Location

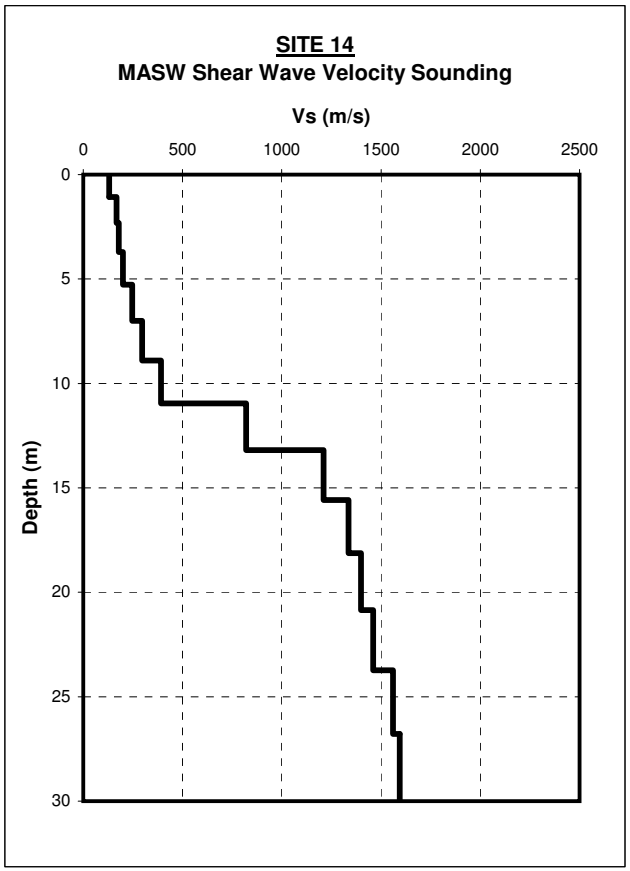
Sounding:	X (m)	Y (m)
MTM/Nad83	316620	4994936

Vs30 (m/s)	465.9
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	245.8					
1.07	181.4	1.07	1.07	0.004358	0.004358	245.8
2.31	506.1	1.24	2.31	0.006816	0.011174	206.5
3.71	256.7	1.40	3.71	0.002768	0.013942	266.0
5.27	584.1	1.57	5.27	0.006101	0.020044	263.2
7.01	772.2	1.73	7.01	0.002963	0.023007	304.5
8.90	529.8	1.90	8.90	0.002455	0.025461	349.6
10.96	737.2	2.06	10.96	0.003889	0.029351	373.5
13.19	1581.0	2.23	13.19	0.003018	0.032369	407.4
15.58	1638.5	2.39	15.58	0.001512	0.033881	459.8
18.13	1641.9	2.55	18.13	0.001559	0.035440	511.6
20.85	1716.3	2.72	20.85	0.001656	0.037097	562.1
23.74	1696.1	2.88	23.74	0.001681	0.038777	612.1
26.79	1646.8	3.05	26.79	0.001798	0.040575	660.2
30.00	1716.3	3.21	30.00	0.001952	0.042527	705.4

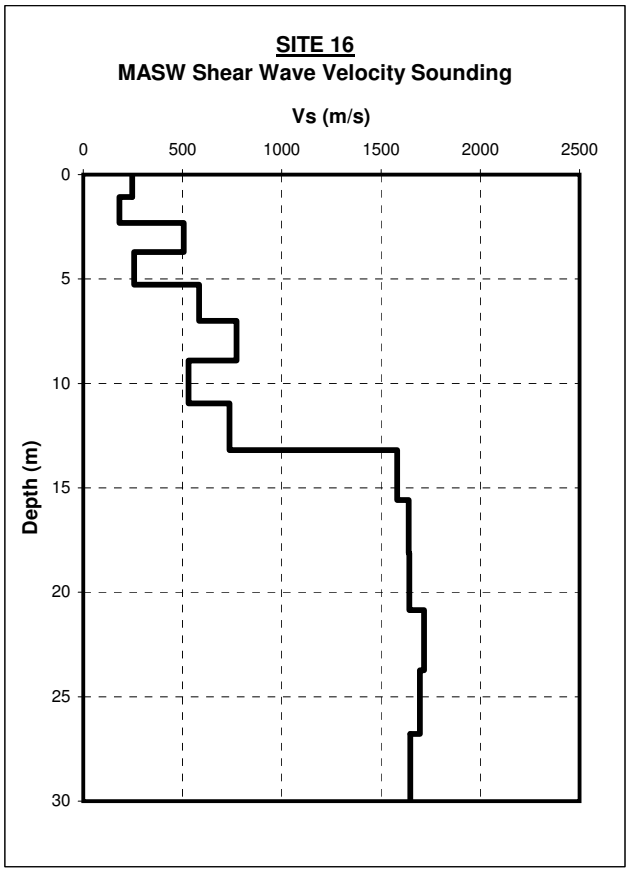
Location

Sounding:	X (m)	Y (m)
MTM/Nad83	316876	5001955

Vs30 (m/s)	705.4
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	115.0					
1.07	105.6	1.07	1.07	0.009318	0.009318	115.0
2.31	271.6	1.24	2.31	0.011706	0.021024	109.8
3.71	232.9	1.40	3.71	0.005158	0.026182	141.7
5.27	272.9	1.57	5.27	0.006725	0.032907	160.3
7.01	449.7	1.73	7.01	0.006342	0.039248	178.5
8.90	691.6	1.90	8.90	0.004215	0.043463	204.8
10.96	886.5	2.06	10.96	0.002979	0.046443	236.0
13.19	1010.1	2.23	13.19	0.002510	0.048953	269.4
15.58	1089.6	2.39	15.58	0.002366	0.051319	303.5
18.13	1137.1	2.55	18.13	0.002345	0.053664	337.9
20.85	1175.8	2.72	20.85	0.002392	0.056055	372.0
23.74	1295.0	2.88	23.74	0.002453	0.058509	405.7
26.79	1612.7	3.05	26.79	0.002355	0.060864	440.1
30.00	1751.3	3.21	30.00	0.001993	0.062857	477.3

Location

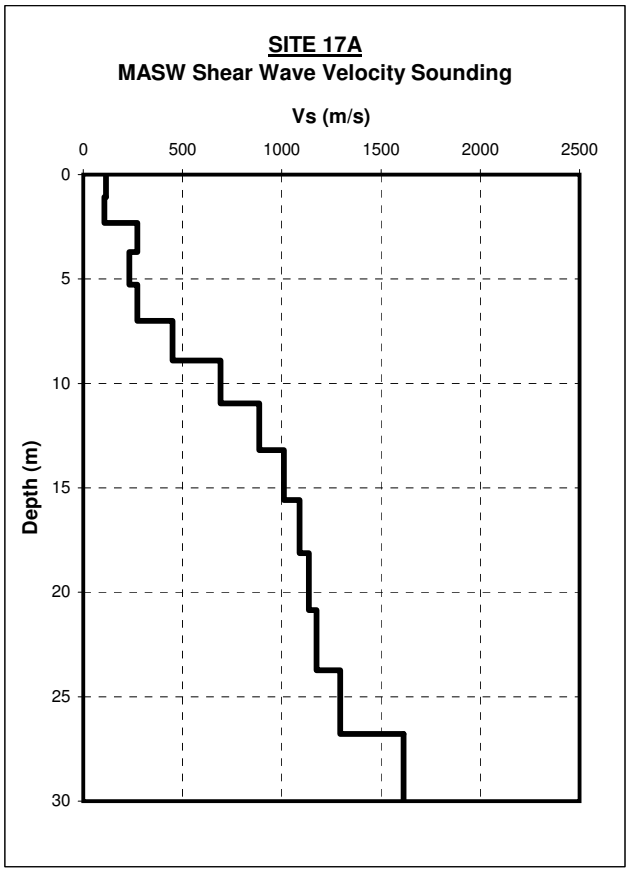
Sounding:	X (m)	Y (m)
MTM/Nad83	317102	5001353

Vs30 (m/s)	477.3
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 2-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	158.9					
1.07	197.8	1.07	1.07	0.006743	0.006743	158.9
2.31	257.8	1.24	2.31	0.006251	0.012994	177.6
3.71	421.7	1.40	3.71	0.005434	0.018428	201.3
5.27	515.8	1.57	5.27	0.003713	0.022142	238.2
7.01	1145.7	1.73	7.01	0.003355	0.025497	274.8
8.90	1406.6	1.90	8.90	0.001655	0.027152	327.8
10.96	1416.0	2.06	10.96	0.001465	0.028616	383.0
13.19	1427.8	2.23	13.19	0.001572	0.030188	436.8
15.58	1440.0	2.39	15.58	0.001674	0.031862	488.9
18.13	1466.9	2.55	18.13	0.001774	0.033636	539.1
20.85	1486.0	2.72	20.85	0.001854	0.035490	587.5
23.74	1518.1	2.88	23.74	0.001941	0.037432	634.1
26.79	1548.8	3.05	26.79	0.002009	0.039440	679.1
30.00	1716.2	3.21	30.00	0.002075	0.041516	722.6

Location

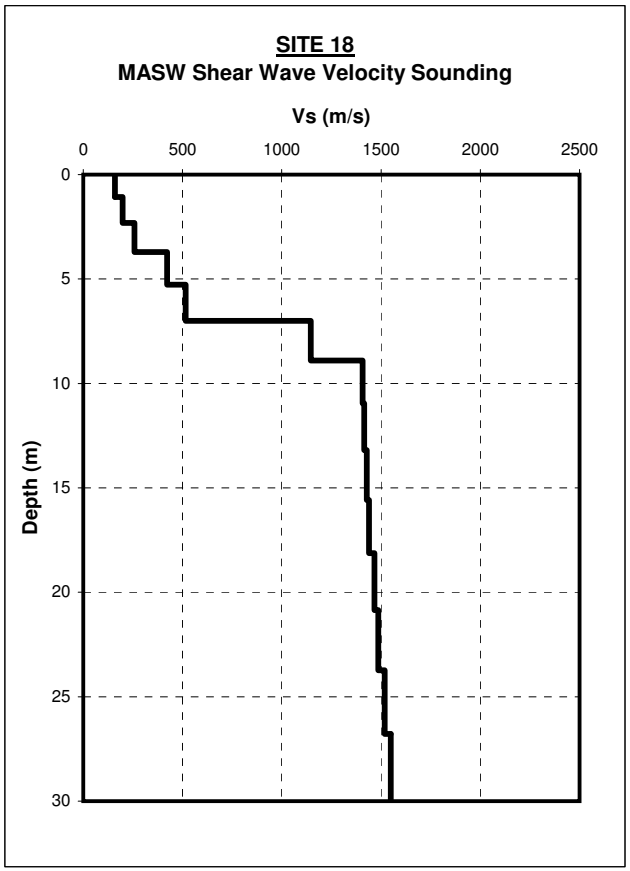
Sounding:	X (m)	Y (m)
MTM/Nad83	317273	5002650

Vs30 (m/s)	722.6
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The site coordinates were provided by the client.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	155.2					
1.07	125.0	1.07	1.07	0.006902	0.006902	155.2
2.31	155.2	1.24	2.31	0.009888	0.016790	137.4
3.71	248.4	1.40	3.71	0.009026	0.025816	143.7
5.27	390.5	1.57	5.27	0.006305	0.032121	164.2
7.01	678.1	1.73	7.01	0.004432	0.036553	191.7
8.90	707.5	1.90	8.90	0.002795	0.039349	226.2
10.96	760.0	2.06	10.96	0.002912	0.042261	259.4
13.19	900.3	2.23	13.19	0.002928	0.045189	291.8
15.58	945.9	2.39	15.58	0.002655	0.047843	325.6
18.13	1111.1	2.55	18.13	0.002701	0.050544	358.7
20.85	1137.3	2.72	20.85	0.002448	0.052992	393.5
23.74	1330.1	2.88	23.74	0.002536	0.055529	427.5
26.79	1356.2	3.05	26.79	0.002293	0.057821	463.2
30.00	1790.8	3.21	30.00	0.002370	0.060191	498.4

