



**LA GRANDE ALLIANCE FEASIBILITY
STUDY – PHASE I**

PRELIMINARY GEOTECHNICAL
INVESTIGATION – GREVET-CHAPAIS
RAILWAY

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1.0 Introduction

1.1 General

La Grande Alliance refers to the Memorandum of Understanding (MOU) on the Cree-Québec Sustainable Infrastructure Program in Eeyou Istchee Baie-James, signed between the Cree Nation Government (CNG) and the Government of Québec on February 17, 2020. The purpose of the MOU is to provide a framework for Cree local and regional entities to work closely with relevant Québec government ministries to connect, develop and protect the territory of the Eeyou Istchee Baie-James region of northern Québec in an inclusive and participatory manner. The main objective of La Grande Alliance is to build a promising program for the strategic, predictable, and sustainable development of the territory over a 30-year time horizon.

Infrastructure development is a major component of *La Grande Alliance*. The program aims at improving and building major transportation infrastructure on the territory, including the implementation of a railway alongside the Billy-Diamond Highway to Whapmagoostui, where the construction of a deep-water port is being considered. The current program is divided into three phases. Phase I being carried out by Vision Eeyou Istchee Consortium, focusing on the feasibility design of the following infrastructures:

- Upgrade of the existing access roads between the Billy-Diamond Highway (BDH) and the Cree communities of Waskaganish, Eastmain and Wemindji;
- Upgrade of the existing access road between the Route du Nord and the community of Nemaska;
- New railway along the Billy-Diamond Highway (BDH) between the town of Matagami and KM 257 of the same highway (Rupert River Bridge);
- Recommissioning of the railway line from Grevet (Lebel-sur-Quévillon) to Chapais (approximately 225 km);
- Construction of transfer areas along the Billy-Diamond Highway and Grevet-Chapais line corridors, specifically the area at KM 257;
- Upgrade of the Route du Nord, and;
- Construction of a secondary access road to the Cree Nation of Mistissini.

The location of the infrastructures listed above is shown on Figure 1.

Limitations associated with this report and its contents are provided in the Statement of General Conditions included in Appendix A.



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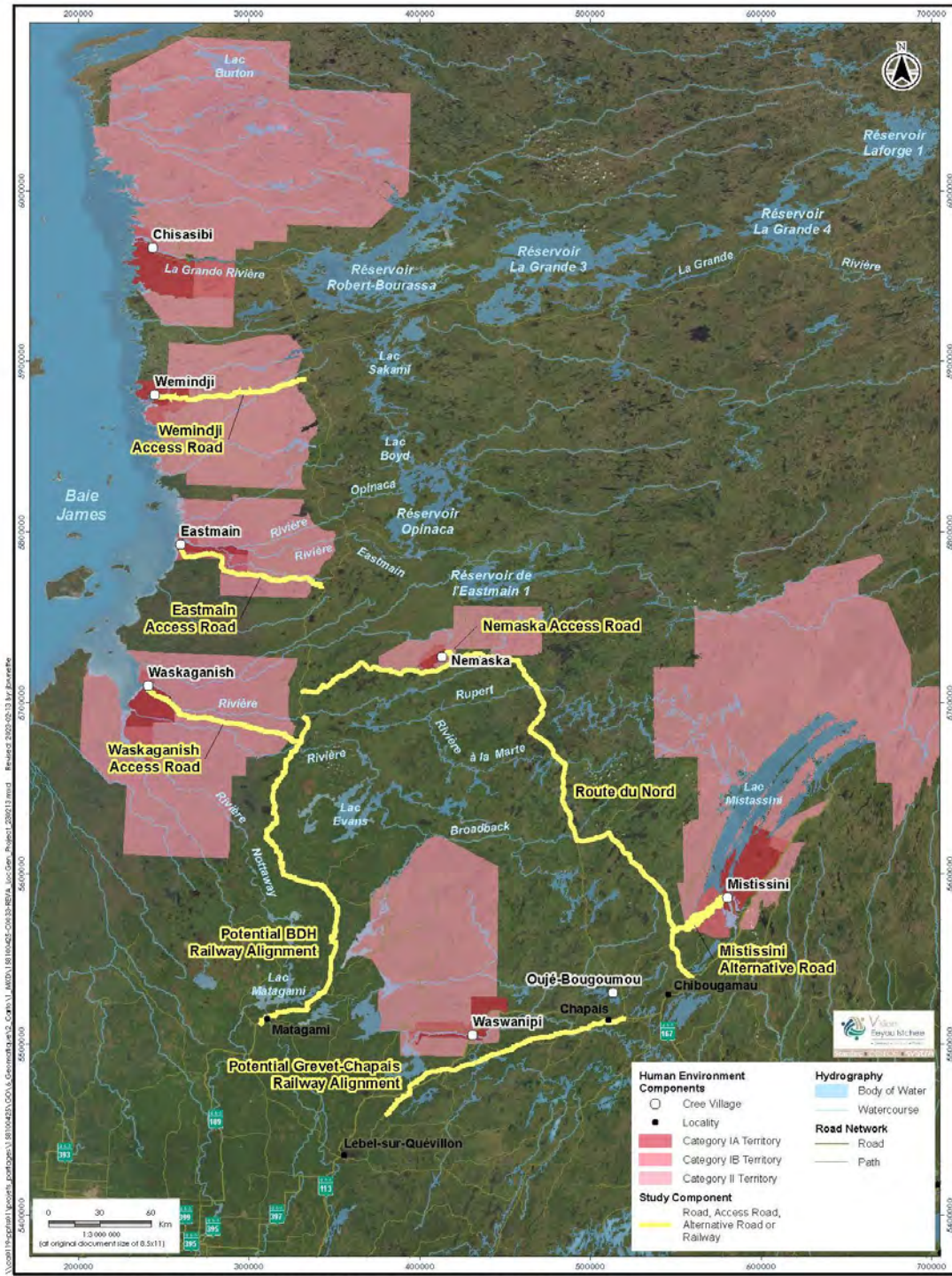


Figure 1 La Grande Alliance – Phase I Feasibility Study Area Overview



1.2 Scope of Work and Objective

As part of the Feasibility Study, the scope of work included carrying out a Preliminary Geotechnical Investigation for each of the transportation infrastructure corridors listed in Section 1.1 of this report.

The current report focuses on the Grevet-Chapais Railway alignment located between the town of Grevet and the town of Chapais, (the “Site”).

The preliminary geotechnical investigation was carried out to determine the site characteristics with regards to the nature and properties of soils and bedrock in place. The information gathered during this investigation was used to estimate the baseline in-situ conditions at the Site that feeds the Feasibility Study for the preliminary design of the Grevet-Chapais Railway.

1.3 Site and project description

The project consists of the design, development and construction of a new railway that will extend from the town of Grevet at south (KP 123) to the town of Chapais (KP 288). It should be noted that the term « KP » will be used to refer to the kilometer point of the future railway. A key plan showing the location of the Site is presented in Figure 2 below and in Appendix B.



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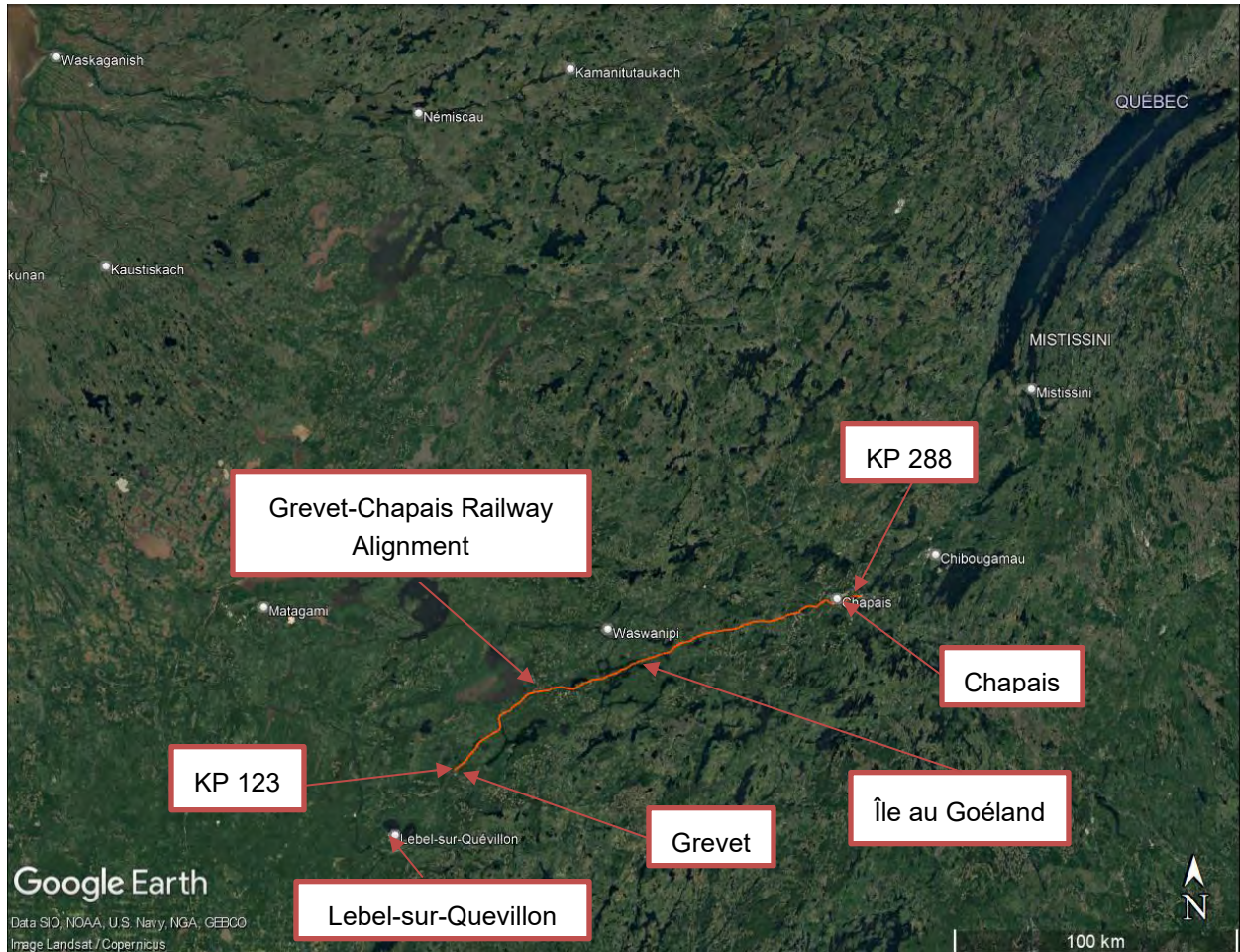


Figure 2 Grevet-Chapais Railway Location (Google Earth)

The Grevet-Chapais railway alignment closely follows an old alignment of railway connecting Quévillon to Chapais. The railway will be built on the old roadbed, in forested and undeveloped areas. Existing bridges and culverts along the alignment will be reused. Following inspections of these structures, partial rehabilitation or total reconstruction will be planned for the return to service of the railway. The geodetic elevations range from el. ≈ 321 m at Grevet to el. ≈ 389 m at Chapais.



2.0 METHOD OF INVESTIGATION

2.1 Environmental permitting

Before undertaking any geotechnical work on the targeted territory, Vision Eeyou Ischee has ensured to obtain the necessary authorizations and permits for the execution of the work:

- Land use (MERN);
- Tree cutting (MFFP), and;
- Declaration of compliance (MELCC).

All activities conducted on the territory (land occupancy, wood cutting, preparation of accesses and drilling) were carried out in compliance with the current laws and regulations. Also, following the completion of the fieldwork, effort was made at each of the investigated sites to minimize the impact of the work.

2.2 Utility Locates

A request was filed by Stantec to Info-excavation to identify underground public utilities present in the vicinity of the work site. Where present, all identified utilities were marked on the ground prior to the execution of the field work.

2.3 Health and Safety

The Stantec employees who participated in this project familiarized themselves with all the relevant Stantec Safe Work Practices (SWPs) prior to beginning of any fieldwork. In addition, Stantec's pre-job Health and Safety Checklist, that identifies any health and safety risks, was filled out and signed by all the participants in the fieldwork, including the subcontractors. The goal of this document is to identify any potential dangers in order to prevent accidents and injuries from occurring. No health and safety incidents occurred while Stantec was present at the Site.



2.4 Geotechnical field investigation

Thirty-five (35) boreholes, identified BH22-01 to BH22-35, were drilled as part of the investigation. The boreholes were drilled to obtain general information on the geotechnical properties of the soils at actual bridges and culverts sites. They were advanced using a CME drill rig mounted on tracks, operated by *Forage Boislard* Inc. under the constant supervision of an experienced Stantec technician. The borehole reports are presented in Appendix C.

At each borehole, the soils were sampled at regular intervals using a 610 mm long and 51 mm external diameter split spoon sampler (*B* size sampler) or a 63 mm external diameter split spoon sampler (*N* size sampler). With the *B* size sampler, the Standard Penetration Tests (SPTs) was performing as defined in ASTM D-1586. The soils collected from split-spoon samplers were examined and described, and the soil recovery measured and recorded.

The SPT test consists of counting the numbers of blows required to drive a *B* size sampler 12 in. (305 mm) into a soil by means of a 140 lb (63.5 kg) mass falling a height of 30 in. (762 mm). The blow count is referred to as the *N*-value of the soil, which is a description of its state of compactness.

Shelby tube samplers, or thin-walled hollow steel tubes, were pushed into the ground to extract relatively undisturbed cohesive soil samples during the drilling activities in accordance with ASTM D-1587.

Field vane shear tests were carried out in four (4) boreholes to determine the undrained shear strength of intact and remoulded clays at various depths in accordance with ASTM D-2573.

Dynamic cone penetration test (DCPT) was carried out in boreholes B22-01, BH22-18, BH22-27, and BH22-28 after sampling in accordance with BNQ 2501-145. The dynamic cone penetration is a continuous test which uses a drop weight to drive a cone and rod into the ground. The number of blows for each 12 in. (305 mm) of penetration is recorded until reaching refusal on very dense soils, cobbles, boulders, or bedrock. A continuous resistance versus depth profile is obtained from the dynamic cone penetration test which can provide a visual relationship of soil type or density variations.

The bedrock coring was carried out in boreholes BH22-19, BH22-22, BH22-23, BH22-24, BH22-25, BH22-26, BH22-34, and BH22-35. Conventional rock coring was used to advance the boreholes into bedrock and obtain continuous samples of rock in accordance with ASTM D-2113. A 75.7 mm diameter hole was drilled using a diamond-impregnated, annular, rotary drill bit with an inner diameter of 47.7 mm (*NQ* size sampler). A double inner tube system to recover the rock core samples was used. Throughout the drilling process, water was used as a circulation fluid to both lubricate and cool the drill bit. Geological and engineering descriptions and rock quality designation (RQD) were recorded on the borehole log for each core run. Rock cores from each borehole were placed in core boxes and transferred to our laboratory.

The field work was conducted under the supervision of engineering staff from Stantec who maintained detailed logs of the subsurface and drilling conditions encountered and obtained representative samples of the various strata encountered. Soils were classified in accordance with the Unified Soil Classification System (USCS) ASTM D-2487 and D-2488. All soil samples were stored in moisture proof bags and



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returned to our laboratory in Laval, Quebec, for selected laboratory testing. Rock core samples were inspected and logged by Stantec personnel at the borehole locations prior to being transferred to our laboratory for detailed geological logging and storage. Handling, transportation and storage of soil and bedrock samples were undertaken with care to minimize disturbance.

2.5 Site survey

The geotechnical borehole locations were selected by the team carrying out the project Feasibility Study in order to characterize the *in-situ* conditions at the bridges, culvert and high-water level locations within the future alignment. The boreholes were positioned on Site using a handheld GPS providing a 3 m precision, and where the boreholes were drilled at a different location than initially targeted, the new coordinates were recorded by the field technician.

No geodetic elevations were measured during this investigation. All depths presented in this report refer to the ground surface level at the time of the investigation as « meter below ground surface (mbgs) ».

The geodetic coordinates at each borehole location are presented below and are shown on the borehole location plan in Appendix B and the borehole reports in Appendix C. It should be noted that the kilometer point (KP) indicated in this report were provided by the rail design team, based on the latest version of the alignment available at the time of writing this report.

Table 1 Borehole Location and Description

Borehole #	Geodetic coordinates U18		Kilometer Point (KP)	Description
	East (m)	North (m)		
BH22-01	297 401	5 463 227	130.7	Embankment
BH22-02	298 253	5 454 116	131.3	Embankment
BH22-03	300 698	5 467 590	136.2	Embankment
BH22-04	307 357	5 471 737	144.1	Bridge
BH22-05	307 479	5 471 891	144.3	
BH22-06	307 883	5 472 451	144.9	Embankment
BH22-07	307 720	5 473 916	146.4	Bridge 1
BH22-08	307 699	5 474 004	146.5	
BH22-09	308 482	5 477 171	150.2	Embankment
BH22-10	309 446	5 477 700	151.3	Embankment and High-Water Level
BH22-11	319 175	5 486 648	163.8	Bridge 2
BH22-12	319 232	5 484 658	163.9	
BH22-13	322 850	5 485 372	167.6	Bridge 3
BH22-14	322 892	5 485 379	167.6	
BH22-15	325 106	5 485 776	169.9	Bridge 4
BH22-16	325 150	5 485 802	170.0	



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Borehole #	Geodetic coordinates U18		Kilometer Point (KP)	Description
	East (m)	North (m)		
BH22-17	325 961	5 486 239	170.9	Embankment
BH22-18	334 103	5 486 214	179.2	Embankment and High-Water Level
BH22-19	338 285	5 488 413	184.0	High-Water Level
BH22-20	347 432	5 491 346	193.8	Embankment and High-Water Level
BH22-21	348 756	5 491 771	195.2	Embankment
BH22-22	350 015	5 492 789	196.8	Bridge 5
BH22-23	350 071	5 492 802	196.9	
BH22-24	352 238	5 493 577	199.2	Embankment and High-Water Level
BH22-25	354 247	5 494 955	201.6	Bridge 6
BH22-26	354 337	5 494 954	201.7	
BH22-27	359 877	5 496 801	207.7	High-Water Level
BH22-28	362 867	5 497 902	210.9	High-Water Level
BH22-29	370 255	5 501 717	219.5	High-Water Level
BH22-30	386 432	5 506 562	236.7	Bridge 7
BH22-31	386 503	5 506 567	236.7	
BH22-32	399 987	5 509 521	250.9	Bridge 8
BH22-33	400 075	5 509 514	251.0	
BH22-34	412 177	5 513 314	264.1	High-Water Level
BH22-35	197 548	5 514 172	265.8	High-Water Level

2.6 Laboratory testing

All collected samples returned to our laboratory were subjected to a detailed visual examination and additional classification by a geotechnical engineer. The following geotechnical laboratory tests were performed on selected samples:

Table 2 Geotechnical Laboratory Tests

Laboratory Testing	Standards	Number of tests
Grain-size distribution by mechanical sieve (coarse soil fraction)	BNQ 2501-025	122
Grain-size distribution by hydrometer test (fine soil fraction)	BNQ 2501-025	58
Atterberg's Limit	BNQ 2501-092	22
Water content	BNQ 2501-170	134
Undrained shear strength by fall cone test	BNQ 2501-110	09



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Laboratory Testing	Standards	Number of tests
One-dimensional consolidation test	ASTM D2435	8
Unit Weights	--	16
Compressive strength of intact rock core specimen	ASTMD 7012	4

The results of the laboratory tests are discussed in the text of this report and are presented in Appendix D.

The soil samples will be stored for a period of 12 months after issuing of the final report. Samples will then be discarded unless otherwise directed.



3.0 SUBSURFACE CONDITIONS

3.1 Subsurface stratigraphy

The borehole records depict conditions at specific locations and on the dates indicated. Subsurface soil and groundwater conditions at locations away from the boreholes could vary from those indicated on the borehole reports.

It should be noted that the term "depth" always refers to the ground surface level during field work (mbgs) as defined previously in section 2.5.

The subsurface stratigraphy summary is presented in the following tables. Table 3 presents the boreholes drilled for the bridges, while Table 4 presents boreholes drilled for the high embankments or the high-water level. The subsurface conditions observed, and the results of the field and laboratory testing, are detailed in the borehole reports included in Appendix C.



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Table 3 Subsurface Stratigraphy Summary – Bridges

Kilometers Point (KP)	Description	Borehole	Stratigraphy (Depth, m)					Bedrock
			Fill	Peat / organic soils	Native cohesive deposit	Native granular deposit	Till	
144.1	Bridge 1	BH22-04	0.00 – 5.18 ⁽¹⁾	--	5.18 – 5.79	5.79 – 9.91	9.91 – 11.84 ⁽³⁾	
144.3		BH22-05	0.00 – 6.05	--	6.05 – 11.43	11.43 – 19.81	--	--
146.4	Bridge 2	BH22-07	0.00 – 6.86	--	--	--	6.86 – 11.81 ⁽³⁾	
146.5		Bh22-08	0.00 – 6.71	--	--	--	6.71 – 12.19	--
163.8	Bridge 3	BH22-11	0.00 – 4.57	--	4.57 – 5.33	--	5.33 – 13.82 ⁽³⁾	--
163.9		BH22-12	0.00 – 4.57	--	4.57 – 5.33	--	5.33 – 12.34 ⁽¹⁾	--
167.6	Bridge 4	BH22-13	0.00 – 2.44	--	2.44 – 13.72	13.72 – 18.29	18.29 – 18.90	--
167.6		BH22-14	0.00 – 6.10	--	6.10 – 12.19	--	12.19 – 17.37	--
169.9	Bridge 5	BH22-15	0.00 – 4.70	4.70 – 5.33	5.33 – 6.86	--	6.86 – 12.73 ⁽¹⁾	--
170.0		BH22-16	0.00 – 1.83	--	1.83 – 2.44	2.44 – 7.62	7.62 – 12.80	--
196.8	Bridge 6	BH22-22	0.00 – 5.84	--	--	--	--	5.84 – 7.62
196.9		BH22-23	0.00 – 5.26	--	--	--	--	5.26 – 7.92
201.6	Bridge 7	BH22-25	0.00 – 8.92 ⁽¹⁾	--	--	--	--	8.92 – 10.52
201.7		BH22-26	0.00 – 3.66	--	3.66 – 4.27	--	4.27 – 4.72 ⁽¹⁾	4.72 – 8.69
236.7	Bridge 8	BH22-30	0.00 – 4.39 ⁽¹⁾	4.39 – 6.10	6.10 – 10.67	--	10.67 – 14.27 ⁽¹⁾	
236.7		BH22-31	0.00 – 3.66 ⁽¹⁾	3.66 – 5.49	5.49 – 7.62	--	7.62 – 12.45 ⁽¹⁾	
250.9	Bridge 9	BH22-32	0.00 – 5.49	--	5.49 – 15.24	--	15.24 – 17.37	
251.0		BH22-33	0.00 – 6.22 ⁽¹⁾	6.22 – 6.86	6.86 – 13.72	--	13.72 – 18.34 ⁽¹⁾	

⁽¹⁾ Presence of boulders and/or cobbles.

⁽²⁾ Inferred bedrock following a refusal during the dynamic cone penetration (BNQ 2501-145).

⁽³⁾ Inferred bedrock, very dense soil and/or boulders following a refusal during drilling.



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Table 4 Subsurface Stratigraphy Summary – Embankment and High-Water Level

Kilometers Point (KP)	Embankment or High-Water Level	Borehole	Stratigraphy (Depth, m)					
			Fill	Peat / organic soils	Native cohesive deposit	Native granular deposit	Till deposit	Bedrock
130.7	Embankment	BH22-01	0.00 – 3.05	--	6.55 – 16.40	3.05 – 6.55 ⁽¹⁾	16.40 – 17.68 ⁽²⁾	--
131.3	Embankment	BH22-02	0.00 – 1.22	1.22 – 3.35	3.35 – 7.62	7.62 – 9.91	9.91 – 11.53 ⁽³⁾	
136.2	Embankment	BH22-03	0.00 – 1.22	--	1.22 – 1.83	--	1.83 – 7.09 ⁽³⁾	--
144.9	Embankment	BH22-06	0.00 – 4.27	--	4.27 – 16.74	--	16.74 – 22.15 ⁽³⁾	
150.2	Embankment	BH22-09	0.00 – 1.22	--	1.22 – 3.81	3.81 – 6.10	6.10 – 7.70 ⁽³⁾	--
151.3	Embankment	BH22-10	0.00 – 2.44	--	2.44 – 6.86	--	6.86 – 7.98 ⁽³⁾	--
170.9	Embankment	BH22-17	0.00 – 1.22	--	1.22 – 4.57	4.57 – 9.14	9.14 – 12.29 ⁽³⁾	
179.2	Embankment	BH22-18	0.00 – 1.22	1.22 – 3.48	3.48 – 31.39	--		--
184.0	High water level	BH22-19	0.00 – 1.22	--	1.22 – 4.27	--	4.27 – 6.86	6.86 – 8.99
193.8	Embankment	BH22-20	0.00 – 1.22	1.22 – 2.44	2.44 – 9.14	--	9.14 – 11.51 ⁽³⁾	--
195.2	Embankment	BH22-21	0.00 – 1.83	--	1.83 – 7.62	--	7.62 – 9.98 ⁽³⁾	
199.2	Embankment	BH22-24	0.00 – 1.22	--	1.22 – 7.92	--	7.92 – 9.25	9.25 – 10.67
207.7	High water level	BH22-27	0.00 – 3.66	--	3.66 – 9.91	9.91 – 12.19	12.19 – 14.99 ⁽²⁾	--
210.9	High water level	BH22-28	0.00 – 1.22	1.22 – 2.59	2.59 – 6.25	6.25 – 12.50	12.50 – 13.72 ⁽²⁾	--
219.5	High water level	BH22-29	0.00 – 1.35	1.35 – 2.44	2.44 – 3.35	3.35 – 8.23 ⁽¹⁾	--	--
264.1	High water level	BH22-34	0.00 – 1.22 ⁽¹⁾	1.22 – 2.44	--	2.44 – 9.14	9.14 – 9.98	9.98 -11.58
265.8	High water level	BH22-35	0.00 – 1.22	1.22 – 2.34	--	2.34 – 7.67 ⁽¹⁾	--	7.67 – 9.19

⁽¹⁾ Presence of boulders and/or cobbles.