Location

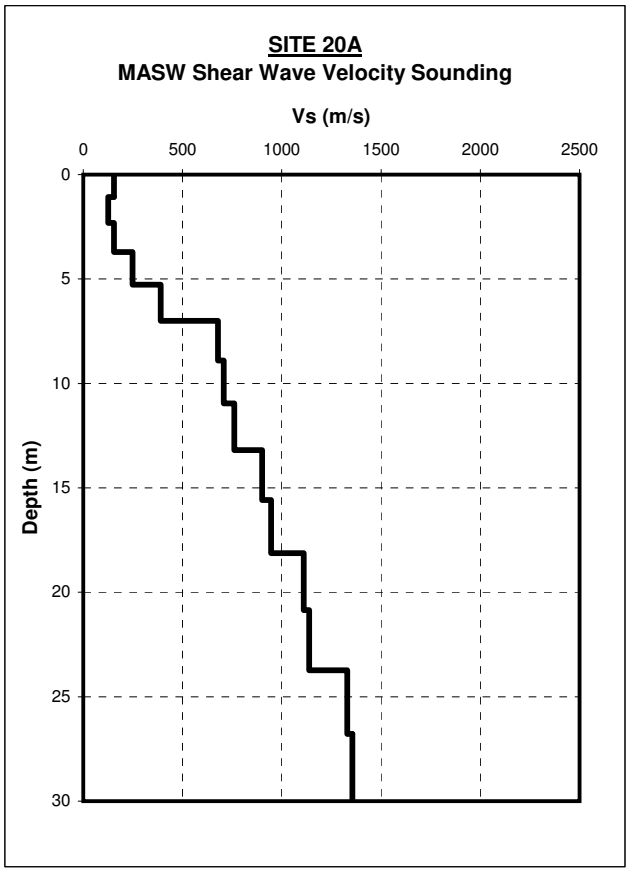
Sounding:	X (m)	Y (m)
MTM/Nad83	317482	5002277

Vs30 (m/s)	498.4
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 2-4 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	820.2					
1.07	59.0	1.07	1.07	0.001306	0.001306	820.2
2.31	192.5	1.24	2.31	0.020965	0.022271	103.6
3.71	217.7	1.40	3.71	0.007279	0.029550	125.5
5.27	257.2	1.57	5.27	0.007192	0.036742	143.6
7.01	392.9	1.73	7.01	0.006728	0.043470	161.2
8.90	532.0	1.90	8.90	0.004825	0.048295	184.3
10.96	1395.4	2.06	10.96	0.003873	0.052168	210.1
13.19	1411.5	2.23	13.19	0.001595	0.053763	245.3
15.58	1411.5	2.39	15.58	0.001693	0.055456	280.9
18.13	1430.8	2.55	18.13	0.001810	0.057266	316.6
20.85	1442.7	2.72	20.85	0.001901	0.059167	352.4
23.74	1475.4	2.88	23.74	0.001999	0.061167	388.1
26.79	1515.5	3.05	26.79	0.002067	0.063234	423.6
30.00	1537.7	3.21	30.00	0.002121	0.065355	459.0

Location

Sounding:	X (m)	Y (m)
MTM/Nad83	318008	5002258

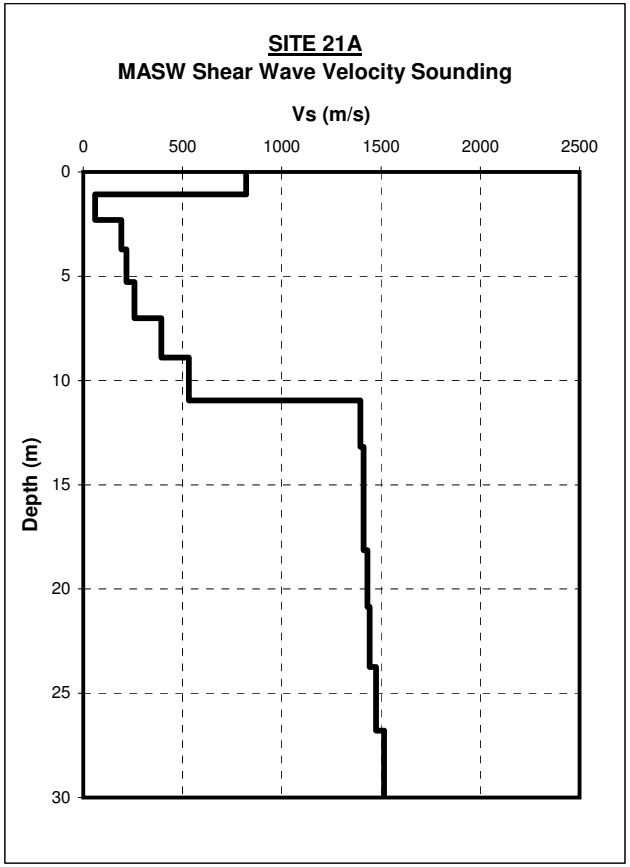
Vs30 (m/s)	459.0
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.

3- The site coordinates were provided by the client.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	225.7					
1.07	194.3	1.07	1.07	0.004748	0.004748	225.7
2.31	224.8	1.24	2.31	0.006363	0.011111	207.7
3.71	275.3	1.40	3.71	0.006233	0.017344	213.8
5.27	388.1	1.57	5.27	0.005687	0.023031	229.0
7.01	517.3	1.73	7.01	0.004460	0.027491	254.8
8.90	608.3	1.90	8.90	0.003664	0.031155	285.7
10.96	626.8	2.06	10.96	0.003387	0.034542	317.3
13.19	966.1	2.23	13.19	0.003550	0.038093	346.2
15.58	1099.7	2.39	15.58	0.002474	0.040567	384.0
18.13	1106.1	2.55	18.13	0.002323	0.042890	422.8
20.85	1121.1	2.72	20.85	0.002459	0.045349	459.8
23.74	1129.8	2.88	23.74	0.002573	0.047922	495.3
26.79	1199.6	3.05	26.79	0.002699	0.050621	529.1
30.00	1386.8	3.21	30.00	0.002680	0.053301	562.8

Location

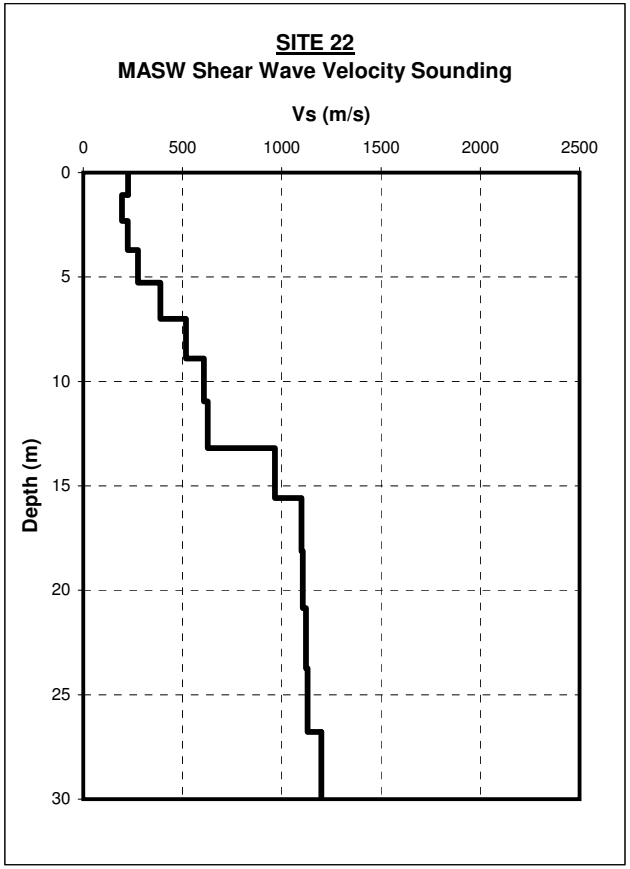
Sounding:	X (m)	Y (m)
MTM/Nad83	318187	5001293

Vs30 (m/s)	562.8
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	119.6					
1.07	187.1	1.07	1.07	0.008957	0.008957	119.6
2.31	221.7	1.24	2.31	0.006606	0.015563	148.3
3.71	222.3	1.40	3.71	0.006321	0.021884	169.5
5.27	704.3	1.57	5.27	0.007045	0.028929	182.3
7.01	983.0	1.73	7.01	0.002457	0.031386	223.2
8.90	1212.6	1.90	8.90	0.001928	0.033315	267.2
10.96	1774.4	2.06	10.96	0.001699	0.035014	313.1
13.19	1862.9	2.23	13.19	0.001254	0.036268	363.6
15.58	1824.9	2.39	15.58	0.001283	0.037551	414.8
18.13	1798.4	2.55	18.13	0.001400	0.038951	465.5
20.85	1818.5	2.72	20.85	0.001512	0.040463	515.3
23.74	1901.6	2.88	23.74	0.001586	0.042050	564.5
26.79	1924.8	3.05	26.79	0.001604	0.043653	613.6
30.00	2437.9	3.21	30.00	0.001670	0.045323	661.9

Location

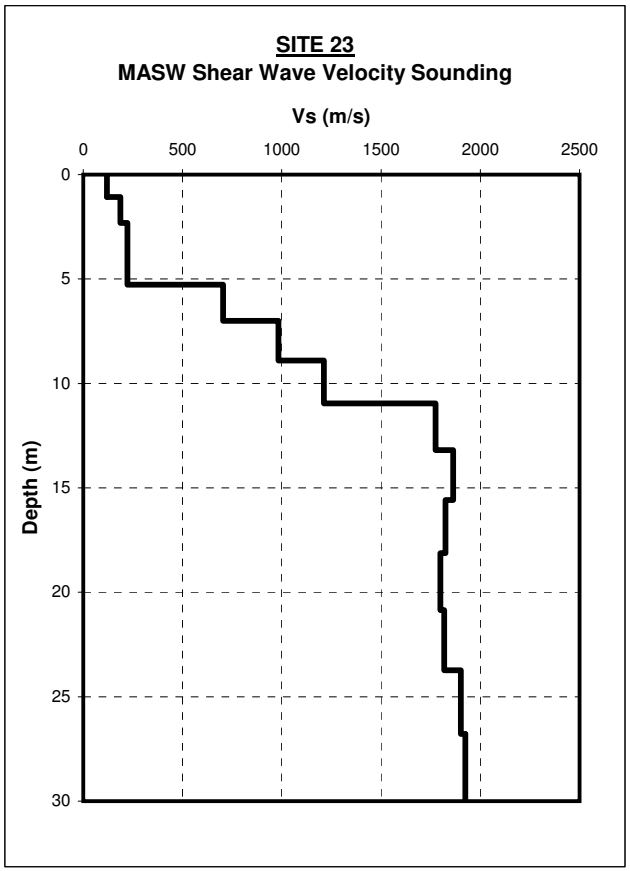
Sounding:	X (m)	Y (m)
MTM/Nad83	318195	5001745

Vs30 (m/s)	661.9
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	123.0					
1.07	97.6	1.07	1.07	0.008714	0.008714	123.0
2.31	130.3	1.24	2.31	0.012669	0.021384	107.9
3.71	355.9	1.40	3.71	0.010754	0.032137	115.4
5.27	567.9	1.57	5.27	0.004400	0.036537	144.4
7.01	668.1	1.73	7.01	0.003048	0.039585	177.0
8.90	695.1	1.90	8.90	0.002837	0.042423	209.8
10.96	1014.1	2.06	10.96	0.002964	0.045387	241.5
13.19	1162.9	2.23	13.19	0.002194	0.047581	277.1
15.58	1166.1	2.39	15.58	0.002055	0.049637	313.8
18.13	1163.9	2.55	18.13	0.002191	0.051828	349.8
20.85	1196.4	2.72	20.85	0.002337	0.054164	385.0
23.74	1185.9	2.88	23.74	0.002411	0.056575	419.6
26.79	1182.8	3.05	26.79	0.002572	0.059147	452.9
30.00	1317.0	3.21	30.00	0.002717	0.061864	484.9

Location

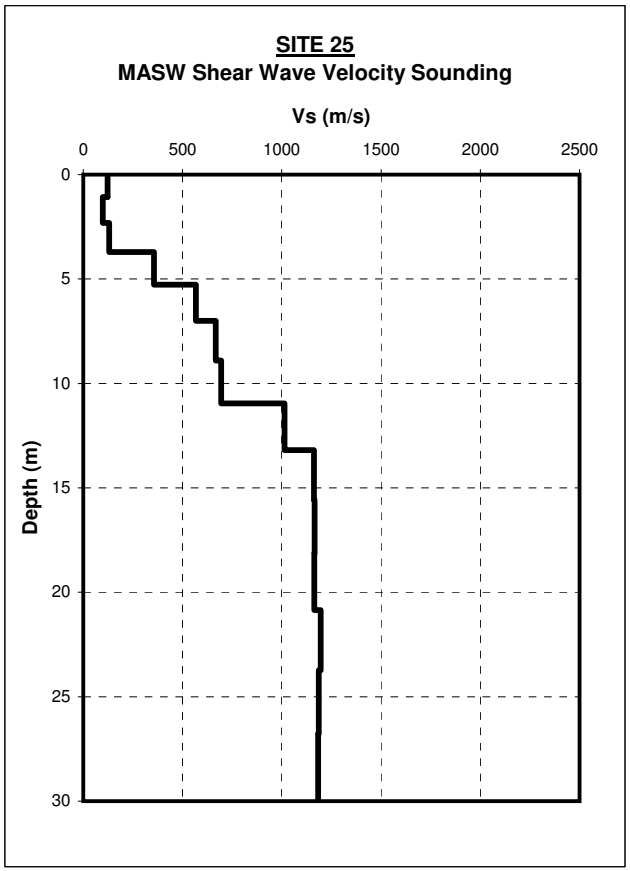
Sounding:	X (m)	Y (m)
MTM/Nad83	319312	4997246

Vs30 (m/s)	484.9
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	173.4					
1.07	172.9	1.07	1.07	0.006178	0.006178	173.4
2.31	357.4	1.24	2.31	0.007152	0.013330	173.1
3.71	409.2	1.40	3.71	0.003920	0.017250	215.0
5.27	993.4	1.57	5.27	0.003827	0.021077	250.3
7.01	1144.9	1.73	7.01	0.001742	0.022820	307.0
8.90	1189.2	1.90	8.90	0.001656	0.024475	363.7
10.96	1241.8	2.06	10.96	0.001733	0.026208	418.3
13.19	1281.8	2.23	13.19	0.001792	0.028000	471.0
15.58	1324.5	2.39	15.58	0.001865	0.029865	521.6
18.13	1353.7	2.55	18.13	0.001929	0.031794	570.3
20.85	1395.9	2.72	20.85	0.002009	0.033803	616.9
23.74	1509.9	2.88	23.74	0.002066	0.035869	661.7
26.79	1643.0	3.05	26.79	0.002020	0.037889	707.0
30.00	2181.4	3.21	30.00	0.001956	0.039845	752.9

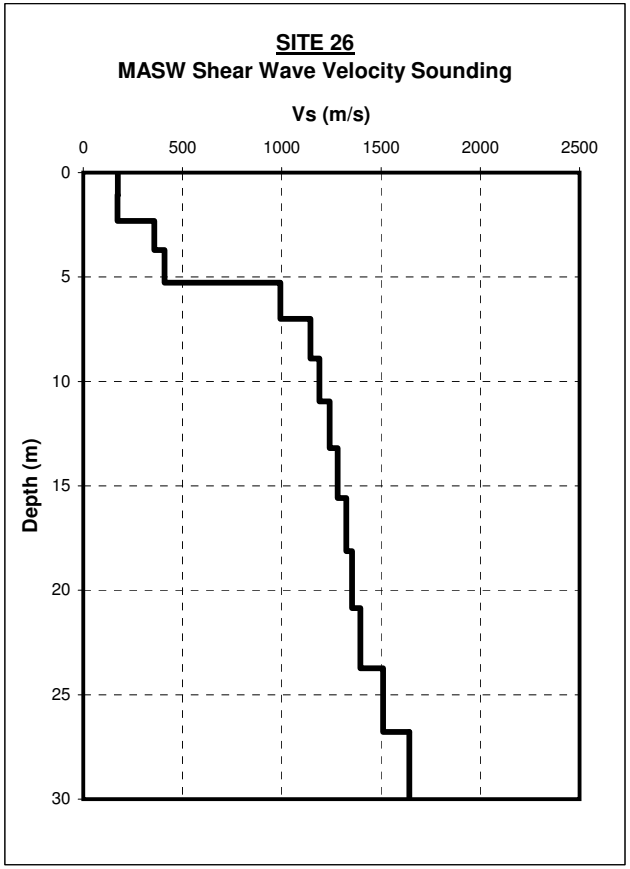
Location

Sounding:	X (m)	Y (m)
MTM/Nad83	319774	5001316

Vs30 (m/s)	752.9
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	169.3					
1.07	106.8	1.07	1.07	0.006330	0.006330	169.3
2.31	144.6	1.24	2.31	0.011578	0.017908	128.9
3.71	194.3	1.40	3.71	0.009688	0.027595	134.4
5.27	305.7	1.57	5.27	0.008058	0.035653	147.9
7.01	411.3	1.73	7.01	0.005661	0.041314	169.6
8.90	486.2	1.90	8.90	0.004609	0.045923	193.8
10.96	1175.8	2.06	10.96	0.004238	0.050161	218.5
13.19	1303.2	2.23	13.19	0.001893	0.052054	253.3
15.58	1331.4	2.39	15.58	0.001834	0.053888	289.1
18.13	1355.6	2.55	18.13	0.001919	0.055807	324.9
20.85	1371.4	2.72	20.85	0.002006	0.057813	360.7
23.74	1383.8	2.88	23.74	0.002103	0.059917	396.2
26.79	1445.2	3.05	26.79	0.002204	0.062120	431.2
30.00	1671.3	3.21	30.00	0.002224	0.064344	466.2

Location

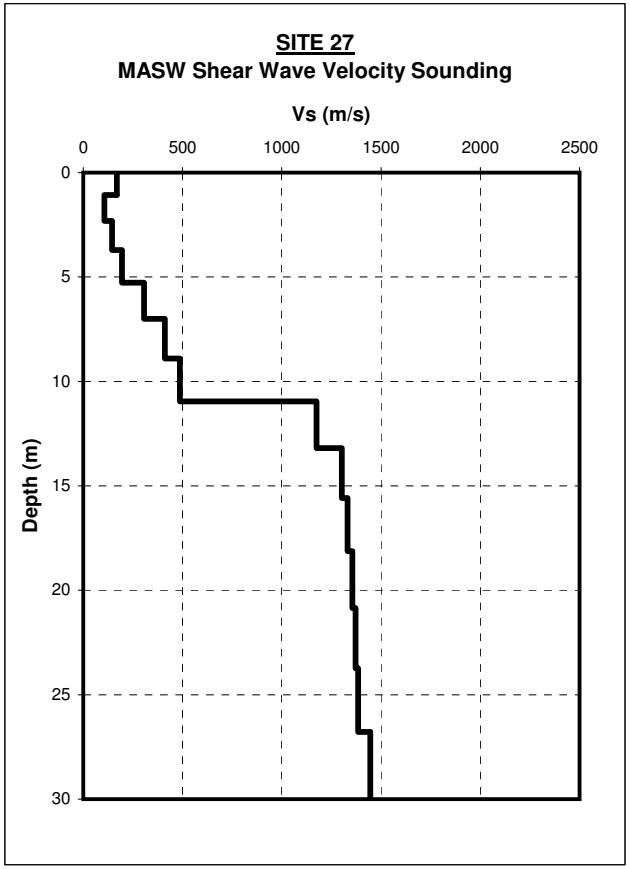
Sounding:	X (m)	Y (m)
MTM/Nad83	319664	4996999

Vs30 (m/s)	466.2
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	177.6					
1.07	130.5	1.07	1.07	0.006035	0.006035	177.6
2.31	131.2	1.24	2.31	0.009473	0.015508	148.8
3.71	161.8	1.40	3.71	0.010677	0.026185	141.6
5.27	419.9	1.57	5.27	0.009679	0.035864	147.1
7.01	550.7	1.73	7.01	0.004122	0.039986	175.2
8.90	942.8	1.90	8.90	0.003442	0.043428	205.0
10.96	1115.0	2.06	10.96	0.002185	0.045613	240.3
13.19	1146.6	2.23	13.19	0.001996	0.047609	277.0
15.58	1140.0	2.39	15.58	0.002085	0.049694	313.5
18.13	1160.8	2.55	18.13	0.002241	0.051935	349.1
20.85	1212.8	2.72	20.85	0.002343	0.054278	384.2
23.74	1236.6	2.88	23.74	0.002379	0.056657	418.9
26.79	1353.1	3.05	26.79	0.002466	0.059122	453.1
30.00	1671.8	3.21	30.00	0.002376	0.061498	487.8

Location

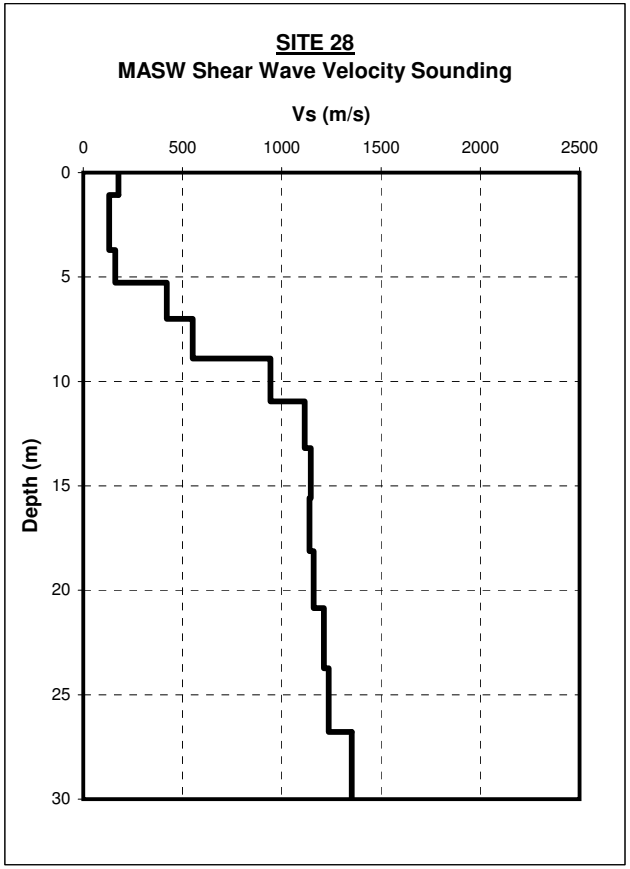
Sounding:	X (m)	Y (m)
MTM/Nad83	319665	4997492

Vs30 (m/s)	487.8
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	93.3					
1.07	204.7	1.07	1.07	0.011483	0.011483	93.3
2.31	129.0	1.24	2.31	0.006040	0.017523	131.7
3.71	208.3	1.40	3.71	0.010863	0.028386	130.7
5.27	510.6	1.57	5.27	0.007517	0.035903	146.9
7.01	704.0	1.73	7.01	0.003390	0.039293	178.3
8.90	778.8	1.90	8.90	0.002693	0.041986	212.0
10.96	1383.9	2.06	10.96	0.002646	0.044631	245.6
13.19	1416.3	2.23	13.19	0.001608	0.046239	285.2
15.58	1599.9	2.39	15.58	0.001688	0.047927	325.0
18.13	1605.6	2.55	18.13	0.001597	0.049524	366.1
20.85	1614.0	2.72	20.85	0.001694	0.051218	407.1
23.74	1623.7	2.88	23.74	0.001787	0.053005	447.8
26.79	1648.4	3.05	26.79	0.001878	0.054883	488.1
30.00	2254.3	3.21	30.00	0.001950	0.056833	527.9

Location

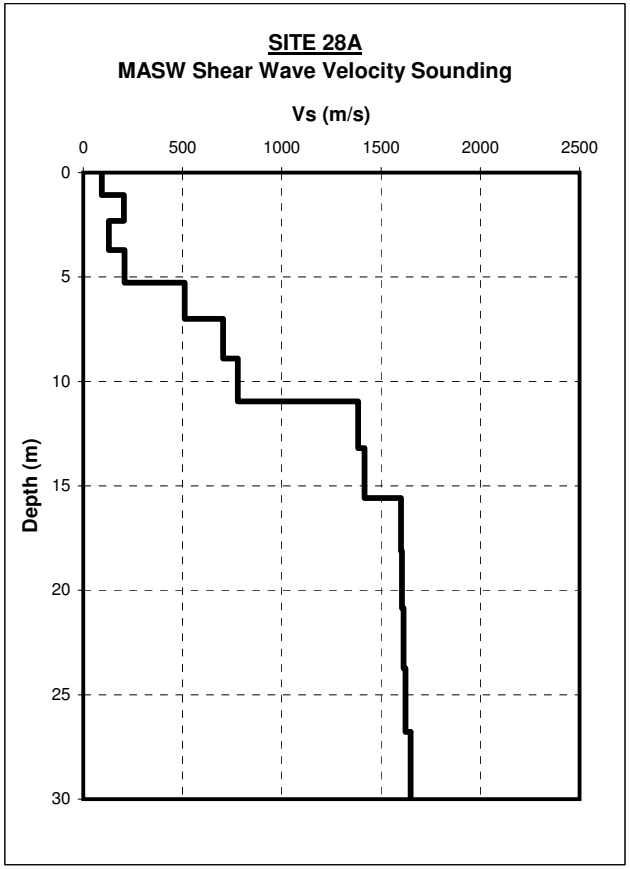
Sounding:	X (m)	Y (m)
MTM/Nad83	319414	4997499

Vs30 (m/s)	527.9
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-5 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	240.4					
1.07	184.6	1.07	1.07	0.004456	0.004456	240.4
2.31	372.4	1.24	2.31	0.006698	0.011154	206.9
3.71	529.1	1.40	3.71	0.003763	0.014917	248.6
5.27	519.6	1.57	5.27	0.002960	0.017877	295.1
7.01	867.3	1.73	7.01	0.003331	0.021208	330.3
8.90	1135.6	1.90	8.90	0.002186	0.023393	380.5
10.96	1164.9	2.06	10.96	0.001814	0.025208	434.8
13.19	1307.3	2.23	13.19	0.001910	0.027118	486.3
15.58	1339.0	2.39	15.58	0.001828	0.028946	538.1
18.13	1355.7	2.55	18.13	0.001908	0.030854	587.7
20.85	1389.3	2.72	20.85	0.002006	0.032860	634.6
23.74	1415.2	2.88	23.74	0.002076	0.034937	679.4
26.79	1632.7	3.05	26.79	0.002155	0.037092	722.2
30.00	1737.2	3.21	30.00	0.001969	0.039060	768.0