⁽²⁾ Inferred bedrock following a refusal during the dynamic cone penetration (BNQ 2501-145).

⁽³⁾ Inferred bedrock, very dense soil and/or boulders following a refusal during drilling.

The subsurface conditions observed, and the results of the field and laboratory testing, are presented on the borehole logs included in Appendix C



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3.1.1 Fill

A layer of fill was encountered at the surface of all the boreholes. It is essentially made up of granular materials placed during the construction of the old railway. In some areas, cohesive fill was encountered.

The presence of cobbles and/or boulders was observed within the layer of fill at boreholes BH22-04, BH22-25, BH22-30, BH22-31, BH22-33 and BH22-34.

The presence of organic matters and/or woods was observed within the fill at boreholes BH22-05, BH22-06, BH22-07, BH22-11, BH22-13, BH22-14, BH22-15, BH22-17, BH22-18, BH22-21, BH22-24, BH22-25, BH22-27, BH22-29, BH22-30 and BH22-33.

Fifty-nine (59) representative sample of this fill were selected for grain size distribution. The laboratory results are presented in the following table and are included in Appendix D.

Table 5 Laboratory Results – Fill

Borehole	Sample	Depth (m)	Moisture Content (%)	Fines (%)		Sand (%)	Gravel (%)
				Clay (%)	Silt (%)		
BH22-01	SS-01	0.00 – 0.61	3.0	3.7		26.5	69.8
BH22-02	SS-02	0.61 – 1.22	9.1	6.2		72.5	21.3
BH22-03	SS-01	0.00 – 0.61	4.2	4.9		68.6	26.5
BH22-04	SS-02	0.61 – 1.22	3.2	8.0		80.1	11.9
BH22-04	SS-04	1.83 – 2.44	11.7	1.8		72.1	26.1
BH22-05	SS-02B	1.02 – 1.22	45.5	18.3	76.1	5.6	0.0
BH22-05	SS-06	3.05 – 3.66	31.6	17.2	31.9	50.9	0.0
BH22-06	SS-01	0.00 – 0.61	3.0	6.7		69.8	23.5
BH22-07	SS-02	0.61 – 1.22	2.6	10.1		62.4	27.5
BH22-07	SS-06	3.05 – 3.66	15.7	8.8		80.5	10.7
BH22-08	SS-01	0.00 – 0.61	3.6	8.4		78.0	13.6
BH22-08	SS-04	1.83 – 2.44	14.5	8.2		72.5	19.3
BH22-08	SS-08	4.27 – 4.88	13.2	25.5		63.6	10.9
BH22-09	SS-02	0.61 – 1.22	6.2	14.6		70.7	14.7
BH22-10	SS-01	0.00 – 0.61	5.1	19.3		62.7	18.0
BH22-10	SS-04	1.83 – 2.44	17.1	10.7		79.5	9.8
BH22-11	SS-01	0.00 – 0.61	3.0	4.7		59.3	36.0
BH22-12	SS-02	0.61 – 1.22	5.0	8.2		86.1	5.7
BH22-12	SS-06	3.05 – 3.66	19.5	10.8	38.9	40.9	9.4
BH22-13	SS-02	0.61 – 1.22	4.0	8.1		82.0	9.9



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Borehole	Sample	Depth (m)	Moisture Content (%)	Fines (%)		Sand (%)	Gravel (%)
				Clay (%)	Silt (%)		
BH22-14	SS-01A	0.00 – 0.18	4.1	4.5		31.3	64.2
BH22-14	SS-05	2.44 – 3.05	27.2	21.5	61.2	12.4	4.9
BH22-14	SS-08	4.57 – 5.18	33.9	13.7	30.8	55.3	0.2
BH22-15	SS-02	0.61 – 1.22	5.3	11.8		75.2	13.0
BH22-16	SS-01A	0.00 – 0.13	5.7	5.3		34.9	58.8
BH22-17	SS-02	0.61 – 1.22	20.9	41.8	47.1	7.9	3.2
BH22-18	SS-01	0.00 – 0.61	3.8	8.5		66.9	24.6
BH22-19	SS-02	0.00 – 0.61	17.1	50.6		35.0	14.4
BH22-20	SS-01	0.00 – 0.61	5.0	7.7		62.7	29.6
BH22-21	SS-02	0.61 – 1.22	5.2	9.9		71.6	18.5
BH22-22	SS-01	0.00 – 0.61	3.8	10.3		53.2	36.5
BH22-22	SS-04	1.83 – 2.44	14.7	3.2		89.7	7.1
BH22-22	SS-08	4.27 – 4.88	14.5	12.6		66.9	20.5
BH22-23	SS-02	0.61 – 1.22	3.4	11.9		78.2	9.9
BH22-23	SS-06	3.05 – 3.66	8.5	4.2		58.8	37.0
BH22-23	SS-09	4.88 – 5.18	6.2	1.2		28.6	70.2
BH22-24	SS-01	0.00 – 0.61	3.9	7.2		58.4	34.4
BH22-25	SS-02	0.61 – 1.22	4.5	10.7		63.5	25.8
BH22-25	SS-04	1.83 – 2.44	7.9	8.9		56.7	34.4
BH22-25	SS-06	3.05 – 3.66	6.1	4.3		46.6	49.1
BH22-25	SS-10	5.49 – 6.10	6.8	6.5		60.6	32.9
BH22-26	SS-01	0.00 – 0.61	4.6	11.0		62.2	26.8
BH22-26	SS-03	1.83 – 2.44	12.5	7.0		60.5	32.5
BH22-27	SS-01	0.00 – 0.61	2.2	4.9		35.1	60.0
BH22-27	SS-04	1.83 – 2.44	66.3	13.2	69.5	11.9	5.4
BH22-28	SS-01B	0.08 – 0.61	5.8	7.2		72.3	20.5
BH22-29	SS-02	0.61 – 1.22	5.8	6.9		74.3	18.8
BH22-30	SS-01	0.00 – 0.61	6.8	7.6		39.5	52.9
BH22-30	SS-04	1.83 – 2.44	11.5	1.6		64.6	33.8
BH22-31	SS-02	0.61 – 1.22	3.5	8.1		52.9	39.0
BH22-31	SS-04B	1.93 – 2.44	27.1	20.9	36.8	30.9	11.4



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Borehole	Sample	Depth (m)	Moisture Content (%)	Fines (%)		Sand (%)	Gravel (%)
				Clay (%)	Silt (%)		
BH22-31	SS-06	3.05 – 3.66	31.0	23.6	42.9	15.7	17.8
BH22-32	SS-01	0.00 – 0.61	1.5	3.2		28.1	68.7
BH22-32	SS-03	1.22 – 1.83	10.3	1.0		70.3	28.7
BH22-32	SS-09	4.88 – 5.49	12.8	17.1		65.5	17.4
BH22-33	SS-01	0.00 – 0.61	8.0	4.8		40.0	55.1
BH22-33	SS-05	2.44 – 3.05	9.6	17.8		66.6	15.6
BH22-34	SS-02	0.61 – 1.22	1.9	3.7		37.2	59.1
BH22-35	SS-01B	0.10 – 0.61	12.4	6.5		79.1	14.4

One (1) representative sample of the cohesive fill was selected for Atterberg limits testing. The laboratory results are presented in the following table and are included in Appendix D

Table 6 Atterberg Results – Cohesive Fill

Borehole	Sample	Depth (m)	Moisture Content (%)	Liquid Limit (W _L) (%)	Plastic Limit (W _P) (%)	Liquid Index (I _L)	Plastic Index (I _P)	USCS
BH22-14	SS-05	2.44 – 3.05	27.2	24	18	1.5	6	CL-ML

The moisture content obtained on this sample of fill is 27.2%. It is greater than the liquidity limit ($I_L \geq 1.0$), this means that the material could lose its plastic behavior if removed.

3.1.2 Peat / Organic Soil

A layer of organic soil beneath the fill was encountered generally in areas where the ground table was very shallow, and at Bridges 5, 8 and 9, at a depth ranging from 1.22 to 6.22 m below ground surface (mbgs).

This layer of organic deposit had a thickness ranging from 0.63 m (at BH22-15) to 2.26 m (at BH22-18) and essentially consisted of peat, black organic soil with presence of vegetal debris and roots.

3.1.3 Native Cohesive Deposit

A native cohesive deposit was encountered in all boreholes except on bridges 2 and 6, and in boreholes BH22-34 and BH22-35, at depths ranging from 1.22 m to 6.86 m (mbgs).

Based on available geological mapping, the Grevet-Chapais Railway is mostly situated within the glaciolacustrine varved clay plains formed when the region was submerged by glacial Lake Barlow-Ojibway. Visually, varved clays consist of thin laminations, rarely exceeding 2 to 3 cm of light silty layers



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between dark clayey layers. Generally, the Barlow-Ojibway varved clays are slightly over consolidated, soft to firm in consistency, with a high compression index.

Thirty-four (34) representative samples of the native cohesive deposit were selected for hydrometer tests. The laboratory results are presented in the following table and are included in Appendix D.

Table 7 Grain Size Distribution from Hydrometer Tests - Native Cohesive Deposit

Borehole	Sample	Depth (m)	Fines (%)		Sand (%)	Gravel (%)
			Clay	Silt		
BH22-01	SS-11	3.66 – 4.27	73.6	22.6	3.8	0.0
BH22-02	SS-08	4.27 – 4.88	74.7	25.1	0.2	0.0
Bh22-03	SS-03	1.22 – 1.83	50.1	46.8	3.1	0.0
BH22-05	SS-10	6.10 – 6.71	83.4	13.7	2.9	0.0
BH22-06	SS-19	15.24 – 15.85	10.3	85.6	3.8	0.3
BH22-07	SS-10	5.49 – 6.10	59.7	23.3	15.8	1.2
BH22-09	SS-03	1.22 – 1.83	68.5	30.2	1.3	0.0
BH22-10	SS-07	3.81 – 4.42	74.6	24.7	0.7	0.0
BH22-11	SS-08	4.57 – 5.18	43.4	40.2	8.6	7.9
BH22-12	SS-08	4.57 – 5.18	39.9	33.1	13.2	13.8
BH22-13	SS-06	3.05 – 3.66	46.2	39.3	4.9	9.6
BH22-13	SS-12	7.62 – 8.23	72.1	27.3	0.6	0.0
BH22-14	SS-13	9.14 – 9.75	86.9	12.6	0.5	0.0
BH22-15	SS-06	3.05 – 3.66	28.4	34.2	12.9	24.5
BH22-16	SS-04B	1.98 – 2.44	52.6	23.3	8.0	16.1
BH22-17	SS-05	2.44 – 3.05	52.5	44.1	3.4	0.0
BH22-18	SS-07	3.66 – 4.27	76.8	22.5	0.7	0.0
BH22-18	SS-17	10.67 – 11.28	84.5	15.0	0.5	0.0
BH22-19	SS-04	1.83 – 2.44	63.5	30.2	2.5	3.8
BH22-20	SS-06	3.05 – 3.66	50.2	44.5	3.6	1.7
BH22-20	SS-13	7.32 – 7.92	43.4	56.2	0.4	0.0
BH22-21	SS-06	3.66 – 4.27	79.0	20.8	0.2	0.0
BH22-24	SS-04	1.83 – 2.44	31.6	54.6	10.9	2.9
BH22-24	SS-07	3.66 – 4.27	54.8	43.0	0.9	1.3
BH22-24	SS-12	6.71 – 7.32	44.9	54.9	0.2	0.0
BH22-26	SS-06	3.66 – 4.27	55.2	21.5	14.6	8.7



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Borehole	Sample	Depth (m)	Fines (%)		Sand (%)	Gravel (%)
			Clay	Silt		
BH22-27	SS-09	4.88 – 5.49	49.3	40.4	6.3	4.0
BH22-28	SS-05B	2.59 – 3.05	50.7	46.9	2.4	0.0
BH22-29	SS-06A	3.05 – 3.58	43.5	55.3	0.6	0.6
BH22-30	SS-14	9.14 – 9.75	55.5	43.8	0.7	0.0
BH22-31	SS-10	5.49 – 6.10	60.5	38.4	1.1	0.0
BH22-32	SS-15	9.14 – 9.75	20.1	74.3	5.6	0.0
BH22-33	SS-11	6.86 – 7.47	91.3		8.7	0.0
BH22-33	SS-15	12.19 – 12.80	59.2	39.9	0.9	0.0

Twenty-one (21) representative samples of the native cohesive deposit were selected for Atterberg limits testing. The laboratory results are presented in the following table and are included in Appendix D.

Table 8 Atterberg Results – Native Cohesive Deposit

Borehole	Sample	Depth (m)	Moisture Content (%)	Liquid Limit (WL) (%)	Plastic Limit (WP) (%)	Liquid Index (IL)	Plastic Index (IP)	USCS
BH22-01	SS-11	3.66 – 4.27	71.9	73	25	1.0	48	CH
BH22-02	SS-08	4.27 – 4.88	71.0	48	20	1.8	28	CL
BH22-03	SS-03	1.22 – 1.83	29.9	34	20	0.7	14	CL
BH22-05	SS-10	6.10 – 6.71	78.7	51	19	1.9	32	CH
BH22-07	SS-10	5.49 – 6.10	33.4	45	19	0.6	26	CL
BH22-09	SS-03	1.22 – 1.83	41.1	50	23	0.7	27	CL
BH22-10	SS-07	3.81 – 4.42	31.3	46	23	0.4	23	CL
BH22-13	SS-06	3.05 – 3.66	33.1	42	17	0.6	25	CL
BH22-13	SS-12	7.62 – 8.23	99.7	81	28	1.4	53	CH
BH22-14	SS-13	9.14 – 9.75	88.8	81	29	1.2	52	CH
BH22-15	SS-06	3.05 – 3.66	31.4	45	23	0.4	22	CL
BH22-17	SS-05	2.44 – 3.05	30.3	44	22	0.4	22	CL
BH22-18	SS-07	3.66 – 4.27	62.1	62	23	1.0	39	CH
BH22-20	SS-13	7.32 – 7.92	48.9	30	17	2.5	13	CL
BH22-21	SS-06	3.66 – 4.27	84.0	73	25	1.2	48	CH
BH22-24	SS-12	6.71 – 7.32	50.4	38	18	1.6	20	CL
BH22-27	SS-09	4.88 – 5.49	51.2	45	19	1.2	26	CL



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Borehole	Sample	Depth (m)	Moisture Content (%)	Liquid Limit (W _L) (%)	Plastic Limit (W _P) (%)	Liquid Index (I _L)	Plastic Index (I _P)	USCS
BH22-30	SS-14	9.14 – 9.75	53.1	38	19	1.8	19	CL
BH22-31	SS-10	5.49 – 6.10	46.6	51	21	0.9	30	CH
BH22-32	SS-15	9.14 – 9.75	31.3	23	18	2.7	5	CL-ML
BH22-33	SS-15	12.19 – 12.80	59.4	42	18	1.7	24	CL

The moisture contents obtained on representative samples of this native cohesive deposit range from 29.9% to 99.7%.

Thirteen (13) samples have moisture contents greater than the liquidity limit ($IL \geq 1.0$), this means that the material could lose its plastic behavior and act as a liquid when excavated and reworked.

Eight (8) samples have moisture contents lower than the liquidity limit ($0 \leq IL < 1.0$), this means that the material will keep his plastic behavior when excavated and reworked.

Eight (8) consolidations from the native cohesive deposit were selected for testing. The results are presented in the following table and are included in Appendix D.

Table 9 Consolidation Test Results – Native Cohesive Deposit

Borehole	Depth (m)	σ'_{v0} (kPa)	σ'_p (kPa)	OCR	Cr	Cc	Soil condition
BH22-05	9.14 – 9.45	82	102	1.2	0.057	1.417	Over-consolidated
BH22-10	4.75 – 5.18	59	> 59	NA	0.106	0.138	Disturbed Sample
BH22-13	3.66 – 4.27	44	80	1.8	0.043	0.821	Over-consolidated
BH22-14	7.62 – 8.23	84	> 84	NA	0.062	0.826	Disturbed Sample
BH22-17	3.81 – 4.42	41	100	2.4	0.048	0.590	Over-consolidated
BH22-21	4.88 – 5.49	40	60	1.5	0.048	1.182	Over-consolidated
BH22-30	9.75 – 10.36	102	> 102	NA	0.040	0.061	Disturbed Sample
BH22-32	9.91 – 10.52	128	> 128	NA	0.662	0.293	Disturbed Sample

Four (4) in-situ field vane shear tests and one (1) in-situ remoulded vane shear test were conducted on this native cohesive deposit. The tests indicated undrained shear strength values ranging from approximately 4 kPa to 51 kPa, and a remoulded shear strength of 4 kPa. These values indicate that the native cohesive deposit highly sensitive.



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Twelve (12) Swedish fall cone tests were conducted on the native cohesive deposit to measure the undrained shear strength of the clay. The test results are presented in the following table and are included in Appendix D.

Table 10 Swedish Fall Cone Test Results – Native Cohesive Deposit

Borehole	Sample	Depth (m)	Undrained Shear Strength Intact Soil Cu (kPa)	Undrained Shear Strength Remoulded Soil Cu _r (kPa)	Moisture Content (%)	Unit Weight (kN/m ³)
BH22-05	TS-23	9.14 – 9.75	27	1.0	78.2	15.2
BH22-06	TS-24	6.10 – 6.71	--	--	72.9	14.8
BH22-09	TS-12	2.44 – 3.05	--	--	41.4	17.7
BH22-10	TS-12	4.75 – 5.18	--	--	36.7	18.4
BH22-13	TS-07	3.66 – 4.27	20	3.6	65.5	15.8
BH22-14	TS-12	7.62 – 8.23	11	1.2	99.3	14.8
BH22-17	TS-07	3.81 – 4.42	20	0.5	49.5	16.5
BH22-21	TS-15	4.27 – 4.88	17	2.2	80.8	14.9
BH22-28	TS-10	5.49 – 6.10	8	1.2	62.9	15.6
BH22-30	TS-15	9.75 – 10.36	48	3.6	28.1	18.6
BH22-32	TS-16	9.91 – 10.52	48	7.1	36.6	16.4
BH22-33	TS-16	12.95 – 13.56	61	2.2	30.9	19.0

The Swedish fall cone tests resulted in undrained shear strength values ranging from approximately 11 kPa to 61 kPa; the very soft to very stiff soils were observed at shallow depths, and the strength of the clay gradually increased with depth.

3.1.4 Native Granular Deposit

A native granular deposit was encountered at a depth ranging from 2.34 m (at BH22-35) to 13.72 m (at BH22-13) below ground surface (mbgs).

Standard Penetration Test N-values measured in this deposit ranged between 0 to 37, indicating that the soil is in a very loose to dense state with an average value of 10, corresponding to a compact state.

Seventeen (17) representative samples of this deposit were selected for grain size distribution tests. The laboratory results are presented in the following table and are included in Appendix D.



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Table 11 Laboratory Test Results – Native Granular Deposit

Borehole	Sample	Depth (m)	Moisture Content (%)	Fines (%)		Sand (%)	Gravel (%)	USCS
				Clay	Silt			
BH22-01	SS-07	3.66 – 4.27	15.5	0.7		88.4	10.4	SW
BH22-02	SS-12	7.62 – 8.23	25.9	8.2	81.3	10.4	0.1	ML or MH
BH22-03	SS-05	2.44 – 3.05	22.5	22.4	17.7	15.4	44.5	GC
BH22-04	SS-09	6.71 – 7.32	24.7	1.5	62.1	35.3	1.1	ML or MH
BH22-04	SS-12	9.14 – 9.75	17.2	4.7	39.4	51.1	4.8	SM
BH22-05	SS-16	11.43 – 12.04	38.6	59.6		33.7	6.7	SM
BH22-13	SS-17	15.24 – 15.85	11.5	12.6		77.4	10.0	SM or SW
BH22-16	SS-09	4.88 – 5.49	14.7	8.8		80.0	11.2	SM or SW
BH22-17	SS-12	7.62 – 8.23	22.8	5.4	93.9	0.7	0.0	ML or MH
BH22-19	SS-09	4.88 – 5.49	14.3	5.1	47.8	37.3	9.8	ML or MH
BH22-28	SS-11B	6.24 – 6.71	21.6	7.6	80.3	12.1	0.0	ML or MH
BH22-29	SS-07	3.66 – 4.27	15.6	3.8	86.5	9.7	0.0	ML or MH
BH22-29	SS-11	6.10 – 6.71	15.4	9.9		56.8	33.3	SW
BH22-34	SS-05	2.44 -3.05	24.4	68.3		30.3	1.4	SM
BH22-34	SS-08	4.57 – 5.18	16.7	2.3	87.5	10.2	0.0	ML or MH
BH22-35	SS-05	2.44 – 3.05	22.4	4.8	87.4	7.7	0.1	ML or MH
BH22-35	SS-08	4.57 – 5.18	15.4	1.8	48.5	49.7	0.0	SM

Boreholes BH22-05 and BH22-29 ended respectively within this native granular deposit, at 19.81 m and 8.23 m below ground surface (mbgs).

3.1.5 Till

A till deposit was encountered in most boreholes at a depth ranging from 1.83 m (at BH22-03) to 18.29 m (at BH22-13) (mbgs).

Standard Penetration Test N-values measured in this deposit ranged between 4 to 85 indicating the soil to be in a very loose to very dense state.

It is important to note that the till is naturally a heterogeneous unconsolidated deposit and that it may exhibit a significant degree of vertical and lateral variability in grain size distribution. It's likely that larger boulders and cobbles are present in the deposit in greater quantities than observed in the boreholes drilled for this investigation.

Twelve (12) representative samples of this till deposit were selected for grain size distribution analysis. The laboratory results are presented in the following table and are included in Appendix D.



Table 12 Laboratory Test Results – Till Deposit

Borehole	Sample	Depth (m)	Moisture Content (%)	Fines (%)		Sand (%)	Gravel (%)	USCS
				Clay	Silt			
BH22-09	SS-11	7.62 – 7.85	11.9	5.4		80.6	14.0	SW
BH22-11	SS-12	7.62 – 8.23	6.4	20.5		36.0	43.5	SW
BH22-12	SS-10	6.10 – 6.71	8.9	4.6	25.7	41.0	28.7	SM
BH22-15	SS-12	7.62 – 8.23	7.5	3.6		50.4	46.0	SW
BH22-16	SS-15	10.67 – 11.28	9.1	0.4		66.4	33.2	SW
BH22-20	SS-16	9.91 – 10.52	9.9	3.1	33.6	47.0	16.3	SM
BH22-21	SS-13	9.14 – 9.75	8.1	2.5	19.4	47.6	30.5	SW
BH22-24	SS-15	8.53 – 9.14	13.3	10.4		65.4	24.2	SW
BH22-27	SS-16	9.91 – 10.52	29.7	15.4	63.1	20.4	1.1	ML ou MH
BH22-30	SS-19	13.41 – 14.02	8.2	5.8		66.7	27.5	SW
BH22-31	SS-14	9.14 – 9.75	12.5	2.2	39.9	52.5	5.4	SM
BH22-34	SS-13	9.14 – 9.75	11.1	15.1		40.7	44.2	SW

Boreholes BH22-01 to BH22-04, BH22-06 to BH22-18, BH22-20, BH22-21, BH22-27, BH22-28, BH22-30 to BH22-33, and BH22-35 ended within this native till deposit, at depth ranging from 7.09 m and 22.15 m below ground surface (mbgs).

3.1.6 Bedrock

According to the Geomining information system (SIGEOM), the bedrock at the site is composed of monzonite, basalt, andesitic basalt, amphibolite and mafic to felsic volcanoclastic rocks, gabbro, tonalite and tonalitic gneiss, all belonging to the Pluton de Lichen, the Pluton de La Ronde, the Pluton d’Anville, the Chrissie, from Complexe de la Rivière Opawica and from Groupe de Roy.

The bedrock was intercepted at depth ranging from 4.72 m to 9.98 m at boreholes BH22-19, BH22-22 to BH22-26, BH22-34, and BH22-35. During the drilling program, the bedrock was cored over a length varying between 1.42 and 3.97 m at the borehole locations. The percent recovery measured for the different sample lengths varies between 63% and 100%.

The recovered bedrock samples were described as grey manzonite or basalt. The rock quality index (RQD) was determined on recovered rock cores. This index is an indirect assessment of the number of fractures in the rock. RQD index values varied between 40 and 100%, corresponding to a poor-quality rock at the surface to excellent quality rock at depth for boreholes BH22-19, BH22-22 to BH22-25, BH22-34 and BH22-35. The different RQD values measured seem to show that the rock is generally of fair quality, with an average RQD of about 59%.



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For the borehole BH22-26, the RQD index value varied between 0 and 83%, corresponding to very poor quality at the surface to good quality rock at depth. The different RQD values measured in this borehole seem to show that the rock is generally of very poor quality, with an average RQD of about 20%. Four (4) uniaxial compressive strength and unit weight tests were selected on representative samples of the bedrock. The laboratory results are presented in the following table and are included in Appendix D.

Table 13 Laboratory Test Results – Bedrock

Boreholes	Sample	Description	Depth (m)	Mass (kg/m ³)	Unit Weight (kN/m ³)	Compressive Strength (MPa)	Classification (ISRM, 1981)
BH22-19	DC-19	Manzonite	8.50 – 8.62	2820	27.7	145.7	R5 – Very strong
BH22-22	DC-12	Basalt	7.18 – 7.30	2857	28.0	82.6	R4 – Strong
BH22-23	DC-10	Basalt	6.25 – 6.37	2984	29.3	56.6	R4 – Strong
BH22-26	DC-12	Basalt	8.41 – 8.53	2882	28.3	63.1	R4 – Strong

Boreholes BH22-19, BH22-22 to BH22-26, BH22-34 and BH22-35 ended within this bedrock, at depth ranging from 7.62 m to 11.58 m below ground surface (mbgs).

3.2 Groundwater

For safety reasons, monitoring wells were not installed as part of this preliminary investigation; the boreholes were drilled on an existent railway roadbed which is currently used as a recreational off-road vehicle trail.

It should be noted that groundwater levels can be expected to fluctuate during periods of heavy precipitation associated with seasonal weather trends, or particular events, site use, adjacent site use, or construction activities. Therefore, it is possible that the groundwater levels will be different at the time of constructing the planned work.



4.0 Discussions and Recommendations

This section provides general guidance related to the geotechnical design aspects of the rehabilitation of the Grevet-Chapais railway, based on our interpretation of the available subsurface information described herein, and our understanding of the project requirements.

The discussion and recommendations presented in the following sections are to provide the designers with functional information for planning and preliminary design purposes only. A detailed geotechnical investigation and design report, complete with additional boreholes, will be required prior to or during the final design stage of the project.

4.1 Project Summary

The project consists of the rehabilitation of the former railway line extending from the town of Grevet, at the south, (KP 123) to the town of Chapais (KP 288).

The old railway alignment will be followed for the reinstatement of the transportation infrastructure. Currently, only the roadbed embankment and the granular structure (ballast and sub-ballast) are in place. A new granular structure will be placed to support of the future rails, the infrastructure drainage and subgrade soils will be improved, and portions of the vertical and horizontal alignments may have to be rebuilt to accommodate curvature requirements.

The existing bridges and culverts along the alignment have been, or will be, inspected, and rehabilitation or replacement work (new construction) will be required to reinstate the railway line.

In widening, profile correction, curve correction, new bridge approaches, and high-water levels areas, new embankment fill will be constructed. In some areas, these embankments could reach significant heights, requiring additional geotechnical investigations and analyses in subsequent phases.

The preliminary geotechnical investigation was carried out to determine the general *in-situ* conditions at the Site that will influence the Feasibility Study for the proposed reinstatement of the Grevet-Chapais railway. The following sections outline the geotechnical constraints that could influence the feasibility and the design of the project.

This report discusses construction design methods which may be considered for the preliminary design of the railway, while referring to certain typical concepts applicable to road infrastructures in a northern environment and reflecting the subsurface conditions encountered during the present investigation (presence of fine compressible soils and large areas of organic soils/peat). It provides guidance to the designer in modifying or amending current practices, considering the specific context of the project. A list of relevant elements to consider when selecting the design and construction methods and carrying out a preliminary design is also provided. Finally, recommendations are made to carry out additional and detailed geotechnical studies in specific areas or structure locations.



4.2 Roadbed Construction

4.2.1 General

Section 4.2 discusses issues which will need to be evaluated as part of the design of cuts and fills along the railroad alignment. The roadbed, which will support the subballast and ballast layers, is referred to as the *top of subgrade*.

Where new embankments fill will be required to raise the ground surface to the proposed new top of subgrade, this report refers to the materials required to raise the grade as *embankment fill* which are constructed over the existing *foundation soils*. In fill sections, the top of subgrade will consist of embankment fills, and in cut sections, of foundation soils.

Most of the actual roadbed project extends the Barlow-Ojibway varved clay plains which are normally to slightly over consolidated, soft to firm in consistency, with a high compression index. The stability of roadbed embankments in clay soils is discussed separately in *Section 4.3: Stability Analysis of Embankments*.

4.2.1.1 Assumed Cross-Section

If new cross-sections are to be built, the design will need to be developed as part of the detail design stages. The discussions in this report generally assume the following in fill and cut sections.

- Embankment foreslopes (in fill areas) and ditch foreslopes (in cut areas), to the left and right of the tracks, will be no steeper than 2H:1V but could be flatter to accommodate geotechnical issues.
- Where ditches are required, they would be at least 3.0 m wide at the base but could be wider if deemed necessary to accommodate hydraulics.
- Where ditches are required, the bottom of the ditch would be at least 1.0 m below the bottom of the ballast but could be deeper to accommodate hydraulics.
- Within soil cut areas, the backslope located between the outer ditch line and the natural ground will be no steeper than 2H:1V but could be flatter to accommodate geotechnical issues.
- Within rock cut areas that are less than 6 m in height, the backslopes in sedimentary rock will be 2.5V:1H and 10V:1H in other rock types.
- Within rock cut areas, at detail design it could be determined that a wider ditch is required in some areas to act as a rock catchment area to contain potential rock fall without impeding the hydraulic function of the ditch.
- That interceptor ditches will be constructed above cut slope to prevent surface water runoff from entering the cut areas.



4.2.1.2 Frost Penetration

Based on available information, the mean freezing index along the alignment range about 2100 mean Degree-Days below 0°C, which corresponds to a frost penetration depth of approximately 3.0 m. The AREMA manual suggests that in areas with frost heave problems, a frost treatment depth of 60% of the frost penetration should be used for soil replacement, which would correspond to 1.8 m.

As a preliminary design strategy, except in areas where the roadbed consists of bedrock or a well-graded sand with a USCS symbol of SW, it is recommended that the rail embankment be designed to ensure a minimum vertical height of 1.8 m from the bottom of the ballast to the top of the natural foundation soil. For most soil types, this will ensure that the total seasonal frost heave will be less than 75 mm. The embankment fills placed between the sub-ballast and the natural foundation soil should consist of a soil containing less than 30% silt and clay size particles, commonly referred to as a coarse-SM soil.

In areas where the natural foundation soils consist of clays (CH) or silts (ML), significantly greater frost heave would be anticipated, even when using a frost treatment depth of 1.8 m. The following provides an estimate of anticipated frost heaves when using a 1.8 m frost treatment depth for various soil types encountered along the alignment.

- For soils where the natural foundation soils are designated as SM (silty sands), frost heaving in the order of 50 mm to 75 mm would be expected.
- In the case where the natural foundations soils have been designated as ML (silt and sandy silt), frost heaves in the order of 150 mm would be expected.
- In the case where the natural foundation soils have been designated as CH (clays), frost heaves in the order of up to 300 m would be expected.

Where subgrade transitions are anticipated between ML or CL soil types and other soil types, a frost treatment depth of 2.5 m is recommended, with the limits of the tapered excavations selected based on AREMA Section 1.4.1.7.4: Replacement of Frost-Heaving Material.

As part of the final design, the frost heave tolerances should be reviewed for the rail project. The recommended global frost treatment depth for the project should be selected based on this review.

4.2.2 Natural Foundation Soils

If present, areas where new embankment fill or railway structure (ballast and sub-ballast) be constructed on natural or organic soils, the natural foundation soil should be prepared to ensure adequate drainage and to provide sufficient bearing capacity to offer an acceptable factor of safety against the loads that will be imposed by the tracks. In addition, the embankment fill should be designed and constructed to tolerate the settlements associated with the compression of the natural foundation soils. Based on consolidation test results presented in Table 10, it is anticipated, depending on the specific site location, that primarily consolidation settlements within the clay deposits will be initiate once 1 to 2 m of embankment fill is place. Once the profile height has been confirmed, it is recommended that settlement calculations be undertaken to assess the magnitudes of settlements anticipated.



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As part of the preliminary design considerations, the following general soil removal should be anticipated when preparing the subgrade.

- Where less than 2.0 m of embankment fill material is to be placed, organic soils and peats should be removed.
- Except where peat treatments will be proposed if there are any, topsoil and peat thicknesses of less than 1.0 m, and other organic layers, should be stripped from beneath the proposed embankment fill.
- Silty clays, and silt and clay soils within 1.8 m of the underside of the ballast should be removed and replaced with a soil containing less than 30% fine particles or with rockfill.
- Locally soft or wet soils that cannot be compacted to 90% of its optimum dry density as defined by the modified Proctor test should be removed. In this case, the soft soils should be subexcavated and replaced with a compacted fill containing less than 30% fine particles.
- Large areas of soft and wet soils could be treated using geosynthetics (geogrids, geotextiles and geocells) to replace potential subexcavation and replacement works. The potential for this application should be assessed as part of the detail design.

Where the natural foundation soils consist of silty clay, or silt and clay (cohesive deposits), special construction techniques may be required to ensure that the embankment fill is stable, both during and after construction, and that the post construction settlements are tolerable. The following construction methods are anticipated.

- In the case tall fills over 3 m, it may be necessary to construct the embankment in stages to avoid overstressing the underlying cohesive soils. Once the embankment heights have been determined, the potential requirement to construct the embankments in stages will need to be evaluated by a geotechnical engineer.
- Depending on the settlement objectives and the proposed embankment heights, preloading and surcharging the site may be required prior to track construction to limit post construction settlements.

The study area includes natural foundation soils consisting of soft compressible fine soils and organic deposits directly underlain by fine compressible soils. It is anticipated that these soils will not be suitable to directly support construction traffic and that a separation barrier should be placed in these areas prior to construction of the embankment fill to prevent soil pumping and disturbance of the natural foundation soil during the construction process. Accordingly, it is recommended that a geotextile be placed on the natural foundation soil in areas where organic soils are to be removed and/or in areas where soft clay (silty clay, silt and clay soil) are present.

It is also suggested that the initial layer of embankment fill be at least 600 mm thick to protect the natural foundation soils, particularly when the embankment is placed on soft soils or on organic soils to prevent



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the instability of the natural foundation soils. Where the embankment is constructed of rockfill, the initial layer would be increased to 900 mm (see section 4.2.5).

In all cases, embankment slopes should not be steeper than 2H:1V to ensure the stability of the embankments throughout the construction period and the lifetime of the infrastructure. If slopes steeper than the latter are considered, stability studies should be performed to ensure their short- and long-term stability. Stability analyses that will be performed for every high embankment may imply that a flatter slope at the embankment is required.

4.2.3 Organic Soils

If embankment fills are to be built, vegetation, topsoil and organic soils should be removed to ensure an appropriate contact between the foundation soils and the embankment fill. The removed organic soils can be stockpiled and reused for landscaping purposes if deemed appropriate; it is noted that an assessment of potential topsoil recovery has not been carried out as part this study.

The excavation of organic soils is not required if more than 2 m of granular fill (including the granular structure of the railway) is anticipated. In cases where the embankment fill is thinner, it should be assumed that the organic soils will be completely excavated.

If the rail alignment crosses peat areas, the treatment of these soils will require specific investigations.

The boreholes advanced as part of this investigation were drilled through the existing embankment fill materials. Within some of these boreholes, more than 0.6 m of organic matter was encountered and are assumed to consist of peat compressed by the embankment fill. For preliminary design purposes, where embankment widening is proposed in these areas, it should be assumed that the new fill will be placed on peat materials that currently exists adjacent to the existing rail embankment. The following boreholes included over 0.6 m of compressed organic material: BH22-02 (2.15 m); BH22-15 (0.63 m); BH22-18 (2.26 m); BH22-20 (1.22 m); BH22-28 (1.39 m); BH22-29 (1.09 m); BH22-30 (1.71 m); BH22-31 (1.83 m); BH22-33 (0.64 m); BH22-34 (1.22 m); and, BH22-35 (1.12 m).

For all proposed widening areas, the terrain map should be consulted to determine if the presence of an organic deposit is anticipated. As part of the original rail construction, it is possible that peat deposits were removed in some areas prior to constructing the embankment fills. Therefore, the lack of an organic matter layer at a specific borehole location does not necessarily indicate that there is no organic or peat deposit adjacent to the existing rail line.

4.2.4 Geogrids

As part of the final design, the use of geogrids should be considered if new embankment fill will be built on peat areas where the peat is to remain in place. The use of geogrids is also recommended in the following cases:

- Peat deposits which do not have an intact fibrous crust.
- Ditch crossings.



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- Culvert transitions.
- Peat deposits with open water.
- Peat surfaces with ruts due to the passage of heavy machinery (ex.: presence of old logging sites in some peatlands of the alignment).
- Initial layer of fill constructed with material other than MG 112, MG 20 (e.g.: rock fill of controlled caliber).

The extended use of geogrids over the entire fill on organic soils is not required. Geogrids will not improve the total capacity of the embankment and will not prevent failure if the control of the thickness of the initial layer is not properly performed.

4.2.5 Fill Construction (New Embankments and Widening)

Embankment fills will be built in areas where the rail bed must be raised to its final elevation. The composition of the embankment itself and the native foundation soils are the two main components that must be considered for the design of embankments (except high embankments). The geotechnical constraints should be considered when determining the embankment geometry and its material composition.

- Embankment fills must be designed to be fully stable under their own weight and future track loads. Much of the alignment crosses generally weak varved clay deposits which can be prone to global instabilities under tall or over-steep embankments.
- Embankment designs must also consider anticipated settlements. As presented in Section 3.1.3, the clays underlying the site are frequently normally or over-consolidated and are highly compressible.
- The design frost penetration depth in this area is 3.0 m. To limit frost related differential movements, all embankment fill within 1.8 m of the bottom of ballast should consist of soils containing less than 30% fine particles or consist of rockfill.

As much as possible, the embankment fills should be constructed using excavated materials from cut sections and ditch excavations, if there are any. Since the clayey soils are not considered suitable for reuse, it is likely that the required quantities will be greater than those anticipated for the excavation. It is anticipated that manufactured or imported materials from borrow pits or quarries will be required.

It is also suggested that the initial layer of embankment fill be at least 600 mm thick to protect the natural foundation soils, particularly when the embankment is placed on soft soils or on organic soils to prevent the instability of the natural foundation soils.

For excavated materials to be considered reusable, it must have a water content that facilitates compaction and be free of organic soils; for this reason, the clay soils encountered along the project length are not considered suitable for the construction of embankment fill.



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Where fill is to be used behind retaining structures, free-draining backfill materials such as MG-20, MG-56 or CR-14 should be used within a granular wedge extending up from the base of the wall at a slope of 1H:1V.

The construction of embankments must include continuous inspection and testing to ensure that proper fill materials are used and that they are adequately compacted.

Considering the northern context of the Site, a certain flexibility regarding the choice of granular materials may be required. It will be necessary to consider the availability of these materials and the necessary effort to obtain the required grain-size distribution and normally required aggregate physical properties (crushing, screening, transportation, stockpiling, etc.). Available material sources should be reviewed as part of the detail design.

Section 1.2.3.4 of the AREMA outlines specific requirements for the construction of rock fill that could be used as an alternative to mineral soils or granular materials. This option could be considered for reasons of cost/or availability of materials in northern areas. Rock fill will tend to cause long-term settlement due to the gradual compaction of the fill itself. In areas where long-term settlement will not be tolerated, the use of borrow pits materials should be preferred for the construction of the fill. Rock fill should be used primarily in areas where settlement can be corrected, and the surface easily reshaped. The design of rock fill and the establishment of project-specific requirements should be carried out by a geotechnical engineer experienced in the construction of rock fill, taking into account the project-specific conditions (presence of peats areas and fine compressive soils). Where the embankment is constructed of rockfill, the initial layer would be increased to 900 mm.

Based on the Atterberg limits test results carried out on the clay samples, approximately half of the samples had a liquid content above the liquid limit when tested in the laboratory (liquidity index greater than or equal to 1). This implies that the soft clay soils present in the study site could lose their plastic behavior when handled and transported and become difficult to dispose of.

4.2.6 High Embankments (Including Widening)

If there are railway embankments over 4 m in height, they will be considered as "high embankments". The soil conditions at each of the boreholes drilled in the identified new embankment areas are presented in Table 4 in Section 3.1.

According to AREMA, embankments should be designed to account for settlements and to prevent failure of the underlying soils. As previously indicated, where clay deposits have been identified, the natural foundation soils are highly compressible and weak. Potential treatment or soil improvement methods for these areas are discussed further below. Future investigations in the high embankment areas may identify different ground improvement methods to be considered, depending on the soil conditions encountered in future investigations.

In areas with granular or dense soils, or with shallow bedrock, the use of ground improvement methods is not anticipated. Future investigations and analysis in these areas will also be required to confirm the



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geotechnical parameters to be used to model the behaviour of the natural foundation soils beneath the proposed high embankments.

In the context of the feasibility study, only one borehole was drilled for each embankment area, which can extend over several hundred meters. The number of boreholes, depth, and in-situ tests to be performed for complementary investigations must be sufficient to provide a reliable representation of the full length of the high embankment area, including the natural foundation soils beneath potential embankment berms, where required. The future investigations in embankment areas underlain by clay will need to identify construction staging requirements, where applicable.

Each high embankment area should be subjected to a stability and settlement analysis to ensure the stability of the future railway platform. The analysis must consider settlements of the underlying organic soils (when left in place) and the mineral soils. According to AREMA the following should be checked.

- The stability of the embankment under its own weight and imposed loads.
- The stability of the embankment and natural foundation soils system in combination.
- An economic tolerance on the magnitude of anticipated settlement.

For the design of a railway embankment, a safety factor of 1.5 is generally considered adequate. However, if the engineer performing the stability analyses has sufficient information for the analyses, a smaller safety factor could be considered. If field and laboratory data are inconsistent or inadequate, the engineer should consider increasing the factor safety factor.

In case the required factor of safety cannot be reached, or where settlements are considered excessive, one or more of the soil improvement methods listed in the AREMA can be considered:

- Replacing unsuitable foundation soils with compacted structural fill.
- Flattening embankment slopes or adding berms at the toes of the embankment.
- Installation of a foundation drainage system to reduce pore water pressures.
- Construction of the embankment in several stages.
- Densification of granular foundation soils, where possible.
- Use of light embankment materials (fill).
- Mechanical reinforcement of foundation soils and/or embankment.
- Preloading and surcharging the fill areas to accelerate consolidation of organic or cohesive soils.
- Installation of retaining walls.

It should be anticipated that combinations of these soil improvement methods will be required in all areas identified as high embankment areas where the natural foundation soils consist of clay.



4.2.7 Cuts

If deep cuts (greater than 5 m) are proposed, they must be analyzed in detail and a stability study must be carried out for the final design. For the present feasibility study, it is assumed that no deep cuts will be required within areas underlain by clays; if deep cuts are proposed in the clay deposits, these will require boreholes specifically at those locations to identify a safe slope profile.

Generally, excluding the clay soils, cut slopes of 2H:1V can be considered for the feasibility study for the soils encountered at the site. This assumes that adequate ditch drainage will be provided at the toe of slope and that interceptor drains will be constructed at the top of slopes. Should the detail investigations to be carried at the later stages of the project identify a risk that groundwater could emerge from the face of the slope, special treatments such the placement of granular drainage layer, construction of drainage buttresses, or the installation of toe drains could be considered.

In areas with clay deposits, silt deposits or with unfavourable groundwater conditions, flatter slopes may be required. This would ultimately increase the volume of spoils and widen the overall width of the railway construction zone.

For all soil types, it is essential to maintain stable and safe permanent cut slopes. The width of the cut area should be sufficient for the installation of ditches at the bottom of the slope to collect resurging groundwater. In some areas, the results of the stability analyses may justify that the cut slope be benched, or that other measures such as additional drainage systems, erosion protection or filter layers, and revegetation be applied.

Where the factors of safety obtained from the slope stability analyses do not provide a safe geometry, the use of retaining walls could be also considered if the other cost-effective alternatives mentioned above cannot be achieved.

For the design of all cut areas, Article 1.2.2 of the AREMA manual should be consulted. It outlines the essential components and features to be considered in the preparation and design of soil and rock cut areas. It includes factors that may affect the depth of excavations and provides general recommendations for the design and geometry of cut slopes.

4.3 Stability Analysis of New or Widened Embankments

In addition to stability analyses on potential high embankments, stability analyses will be required in areas of peat deposits and/or compressible fine soils if a new or widened embankment will be built on these areas.

Organic soils tend to be very compressible and have a low bearing capacity. It will therefore be necessary to ensure that the organic deposit can support the embankment to be placed. The short-term stability analysis should consider the undrained shear strength measurements of the organic soils in terms of their vertical and horizontal variability. Anticipated settlement during construction should also be considered in these analyses. A minimum factor of safety of 1.3 is normally judged acceptable for peat stability analyses.



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Similarly, it is possible that the mineral deposits underlying the organic soils are too weak to support the embankment without the risk of failure, especially in the presence of soft and compressible fine soils. A geotechnical and stability analysis will be necessary in these areas and will need to account for the behaviour of the organic soils combined with the behaviour of the underlying mineral soils and the minimum safety factor would be 1.5.

In case the minimum safety factors mentioned above cannot be achieved, lowering the embankment profile or height could be considered as a first alternative. Another alternative would be to flatten the embankment slopes and/or add lateral counterweights (berms). The dimensions and geometry of these berms would then be determined by performing new stability calculations. Lastly, if the contribution of the counterweights does not provide sufficient safety factors, light materials such as polystyrene or wood residues could be placed to lighten the embankment (light weight fill).

4.4 Bridges and Culverts

Each structure that will be reconstructed or rehabilitated, including the construction of new foundation elements, shall be subject to a detailed geotechnical investigation to supplement the information provided in this preliminary study. Each investigation plan should be based on the proposed structure type and the precise location of the proposed structure. The documents "*Guide de planification et de réalisation des études de reconnaissance de sols*" and its Appendix 1: "*Spécifications pour les forages et sondages d'une étude géotechnique pour le remplacement ou la construction d'ouvrages d'art*" issued by the *Ministère des Transports du Québec* should be used as references for the planning of the detailed geotechnical investigations programs. In all cases, the AREMA guidelines regarding soil investigations for the construction of structures should also be considered.

According to the preliminary geotechnical investigation results, soils in the areas of future bridges/culverts may vary greatly from one structure to another. Some structures may rest directly on bedrock or on a dense natural deposit, such as the till, where spread footing foundations would be anticipated for bridges, but other structures must be built on highly sensitive and compressible clay soils of significant thickness where piled foundations would be anticipated. As part of the preliminary design considerations, the following can be anticipated.

- Bridge structures in areas underlain clay soils would be supported by piles driven to bedrock, or to refusal within dense till if the dense till is deeper than a few meters.
- Bridges structures in areas underlain by bedrock and dense till would be supported on spread footing foundations.
- Closed box culverts would be anticipated in areas underlain by clay soils, and in some areas, depending on settlement tolerances, the use of light weight fill materials could be required at these culverts.
- Open box culverts would be anticipated in areas underlain by bedrock and dense till.

Special attention will be required in designing the approach embankments to bridges and culverts underlain by clay deposits. For high approach embankments, it should be anticipated that light weight fill



(polystyrene blocks) would be required to avoid differential settlements between the structures and the approach embankment fills.

4.5 Railway Structure Design

4.5.1 Ballast and Sub-ballast

The ballast and sub-ballast must be constructed of materials that comply with the Article 2.3.1 of the AREMA. The nature, the manufacturing specifications, as well as the intrinsic properties of the materials used for the railway structure should meet the requirements of this article. In the context of this study, limited research and investigations were carried out on potential borrow pits and quarries located in the vicinity of the alignment to determine the quantities and quality of deposits or bedrock available to be used in the project. Two separate reports were prepared by Stantec to outline these studies (borrow pits and quarries).

The sizing of the ballast and sub-ballast layers must be performed according to AREMA requirements, based on the subgrade conditions encountered in the current summary investigation and the nature and characteristics of the materials to be used (see borrow pits and quarries report).

According to AREMA, a minimum value of 300 mm, after compaction, is recommended for the thickness of ballast and sub-ballast to be placed. These thicknesses must be confirmed in the subsequent engineering phases, taking into consideration the specific constraints of the project. Furthermore, the requirements of the railway company must be verified. In all cases, to ensure sufficient frost protection of the foundation materials, the total thickness of ballast and sub-ballast should not be less than 600 mm.

4.5.2 Drainage

Adequate drainage is typically provided by ditching, where required, and ensuring that the top of subgrade has a cross-fall of at least 2% to prevent water from accumulating within the sub-ballast and entering the subgrade.

Ditches will need to be cleaned, reprofiled and improved to ensure proper drainage efficiency. Ditches will need to collect surface water, store snow and control rock or debris fall from the cut slopes. The capacity of these ditches will be influenced by their width, depth, and the nature/permeability of the ditch soils. It is also recommended to refer to section 1.2.4 of the AREMA for the design of drainage ditches.

4.6 Recommended Level of Inspection and Testing

To ensure compliance with the design and to confirm assumptions made in this report and by the designers, construction observation, inspection and testing by a geotechnical engineer, as described below, are recommended.

All exposed soils should be inspected by a geotechnical engineer prior to the placement of granular materials. Such inspections are necessary to confirm the expected consistency and nature of the subgrade soils, to ensure that all soft spots have been identified and remediated and that the drainage of



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surface water has been ensured by the contractor. Subgrade inspections should be carried out to verify nature of the soil subgrade and the granular structure.

All sources of granular materials imported on site should be sampled, tested, and reviewed by a geotechnical engineer. The placement of granular materials should be observed and tested by geotechnical personnel using nuclear density gauge to ensure all compaction requirements and optimal moisture content are achieved during construction.