Location

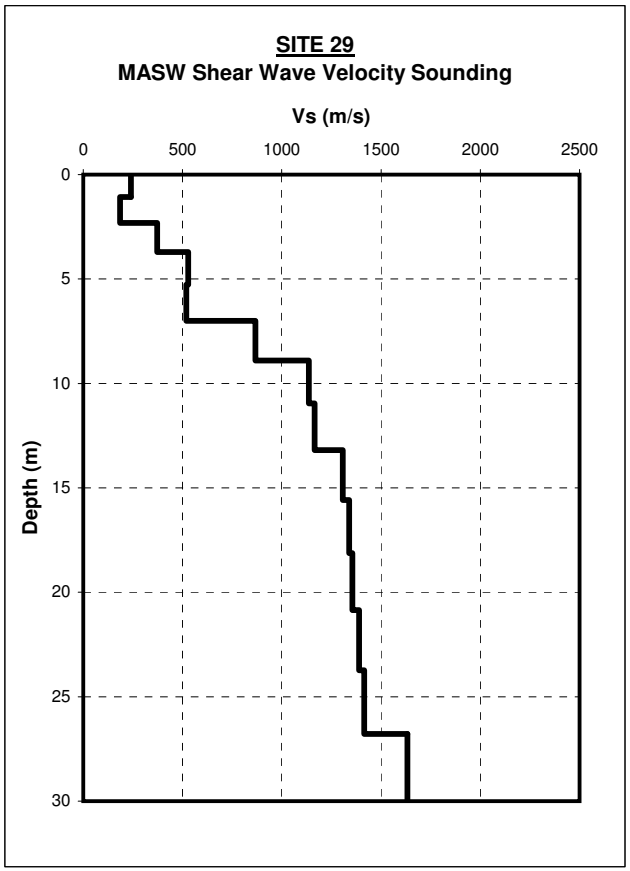
Sounding:	X (m)	Y (m)
MTM/Nad83	319828	5002096

Vs30 (m/s)	768.0
Class :	B

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The site class B can be considered only if there is less than 3 meters of overburden between the rock surface and the bottom of the mat foundation (cf. CNBC 2005 ; Commentary J ; Sentence 100).



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	170.6					
1.07	240.6	1.07	1.07	0.006281	0.006281	170.6
2.31	233.5	1.24	2.31	0.005137	0.011418	202.1
3.71	1055.2	1.40	3.71	0.006000	0.017419	212.9
5.27	1300.4	1.57	5.27	0.001484	0.018903	279.0
7.01	1385.4	1.73	7.01	0.001331	0.020234	346.2
8.90	1480.9	1.90	8.90	0.001368	0.021602	412.1
10.96	1732.5	2.06	10.96	0.001391	0.022993	476.7
13.19	1684.0	2.23	13.19	0.001284	0.024278	543.2
15.58	1635.5	2.39	15.58	0.001419	0.025697	606.2
18.13	1601.8	2.55	18.13	0.001562	0.027259	665.2
20.85	1630.6	2.72	20.85	0.001698	0.028957	720.1
23.74	1699.2	2.88	23.74	0.001769	0.030726	772.5
26.79	1935.6	3.05	26.79	0.001795	0.032521	823.7
30.00	3419.6	3.21	30.00	0.001661	0.034181	877.7

Location

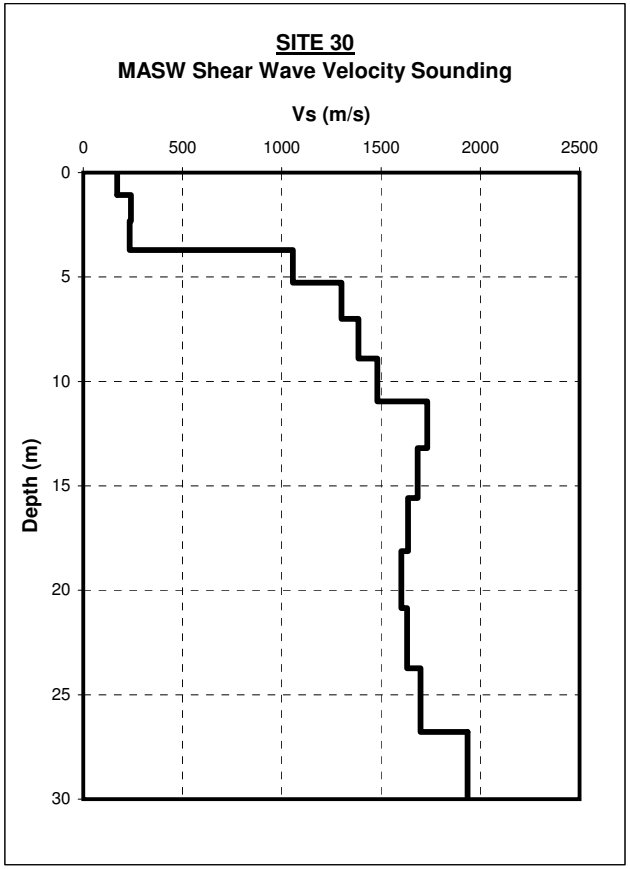
Sounding:	X (m)	Y (m)
MTM/Nad83	320091	5001646

Vs30 (m/s)	**877.7**
Class :	**B**

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The site class B can be considered only if there is less than 3 meters of overburden between the rock surface and the bottom of the mat foundation (cf. CNBC 2005 ; Commentary J ; Sentence 100). As 10BH-30 shows, the bedrock is at 6.5 meters deep, the class C should be considered.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	179.1					
1.07	108.4	1.07	1.07	0.005981	0.005981	179.1
2.31	135.5	1.24	2.31	0.011408	0.017389	132.7
3.71	159.1	1.40	3.71	0.010337	0.027726	133.8
5.27	213.7	1.57	5.27	0.009840	0.037566	140.4
7.01	327.1	1.73	7.01	0.008100	0.045666	153.4
8.90	433.4	1.90	8.90	0.005794	0.051461	173.0
10.96	782.7	2.06	10.96	0.004754	0.056215	195.0
13.19	1185.5	2.23	13.19	0.002843	0.059058	223.3
15.58	1261.5	2.39	15.58	0.002016	0.061074	255.0
18.13	1276.8	2.55	18.13	0.002025	0.063100	287.4
20.85	1316.2	2.72	20.85	0.002130	0.065230	319.7
23.74	1354.6	2.88	23.74	0.002192	0.067421	352.1
26.79	1391.3	3.05	26.79	0.002251	0.069673	384.5
30.00	1451.5	3.21	30.00	0.002310	0.071983	416.8

Location

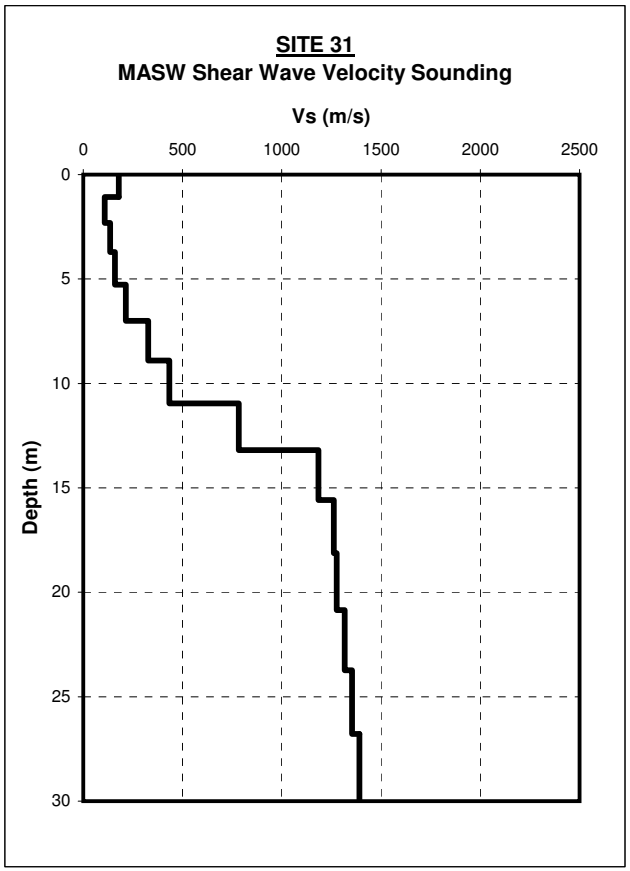
Sounding:	X (m)	Y (m)
MTM/Nad83	320095	4997479

Vs30 (m/s)	416.8
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 4-7 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	154.1					
1.07	141.3	1.07	1.07	0.006953	0.006953	154.1
2.31	235.3	1.24	2.31	0.008751	0.015705	146.9
3.71	225.3	1.40	3.71	0.005956	0.021660	171.2
5.27	237.4	1.57	5.27	0.006949	0.028609	184.4
7.01	347.9	1.73	7.01	0.007290	0.035899	195.1
8.90	437.4	1.90	8.90	0.005448	0.041347	215.3
10.96	1201.9	2.06	10.96	0.004711	0.046058	238.0
13.19	1245.1	2.23	13.19	0.001851	0.047910	275.2
15.58	1271.9	2.39	15.58	0.001920	0.049830	312.6
18.13	1302.3	2.55	18.13	0.002009	0.051838	349.8
20.85	1327.2	2.72	20.85	0.002088	0.053927	386.7
23.74	1356.1	2.88	23.74	0.002173	0.056100	423.1
26.79	1384.4	3.05	26.79	0.002249	0.058349	459.1
30.00	1444.1	3.21	30.00	0.002322	0.060671	494.5

Location

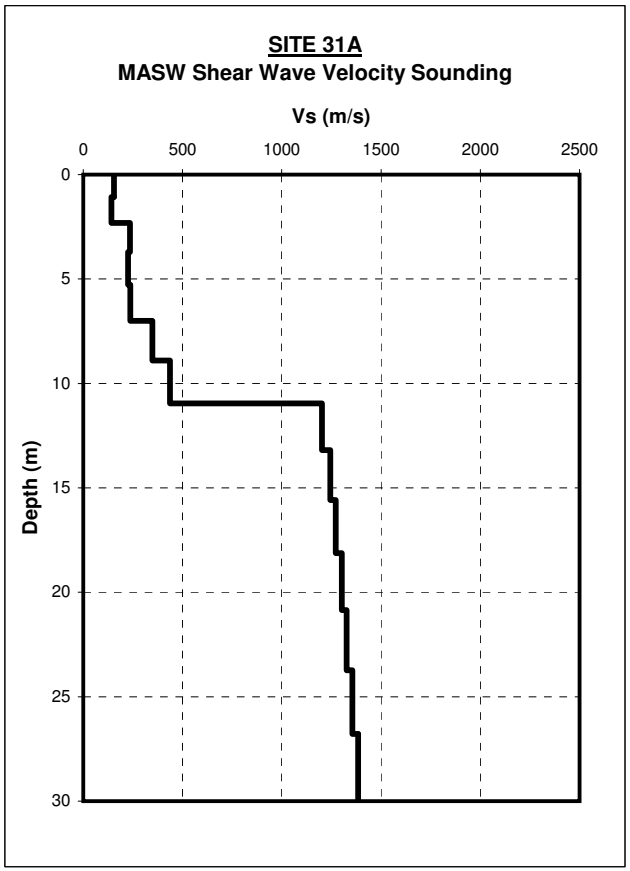
Sounding:	X (m)	Y (m)
MTM/Nad83	319926	4997484

Vs30 (m/s)	494.5
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs values for the first 2-4 meters are abnormally low. This could be related to a soil with a liquefaction potential. An adequate geotechnical accessment should be made to ensure that the site class remains C, or be re-classified as a F.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	257.5506					
1.07	201.0363	1.07	1.07	0.004160	0.004160	257.6
2.31	273.5122	1.24	2.31	0.006149	0.010310	223.8
3.71	455.2144	1.40	3.71	0.005123	0.015432	240.3
5.27	770.9427	1.57	5.27	0.003440	0.018872	279.5
7.01	1383.861	1.73	7.01	0.002245	0.021117	331.7
8.90	1520.026	1.90	8.90	0.001370	0.022487	395.8
10.96	1539.346	2.06	10.96	0.001356	0.023842	459.7
13.19	1569.83	2.23	13.19	0.001446	0.025288	521.5
15.58	1593.021	2.39	15.58	0.001523	0.026811	581.0
18.13	1628.209	2.55	18.13	0.001604	0.028414	638.1
20.85	1656.517	2.72	20.85	0.001670	0.030085	693.1
23.74	1683.846	2.88	23.74	0.001741	0.031826	745.8
26.79	1707.615	3.05	26.79	0.001811	0.033637	796.3
30.00	1738.884	3.21	30.00	0.001882	0.035520	844.6