5.0 References

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APPENDICES

Appendix A Statement of General Conditions



STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Experts-conseils and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec Experts-conseils present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec Experts-conseils is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

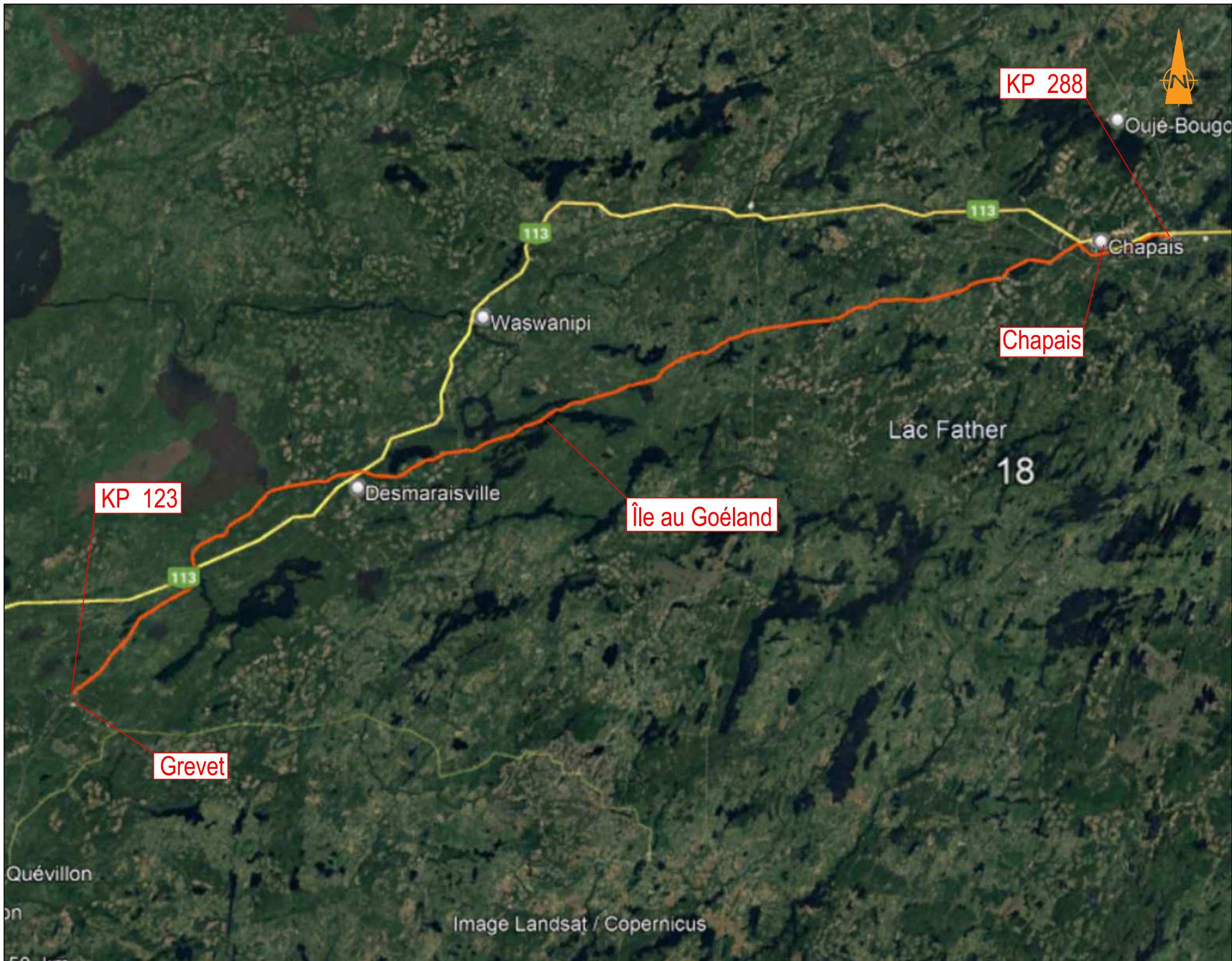
INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Experts-conseils at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec Experts-conseils must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec Experts-conseils will not be responsible to any party for damages incurred as a result of failing to notify Stantec Experts-conseils that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec Experts-conseils, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec Experts-conseils cannot be responsible for site work carried out without being present.

Appendix B Figure

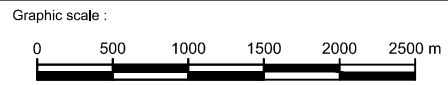




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Location :
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Figure title :
 Key Plan

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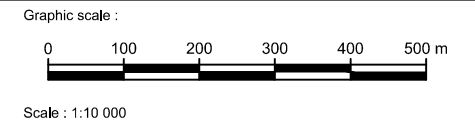


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- Legend :**
-  BH22-xx Borehole 2022 (Stantec)
 -  Grevet-Chapais Railway

Geodesic coordinates (MTM-9)		
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BH22-01	297401	5463227
BH22-02	298253	5454116



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Location :
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Figure title :
 Borehole Location



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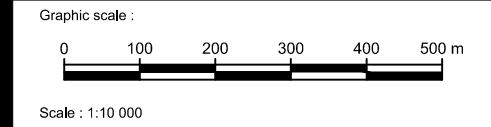


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- Legend :
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 -  Grevet-Chapais Railway

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Borehole N°	East (m)	North (m)
BH22-03	300698	5467590



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Figure title :
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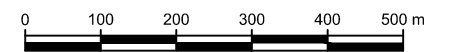
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-  Grevet-Chapais Railway

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BH22-04	307357	5471737
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BH22-08	307699	5474004

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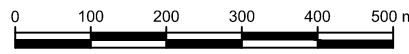


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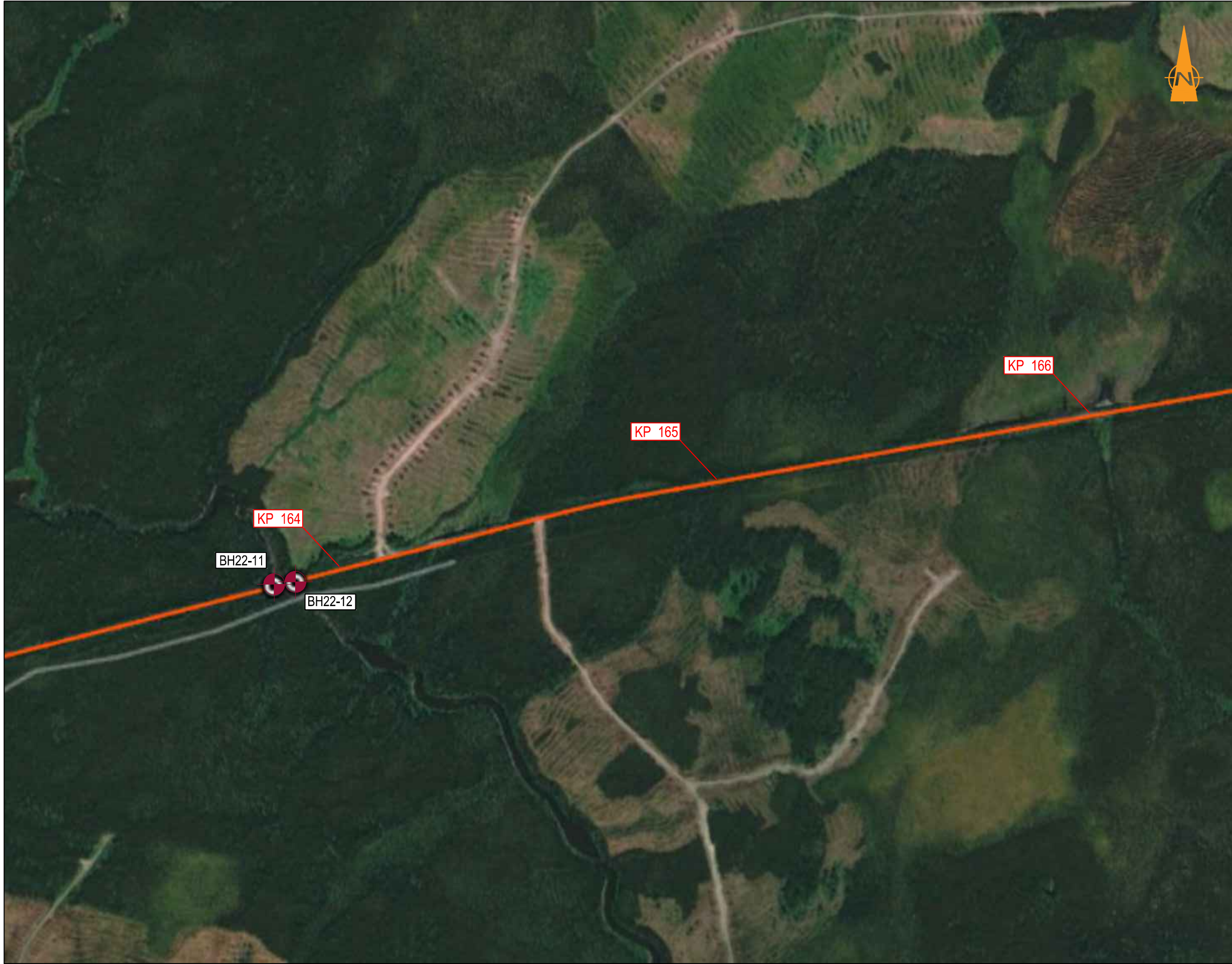
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Figure title :
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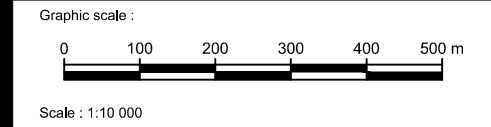


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- Legend :**
-  BH22-xx Borehole 2022 (Stantec)
 -  Grevet-Chapais Railway

Geodesic coordinates (MTM-9)		
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BH22-11	319175	5484648
BH22-12	319232	5484658



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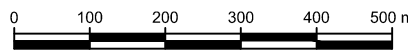
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-  Grevet-Chapais Railway

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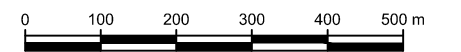
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BH22-17	325961	5486239

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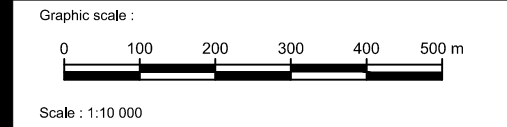
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- Grevet-Chapais Railway

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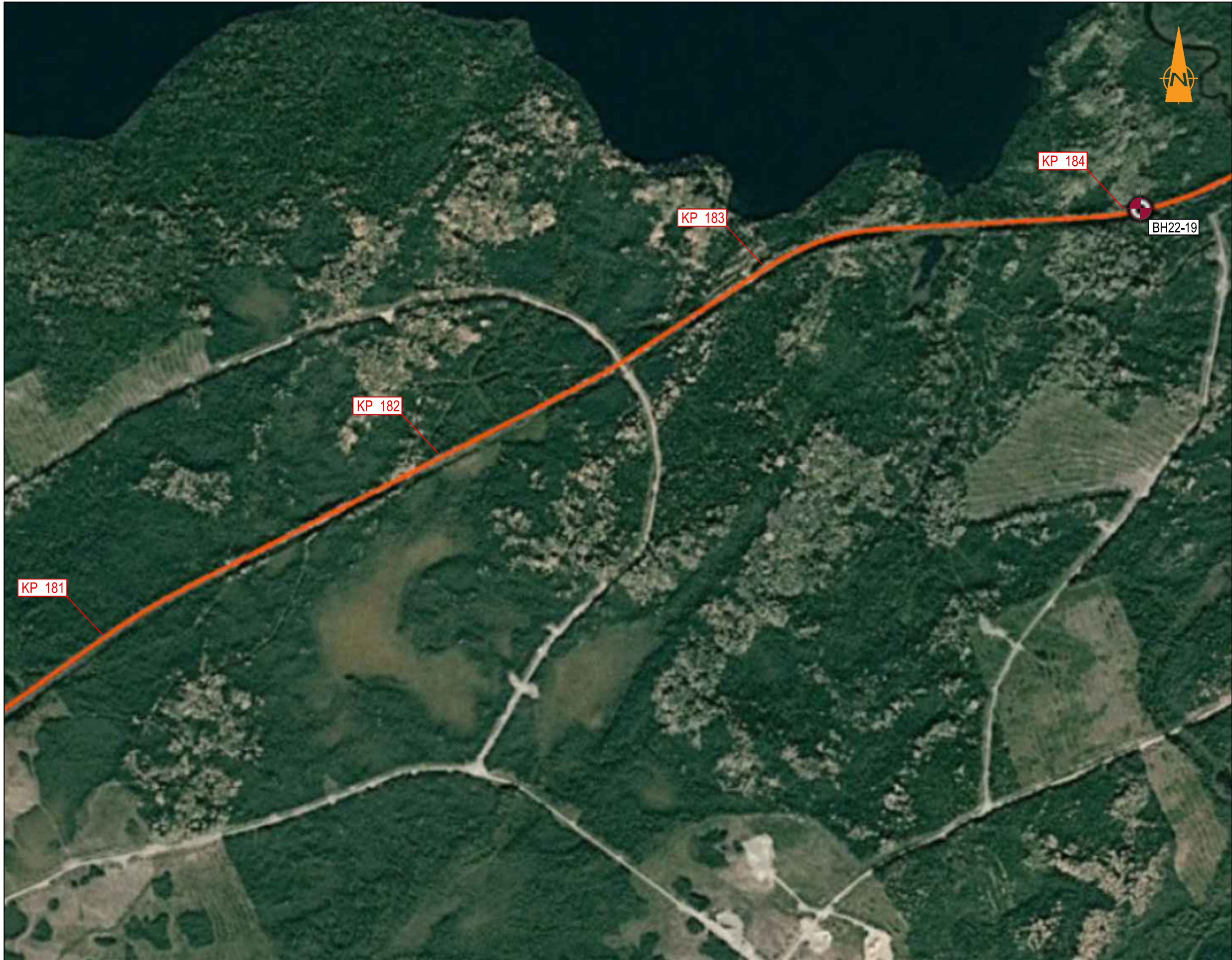
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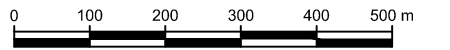
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- Grevet-Chapais Railway

Geodesic coordinates (MTM-9)		
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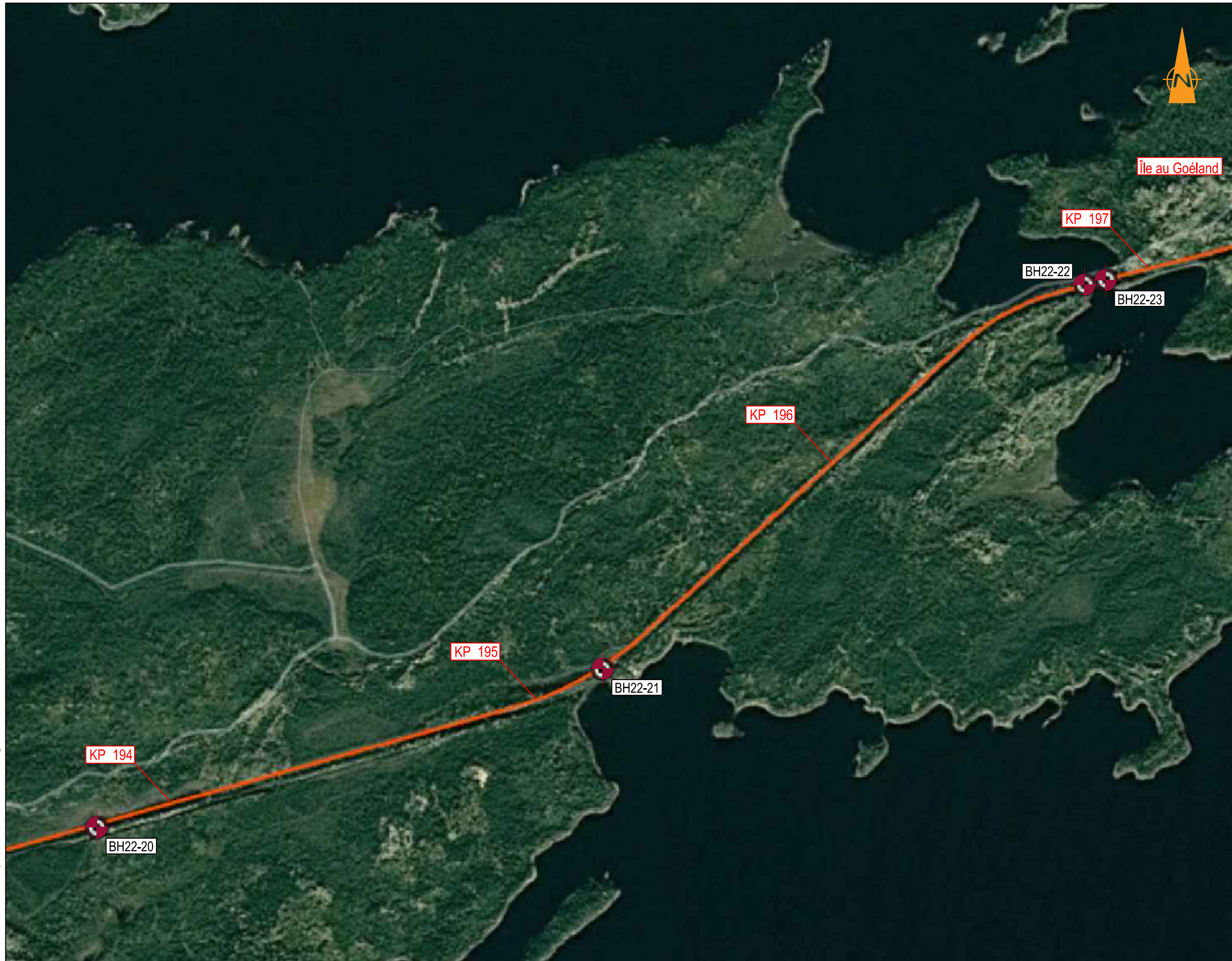
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Figure title :
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-  Grevet-Chapais Railway

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BH22-22	350015	5492789
BH22-23	350071	5492802

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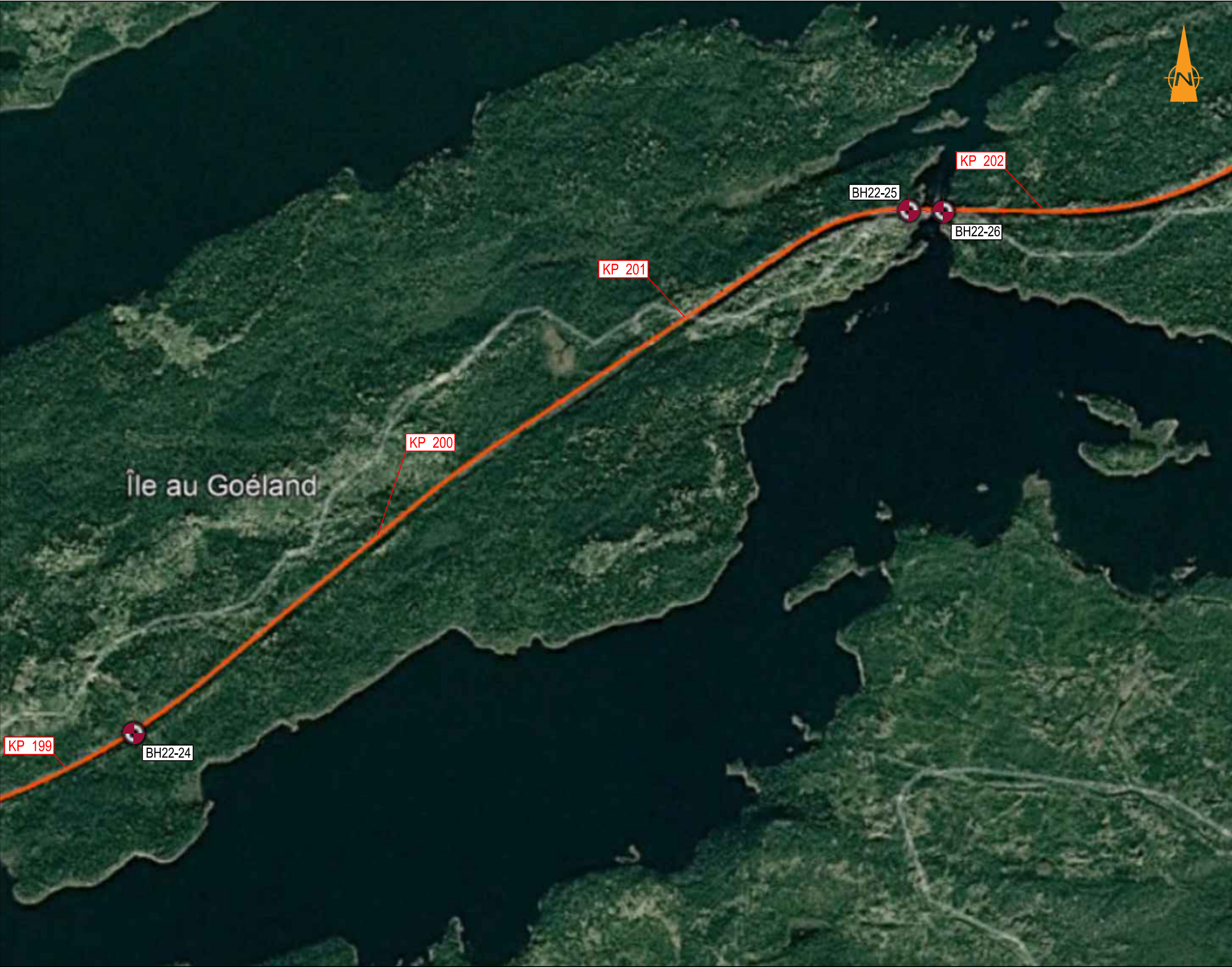
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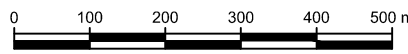
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-  Grevet-Chapais Railway

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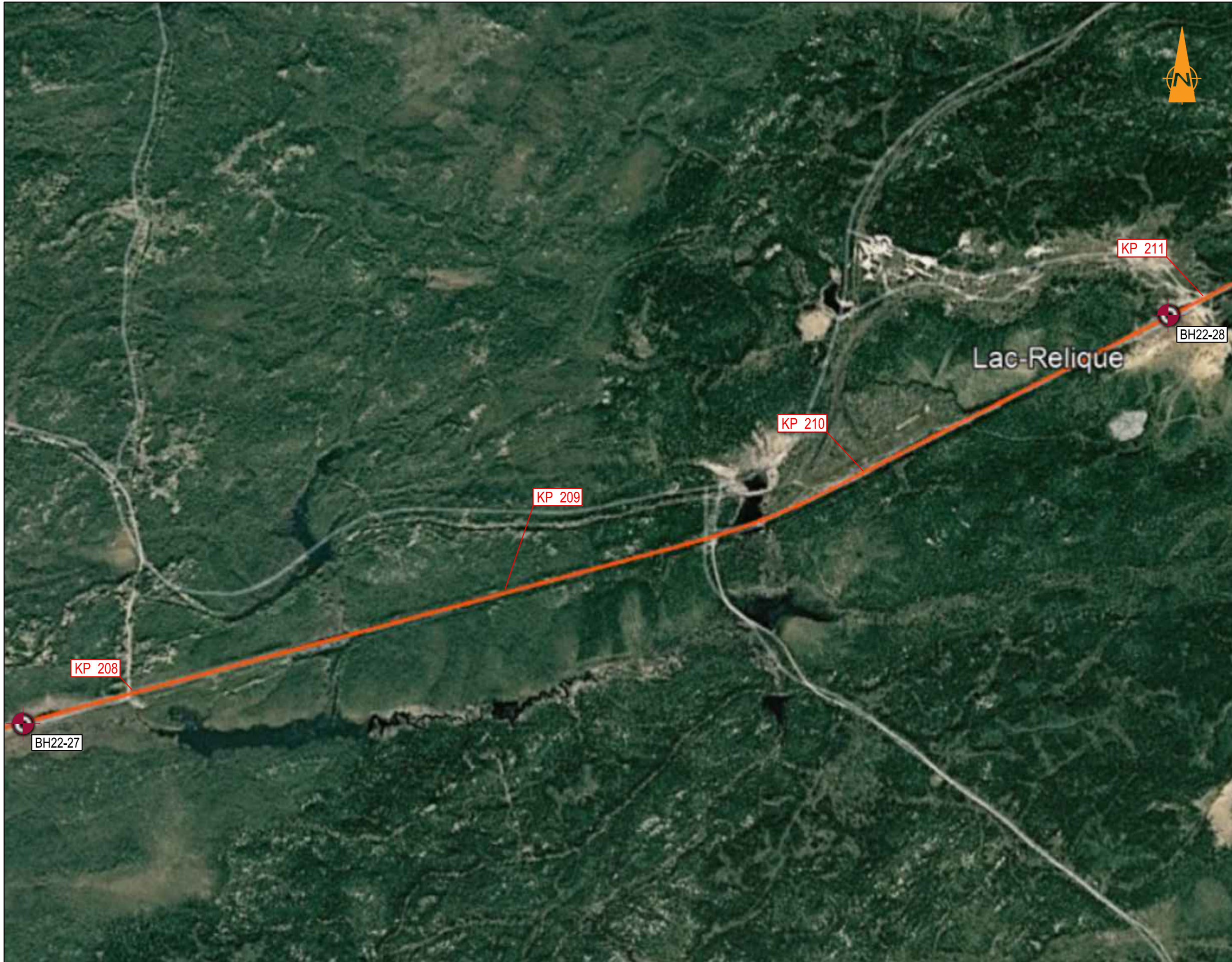
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Figure title :
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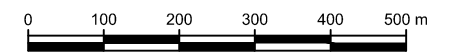
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- Grevet-Chapais Railway

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BH22-28	362867	5497902

Graphic scale :



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Figure title :
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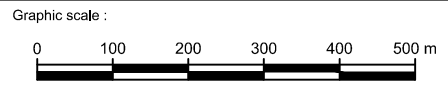
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- Legend :
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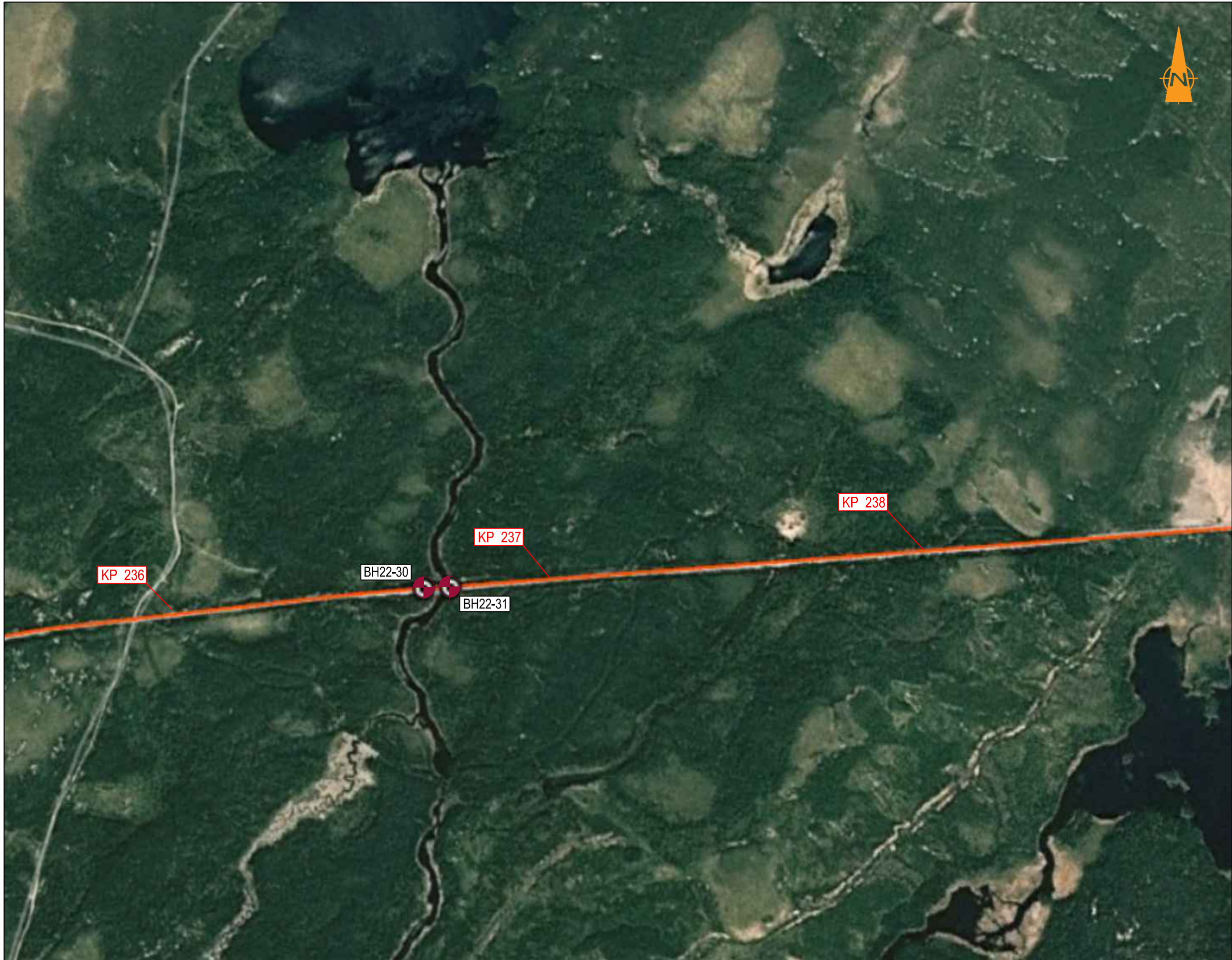
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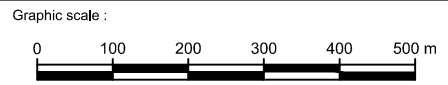


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- Legend :
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 -  Grevet-Chapais Railway

Geodesic coordinates (MTM-9)		
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BH22-31	386503	5506567



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Client :
 Cree Development Corporation

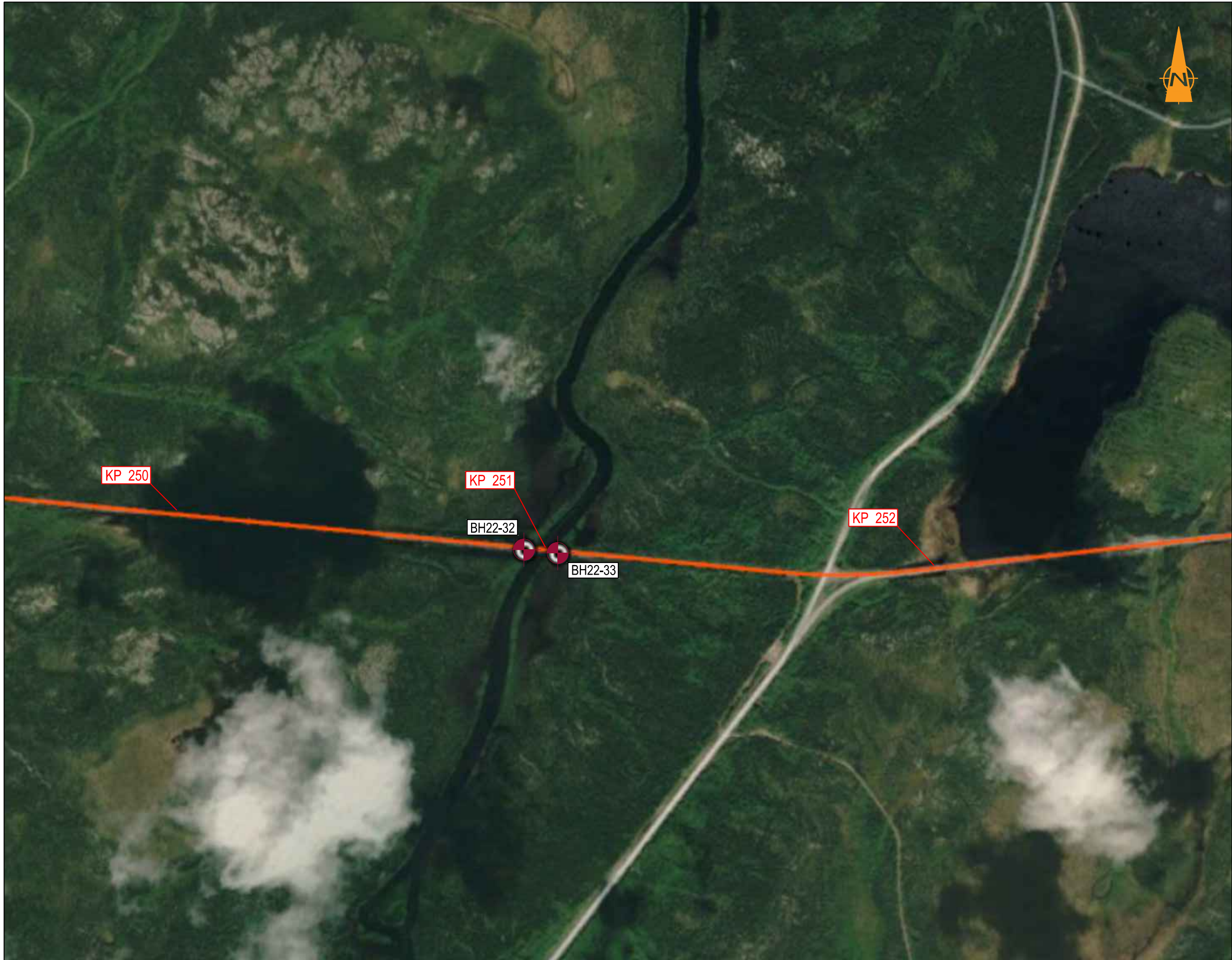
Project :
 La Grande Alliance - Feasibility Study - Phase I
 Preliminary Geotechnical Investigation

Location :
 Grevet-Chapais Railway

Figure title :
 Borehole Location



Project N° : 158100425.500.710.6	Draft by : S. Veillette, tech.
Date : 2023-02-17	Verified by : T. Coulaux, ing.
Drawing n° : 01	Page : 15

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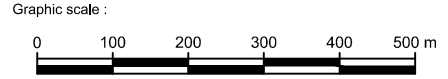


Important note :
 All dimensions shown in this figure are approximate and the user is responsible for checking them, Stantec should be notified of any errors or omissions as soon as possible.

Legend :

-  BH22-xx Borehole 2022 (Stantec)
-  Grevet-Chapais Railway

Geodesic coordinates (MTM-9)		
Borehole N°	East (m)	North (m)
BH22-32	399987	5509521
BH22-33	400075	5509514



Scale : 1:10 000

Source :
 © Draft with Google Earth 2023

Client :
 Cree Development Corporation

Project :
 La Grande Alliance - Feasibility Study - Phase I
 Preliminary Geotechnical Investigation

Location :
 Grevet-Chapais Railway

Figure title :
 Borehole Location



Project N° : 158100425.500.710.6	Draft by : S. Veillette, tech.
Date : 2023-02-17	Verified by : T. Coulaux, ing.
Drawing n° : 01	Page : 16

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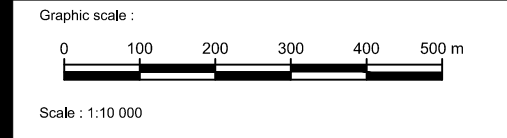


Important note :
All dimensions shown in this figure are approximate and the user is responsible for checking them, Stantec should be notified of any errors or omissions as soon as possible.

Legend :

-  BH22-xx Borehole 2022 (Stantec)
-  Grevet-Chapais Railway

Geodesic coordinates (MTM-9)		
Borehole N°	East (m)	North (m)
BH22-34	412177	5513314
Geodesic coordinates (MTM-8)		
Borehole N°	East (m)	North (m)
BH22-35	197548	5514172



Source :
© Draft with Google Earth 2023

Client :
Cree Development Corporation

Project :
La Grande Alliance - Feasibility Study - Phase I
Preliminary Geotechnical Investigation

Location :
Grevet-Chapais Railway

Figure title :
Borehole Location

Project N° : 158100425.500.710.6	Draft by : S. Veillette, tech.
Date : 2023-02-17	Verified by : T. Coulaux, ing.
Drawing n° : 01	Page : 17

Appendix C Borehole Reports



Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : X : 297 401 Y : 5 463 227 Type of borehole : Hollow Stem Auger + Diamond Core Equipment : CME 55 Sampling type : B, N Corer : NW	Geo. System : MTM-NAD83 Zone: 9 Borehole : BH22-01 Page : 1 of 3 Start date : 2022-08-30 Inspector : A. Bogaert, tech. Depth : 17,68 m
Project No.: 158100425.500.710.6	Figure : 01	
Client: Cree Development Corporation		
Site: Grevet-Chapais Railway		

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table> Remarks :	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0,00	Granular fill : Brown moist to saturated Sandy GRAVEL with traces of silt.			SS-01	N	38	17	5-5-12-11		GA	
		0,61	Brown saturated Gravelly SAND with some silt.			SS-02	B	29	35	5-13-22-13			
		1,22	Brown saturated Sandy GRAVEL with traces of silt.			SS-03	B	25	5	1-1-4-8			
		1,83	Grey saturated SAND and GRAVEL with some silt.			SS-04	B	58	32	14-15-17-18			
		2,44	Grey saturated GRAVEL with traces of sand and silt.			SS-05	B	21	20	11-10-10-12			
		3,05	Native granular deposit : Grey saturated SAND and GRAVEL with traces of silt, compact.			SS-06	B	63	18	14-10-8-9			
		3,66	Grey saturated SAND with some gravel and traces of silt, compact to dense. - Presence of boulders.			SS-07	B	58	13	1-3-10-8		GA	
		5,18	Grey saturated Gravelly SAND with some silt and traces of clay, very loose.			SS-08	B	21	37	8-14-23-28			
						SS-09	B	25	3	1-1-2-1			

General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : T. Coulaux, ing. Date : 2023-04-03
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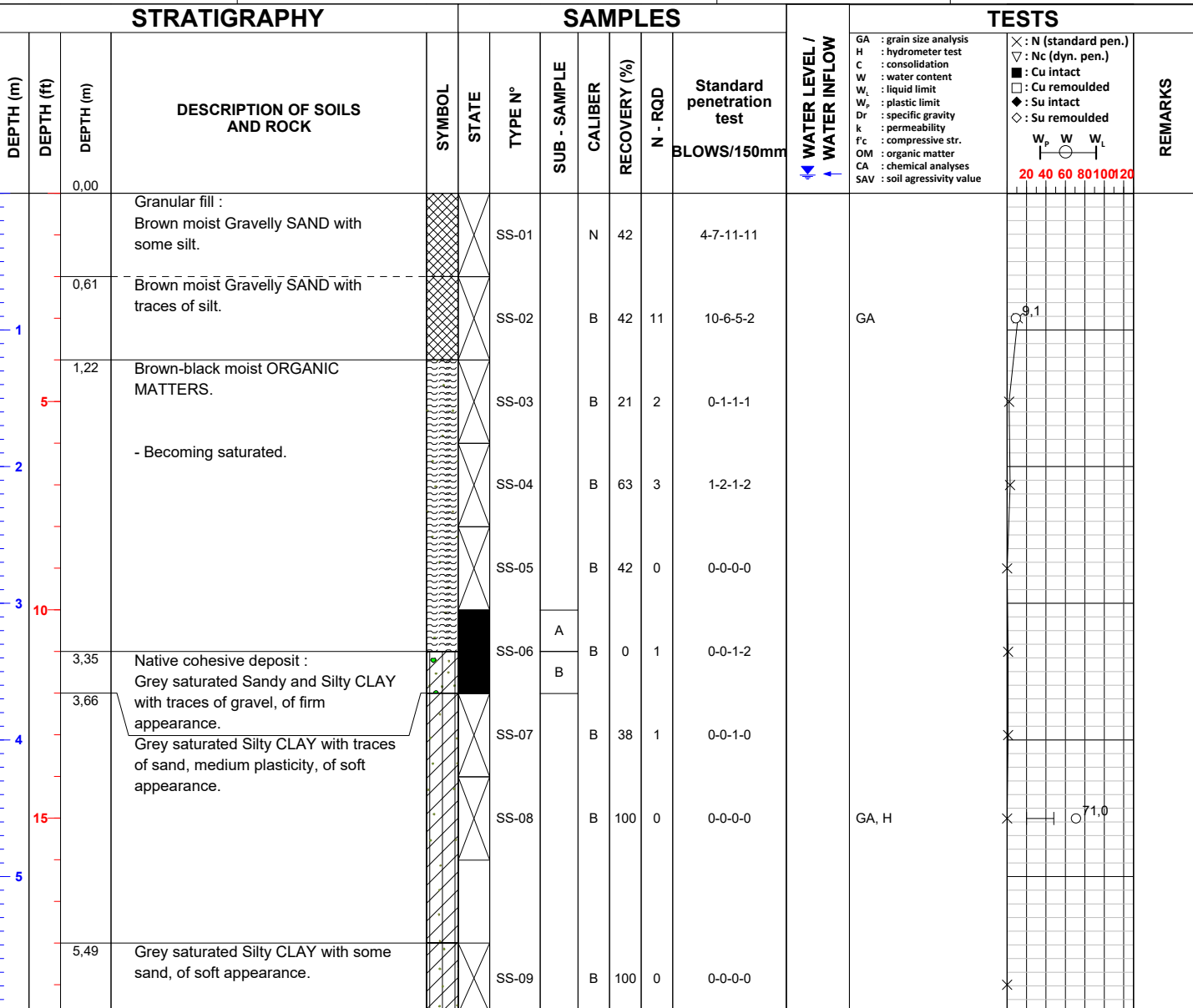
STRATIGRAPHY				SAMPLES					TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS
													GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W _p W W _L	
		6,55	Cohesive deposit : Grey saturated Silty CLAY with traces of sand, high plasticity, of soft appearance.			SS-10	B	75	3		1-2-1-2			
7		7,16		Grey saturated Silty CLAY with traces of sand, of soft appearance.			SS-11	B	100	0		0-0-0-0		GA, H
						SS-12	B	79	0		0-0-0-0			
8						SS-13	B	100	0		0-0-0-0			
						SS-14	B	100	0		0-0-0-0			
9						SS-15	B	100	0		0-0-0-0			
						SS-16	B	100	0		0-0-0-0			
10						SS-17	B	100	0		0-0-0-0			
		10,67	Grey saturated Silty and Sandy CLAY, of firm appearance.											
11		11,28	End of sampling. Start of the dynamic penetration test (Pen-Test).											
12														
13														
14														
15														
16														

STRATIGRAPHY				SAMPLES						WATER LEVEL / WATER INFLOW		TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ∇ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W _p W W _L 20 40 60 80 100 120		
55	17														
		17.68	END OF BOREHOLE (Refusal)												
60															
65	20														
70															
75	23														
80															
85	26														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate: X : 298 253 Y : 5 464 116	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-02
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	Equipment : CME 55	Page : 1 of 2
Client: Cree Development Corporation	Sampling type : B, N	Corer : Figure : 01	Start date : 2022-08-30
Site: Grevet-Chapais Railway			Inspector : A. Bogaert, tech.
			Depth : 11,53 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											
				Remarks :									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50 CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

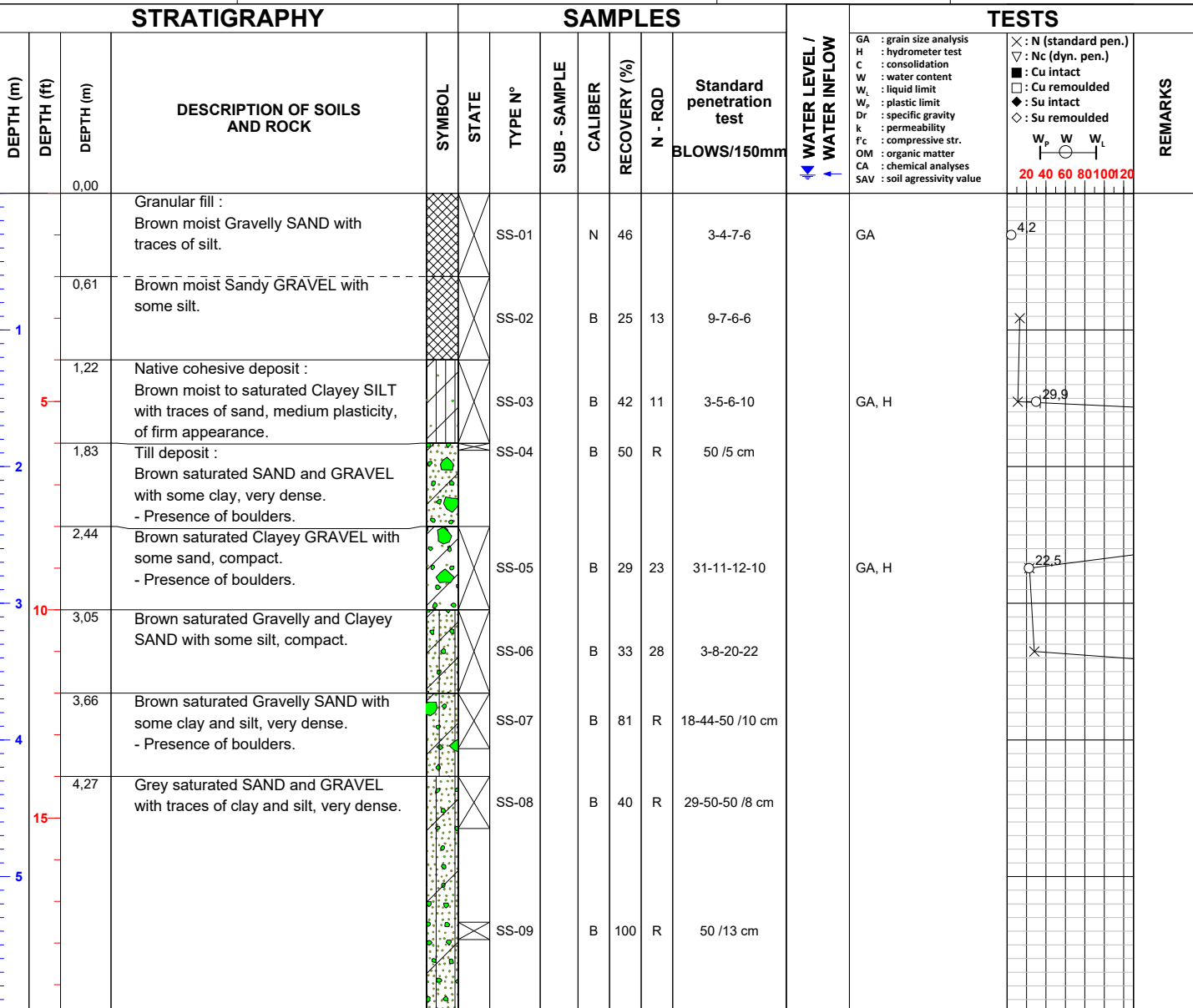
Verified by : T. Coulaux, ing.
Date : **2023-04-03**

STRATIGRAPHY				SAMPLES					TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
7		6,86	Grey saturated Silty and Sandy CLAY, of firm appearance.			SS-10	B	75	0	0	0-0-0-0		
						SS-11	B	58	0	0	0-0-0-0		
25		7,62	Granular deposit : Grey saturated SILT with some sand and traces of clay and gravel, very loose.			SS-12	B	38	4	4	1-2-2-2	GA, H	
8		8,38	Grey saturated SAND with some clay and silt and traces of gravel, very loose.			SS-13	B	46	3	3	3-2-1-2		
		9,14	Grey saturated Gravelly SAND with some silt and traces of clay, loose.			SS-14	B	33	6	6	3-4-2-2		
9		9,91	Till deposit : Grey saturated SAND and GRAVEL with traces of clay and silt, compact. - Presence of boulders.			SS-15	B	17	18	18	1-2-16-44		
30		10,67	Grey saturated Sandy GRAVEL with traces of silt and clay, very dense. - Presence of boulders.			SS-16	B	23	57	57	50-22-35-50 /5 cm		
10		11,53	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-17	B	0	R	R	50 /10 cm		
35													
40													
11													
12													
45													
13													
14													
50													
15													
16													

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-03
Project No.: 158100425.500.710.6	X : 300 698	Page : 1 of 2
Client: Cree Development Corporation	Y : 5 467 590	Start date : 2022-08-29
Site: Grevet-Chapais Railway	Type of borehole : Hollow Stem Auger	Inspector : A. Bogaert, tech.
	Equipment : CME 55	Depth : 7,09 m
	Sampling type : B, N	
	Corer : Figure : 01	

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION INDEX "N" Very loose 0 - 4 Loose 4 - 10 Compact 10 - 30 Dense 30 - 50 Very dense > 50	CONSISTENCY Very soft < 12 Soft 12 - 25 Firm 25 - 50 Stiff 50 - 100 Very stiff 100 - 200 Hard > 200	QUALIFICATIVE RQD Very poor < 25 % Poor 25 - 50 % Fair 50 - 75 % Good 75 - 90 % Excellent 90 - 100 %



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by : T. Coulaux, ing.
Date : **2023-04-05**

STRATIGRAPHY			SAMPLES						WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
							SS-10	B	0	R	50 /8 cm		
7							SS-11	B	67	R	50-50 /8 cm		
		7.09	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)										
		25											
8													
		30											
9													
		35											
10													
		40											
11													
		45											
12													
		50											
13													
		55											
14													
		60											
15													
		65											
16													
		70											

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : X : 307 357 Y : 5 471 737	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-04
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger		Page : 1 of 2
Client: Cree Development Corporation	Equipment : CME 55		Start date : 2022-08-28
Site: Grevet-Chapais Railway	Sampling type : B, N	Corer : Figure : 01	Inspector : A. Bogaert, tech.
			Depth : 11,84 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION INDEX "N" Very loose 0 - 4 Loose 4 - 10 Compact 10 - 30 Dense 30 - 50 Very dense > 50	CONSISTENCY Very soft < 12 Soft 12 - 25 Firm 25 - 50 Stiff 50 - 100 Very stiff 100 - 200 Hard > 200	QUALIFICATIVE RQD Very poor < 25 % Poor 25 - 50 % Fair 50 - 75 % Good 75 - 90 % Excellent 90 - 100 %

STRATIGRAPHY			SAMPLES					TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)		N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
		0.00	Fill : Brown moist SAND with some gravel and traces of silt.										
		1.22	Grey moist to saturated SAND and GRAVEL with traces of silt.										
		1.83	Grey-brown saturated Gravelly SAND with traces of silt.										
		2.44	Grey saturated Silty CLAY with some sand and gravel. - Presence of boulders.										
		3.05	Brown saturated GRAVEL with some sand and silt and traces of clay. - Presence of boulders.										
		5.18	Native cohesive deposit : Grey saturated Silty CLAY with some sand and gravel.										
		5.79											

General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by : T. Coulaux, ing.
Date : **2023-04-03**

STRATIGRAPHY				SAMPLES					TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS
			Granular deposit : Grey saturated Silty SAND with some clay and traces of gravel, compact.			SS-08	B	21	17	10-8-9-6				
		6,71	Grey saturated SILT and SAND with traces of clay and gravel, very loose.			SS-09	B	42	5	2-4-1-1			GA, H	24.7
		25				SS-10	B	100	2	0-1-1-1				
		8,38	Grey saturated SAND and SILT with traces of gravel and clay, very loose to compact.			SS-11	B	0	0	0-0-0-0				
		30				SS-12	B	100	15	4-10-5-13			GA, H	17.2
		9,91	Till deposit : Grey saturated Gravelly SAND with traces of clay and silt, compact to very dense.			SS-13	B	0	25	18-13-12-13				
		35				SS-14	B	64	R	21-50 /13 cm				
		11,84	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-15	B		R	39-50-50 /10 cm				
		40												
		45												
		50												
		55												
		60												
		65												
		70												
		75												
		80												
		85												
		90												
		95												
		100												

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 307 479 Y : 5 471 891	Borehole : BH22-05 Page : 1 of 3 Start date : 2022-08-28 Inspector : A. Bogaert, tech. Depth : 19,81 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N Corer :	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION	JOINTS SPACING		
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW	TESTS	REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER				RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm		
		0.00	Granular fill : Brown moist SAND with some gravel and traces of silt.			SS-01		N	29		5-6-7-5					
		1.02	Brown moist SILT with some clay and traces of sand.			SS-02	A	B	75	4	3-1-3-5					
		1.22	- Presence of woods. Cohesive fill : Brown-grey moist to saturated Silty CLAY with some gravel and traces of sand.			SS-03		B	33	5	1-2-3-2					
		1.83	- Presence of organic matters. Grey saturated CLAY with some silt and traces of sand.			SS-04		B	33	6	1-2-4-4					
		2.44	Granular fill : Grey saturated Silty SAND with some clay.			SS-05		B	92	2	3-1-1-2					
						SS-06		B	75	3	2-1-2-2					
			- Presence of wood.			SS-07		B	0	3	1-1-2-1					
		4.27	Grey saturated SAND with some silt and traces to some clay, very loose.			SS-08		B	29	2	0-0-2-2					
						SS-24		B	0	1	0-0-1-1					
						SS-09	A	B	100	0	0-0-0-0					