Location

Sounding:	X (m)	Y (m)
MTM/Nad83	320241	5002214

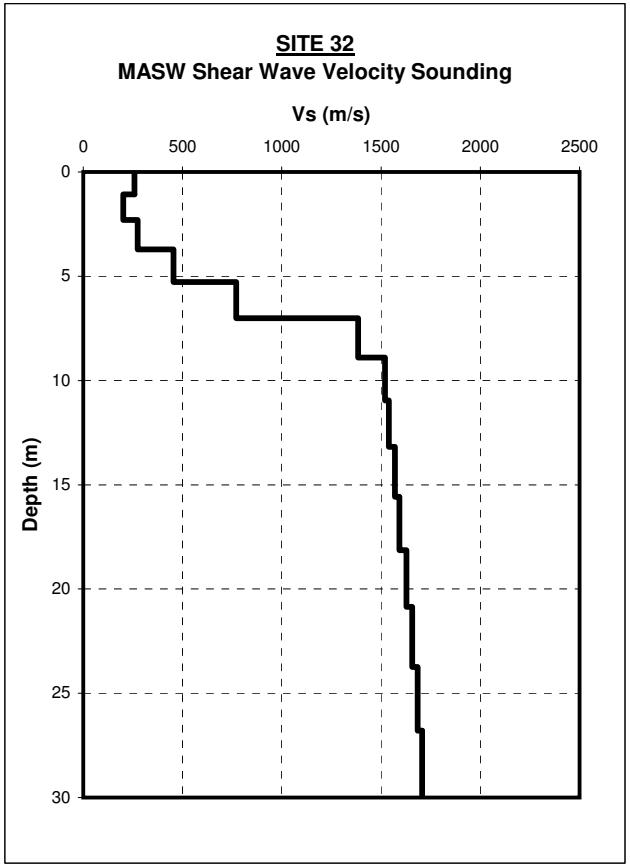
Vs30 (m/s)	844.6
Class :	B

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The Vs sounding was resolved from the surface to 26 meters deep. The lower portion up to 30 meters deep was extrapolated for the calculation needs.

3- The site class B can be considered only if there is less than 3 meters of overburden between the rock surfaceand the bottom of the mat foundation (cf. CNBC 2005 ; Commentary J ; Sentence 100). As 10BH-32 shows, the bedrock is at 6.4 meters deep, the class C should be considered.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	230.8					
1.07	239.7	1.07	1.07	0.004642	0.004642	230.8
2.31	392.9	1.24	2.31	0.005159	0.009801	235.5
3.71	385.5	1.40	3.71	0.003566	0.013367	277.5
5.27	784.2	1.57	5.27	0.004062	0.017429	302.6
7.01	985.2	1.73	7.01	0.002207	0.019636	356.8
8.90	1226.4	1.90	8.90	0.001924	0.021560	412.8
10.96	1340.3	2.06	10.96	0.001680	0.023240	471.7
13.19	1378.3	2.23	13.19	0.001660	0.024901	529.6
15.58	1410.7	2.39	15.58	0.001734	0.026635	584.8
18.13	1526.8	2.55	18.13	0.001811	0.028446	637.4
20.85	1630.8	2.72	20.85	0.001781	0.030227	689.8
23.74	1737.0	2.88	23.74	0.001769	0.031996	741.8
26.79	2102.6	3.05	26.79	0.001756	0.033752	793.6
30.00	2288.3	3.21	30.00	0.001529	0.035280	850.3

Location

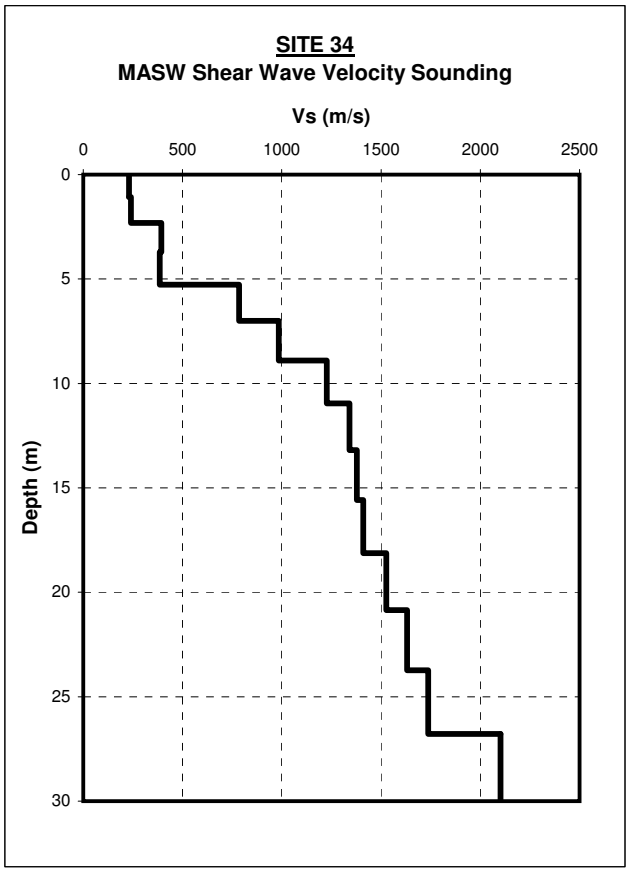
Sounding:	X (m)	Y (m)
MTM/Nad83	319415	5002922

Vs30 (m/s)	**850.3**
Class :	**B**

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The site class B can be considered only if there is less than 3 meters of overburden between the rock surfaceand the bottom of the mat foundation (cf. CNBC 2005 ; Commentary J ; Sentence 100). As 10BH-34 shows, the bedrock is at 5.1 meters deep, the class C should be considered.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	262.7					
1.07	237.5	1.07	1.07	0.004079	0.004079	262.7
2.31	334.5	1.24	2.31	0.005206	0.009285	248.6
3.71	308.7	1.40	3.71	0.004189	0.013473	275.3
5.27	382.7	1.57	5.27	0.005073	0.018546	284.4
7.01	554.0	1.73	7.01	0.004522	0.023068	303.7
8.90	706.1	1.90	8.90	0.003422	0.026490	336.0
10.96	1497.9	2.06	10.96	0.002918	0.029408	372.7
13.19	1513.0	2.23	13.19	0.001486	0.030894	426.8
15.58	1521.8	2.39	15.58	0.001580	0.032473	479.7
18.13	1525.0	2.55	18.13	0.001679	0.034152	530.9
20.85	1547.1	2.72	20.85	0.001783	0.035936	580.2
23.74	1569.3	2.88	23.74	0.001864	0.037800	627.9
26.79	1676.0	3.05	26.79	0.001943	0.039743	674.0
30.00	2150.4	3.21	30.00	0.001918	0.041661	720.1

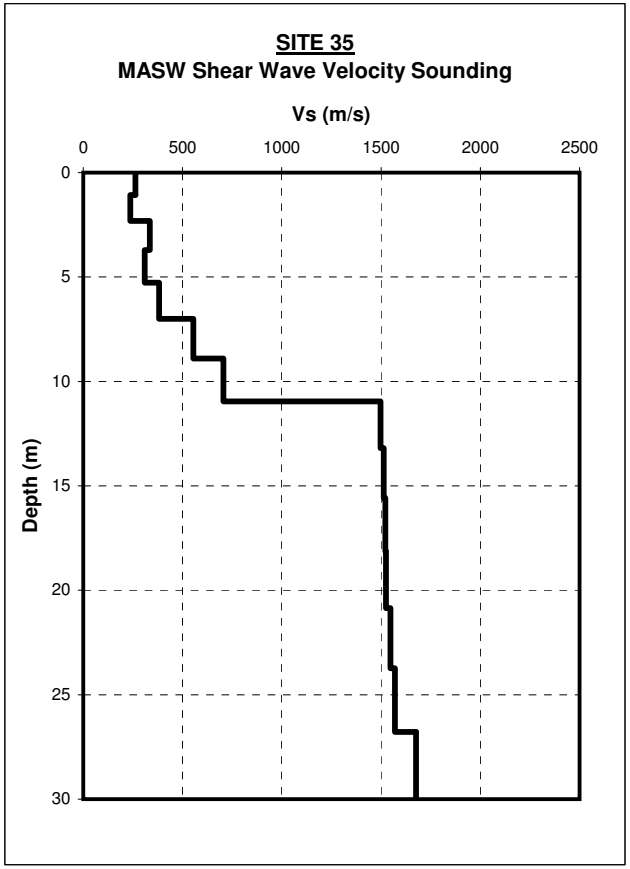
Location

Sounding:	X (m)	Y (m)
MTM/Nad83	319169	5002673

Vs30 (m/s)	720.1
Class :	C

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.



Groupe ABS / Wind Energy Converters (WEC) / Saint-Valentin, Qc

Depth (m)	Vs (m/s)	Thickness (m)	Cumulated thickness (m)	Delay for med. Vs (s)	Cumulated delay (s)	Average Vs at given depth (m/s)
0.00	292.2					
1.07	203.0	1.07	1.07	0.003666	0.003666	292.2
2.31	204.9	1.24	2.31	0.006090	0.009756	236.5
3.71	805.7	1.40	3.71	0.006839	0.016595	223.5
5.27	1466.0	1.57	5.27	0.001944	0.018539	284.5
7.01	1584.1	1.73	7.01	0.001181	0.019720	355.3
8.90	1602.7	1.90	8.90	0.001197	0.020916	425.6
10.96	1662.1	2.06	10.96	0.001286	0.022202	493.7
13.19	1677.1	2.23	13.19	0.001339	0.023541	560.2
15.58	1677.1	2.39	15.58	0.001425	0.024966	623.9
18.13	1677.1	2.55	18.13	0.001523	0.026489	684.5
20.85	1832.1	2.72	20.85	0.001622	0.028111	741.8
23.74	1999.8	2.88	23.74	0.001574	0.029685	799.6
26.79	1999.8	3.05	26.79	0.001525	0.031210	858.2
30.00	1999.8	3.21	30.00	0.001607	0.032818	914.1

Location

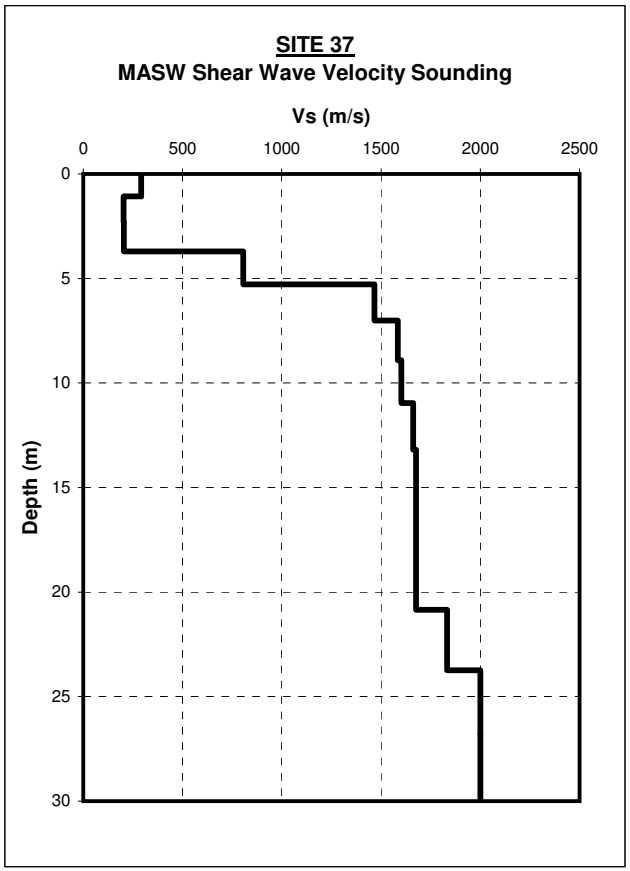
Sounding:	X (m)	Y (m)
MTM/Nad83	318483	5001515

Vs30 (m/s)	914.1
Class :	B

NOTES :

1- The Vs values express estimated in-situ shear wave velocities; they were not corrected for the vertical effective overburden stress.

2- The site class B can be considered only if there is less than 3 meters of overburden between the rock surface and the bottom of the mat foundation (cf. CNBC 2005 ; Commentary J ; Sentence 100). As 10BH-37 shows, the bedrock is at 7.8 meters deep, the class C should be considered.