General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : _____ T. Coulaux, ing. Date : 2023-04-10
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STRATIGRAPHY				SAMPLES					TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS
			Native cohesive deposit : Grey saturated CLAY with some silt and traces of sand, high plasticity, of firm appearance.				B						GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value	<ul style="list-style-type: none"> × : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◇ : Su intact ◇ : Su remoulded
		6.71	Grey saturated Silty CLAY with some sand and traces of gravel. - Presence of organic matters.			SS-10	B	B	96	0	0-0-0-0		GA, H	<ul style="list-style-type: none"> ○ 78.7
7		7.62	Grey saturated Silty CLAY with traces to some sand, extremely sensitive, firm.			SS-11	B	B	96	0	0-0-0-0			<ul style="list-style-type: none"> ×
8						SS-12	B	B	100	0	0-0-0-0			<ul style="list-style-type: none"> ×
						SS-13	B	B	100	0	0-0-0-0			<ul style="list-style-type: none"> ×
9						ST-23	B						U.W = 15.2 kN/m³ C	<ul style="list-style-type: none"> □ 1 ■ 27 ○ 78.2
10						SS-14	B	B	100	0	0-0-0-0			<ul style="list-style-type: none"> ×
11						SS-15	B	B	100	1	0-0-1-4			<ul style="list-style-type: none"> ×
12		11.43	Granular deposit : Grey saturated Silty and Clayey SAND with traces of gravel, very loose.			SS-16	B	B	50	2	1-1-1-2		GA	<ul style="list-style-type: none"> ○ 38.6
13		12.19	Grey saturated Gravelly and Silty SAND with some clay, very loose.			SS-17	B	B	33	2	0-1-1-4			<ul style="list-style-type: none"> ×
14		13.72	Grey saturated Gravelly SAND with some silt and traces of clay, compact.			SS-18	B	B	29	16	5-7-9-4			<ul style="list-style-type: none"> ×
15		15.24	Grey saturated GRAVEL with some sand and silt and traces of clay, compact.			SS-19	B		0	12	9-5-7-6			<ul style="list-style-type: none"> ×
16														

STRATIGRAPHY			SAMPLES						TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
55	16,76	17	Grey saturated SAND with traces of clay and silt, loose.			SS-20	B	100	6		2-3-3-3		
60	18,29	19	Grey saturated SAND with some gravel and traces of clay and silt, loose.			SS-21	B	67	6		4-2-4-10		
65	19,81	20	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-22	B	0	R		50 /0 cm		
70		21											
75		22											
80		23											
85		24											
		25											
		26											

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 307 883 Y : 5 472 451	Borehole : BH22-06 Page : 1 of 3 Start date : 2022-08-27 Inspector : A. Bogaert, tech. Depth : 22,15 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
	Corer :	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard
	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %
			JOINTS SPACING < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY			SAMPLES						WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0.00	Fill : Brown moist Gravelly SAND with traces of silt.			SS-01		N	50		5-9-11-16	GA	
		0.91	Brown moist to saturated SILT with some sand and traces of gravel. - Presence of organic matters.			SS-02	A	B	4	13	12-10-3-7		
		1.83	Brown saturated Silty SAND with traces of gravel. - Presence of organic matters. - Presence of wood.			SS-03		B	38	3	1-2-1-2		
		2.44	Brown saturated SILT with some sand. - Presence of organic matters. - Presence of wood.			SS-04		B	25	3	1-2-1-5		
		3.66	Grey saturated Silty CLAY with traces of gravel. - Presence of organic matters. - Presence of wood.			SS-05		B	0	3	2-2-1-2		
		4.27	Native cohesive deposit : Grey saturated Silty CLAY with traces of sand and gravel, of firm appearance. - Presence of organic matters on top.			SS-06		B	4	2	1-1-1-1		
		5.49	Grey saturated Silty CLAY with traces of sand, soft.			SS-07		B	0	2	1-1-1-1		
						SS-08		B	0	2	1-1-1-1		
						SS-09		B	0	2	0-0-2-1		
						SS-10		B	0	2	0-1-1-1		

General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by : T. Coulaux, ing.
Date : 2023-04-05

STRATIGRAPHY				SAMPLES					TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value
7														
		7.62	Grey saturated Silty CLAY with traces of gravel and sand, soft.									U.W = 14.8 kN/m³		○ 72.9
		8.38	Grey saturated Silty CLAY with some sand, very soft.											
25														◆ 16
8														×
														◆ 12
														×
30														◆ 10
9														×
														◆ 4
10														×
35														×
11														×
		11.43	Grey saturated Silty CLAY with traces of sand and gravel, of soft appearance.											×
12														×
40														×
13														×
45														×
14														×
		15.24	Grey saturated SILT with some clay and traces of sand and gravel, of firm appearance.											○ 28.6
50														×
16														×

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STRATIGRAPHY			SAMPLES						TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
55	16,74	17	Till deposit : Grey saturated Clayey and Silty SAND with traces of gravel, loose.		SS-20	B	29	5	2-2-3-1				
60		19			SS-21	B	25	7	2-3-4-4				
65	19,81	20	Grey to brown saturated Sandy GRAVEL with traces of clay and silt, very dense.		SS-22	B	25	76	12-50-26-38				
70		22			SS-23	B	25	60	8-10-50-50 /5 cm				
22,15			END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)										
75		23											
80		24											
85		25											
		26											

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate: X: 307 720 Y: 5 473 916	Geo. System: MTM-NAD83 Zone: 9	Borehole: BH22-07
Project No.: 158100425.500.710.6	Type of borehole: Hollow Stem Auger		Page: 1 of 2
Client: Cree Development Corporation	Equipment: CME 55		Start date: 2022-08-26
Site: Grevet-Chapais Railway	Sampling type: B, N	Corer: 01	Inspector: A. Bogaert, tech.
			Depth: 11,81 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION INDEX "N" Very loose 0 - 4 Loose 4 - 10 Compact 10 - 30 Dense 30 - 50 Very dense > 50	QUALIFICATIVE RQD Very poor < 25 % Poor 25 - 50 % Fair 50 - 75 % Good 75 - 90 % Excellent 90 - 100 %	Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY			SAMPLES						TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
		0.00	Fill : Brown moist Gravelly SAND with traces of silt.				A	N	71		9-13-12-10		
		0.48	Brown moist Gravelly SAND with some silt.				B						
		1.22	Brown moist SAND and GRAVEL with traces of silt. - Presence of wood.				B	B	29	34	11-24-10-14		
		1.83	Brown moist to saturated GRAVEL and SAND with traces of silt.				B	B	13	24	10-14-10-6		
		2.44	Brown saturated SAND with some gravel and traces of silt. - Presence of wood.				B	B	0	13	3-5-8-5		
		3.66	Brown saturated Clayey and Sandy SILT.				B	B	58	6	3-4-2-2		
		4.27	Brown saturated Silty CLAY with some sand and traces of gravel. - Presence of wood.				B	B	38	3	1-2-1-2		
							B	B	33	6	4-1-5-5		
							B	B	79	6	2-2-4-6		

General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by: T. Coulaux, ing.
Date: **2023-04-03**

STRATIGRAPHY			SAMPLES						TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
		6,86	Native till deposit : Brown saturated Silty GRAVEL with some sand and traces of clay, compact.			SS-11	B	0	4		1-2-2-2		
7						SS-12	B	21	15		9-9-6-4		
	25					SS-13	B	8	12		6-4-8-11		
8						SS-14	B	38	19		11-10-9-6		
		8,38	Grey saturated Gravelly SAND with traces to some clay and silt, compact to very dense.			SS-15	B	42	16		6-5-11-23		
9						SS-16	B	60	R		50-50 /10 cm		
			- Presence of boulders.			SS-17	B	80	R		49-50 /10 cm		
10						SS-18	B	56	R		30-50 /8 cm		
		10,67	Grey saturated GRAVEL with some sand and silt and traces of clay, very dense.										
11													
		11,58	Grey saturated Gravelly SAND with some silt and traces of clay, very dense.										
12		11,81	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)										
13													
14													
15													
16													

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation Project No.: 158100425.500.710.6 Client: Cree Development Corporation Site: Grevet-Chapais Railway	Coordinate: X : 307 699 Y : 5 474 004 Type of borehole: Hollow Stem Auger Equipment: CME 55 Sampling type: B, N Corer:	Geo. System: MTM-NAD83 Zone: 9 Borehole: BH22-08 Page: 1 of 2 Start date: 2022-08-26 Inspector: A. Bogaert, tech. Depth: 12,19 m Figure: 01
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SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0.00	Fill : Brown moist Gravelly SAND with traces of silt.			SS-01		N	67		9-7-7-5	GA	
		0.61	Brown moist SAND with some gravel and traces of silt.			SS-02		B	54	5	2-2-3-4		
		1.22	Brown moist to saturated SAND with some gravel and traces of silt.			SS-03		B	17	8	3-5-3-4		
						SS-04		B	46	10	5-5-5-4	GA	
						SS-05		B	33	8	3-4-4-5		
		3.05	Brown saturated Sandy GRAVEL with some silt.			SS-06		B	63	9	5-5-4-11		
		3.66	Grey saturated Silty SAND with some gravel.			SS-07		B	33	6	4-2-4-6		
						SS-08		B	67	15	8-8-7-10	GA	
		4.88	Grey saturated GRAVEL and SAND with traces of silt.			SS-09		B	29	24	11-15-9-6		
						SS-10		B	63	16	5-9-7-5		

General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

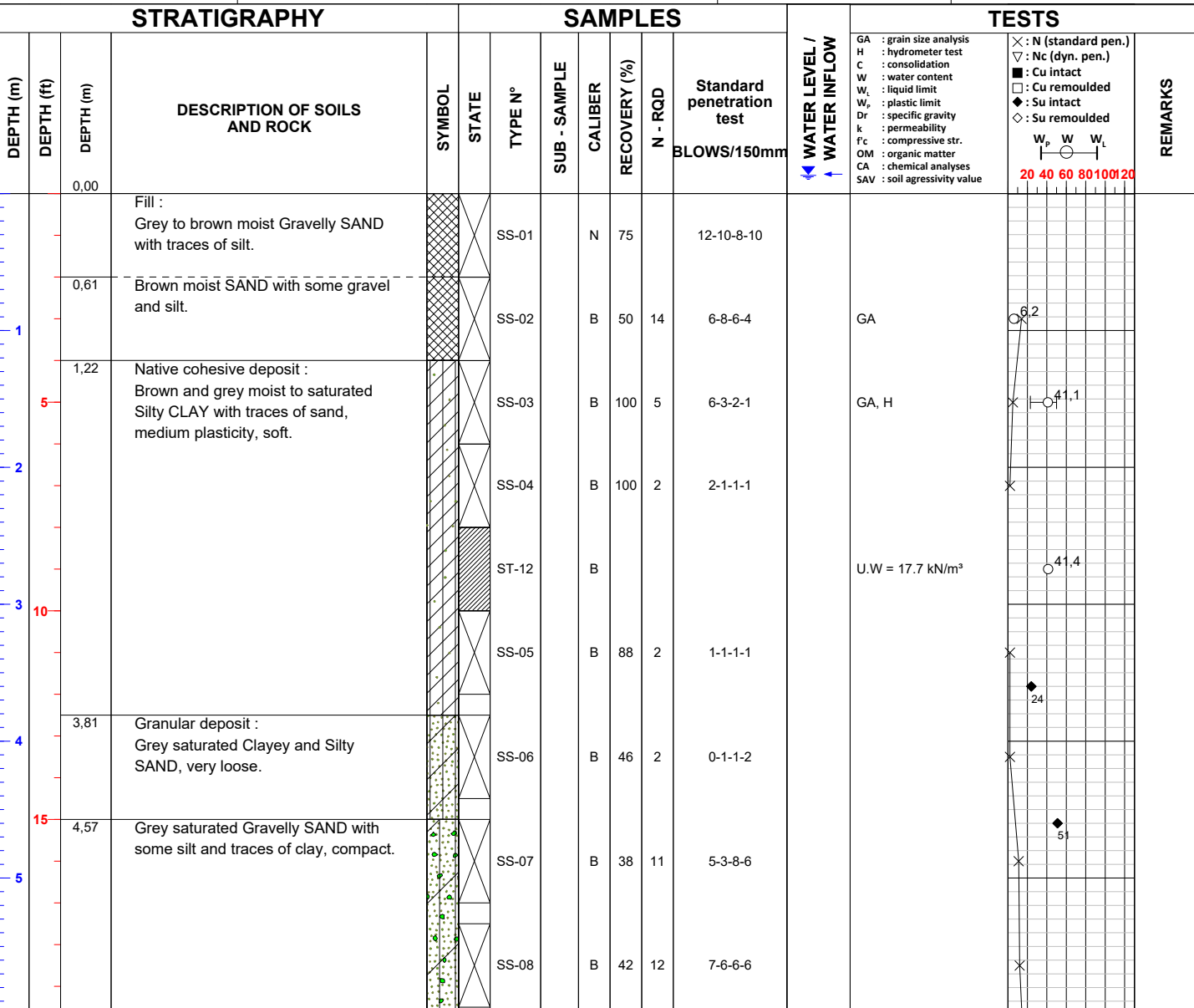
Verified by: T. Coulaux, ing.
 Date: 2023-04-03

STRATIGRAPHY			SAMPLES						TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
		6,10	Grey saturated Silty GRAVEL with traces of sand.			SS-11	B	17	11		6-6-5-6		
		6,71	Native till deposit : Brown saturated Gravelly and Silty SAND with some clay, very dense. - Presence of boulders.			SS-12	B	63	80		10-30-50-29		
		7,32	Brown-grey saturated SAND and GRAVEL with traces of silt, compact to very dense. - Presence of boulders.			SS-13	B	0	29		18-17-12-11		
						SS-14	B	100	R		50 /3 cm		
		9,14	Grey saturated GRAVEL with traces of sand, clay and silt, very dense. - Presence of boulders.			SS-15	B	38	R		50-50 /5 cm		
		9,91	Grey saturated Silty GRAVEL with some clay and sand, very dense.										
		10,67	Grey saturated Gravelly SAND with some silt and traces of clay, very dense.			SS-16	B	54	83		20-33-50-50		
		11,58	Grey saturated GRAVEL with some sand and silt and traces of clay, very dense.			SS-17	B	42	97		19-48-49-29		
		12,19	END OF BOREHOLE										

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation Project No.: 158100425.500.710.6 Client: Cree Development Corporation Site: Grevet-Chapais Railway	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 308 482 Y : 5 477 171 Type of borehole : Hollow Stem Auger Equipment : CME 55 Sampling type : B, N Corer :	Borehole : BH22-09 Page : 1 of 2 Start date : 2022-08-25 Inspector : A. Bogaert, tech. Depth : 7,70 m Figure : 01
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SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



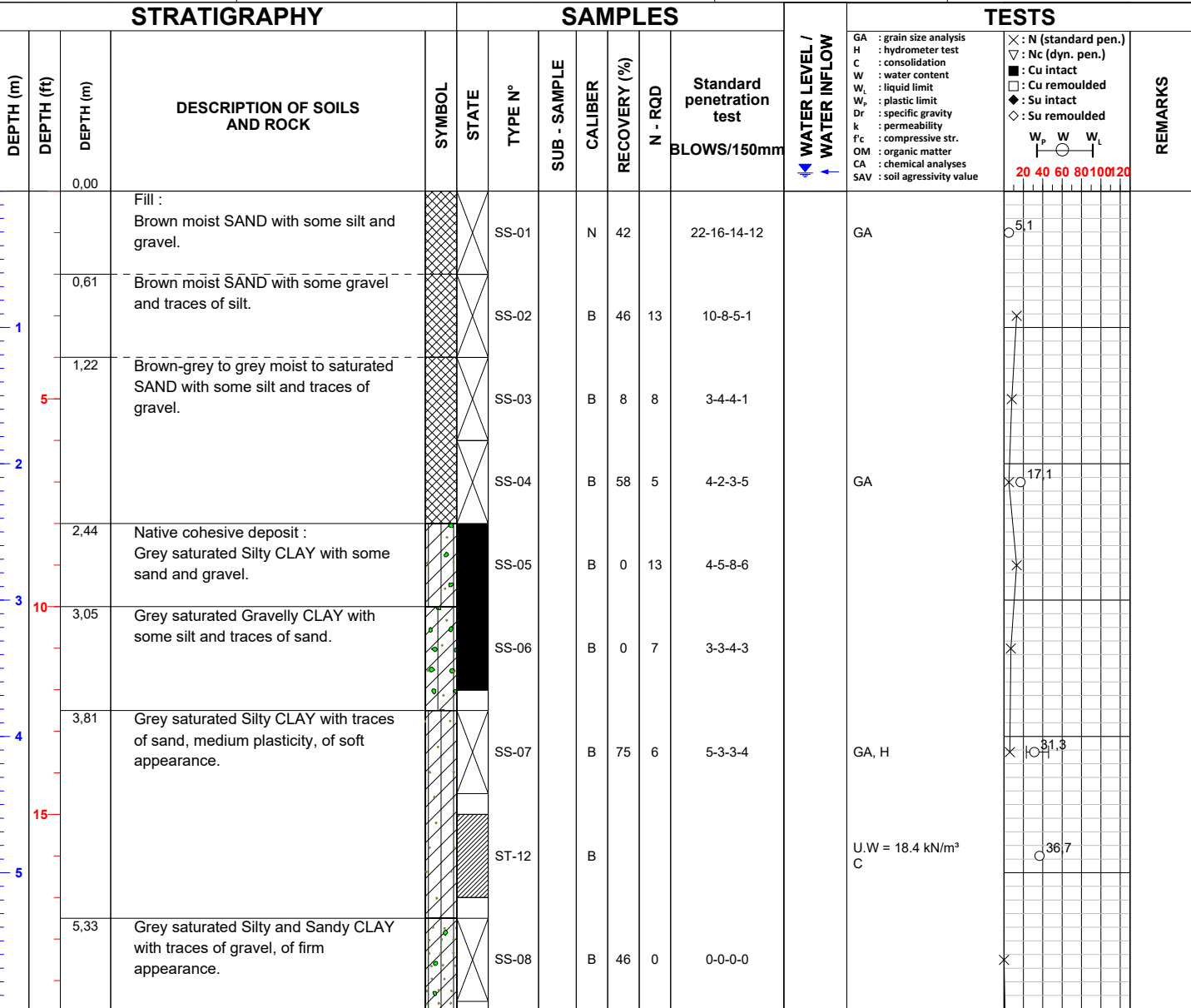
General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : T. Coulaux, ing. Date : 2023-04-03
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STRATIGRAPHY				SAMPLES						WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS	
		6,10	Till deposit : Grey saturated SAND with some gravel and traces of silt, compact to very dense.			SS-09	B	21	17		14-10-7-9	GA	<ul style="list-style-type: none"> GA : grain size analysis H : hydrometer test C : consolidation W : water content W_L : liquid limit W_p : plastic limit Dr : specific gravity k : permeability f_c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value 	<ul style="list-style-type: none"> × : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded
7		SS-10				B	21	74		16-36-38-9				
25		SS-11				B	100	R		37-50 /8 cm				
		7,70	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)											
8														
9														
30														
10														
35														
11														
40														
12														
45														
13														
50														
14														
15														
50														
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate: X: 309 446 Y: 5 477 700	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-10
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	Equipment : CME 55	Page : 1 of 2
Client: Cree Development Corporation	Sampling type : B, N	Corer : Figure : 01	Start date : 2022-08-25
Site: Grevet-Chapais Railway			Inspector : A. Bogaert, tech.
			Depth : 7,98 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50 CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

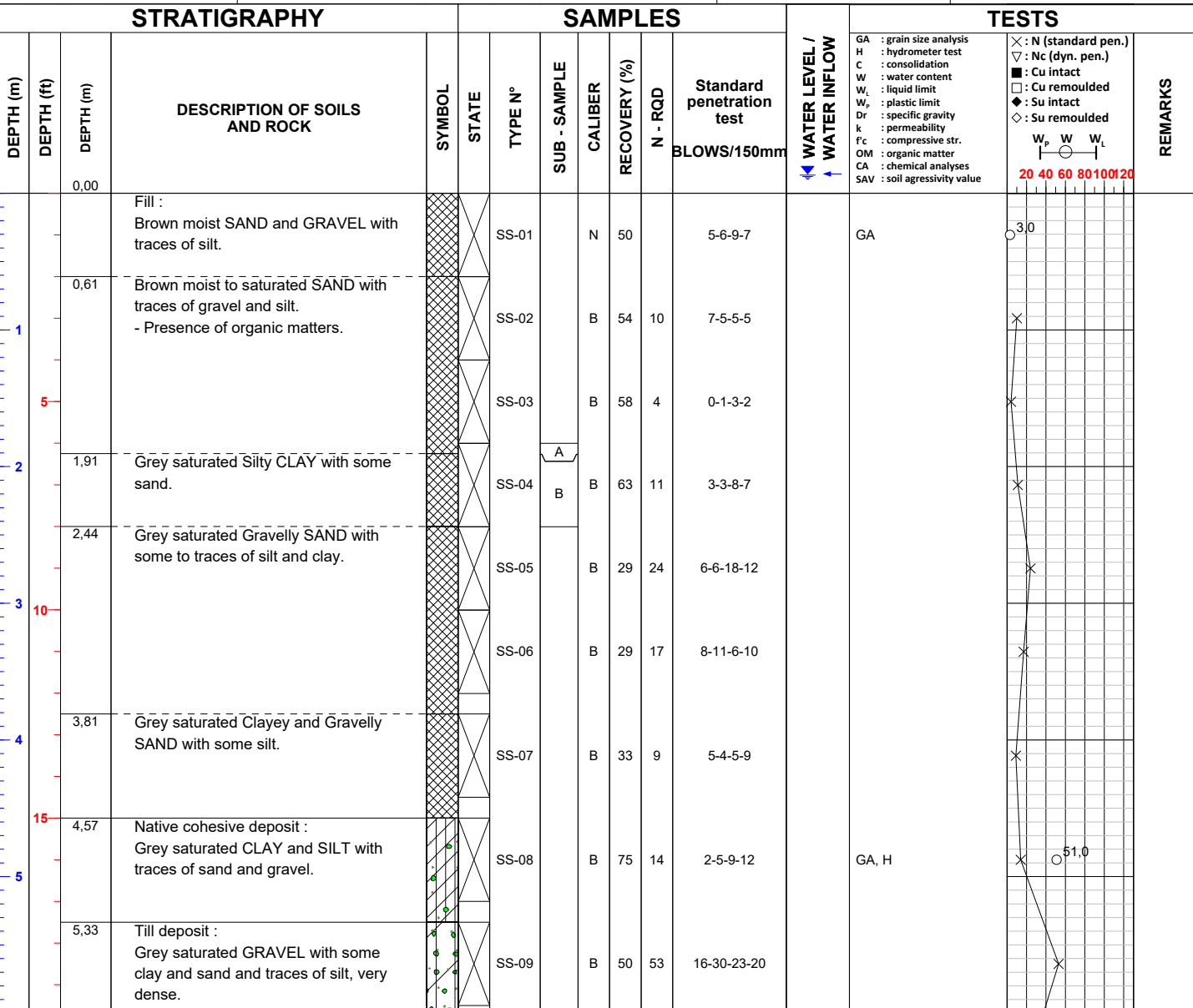
Verified by : T. Coulaux, ing.
Date : **2023-04-05**

STRATIGRAPHY				SAMPLES					TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS
		6,10	Grey saturated Silty CLAY with some sand, firm.			SS-09	B	46	2		0-0-2-2		<ul style="list-style-type: none"> GA : grain size analysis H : hydrometer test C : consolidation W : water content W_L : liquid limit W_p : plastic limit Dr : specific gravity k : permeability f_c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value 	<ul style="list-style-type: none"> × : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded
7		6,86	Till deposit : Grey-brown saturated Gravelly SAND with traces of clay and silt, compact.			SS-10	B	21	10		4-4-6-4			
	25	7,62	Grey saturated Gravelly SAND with traces of silt, compact.			SS-11	B	57	R		9-10-50 /5 cm			
8		7,98	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)											
9		30												
10														
11		35												
12		40												
13														
14		45												
15		50												
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 319 175 Y : 5 494 648	Borehole : BH22-11 Page : 1 of 2 Start date : 2022-08-09 Inspector : H. Desrochers, CPI Depth : 13,82 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger + Diamond Core	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N Corer : NQ	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <thead> <tr> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </tbody> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION	JOINTS SPACING		
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : _____ T. Coulaux, ing. Date : 2023-04-03
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STRATIGRAPHY			SAMPLES					TESTS		REMARKS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)		N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value
		6,10	Grey saturated GRAVEL with some sand and traces of silt, compact.			SS-10	B	33	20		12-10-10-11			
7		6,86	Grey saturated GRAVEL and SAND with some silt, compact.			SS-11	B	46	12		8-6-6-4			
						SS-12	B	50	21		12-9-12-21			
8						SS-13	B	60	85		40-43-42-50 /5 cm			
		9,14	Grey saturated SAND with traces of gravel and silt, very dense.			SS-14	B	0	R		50 /0 cm			
11		10,67	Grey saturated SAND with traces of gravel and silt, very dense. - Presence of boulders.			DC-15	NQ		14					
12						SS-16	B	76	R		49-68-50 /13 cm			
13						SS-17	B	100	R		45-60-50 /10 cm			
14		13,82	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)											
15														
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 319 232 Y : 5 494 658	Borehole : BH22-12 Page : 1 of 2 Start date : 2022-08-09 Inspector : H. Desrochers, CPI Depth : 12,34 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N Corer :	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW	TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER		RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm
		0.00	Granular fill : Brown moist SAND with traces of silt and gravel. - Traces of oxidation.										
		1.22	Brown-grey moist SAND with traces of silt and gravel.										
		1.96	Brown-grey moist to saturated SAND and SILT with some clay and traces of gravel. - Traces of oxidation.				A B						
		3.81	Brown-grey saturated Clayey and Gravelly SAND with some silt.										
		4.57	Native cohesive deposit : Brown-grey saturated Silty CLAY with some sand and gravel, of stiff appearance.										
		5.33	Till deposit : Brown-grey saturated Silty and Gravelly SAND with some clay,										