Appendix F

Rock samples photos

Photography 1 : 10BH-30

Photography 2 : 10BH-32

Photography 3 : 10BH-32

Photography 4 : 10BH-26

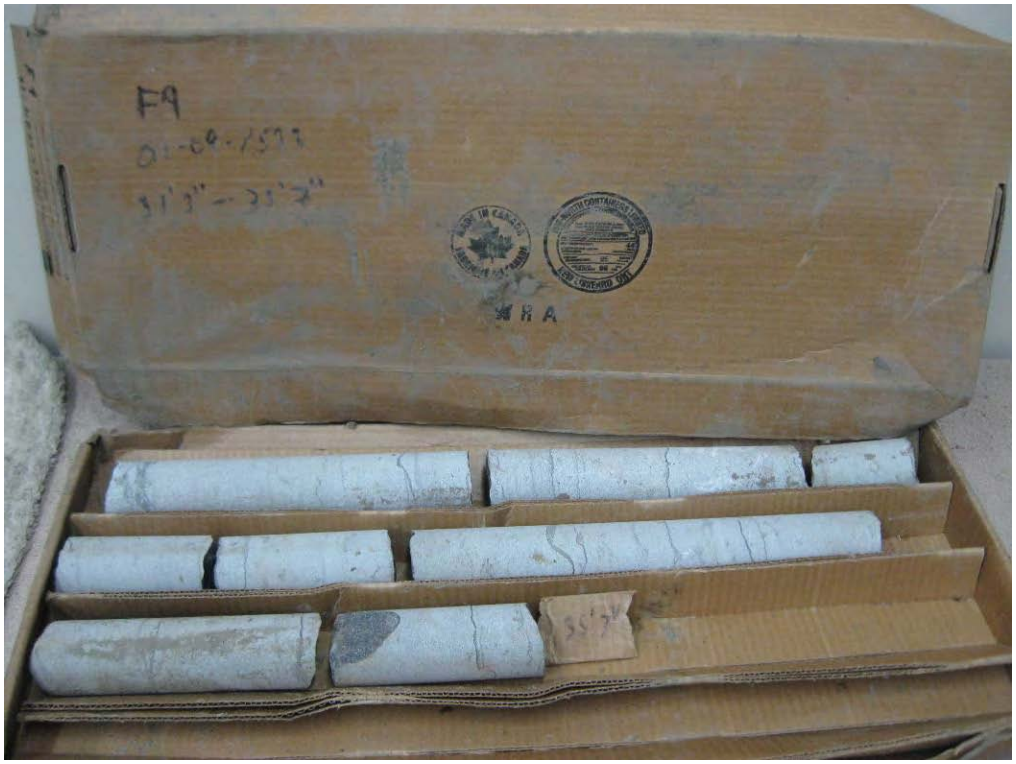
Photography 5 : 10BH-26

Photography 6 : 10BH-16

Photography 7 : 10BH-16

Photography 8 : 10BH-05

Photography 9 : 10BH-05



Photography 10 : 10BH-09

Photography 11 : 10BH-09

Photography 12 : 10BH-07

Photography 13 : 10BH-07

Photography 14 : 10BH-18

Photography 15 : 10BH-18

Photography 16 : 10BH-21

Photography 17 : 10BH-21

Photography 18 : 10BH-20

Photography 19 : 10BH-29

Photography 20 : 10BH-29

Photography 21 : 10BH-04

Photography 22 : 10BH-04

Photography 23 : 10BH-06

Photography 24 : 10BH-06

Photography 25 : 10BH-08

Photography 26 : 10BH-11

Photography 27 : 10BH-11

Photography 28 : 10BH-12

Photography 29 : 10BH-12

Photography 30 :10BH-14

Photography 31 : 10BH-14

Photography 32 : 10BH-25

Photography 33 : 10BH-25

Photography 34 : 10BH-34

Photography 35 : 10BH-34

Photography 36 : 10BH-35

Photography 37 : 10BH-35

Photography 38 : 10BH-22

Photography 39 : 10BH-22

Photography 40 : 10BH-22

Photography 41 : 10BH-31

Photography 42 : 10BH-31

Photography 43 : 10BH-31A

Photography 44 : 10BH-31A

Photography 45 : 10BH-28

Photography 46 : 10BH-28

Photography 47 : 10BH-37

Photography 48 : 10BH-37

Photography 49 : 10BH-27

Photography 50 : 10BH-27

Photography 51 : 10BH-23

Photography 52 :10BH-23

Appendix G

Miscellaneous documents

TEST PIT AND BORING LOG REPORT EXPLANATORY NOTE

Soil description

Each layer of subsoil is described following the terminology listed below. Granular soil compactness is defined by the standard penetration index value "N" and cohesive soil consistency is defined by the undisturbed shear strength (Cu).

Depth, elevation and scale

The depth of the various stratigraphic layers is based upon the ground surface of the corresponding test pit or borehole. All elevations can be arbitrary or geodesic, the reference level always being indicated. The elevation and depth scale is always indicated in meters.

Soil classification

Clay		< 0,002 mm
Silt		0,002 - 0,08 mm
Sand	fine	0,08 - 0,4 mm
	medium	0,4 - 1,0 mm
	coarse	1,0 - 5,0 mm
Gravel	fine	5,0 - 10,0 mm
	coarse	10,0 - 80,0 mm
Cobbles		80,0 - 300,0 mm
Boulders		> 300,0 mm

Terminology and proportions

" traces "	< 10%
" some "	10 - 20%
Adjective (sandy…)	20 - 35%
" and "	> 35%

Granular soils

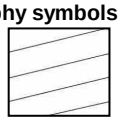
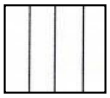
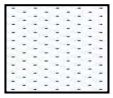
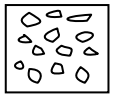
Compactness	**Standard penetration index " N " (blow counts / 300 mm)**
Very loose	< 4
Loose	4 -10
Compact	10 - 30
Dense	30 - 50
Very dense	> 50

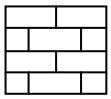
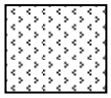
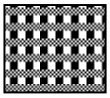
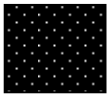
Cohesive soils

Consistency	**Shear strength " Cu " (kPa)**
Very soft	< 12
Soft	12 - 25
Firm	25 -50
Stiff	50 - 100
Very stiff	100 - 200
Hard	> 200

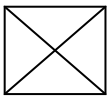
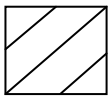
Plasticity index	**Liquid limit " W_L"**	**Sensitivity $S_t = Cu/Cu_R$**
Low	< 30%	< 2
Medium	30 - 50%	2 - 4
High	> 50%	4 - 8
		8 - 16
		> 16

Stratigraphy symbols

Clay 
Silt 
Sand 
Gravel 
Cobbles and Boulders 

Rock 
Organic soil 
Concrete 
Crushed stone 
Asphalt 

Soil state

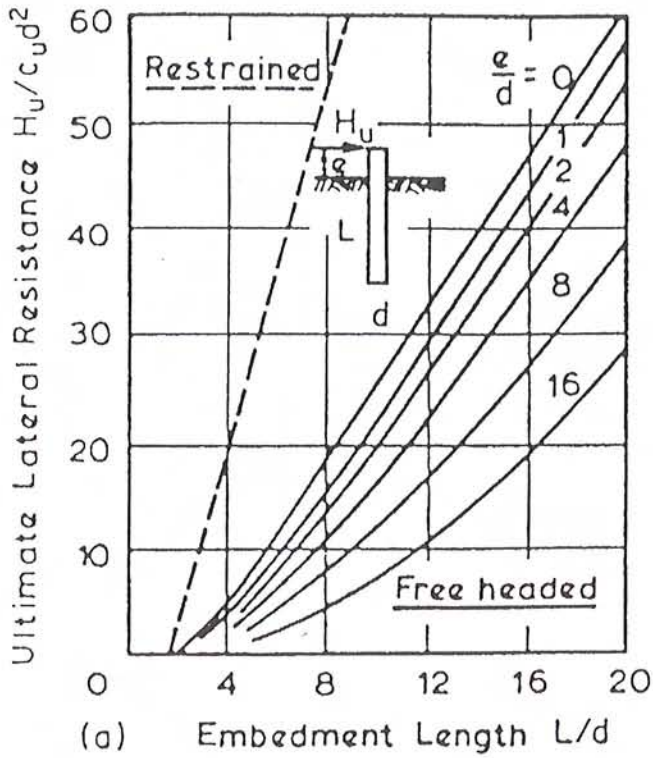
Disturbed 
Intact 

Groundwater symbols

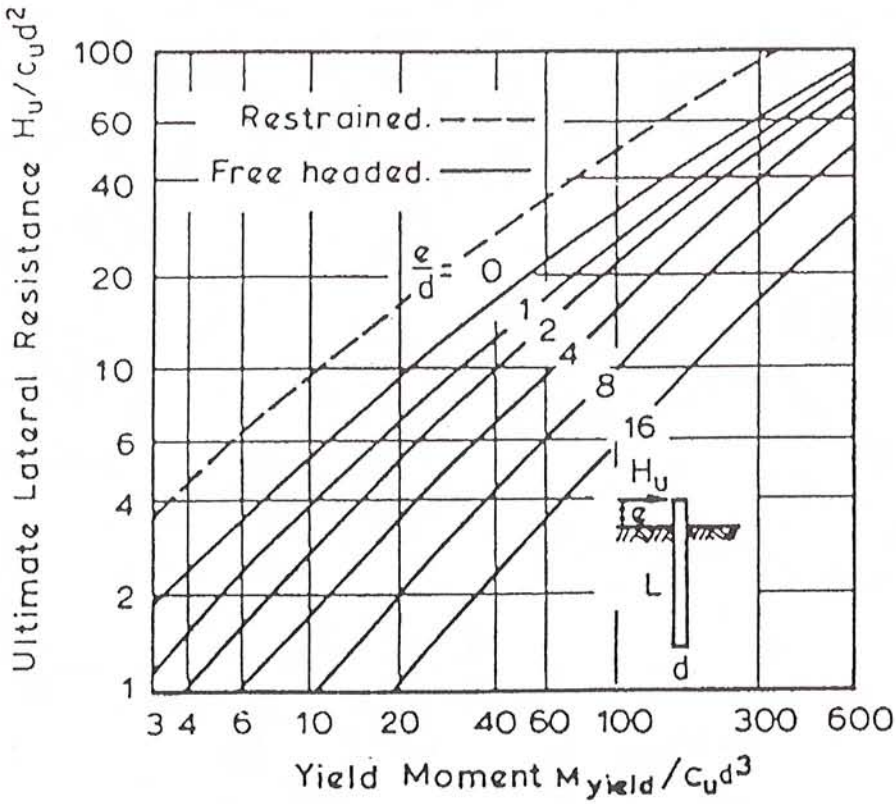
Water infiltration 
Groundwater table 

ABBREVIATIONS

Samples		Split spoon	CF
		Thin wall tube (Shelby)	TM
		Helical auger	TR
		Coring drill	CR
In situ and laboratory tests		Hydrometer test	S
		Grain size analysis	G
Plasticity index	IP	Water content	W
Liquid limit	W_L	Unit weight	γ
Plastic limit	W_P	Consolidation	C
Atterberg limit	A	Swedish fall cone	CS
		Hydraulic conductivity	K
		Refusal	R

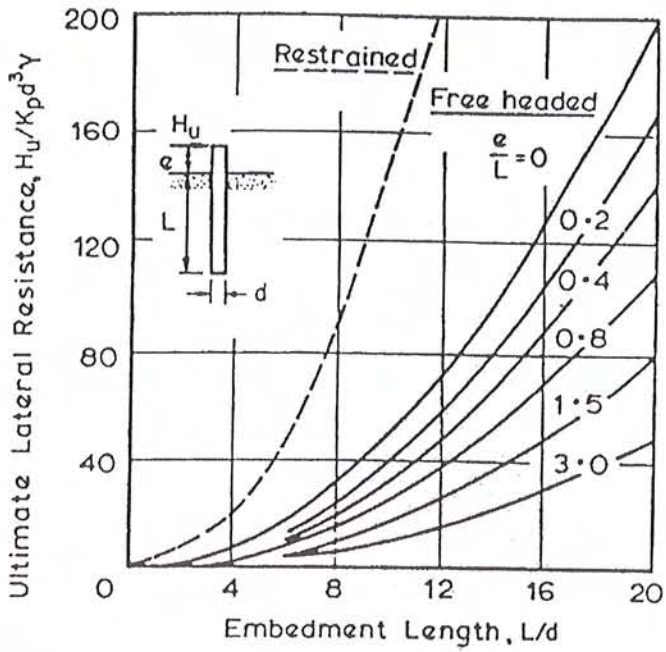


a) Short Pile

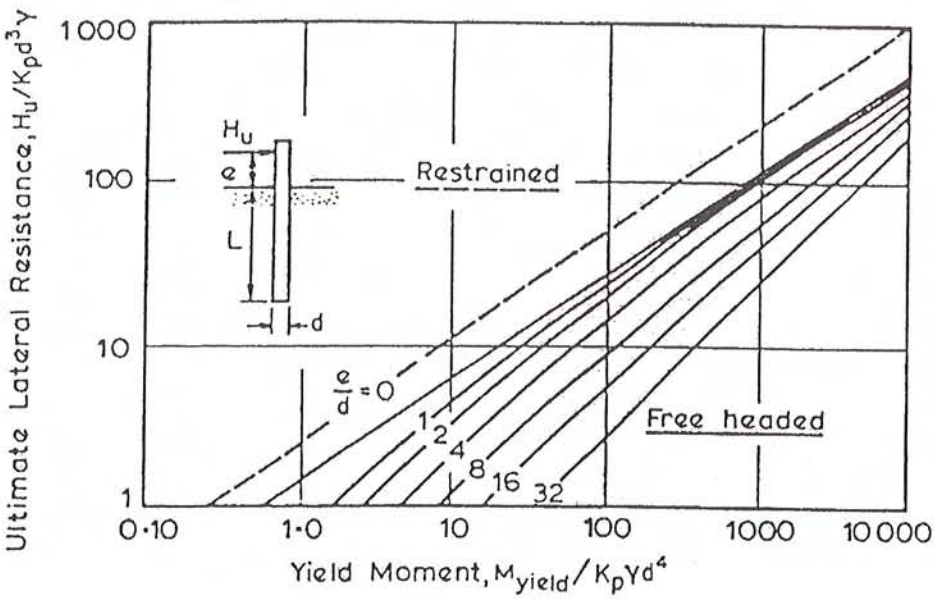


b) Long Pile

FIGURE 18.10 *Ultimate lateral resistance of piles in cohesive soils (after Broms, 1964a)*



a) Short Pile



b) Long Pile

FIGURE 18.9 *Ultimate lateral resistance of piles in cohesionless soils (after Broms, 1964b)*

Figure 37-1 Unified soil classification system.