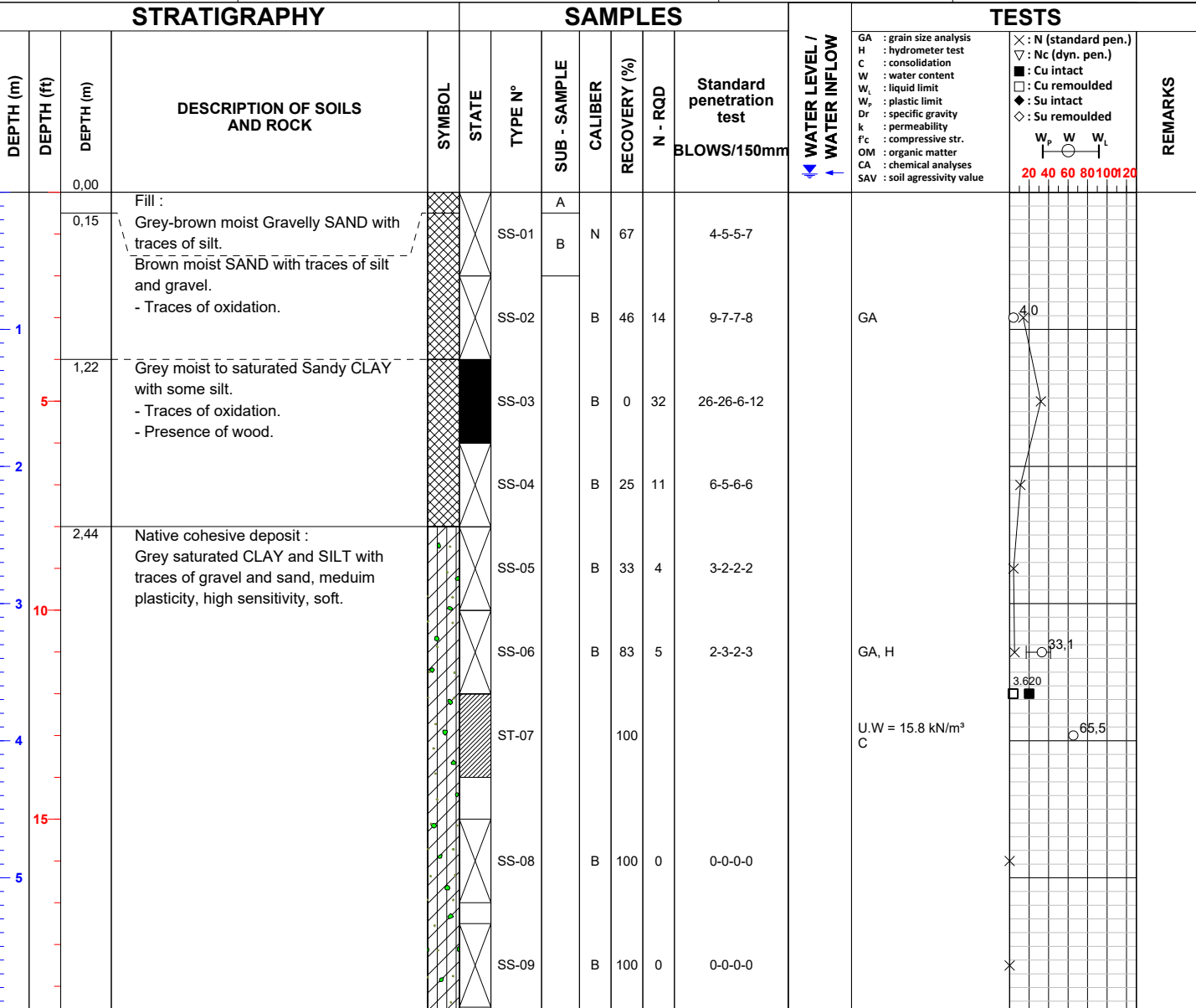
General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : T. Coulaux, ing. Date : 2023-04-04
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STRATIGRAPHY			SAMPLES						TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS
		6,10	compact. - Traces of oxidation. Grey-brown saturated Silty and Gravelly SAND with traces of clay, dense.			SS-10	B	50	31		11-13-18-50 / 10 cm		GA, H	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W _p W W _L
7		6,86	- Presence of boulders. - Traces of oxidation. Grey saturated SAND with some silt and traces of clay, compact to very dense.			SS-11	B	50	15		28-6-9-10			
		25	- Presence of cobbles.			SS-12	B	50	52		36-23-29-60			
8						SS-12	B	50	52		36-23-29-60			
9		30				SS-13	B	100	R		50 / 13 cm			
10						SS-13	B	100	R		50 / 13 cm			
11		35	10,67 Grey saturated SAND with some gravel and silt and traces of clay, very dense. - Presence of boulders.			SS-14	B	82	R		7-15-50 / 13 cm			
12		40	12,19 12,34 Grey saturated Gravelly SAND with traces of silt and clay, very dense. - Presence of boulders. END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-15	B	100	R		50 / 15 cm			
13						SS-15	B	100	R		50 / 15 cm			
14		45				SS-15	B	100	R		50 / 15 cm			
15		50				SS-15	B	100	R		50 / 15 cm			
16						SS-15	B	100	R		50 / 15 cm			

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 322 850 Y : 5 485 372	Borehole : BH22-13 Page : 1 of 3 Start date : 2022-08-11 Inspector : H. Desrochers, CPI Depth : 18,90 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
	Corer :	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard
	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %
			Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by : T. Coulaux, ing.
Date : 2023-04-10

STRATIGRAPHY			SAMPLES						TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ∇ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W _p W W _L
7			Grey saturated Silty CLAY with traces of sand, high plasticity, high sensitivity, soft.			SS-10	B	100	0	0	0-0-0-0		X	
		SS-11				B	63	0	0	0-0-0-0		X		
25	7.62	SS-12				B	100	0	0	0-0-0-0	GA, H	X	99.7	
8		SS-13				B	100	0	0	0-0-0-0		X		
9			Grey saturated Clayey SILT with some sand, of firm appearance.			SS-14	B	100	0	0	0-0-0-0		X	
10		SS-15				B	92	0	0	0-0-0-0		X		
35	12.19	SS-16				B	54	3	2-2-1-2		X			
11			Granular deposit : Brown-grey saturated SAND with some silt and traces of clay, very loose.			SS-17	B	83	8	6-4-4-2		GA	X	11.5
12														
13			Grey-brown saturated SAND with some silt and traces of gravel, loose to compact.											
45	13.72													
14														
15														
50	15.24													
16														

STRATIGRAPHY			SAMPLES						TESTS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS	REMARKS
55	17													
		18,29	Till deposit : Grey-brown saturated SAND and GRAVEL with traces of silt and clay, very dense.		SS-18		B	25	16		15-8-8-5			
		18,90	- Presence of boulders. END OF BOREHOLE		SS-19		B	75	62		28-32-30-47			
65	20													
70	21													
75	22													
80	23													
85	24													
	25													
	26													

GA : grain size analysis
 H : hydrometer test
 C : consolidation
 W : water content
 W_L : liquid limit
 W_p : plastic limit
 Dr : specific gravity
 k : permeability
 f_c : compressive str.
 OM : organic matter
 CA : chemical analyses
 SAV : soil aggressivity value

X : N (standard pen.)
 ∇ : Nc (dyn. pen.)
 ■ : Cu intact
 □ : Cu remoulded
 ◆ : Su intact
 ◇ : Su remoulded

W_p W W_L

20 40 60 80 100 120

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 322 892 Y : 5 485 379	Borehole : BH22-14 Page : 1 of 3 Start date : 2022-08-12 Inspector : H. Desrochers, CPI Depth : 17,37 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
	Corer :	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANICAL CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

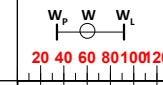
STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0.00	Fill :										
		0,18	Grey moist SANDY GRAVEL with traces of silt.			SS-01	A	N	67		5-3-2-1		
		0,61	Brown moist SAND with traces of silt and gravel.			SS-02	B	B	46	1	1-0-1-4		
			Brown moist SAND with some gravel and traces of silt.			SS-03	B	B	38	3	3-2-1-1		
		1,83	Grey-brown moist to saturated Clayey SILT with some sand and traces of gravel.			SS-04	B	B	100	2	1-1-1-1		
			- Presence of organic matters.			SS-05	B	B	100	0	0-0-0-0	GA, H	
			- Presence of wood.			SS-06	B	B	100	0	0-0-0-3		
		3,81	Brown-grey saturated Sandy SILT with some clay.			SS-07	B	B	83	4	1-1-3-3		
		4,57	Grey saturated Silty SAND with some clay and traces of gravel.			SS-08	B	B	100	2	1-1-1-1	GA, H	
			- Presence of organic matters.			SS-09	B	B	33	1	0-1-0-1		
			- Presence of wood.										

General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : _____ T. Coulaux, ing. Date : 2023-04-04
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STRATIGRAPHY			SAMPLES						TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS
		6,10	Native cohesive deposit : Grey saturated CLAY with some silt and traces of sand, high plasticity, very high sensitivity, very soft.											
						SS-10		B	100	0		0-0-0-0		
						SS-11		B	100	0		0-0-0-0		
		25				ST-12		B	100					
						SS-13		B	100	0		0-0-0-0		
		30												
						SS-14		B	63	0		0-0-0-0		
		35				SS-15		B	79	4		1-1-3-6		
		40	Till deposit : Grey saturated SAND with some clay and silt and traces of gravel, very loose to compact.											
		45				SS-16		B	0	17		5-8-9-5		
		50	Grey saturated SAND with some gravel and traces of silt and clay, very dense.											
		50				SS-17		B	71	61		12-33-28-14		
		15,24												

GA : grain size analysis
 H : hydrometer test
 C : consolidation
 W : water content
 W_L : liquid limit
 W_p : plastic limit
 Dr : specific gravity
 k : permeability
 f_c : compressive str.
 OM : organic matter
 CA : chemical analyses
 SAV : soil aggressivity value

X : N (standard pen.)
 ▽ : Nc (dyn. pen.)
 ■ : Cu intact
 □ : Cu remoulded
 ◆ : Su intact
 ◇ : Su remoulded



U.W = 14.8 kN/m³
C

GA, H

STRATIGRAPHY			SAMPLES						TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS
55	17	17,37	END OF BOREHOLE			SS-18	B	42	81	43-42-39-43			<ul style="list-style-type: none"> GA : grain size analysis H : hydrometer test C : consolidation W : water content W_L : liquid limit W_p : plastic limit Dr : specific gravity k : permeability f_c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value 	<ul style="list-style-type: none"> × : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 325 106 Y : 5 485 776	Borehole : BH22-15 Page : 1 of 2 Start date : 2022-08-13 Inspector : H. Desrochers, CPI Depth : 12,73 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
	Corer :	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard
	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %
			JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0.00	Fill :										
		0.13	Grey moist Gravelly SAND with traces of silt.		SS-01		A	N	100		4-4-5-4	GA	5.3
			Brown moist SAND with some gravel and silt.				B						
		1.22	Grey moist to saturated some to Gravelly SAND with some silt. - Presence of organic matters.		SS-02		B	79	7		5-4-3-2		
		1.22	Grey moist to saturated some to Gravelly SAND with some silt. - Presence of organic matters.		SS-03		B	42	7		5-3-4-2		
		2.29	Grey saturated Gravelly and Clayey SILT with some sand, medium plasticity.		SS-04		A	B	75	4	2-2-2-2	GA, H	31.4
							B						
		2.29	Grey saturated Gravelly and Clayey SILT with some sand, medium plasticity.		SS-05		B	29	1		1-1-0-1		
					SS-06		B	79	2		2-1-1-3		
					SS-07		B	63	3		3-1-2-5		
		4.70	Brown-black saturated ORGANIC MATTERS.		SS-08		A	B	92	2	2-1-1-2		
							B						
		4.70	Brown-black saturated ORGANIC MATTERS.		SS-08		B	92	2		2-1-1-2		
		5.33	Native cohesive deposit : Grey saturated Silty and Sandy CLAY with traces of gravel.		SS-09		B	71	2		0-1-1-2		

General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.

Verified by : T. Coulaux, ing.
Date : 2023-04-04

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW		TESTS
													GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ∇ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W _p W W _L 20 40 60 80 100 120	
7		6,86	Till deposit : Grey saturated SAND and GRAVEL with traces of silt, compact to very dense. - Presence of cobbles.			SS-10	B	67	3		0-1-2-2		X	
	25						SS-11	B	38	27		13-17-10-8		X
8							SS-12	B	63	33		13-11-22-35	GA	7.5 X
			Brown saturated SAND with some gravel and traces of silt, compact to loose. - Presence of cobbles.			SS-13	B	0	63		38-24-39-39		X	
11		10,67					SS-14	B	33	23		3-8-15-20		X
12							SS-15	B	54	9		3-4-5-3		X
			Grey saturated Sandy GRAVEL with traces of silt, very dense. END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-16	B	89	R		25-50 / 8 cm			
13		12,73												
14														
15														
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 325 150 Y : 5 485 802 Type of borehole : Hollow Stem Auger Equipment : CME 55 Sampling type : B, N Corer : _____ Figure : 01	Borehole : BH22-16 Page : 1 of 2 Start date : 2022-08-14 Inspector : H. Desrochers, CPI Depth : 12,80 m
Project No.: 158100425.500.710.6	Client: Cree Development Corporation	Site: Grevet-Chapais Railway

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0.00	Fill :										
		0.13	Grey moist Sandy GRAVEL with traces of silt. Brown moist SAND with traces of gravel and silt.			SS-01	A	N	67		6-4-6-3		
						SS-02	B		67	6	3-3-3-4		
		1.22	Grey-brown moist to saturated Silty CLAY with some sand.			SS-03		B	67	2	2-1-1-1		
		1.83	Native cohesive deposit : Grey saturated Silty CLAY with some gravel and traces of sand.			SS-04		B	63	4	3-1-3-9	GA, H	33.1
		2.44	Granular deposit : Brown saturated Gravelly SAND with traces of silt and clay, loose to compact.			SS-05		B	29	8	1-3-5-6		
						SS-06		B	17	14	7-7-7-6		
		3.66	Grey saturated Sandy GRAVEL with traces of silt, very loose.			SS-07		B	25	4	8-2-2-2		
		4.27	Grey saturated Gravelly SAND with traces of silt, compact. - Presence of cobbles.			SS-08		B	25	10	6-5-5-8		
		4.88	Brown saturated SAND with some gravel and traces of silt, very loose to loose.			SS-09		B	71	6	5-3-3-2	GA	14.7
						SS-10		B	50	4	4-2-2-8		

General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

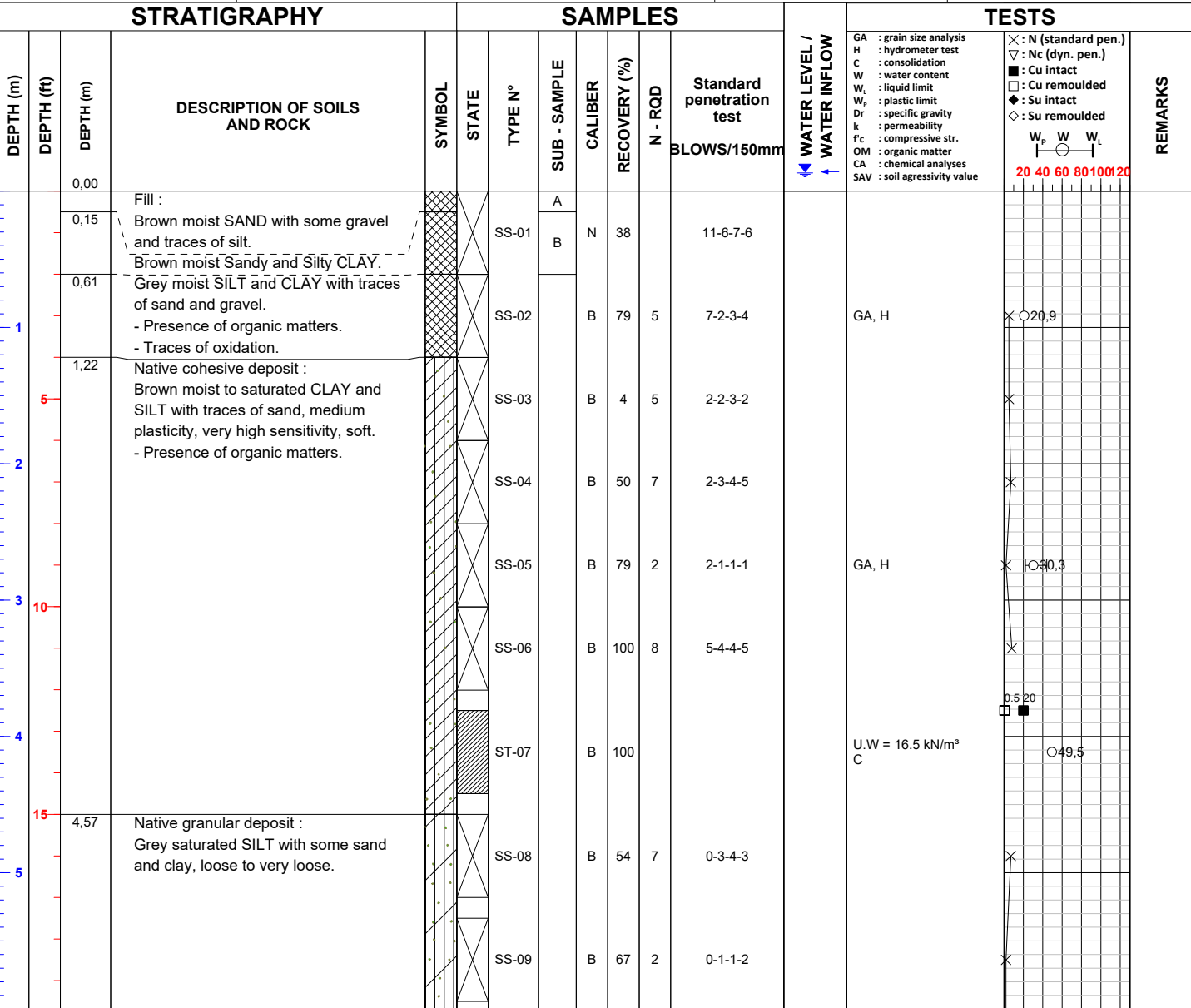
Verified by : _____
 T. Coulaux, ing.
 Date : 2023-04-10

STRATIGRAPHY				SAMPLES						WATER LEVEL / WATER INFLOW		TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS		
7															
25		7.62	Till deposit : Grey saturated Sandy GRAVEL with some silt and traces of clay, loose to compact.												
8															
30															
9															
35		10.67	Grey saturated Gravelly SAND with traces of silt, compact to very dense.												
10															
11															
12															
40															
12															
13		12.80	END OF BOREHOLE												
14															
15															
50															
16															

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate: X : 325 961 Y : 5 486 239	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-17
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger		Page : 1 of 2
Client: Cree Development Corporation	Equipment : CME 55		Start date : 2022-08-14
Site: Grevet-Chapais Railway	Sampling type : B, N	Corer : Figure : 01	Inspector : H. Desrochers, CPI
			Depth : 12,29 m

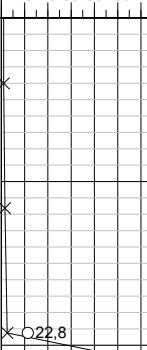
SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION INDEX "N" Very loose 0 - 4 Loose 4 - 10 Compact 10 - 30 Dense 30 - 50 Very dense > 50 CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	QUALIFICATIVE RQD Very poor < 25 % Poor 25 - 50 % Fair 50 - 75 % Good 75 - 90 % Excellent 90 - 100 %	Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

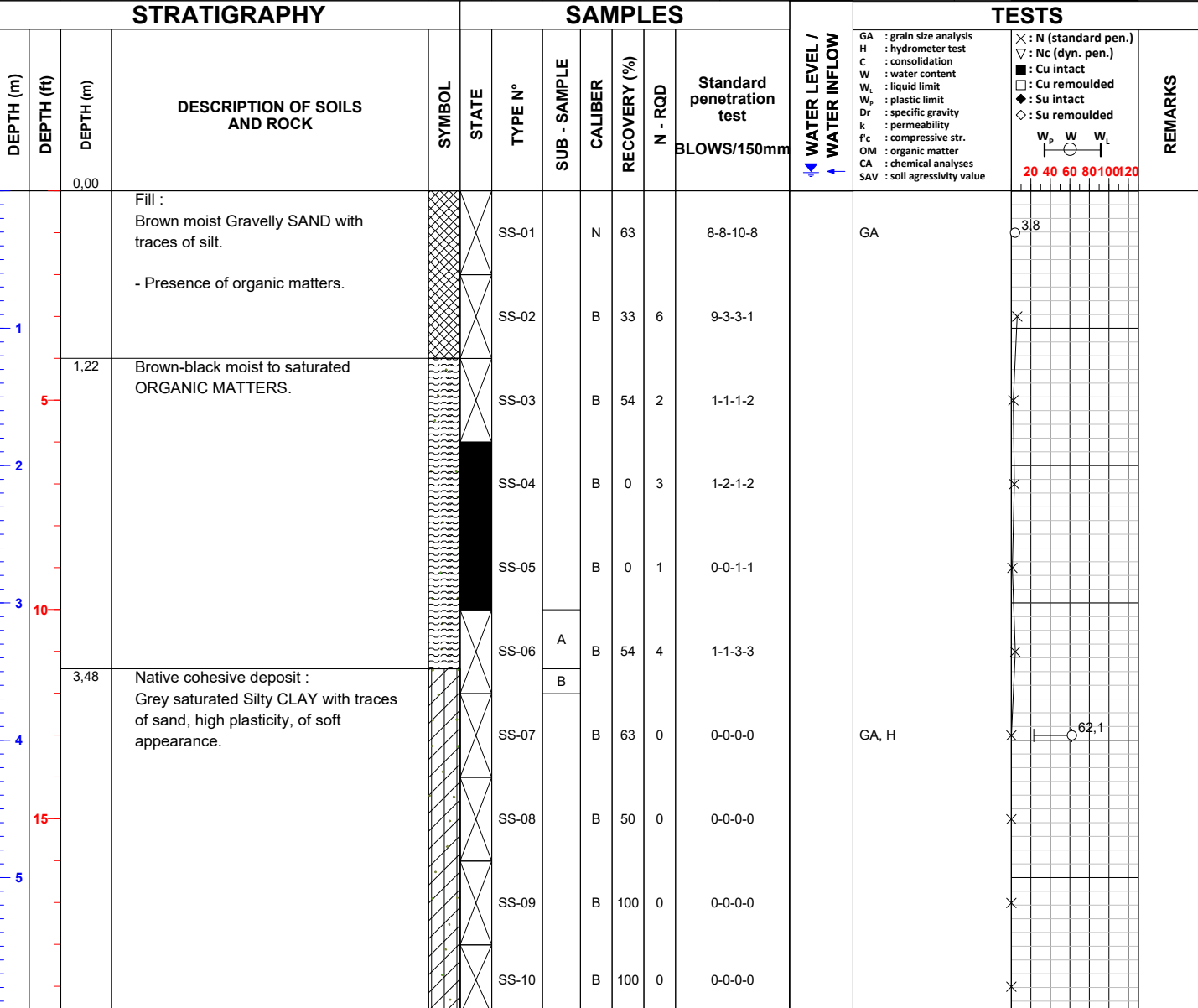
Verified by : T. Coulaux, ing.
Date : **2023-04-10**

STRATIGRAPHY				SAMPLES						TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm		WATER LEVEL / WATER INFLOW
7						SS-10	B	50	2		0-0-2-2		
						SS-11	B	38	3		2-2-1-4		
		7.62	Grey saturated SILT with traces of clay and sand, loose.			SS-12	B	50	5		3-2-3-1	GA, H	
		9.14	Till deposit : Brown saturated SAND with some silt and gravel and traces of clay, very dense. - Presence of boulders.			SS-13	B	33	R		5-18-50 / 15 cm		
		10.67	Grey saturated Silty GRAVEL with some sand and traces of clay, very dense. - Presence of boulders.			SS-14	B	100	R		50 / 5 cm		
		12.19 12.29	Grey saturated SAND and GRAVEL with traces of silt and clay, very dense. END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-15	B	100	R		50 / 10 cm		

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : X : 334 103 Y : 5 486 214	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-18
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	Equipment : CME 55	Page : 1 of 4
Client: Cree Development Corporation	Sampling type : B, N	Corer : 01	Start date : 2022-08-31
Site: Grevet-Chapais Railway			Inspector : A. Bogaert, tech.
			Depth : 31,39 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <thead> <tr> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </tbody> </table>	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									
				Remarks :						

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : <u>T. Coulaux, ing.</u>
	Date : 2023-04-04