MAJOR DIVISIONS		GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA
				Classification on basis of percentage of fines Less than 5% pass 0.075 mm sieve GW, GP, SW, SP More than 12% pass 0.075 mm sieve GM, GC, SM, SC 5% to 12% pass 0.075 mm sieve Border Classification requiring use of dual symbols
COARSE-GRAINED SOILS More than 50% retained on 0.075 mm (No. 200) sieve	GRAVELS 50% or more of coarse fraction retained on 4.75 mm (No. 4) sieve	GW	Well graded gravels and gravel-sand mixtures, little or no fines	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
		GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	
	GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures	Not meeting both criteria for GW Atterberg limits plot below "A" line or plasticity index less than 4 Atterberg limits plot above "A" line and plasticity index greater than 7 Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
		GC	Clayey gravels, gravel-sand-clay mixtures	
	SANDS More than 50% of coarse fraction passes 4.75 mm (No. 4) sieve	SW	Well-graded sands and gravelly sands, little or no fines	$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
		SP	Poorly graded sands and gravelly sands, little or no fines	Not meeting both criteria for SW
		SM	Silty sands, sand-silt mixtures	Atterberg limits plot below "A" line or plasticity index less than 4 Atterberg limits plot above "A" line and plasticity index greater than 7 Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
		SC	Clayey sands, sand-clay mixture	
FINE-GRAINED SOILS 50% or more passing 0.075 mm (No. 200) sieve	SILTS AND CLAYS Liquid limit 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	PLASTICITY CHART For classification of fine-grained soils and fine fraction of coarse-grained soil Atterberg Limits within hatched area indicates a border line classification requiring dual symbols Equation of A-line PI = 0.73(LL-20) Plasticity Index Liquid Limit A-Line CH CL MH or OH ML or OL CL-ML 60 50 40 30 20 10 7 4 0 10 20 30 40 50 60 70 80 90 100
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		OL	Organic silts and organic silty clays of low plasticity	
	SILTS AND CLAYS Liquid limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
		CH	Inorganic clays of high plasticity, fat clays	
		OH	Organic clays of medium to high plasticity	
Highly Organic Soils		PT	Peat, muck and other highly organic soils	
Visual-Manual Identification, See ASTM Designation D 2488.				

Fundamentdatenblatt
für geotechnische Nachweise
Foundation data sheet
for geotechnical calculations

Turmtyp: **E-82/BF/83/17/01**
tower type:

Typenklasse: Windzone 4, GK I (DIBt-Richtlinie)
type class: WTGS class II A (IEC-/NVN-/EN-Richtlinie)

Fundamenttyp: **Tiefgründung - Kreisringfundament**
mit Auftrieb - Ø 15,60m – 36 Pfähle
Auftragsnr.: 2790-06 vom 23.05.2006

foundation type: ***pile foundation – circular ringfoundation***
with buoyancy - Ø 15,60m – 36 piles
order number: 2790-06 dated 23.05.2006

Datum: 04.09.2006
date: Rev. 1.1 / 31.10.2006 OL

ENERCON GmbH
Dreekamp 5
D – 26605 Aurich / Germany
www.enercon.de

Author: Dipl.-Ing. O. Lehmann
Approved: Dipl.-Ing. (FH) M. Schacknies

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Author/ date:	OL / 04.09.2006		
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Revision / date:	1.1 / 31.10.2006	Reference:	WRD-04-FDB_E-82_BF_83_17_01_TGmA_Rev1_1-ger.doc

- **Pfahlkräfte für geotechnische Nachweise**
  Loads of the pile for geotechnical calculations

maximale Druckkraft *maximum compressive force*	**- 1.275 kN**
maximale Zugkraft *maximum tensile force*	**324 kN**

alle Lasten mit Teilsicherheitsbeiwert $\gamma_F = 1{,}0$
all loads with partial safety factor $\gamma_F = 1{,}0$

- **Pfahlgeometrie** / ***pile geometry***

Pfahllänge *length of the piles*		**16,00 m**
Pfahlanzahl *number of piles*		**Pfahlneigung** *pile inclination*
Total	**24**	**4:1 nach außen** 4:1 outwards
	12	**10:1 nach innen** 10:1 inwards
Pfahlquerschnitt *pile cross section*	**Quadrat** *quadrat*	**45 cm/45 cm**

Die Pfähle müssen wegen der Zugbeanspruchung mindestens 5,00 m in den ausreichend tragfähigen Baugrund einbinden.
In consequence of tension in the piles, they must bind 5,00 m into the better ground.

- **Drehfedersteifigkeit** / ***rocking spring stiffness***
  Für die Fundamenteinspannung zwischen Fundament und Baugrund ist eine Mindestdrehfedersteifigkeit von $\mathbf{k_{\varphi,dyn}}$ **= 100.000 MNm/rad (dynamische Bodenkennwerte)** bzw. $\mathbf{k_{\varphi,stat}}$ **= 25.000 MNm/rad (statische Bodenkennwerte)** für das Gesamtssystem (Turm und Gründung inkl. Pfahlsystem) einzuhalten.
  Eine dynamische Mindestdrehfedersteifigkeit des Pfahlsystems von $\mathbf{k_{\varphi,dyn}}$ **= 300.000 MNm/rad (dynamische Bodenkennwerte)** ist einzuhalten.
  The minimum value of rocking spring stiffness for clamping between foundation and soil must be $k_{\varphi,dyn}$ = 100.000 MNm/rad (dynamic soil parameter) as well as $k_{\varphi,stat}$ = 25.000 MNm/rad (static soil parameter) for the total system (tower and foundation incl. piles system).
  The minimum value of rocking spring stiffness for the piles system must be $k_{\varphi,dyn}$ = 300.000 MNm/rad (dynamic soil parameter).

- **Zulässige Schiefstellung** / ***permissible tilting***
  Maximal zulässige Schiefstellung infolge Baugrundsetzung in 20 Jahren bezogen auf den Pfahlkreisdurchmesser.
  Maximum allowed tilting due to settlement of the foundation soil in 20 years relating to the pile circle diameter.

$\Delta s \leq 40$ mm

TÜV NORD 21. NOV. 2006

- **Lastangaben für den inneren Tragsicherheitsnachweis der Pfähle**
  Loads for the dimensioning for the internal force of the piles

maximale Druckkraft *maximum compressive force* (Pfahloberkante / *top of pile*)	**- 1.577 kN**	**Einspannmoment in Platte** *Clamping moment into plate*	**40,0 kNm**
maximale Zugkraft *maximum tensile force* (Pfahloberkante / *top of pile*)	**440 kN**	**Max. Moment im Verlauf des Pfahls** *Max. moment in middle of the pile*	**27,0 kNm**

alle Lasten mit Teilsicherheitsbeiwerten
all loads with partial safety factors

Folgende seitliche Bettung des Pfahls ist einzuhalten (Tiefe bezogen auf UK Fundament)..
The following bedding modulus of the pile has to be considered (depth relates to the bottom of the foundation).

Tiefe *depth*	$E_{s,\,stat}$
0,00 m – 4,50 m	0,0 MN/m²
4,50 m – 7,50 m	1,0 MN/m²
7,50 m – 10,50 m	2,0 MN/m²
10,50 m – 16,00 m	4,0 MN/m²

- **Lasten an der Fundamentunterkante**
  (inkl. Fundamenteigengewicht γ = 25 kN/m³ und Bodenauflast γ = 18 kN/m³ im Trockenzustand)
  Loads at the bottom of foundation
  (incl. foundation dead weight γ = 25 kN/m³ and soil weight γ = 18 kN/m³ for dry conditions)

Lastfall ***load case***	**F_{xy}** **[kN]**	**F_z** **[kN]**	**M_{xy}** **[kNm]**	**M_z** **[kNm]**
DLC 1.0	570	-13.787 mit Auftrieb / *with buoyancy*	37.024	1.750
		-19.425 ohne Auftrieb / *without buoyancy*		
DLC 6.2	850	-13.787 mit Auftrieb / *with buoyancy*	61.370	1.860
		-19.425 ohne Auftrieb / *without buoyancy*		

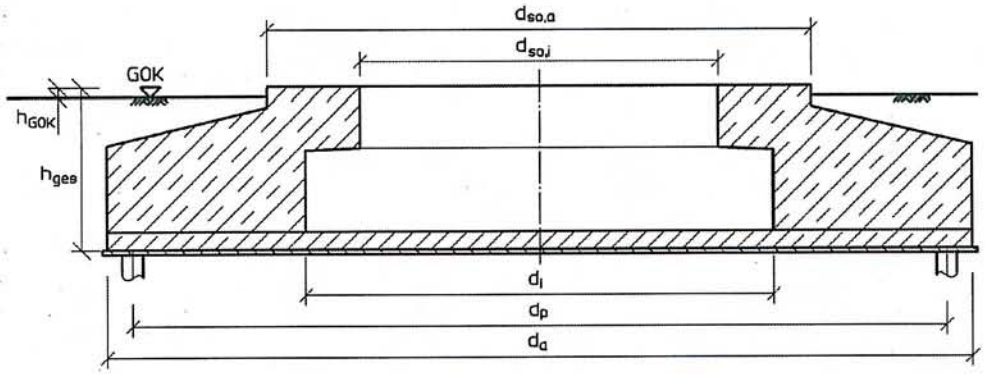
alle Lasten mit Teilsicherheitsbeiwert γ_F = 1,0
all loads with partial safety factor γ_F = 1,0

Lastfall ($\gamma_{aero}/\gamma_{masse}$) ***load case***	**F_{xy}** **[kN]**	**F_z** **[kN]**	**M_{xy}** **[kN]**	**M_z** **[kNm]**
DLC 6.2 (1.10/1.35) **ohne Auftrieb** *without buoyancy*	1.070	-25.934	68.274	1.640
DLC 6.2 (1.10/1.00) **mit Auftrieb** *with buoyancy*	1.070	-13.787	68.274	1.640

alle Lasten mit Teilsicherheitsbeiwerten
all loads with partial safety factors

Fundamentgeometrie / geometry of foundation

Außendurchmesser *outer diameter*	da	15,60 m
Innendurchmesser *inner diameter*	di	6,90 m
Sockeldurchmesser, außen *base diameter, outside*	dso_a	8,70 m
Sockeldurchmesser, innen *base diameter, outside*	dso_i	4,80 m
Pfahlkreisdurchmesser *diameter of the pile circle*	dp	14,80 m
Fundamenthöhe *foundation height*	hges	3,20 m
Differenz Fundamentoberkante - GOK *difference top of foundation – top ground surface*	hgok	0,20 m
Betongüte und Volumen *Concrete and quantity*	C 30/37	440 m³
Betonstahl und Gewicht *Concrete steel and weight*	BSt 500 S (A)	40,8 t



Bemerkungen / *remarks*

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Fundamentdatenblatt
für geotechnische Nachweise
Foundation data sheet
for geotechnical calculations

Turmtyp: **E-82/BF/83/17/01**
tower type:

Typenklasse: Windzone 4, GK 1 (DIBt-Richtlinie)
type class: WTGS class II A (IEC-/NVN-/EN-Richtlinie)

Fundamenttyp: **Flachgründung - Kreisringfundament**
mit Auftrieb - Ø 16,80m
Auftragsnr.: 2790-06 vom 16.05.2006

foundation type: ***shallow foundation – circular ringfoundation***
with buoyancy - Ø 16,80m
order number: 2790-06 dated 16.05.2006

Datum: 04.09.2006
date: Rev. 1.0

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Hamburg
Chr. Hering
Expert of
TÜVNORD SysTec GmbH & Co.KG

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24. NOV. 2006

ENERCON GmbH
Dreekamp 5
D – 26605 Aurich / Germany
www.enercon.de

Author: Dipl.-Ing. O. Lehmann
Approved: Dipl.-Ing. (FH) M. Schacknies

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- **Lasten an der Fundamentunterkante für geotechnische Nachweise**
  (inkl. Eigengewicht Fundament und Bodenauflast γ = 18 kN/m³ im Trockenzustand)
  Loads at the bottom of foundation for geotechnical calculations
  (incl. dead weight foundation and soil weight γ = 18 kN/m³ for dry conditions)

Lastfall *load case*	F_{xy} [kN]	F_z [kN]	M_{xy} [kNm]	M_z [kNm]
DLC 1.0	570	-13.911 mit Auftrieb / *with buoyancy*	36.825	1.750
		-19.674 ohne Auftrieb / *without buoyancy*		
DLC 6.2	850	-13.911 mit Auftrieb / *with buoyancy*	61.073	1.860
		-19.674 ohne Auftrieb / *without buoyancy*		

alle Lasten mit Teilsicherheitsbeiwert γ_F = 1,0
all loads with partial safety factor γ_F = 1,0

- **Aufzunehmende Bodenpressung / *minimum required bearing pressure***
  Der anstehende Baugrund muss mindestens eine Bodenpressung von σ = **242 kN/m²** aufnehmen können.
  Minimum required bearing pressure is σ = 242 kN/m².

- **Drehfedersteifigkeit / *rocking spring stiffness***
  Für die elastische Fundamenteinspannung zwischen Fundament und Baugrund sind folgende Bodenkennwerte einzuhalten.
  The following soil parameters of rocking spring stiffness for clamping between foundation and soil must be meet.

Nichtbindiger Boden / cohesionless soil:	$k_{\varphi,dyn}$	**= 100.000 MNm/rad**
	$E_{oed,dyn}$	**= 180 MN/m²** (ν = 0,35)

Nichtbindiger Boden / cohesionless soil:	$k_{\varphi,stat}$	**= 25.000 MNm/rad**
	$E_{oed,stat}$	**= 45 MN/m²** (ν = 0,35)

Die erforderlichen dynamischen Steifemodule ($E_{oed,dyn}$) bzw. statischen Steifemodule ($E_{oed,stat}$) ergeben sich in Abhängigkeit von Fundamentgeometrie und Querdehnzahl.
The minimum values of dynamic modulus of stiffness ($E_{oed,dyn}$) respectively of static modulus of stiffness ($E_{oed,stat}$) are calculated in dependence on foundation geometry and Poisson's ratio.

Für Kreisfundamente gilt:
For circular foundations:

$$k_\varphi = \frac{8 \cdot G \cdot r^3}{3 \cdot (1-\nu)}$$

$$E_{oed} = k_\varphi \cdot \frac{3}{4} \cdot \frac{1}{r^3} \cdot \frac{(1+\nu) \cdot (1-\nu)^2}{1-\nu-2 \cdot \nu^2}$$

G = Schubmodul / shear modulus

r = Radius / *radius*

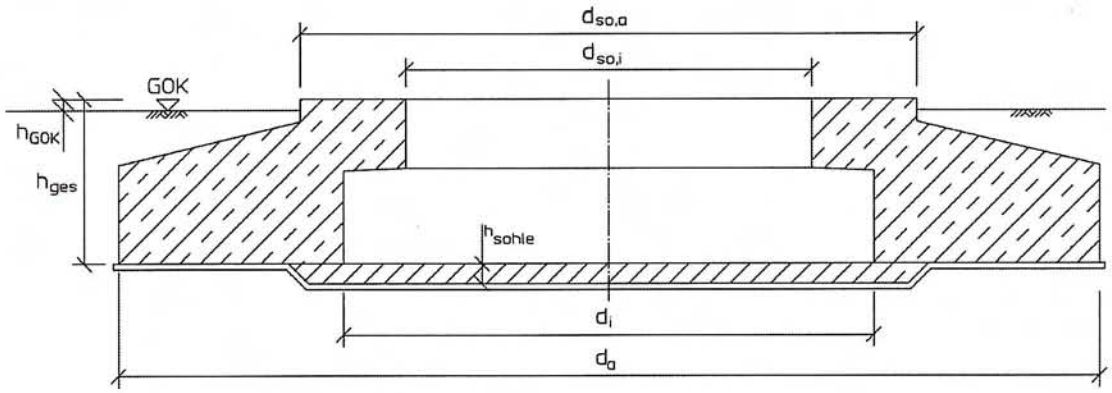
ν = Querdehnzahl / *Poisson's ratio*

- **Zulässige Schiefstellung / *permissible tilting***
  Maximal zulässige Schiefstellung infolge Baugrundsetzung in 20 Jahren bezogen auf den Fundamentdurchmesser.
  Maximum allowed tilting due to settlement of the foundation soil in 20 years relating to the foundation diameter.

$$\Delta s \leq 40 \text{ mm}$$

Fundamentgeometrie
geometry of foundation

Außendurchmesser *outer diameter*	da	16,80 m
Innendurchmesser *inner diameter*	di	6,90 m
Sockeldurchmesser, außen *base diameter, outside*	dso_a	8,70 m
Sockeldurchmesser, innen *base diameter, outside*	dso_i	4,80 m
Fundamenthöhe *foundation height*	hges	2,85 m
Differenz Fundamentoberkante - GOK *difference top of foundation – top ground surface*	hgok	0,20 m
Fundamentsohle *foundation sole plate*	h_{Sohle}	0,30 m
Betongüte und Volumen (Fundament) *Concrete and quantity (foundation)*	C 30/37	426 m³
Betonstahl und Gewicht (Fundament) *Concrete steel and weight (foundation)*	BSt 500 S (A)	35,8 t
Betongüte und Volumen (Fundamentsohle) *Concrete and quantity (foundation sole plate)*	C 25/30 WU	21 m³
Betonstahl und Gewicht (Fundamentsohle) *Concrete steel and weight (foundation sole plate)*	BSt 500 S (A)	1,6 t



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Fundamentdatenblatt
für geotechnische Nachweise
Foundation data sheet
for geotechnical calculations

Turmtyp: **E-82/BF/83/17/01**
tower type:

Typenklasse: Windzone 4, GK I (DIBt-Richtlinie)
type class: WTGS class II A (IEC-/NVN-/EN-Richtlinie)

Fundamenttyp: **Flachgründung - Kreisringfundament**
ohne Auftrieb - Ø 14,20m
Auftragsnr.: 2790-06 vom 19.05.2006

foundation type: ***shallow foundation – circular ringfoundation***
without buoyancy - Ø 14,20m
order number: 2790-06 dated 19.05.2006

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Reviewed by comparing calculation
Reviewed
Hamburg,
Chr. Hering
Expert of
TÜVNORD SysTec GmbH & Co.KG

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date: Rev. 1.0

ENERCON GmbH
Dreekamp 5
D – 26605 Aurich / Germany
www.enercon.de

Author: Dipl.-Ing. O. Lehmann
Approved: Dipl.-Ing. (FH) M. Schacknies

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- **Lasten an der Fundamentunterkante für geotechnische Nachweise**
  (inkl. Eigengewicht Fundament und Bodenauflast γ = 18 kN/m³ im Trockenzustand)
  Loads at the bottom of foundation for geotechnical calculations
  (incl. dead weight foundation and soil weight γ = 18 kN/m³ for dry conditions)

Lastfall *load case*	F_{xy} [kN]	F_z [kN]	M_{xy} [kNm]	M_z [kNm]
DLC 1.0	570	-15.772	36.825	1.750
DLC 6.2	850	-15.772	61.073	1:860

alle Lasten mit Teilsicherheitsbeiwert γ_F = 1,0
all loads with partial safety factor γ_F = 1,0

- **Aufzunehmende Bodenpressung / *minimum required bearing pressure***
  Der anstehende Baugrund muss mindestens eine Bodenpressung von σ = **412 kN/m²** aufnehmen können.
  Minimum required bearing pressure is σ = 412 kN/m².

- **Drehfedersteifigkeit / *rocking spring stiffness***
  Für die elastische Fundamenteinspannung zwischen Fundament und Baugrund sind folgende Bodenkennwerte einzuhalten.
  The following soil parameters of rocking spring stiffness for clamping between foundation and soil must be meet.

Nichtbindiger Boden / cohesionless soil:	$k_{\varphi,dyn}$	**≥ 100.000 MNm/rad**
	$E_{oed,dyn}$	**= 260 MN/m²** (ν = 0,30)

Nichtbindiger Boden / cohesionless soil:	$k_{\varphi,stat}$	**≥ 25.000 MNm/rad**
	$E_{oed,stat}$	**= 65 MN/m²** (ν = 0,30)

Die erforderlichen dynamischen Steifemodule ($E_{oed,dyn}$) bzw. statischen Steifemodule ($E_{oed,stat}$) ergeben sich in Abhängigkeit von Fundamentgeometrie und Querdehnzahl.
The minimum values of dynamic modulus of stiffness ($E_{oed,dyn}$) respectively of static modulus of stiffness ($E_{oed,stat}$) are calculated in dependence on foundation geometry and Poisson's ratio.

Für Kreisfundamente gilt:
For circular foundations:

$$k_\varphi = \frac{8 \cdot G \cdot r^3}{3 \cdot (1-\nu)}$$

$$E_{oed} = k_\varphi \cdot \frac{3}{4} \cdot \frac{1}{r^3} \cdot \frac{(1+\nu) \cdot (1-\nu)^2}{1-\nu-2 \cdot \nu^2}$$

G = Schubmodul / shear modulus

r = Radius / *radius*

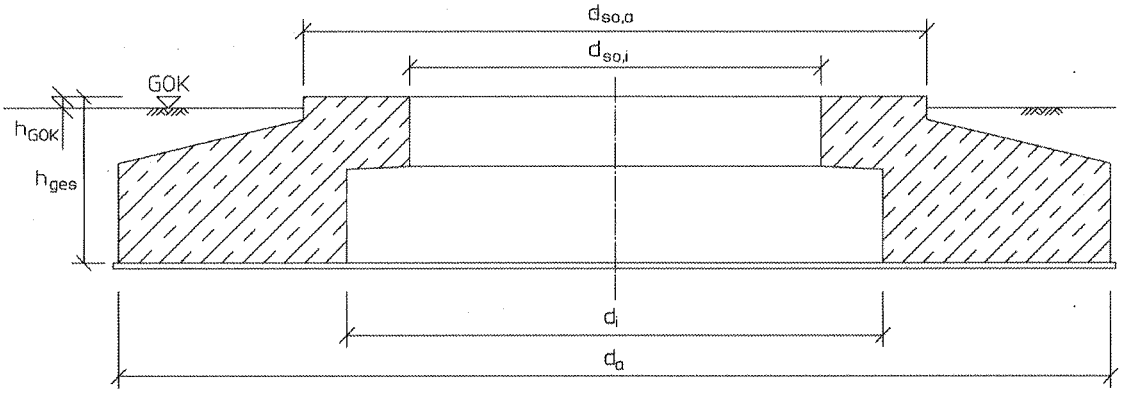
ν = Querdehnzahl / *Poisson's ratio*

- **Zulässige Schiefstellung / *permissible tilting***
  Maximal zulässige Schiefstellung infolge Baugrundsetzung in 20 Jahren bezogen auf den Fundamentdurchmesser.
  Maximum allowed tilting due to settlement of the foundation soil in 20 years relating to the foundation diameter.

$$\Delta s \leq 40 \text{ mm}$$

Fundamentgeometrie
geometry of foundation

Außendurchmesser *outer diameter*	da	14,20 m
Innendurchmesser *inner diameter*	di	6,90 m
Sockeldurchmesser, außen *base diameter, outside*	dso_a	8,70 m
Sockeldurchmesser, innen *base diameter, outside*	dso_i	4,80 m
Fundamenthöhe *foundation height*	hges	2,85 m
Differenz Fundamentoberkante - GOK *difference top of foundation – top ground surface*	hgok	0,20 m
Betongüte und Volumen (Fundament) *Concrete and quantity (foundation)*	C 30/37	300 m³
Betonstahl und Gewicht (Fundament) *Concrete steel and weight (foundation)*	BSt 500 S (A)	30,4



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