STRATIGRAPHY				SAMPLES					TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
7						SS-11	B	100	0	0	0-0-0-0		X
						SS-12	B	100	0	0	0-0-0-0		X
25						SS-13	B	100	0	0	0-0-0-0		X
8						SS-14	B	100	0	0	0-0-0-0		X
						SS-15	B	100	0	0	0-0-0-0		X
9						SS-16	B	100	0	0	0-0-0-0		X
30						SS-17	B	100	0	0	0-0-0-0		X
10		9,91	Grey saturated Silty CLAY with traces of sand and gravel.										
35		10,67	Grey saturated CLAY with some silt and traces of sand.										
11		11,28	End of sampling. Start of dynamic penetration test (Pen-Test)									GA, H	X
													77,8
12													▽
40													▽
13													▽
45													▽
14													▽
50													▽
15													▽
16													▽

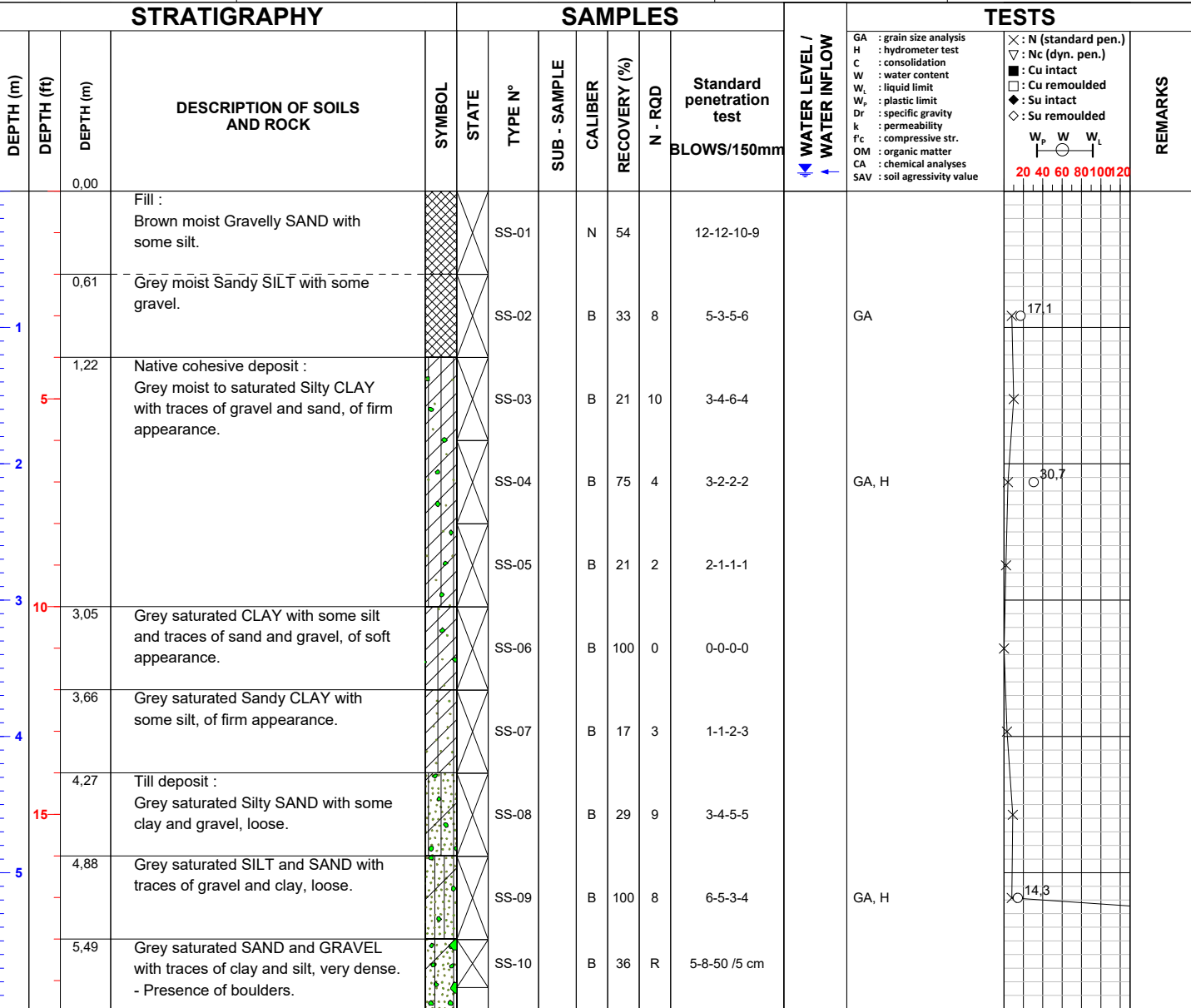
STRATIGRAPHY				SAMPLES						TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm		WATER LEVEL / WATER INFLOW
55	17												
60													
65	20												
70	21												
75	23												
80	24												
85	26												

STRATIGRAPHY				SAMPLES					TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
27													
	90												
28													
29													
	95												
30													
31													
	100												
31													
		31,39	END OF BOREHOLE										
32													
	105												
33													
34													
	110												
35													
	115												
36													
	120												

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 338 285 Y : 5 488 413	Borehole : BH22-19 Page : 1 of 2 Start date : 2022-08-31 Inspector : A. Bogaert, tech. Depth : 8,99 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger + Diamond Core	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N Corer : NQ	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon	Clay < 0.002 mm	Traces < 10 %	N Standard penetration value (ASTM D 1586)	<table border="1" style="width:100%"> <tr><th>Date</th><th>Depth</th></tr> <tr><td> </td><td>m</td></tr> <tr><td> </td><td>m</td></tr> </table>	Date	Depth		m		m
Date	Depth									
	m									
	m									
CS Continuous sampling	Silt 0.002 - 0.08 mm	Some 10 - 20 %	Nc Dynamic cone penetration value (BNQ 2501-145)							
DC Diamond rock core	Sand 0.08 - 5 mm	Adjective (...y) and (ex: and gravel) > 35 %	RQD Rock Quality Designation (%)							
AS Auger	Gravel 5 - 80 mm	Main word Dominant fraction								
TW Thin wall sampler	Cobbles 80 - 200 mm									
ST Shelby tube	Boulders > 200 mm									
MA Manual sample										


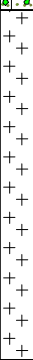

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded	COMPACTION	INDEX "N"	CONSISTENCY	Cu OR Su (kPa)	QUALIFICATIVE	RQD	Very tight < 20 mm
Intact (thin wall sampler)	Very loose	0 - 4	Very soft	< 12	Very poor	< 25 %	Tight 20 - 60 mm
Lost	Loose	4 - 10	Soft	12 - 25	Poor	25 - 50 %	Close 60 - 200 mm
Core (diamond rock core)	Compact	10 - 30	Firm	25 - 50	Fair	50 - 75 %	Moderately spaced 200 - 600 mm
	Dense	30 - 50	Stiff	50 - 100	Good	75 - 90 %	Spaced 600 - 2000 mm
	Very dense	> 50	Very stiff	100 - 200	Excellent	90 - 100 %	Very spaced 2000 - 6000 mm
			Hard	> 200			Wide > 6000 mm



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by : _____
T. Coulaux, ing.

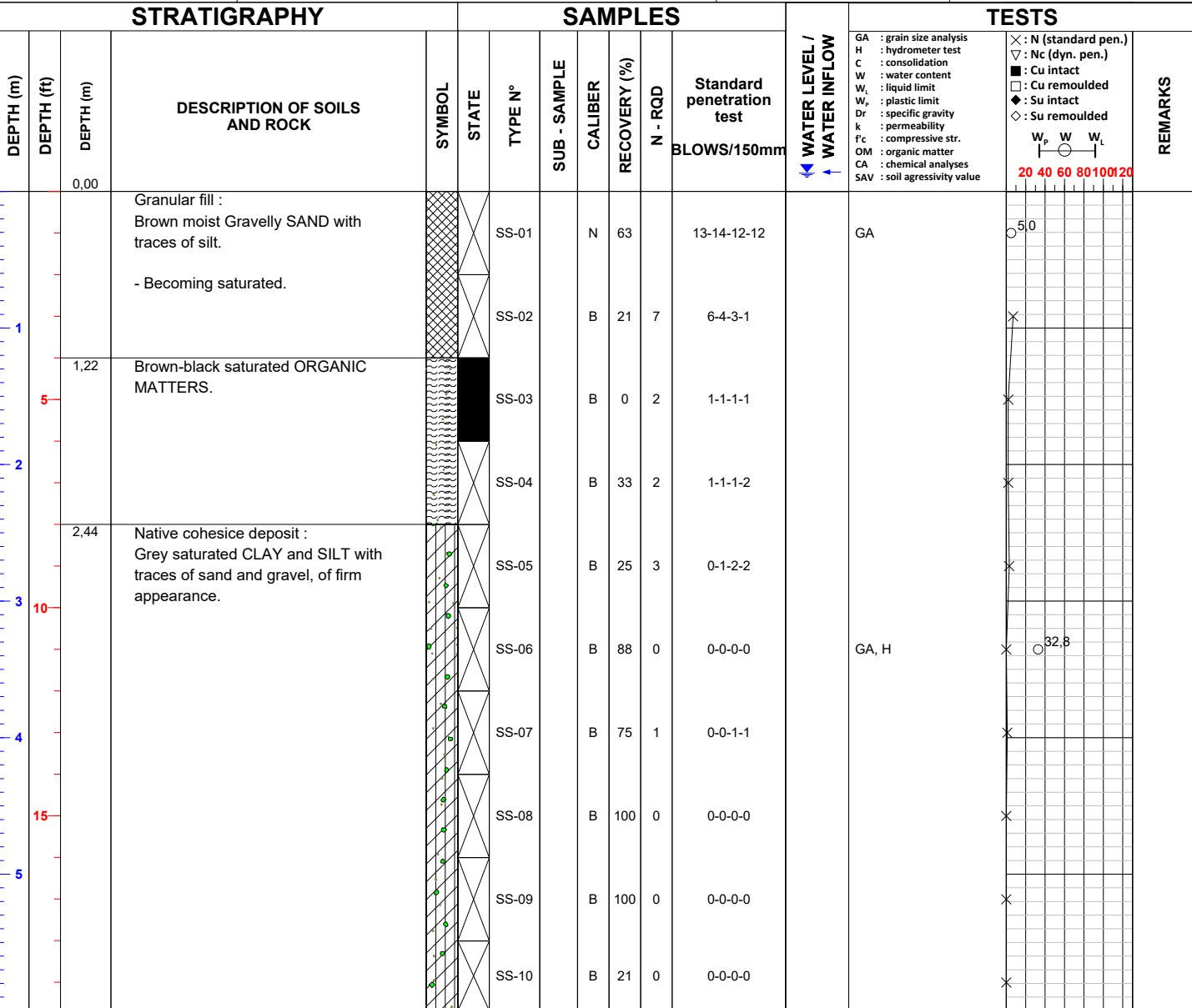
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STRATIGRAPHY			SAMPLES						TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
					SS-11		B		50	R	50 /13 cm		
7		6,86	Bedrock : Grey MONZONITE, of poor to excellent quality.			DC-12		NQ	82	42			
8						DC-13		NQ	100	100			
9		8,99	END OF BOREHOLE										
10													
11													
12													
13													
14													
15													
16													

f_c = 145,7 MPa
U.W. = 27.7 kN/m³

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation
Coordinate: X: 347 432 Y: 5 491 346
Geo. System: MTM-NAD83 **Zone:** 9
Borehole: BH22-20
Page: 1 of 2
Project No.: 158100425.500.710.6
Type of borehole: Hollow Stem Auger
Start date: 2022-09-01
Client: Cree Development Corporation
Equipment: CME 55
Inspector: A. Bogaert, tech.
Site: Grevet-Chapais Railway
Sampling type: B, N
Corer:
Figure: 01

SAMPLE TYPE SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	QUALITATIVE TERMINOLOGY Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	QUANTITATIVE TERMINOLOGY Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	SYMBOLS N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	GROUNDWATER <table border="1"> <thead> <tr> <th></th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table> Remarks :		Date	Depth	Reading 1		m	Reading 2		m																																														
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General remarks: Boreholes positionned on Site with a handheld GPS of 3 m precision.
Verified by: T. Coulaux, ing.
Date: 2023-04-04

STRATIGRAPHY				SAMPLES					TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS
		6,10	Grey saturated Silty CLAY with traces of sand, of soft appearance.			SS-11	B	100	0	0	0-0-0-0		GA, H	X
7						SS-12	B	100	1	1	0-0-1-2			X
		7,32	Grey saturated SILT and CLAY with traces of sand, low plasticity, of soft appearance.			SS-13	B	100	1	1	0-0-1-2			X H O 48,9
8	25					SS-14	B	17	0	0	0-0-0-8			X
9		9,14	Till deposit : Grey saturated Gravelly SILT with some clay and traces of sand, compact.			SS-15	B	29	16	16	13-10-6-3			X
10		9,91	Grey saturated Silty SAND with some gravel and traces of clay, compact to very dense.			SS-16	B	54	19	19	8-4-15-31			O 9,9
11	35					SS-17	B	100	R	R	16-50 / 8 cm			
12	40	11,43 11,51	Grey saturated GRAVEL with some silt and traces of sand. END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-18	B	67	R	R	50			
13														
14	45													
15	50													
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate: X: 348 756 Y: 5 491 771	Geo. System: MTM-NAD83 Zone: 9	Borehole: BH22-21
Project No.: 158100425.500.710.6	Type of borehole: Hollow Stem Auger		Page: 1 of 2
Client: Cree Development Corporation	Equipment: CME 55		Start date: 2022-09-01
Site: Grevet-Chapais Railway	Sampling type: B, N	Corer: 01	Inspector: A. Bogaert, tech.
			Depth: 10,06 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
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SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
<div style="display: flex; justify-content: space-between;"> <div> <p>Remoulded</p> <p>Intact (thin wall sampler)</p> <p>Lost</p> <p>Core (diamond rock core)</p> </div> <div> <p>COMPACTION</p> <p>Very loose</p> <p>Loose</p> <p>Compact</p> <p>Dense</p> <p>Very dense</p> </div> <div> <p>INDEX "N"</p> <p>0 - 4</p> <p>4 - 10</p> <p>10 - 30</p> <p>30 - 50</p> <p>> 50</p> </div> <div> <p>CONSISTENCY</p> <p>Very soft</p> <p>Soft</p> <p>Firm</p> <p>Stiff</p> <p>Very stiff</p> <p>Hard</p> </div> <div> <p>Cu OR Su (kPa)</p> <p>< 12</p> <p>12 - 25</p> <p>25 - 50</p> <p>50 - 100</p> <p>100 - 200</p> <p>> 200</p> </div> </div>	<p>QUALIFICATIVE</p> <p>Very poor</p> <p>Poor</p> <p>Fair</p> <p>Good</p> <p>Excellent</p>	<p>RQD</p> <p>< 25 %</p> <p>25 - 50 %</p> <p>50 - 75 %</p> <p>75 - 90 %</p> <p>90 - 100 %</p>	<p>Very tight < 20 mm</p> <p>Tight 20 - 60 mm</p> <p>Close 60 - 200 mm</p> <p>Moderately spaced 200 - 600 mm</p> <p>Spaced 600 - 2000 mm</p> <p>Very spaced 2000 - 6000 mm</p> <p>Wide > 6000 mm</p>

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW	TESTS	REMARKS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER				RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	
		0.00	Fill : Brown moist Gravelly SAND with some silt.												
		0.61	Brown moist SAND with some gravel and traces of silt.												
		1.22	Grey moist to saturated Gravelly SILT with some clay. - Presence of organic matters.												
		1.83	Native cohesive deposit : Grey-black saturated Clayey SILT with traces of sand, of soft appearance. - Presence of organic matters on top.												
		3.66	Grey saturated Silty CLAY with traces of sand, high plasticity, very high sensitivity, firm.												

General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by: T. Coulaux, ing.
	Date: 2023-04-04

STRATIGRAPHY				SAMPLES					TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
7													
		7.62	Till deposit : Grey saturated Gravelly and Sandy SILT with some clay, dense.			SS-09	B	100	0	0	0-0-0-0		
						SS-10	B			6	2-3-3-5		
8		8.38	Grey saturated GRAVEL and SAND with traces of clay, very loose.			SS-11	B	75	32		8-23-9-4		
						SS-12	B	63	2		2-1-1-1		
9		9.14	Grey saturated Gravelly SAND with some silt and traces of clay, loose.			SS-13	B	100	R		3-2-50 /8 cm	GA, H	
10		9.91 9.98	Grey saturated SAND and GRAVEL with traces of clay, very dense. END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-14	B	100	R		50 /8 cm		
11													
12													
13													
14													
15													
16													

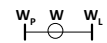

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : X : 350 015 Y : 5 492 789 Geo. System : MTM-NAD83 Zone: 9 Type of borehole : Hollow Stem Auger + Diamond Core Equipment : CME 55 Sampling type : B, N Corer : NQ	Borehole : BH22-22 Page : 1 of 2 Start date : 2022-09-02 Inspector : A. Bogaert, tech. Depth : 7,62 m
Project No.: 158100425.500.710.6	Figure : 01	
Client: Cree Development Corporation Site: Grevet-Chapais Railway		

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0,00	Fill : Brown moist SAND and GRAVEL with some silt.			SS-01		N	58		25-13-12-3	GA	
		0,61	Brown moist Gravelly SAND with traces of silt.			SS-02		B	46	31	5-8-23-16		
		1,22	Brown moist to saturated Sandy GRAVEL with traces of silt.			SS-03		B	38	19	7-9-10-15		
		1,83	Brown saturated SAND with traces of gravel and silt.			SS-04		B	46	12	15-11-1-13	GA	
		2,44	Brown saturated Gravelly SAND with some silt.			SS-05		B	21	23	14-10-13-11		
						SS-06		B	63	16	11-9-7-12		
						SS-07		B	33	12	8-6-6-7		
						SS-08		B	54	13	7-6-7-8	GA	
		4,88	Brown saturated Sandy GRAVEL with some silt.			SS-09		B	17	12	4-7-5-4		
		5,49	Brown saturated SAND and GRAVEL with traces of silt.			SS-10		B	21	R	2-7-50 /5 cm		
		5,84											

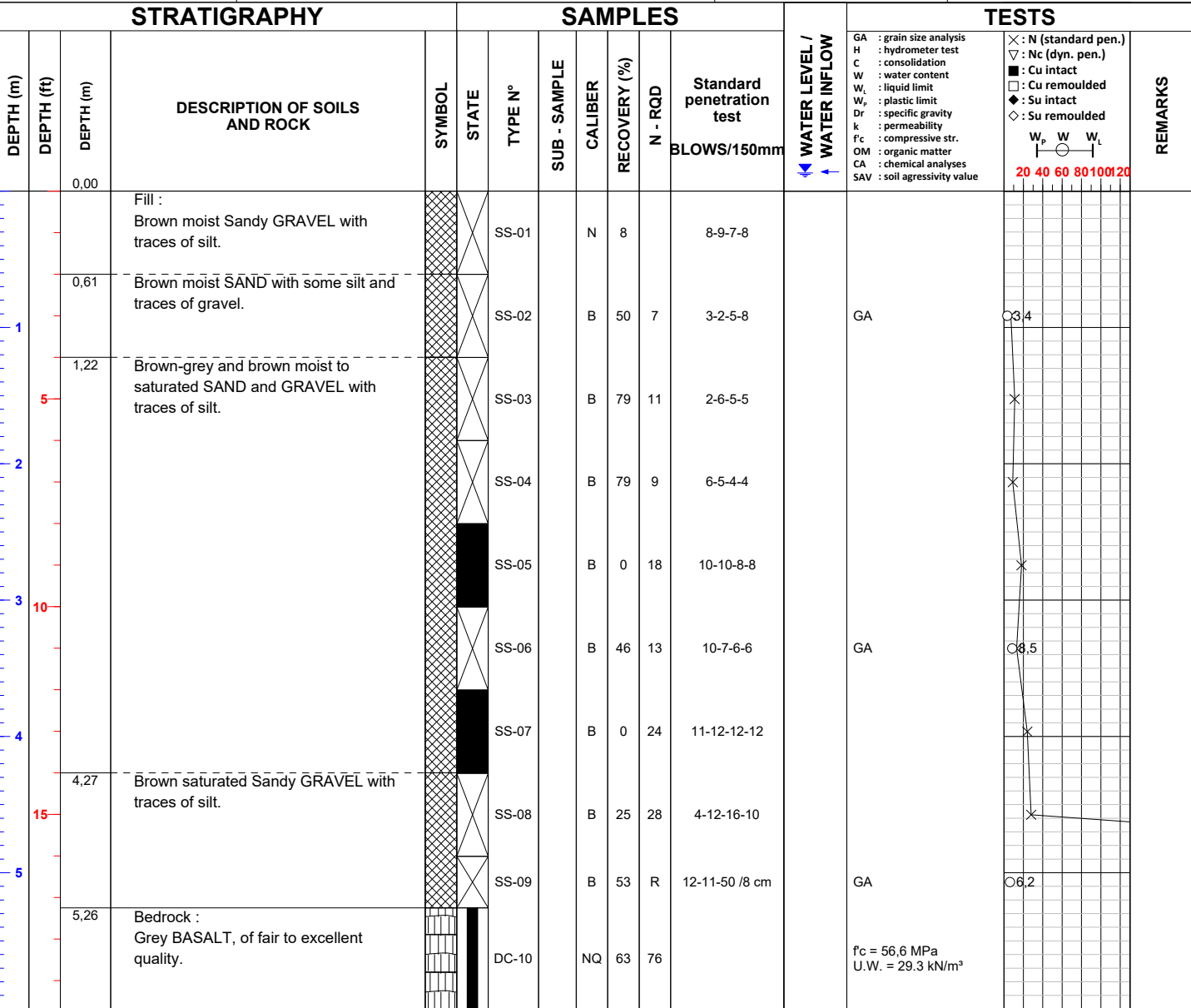
General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : _____ T. Coulaux, ing. Date : 2023-04-10
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STRATIGRAPHY			SAMPLES						TESTS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value × : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded  20 40 60 80 100 120	REMARKS
			Bedrock : Grey BASALT, of poor to excellent quality.			DC-11		NQ	100	40				
7						DC-12		NQ	100	95				
		7.62	END OF BOREHOLE											
25														
8														
9														
30														
10														
35														
11														
40														
12														
45														
13														
50														
14														
15														
50														
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : X : 350 071 Y : 5 492 802	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-23
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger + Diamond Core	Equipment : CME 55	Page : 1 of 2
Client: Cree Development Corporation	Sampling type : B, N	Corer : NQ	Start date : 2022-09-03
Site: Grevet-Chapais Railway	Figure : 01	Inspector : A. Bogaert, tech.	Depth : 7,92 m


SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50 CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by: T. Coulaux, ing.
Date: **2023-04-10**

STRATIGRAPHY				SAMPLES						TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm		WATER LEVEL / WATER INFLOW
													
							DC-10	NQ	63	76			
							DC-11	NQ	100	98			
		7.92	END OF BOREHOLE										
7													
		25											
8													
		30											
9													
		35											
10													
		40											
11													
		45											
12													
		50											
13													
14													
15													
16													

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate: X : 352 238 Y : 5 493 577	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-24
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger + Diamond Core	Equipment : CME 55	Page : 1 of 2
Client: Cree Development Corporation	Sampling type : B, N	Corer : NQ	Start date : 2022-09-03
Site: Grevet-Chapais Railway	Figure : 01	Inspector : A. Bogaert, tech.	Depth : 10,67 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION INDEX "N" Very loose 0 - 4 Loose 4 - 10 Compact 10 - 30 Dense 30 - 50 Very dense > 50	CONSISTENCY Very soft < 12 Soft 12 - 25 Firm 25 - 50 Stiff 50 - 100 Very stiff 100 - 200 Hard > 200	QUALIFICATIVE RQD Very poor < 25 % Poor 25 - 50 % Fair 50 - 75 % Good 75 - 90 % Excellent 90 - 100 %

STRATIGRAPHY			SAMPLES					TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)		N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
		0.00	Fill : Brown to brown-black moist Gravelly SAND with traces of silt. - Presence of organic matters.										
		1.22	Native cohesive deposit : Grey-black moist to saturated Clayey SILT with some sand and traces of gravel, of stiff appearance.										
		2.44	Grey saturated Clayey SILT with some sand, of firm appearance.										
		3.05	Grey saturated CLAY and SILT with traces of gravel and sand, of firm appearance.										
		3.66	Grey saturated Sandy and Clayey SILT, of firm appearance.										
		4.27	Grey saturated Clayey SILT with traces of sand, of soft appearance.										
		4.88	Grey saturated SILT and CLAY with traces of sand, medium plasticity, of soft appearance.										





General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by: T. Coulaux, ing.
Date: **2023-04-10**

STRATIGRAPHY				SAMPLES					TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
7													
		7,32	Grey saturated Silty and Sandy CLAY, of firm appearance.										
		25											
		7,92	Till deposit : Grey saturated Clayey and Gravelly SAND with traces of silt, compact.										
8		8,53	Grey saturated Gravelly SAND with traces of silt and clay, compact to very dense.										
		9,25	Bedrock : Grey BASALT, of good quality. - Presence of quartz veins.										
9		30											
		10,67	END OF BOREHOLE										
10													
		35											
		40											
11													
		45											
12													
		50											
13													
		55											
14													
		60											
15													
		65											
16													
		70											
		75											
		80											
		85											
		90											
		95											
		100											

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate: X : 354 247 Y : 5 494 955	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-25
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger + Diamond Core	Equipment : CME 55	Page : 1 of 2
Client: Cree Development Corporation	Sampling type : B, N	Figure : 01	Start date : 2022-09-04
Site: Grevet-Chapais Railway	Corer : NQ		Inspector : A. Bogaert, tech.
			Depth : 10,52 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											
				Remarks :									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
   	COMPACTION INDEX "N" Very loose 0 - 4 Loose 4 - 10 Compact 10 - 30 Dense 30 - 50 Very dense > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	QUALIFICATIVE RQD Very poor < 25 % Poor 25 - 50 % Fair 50 - 75 % Good 75 - 90 % Excellent 90 - 100 %
	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm	

STRATIGRAPHY			SAMPLES					WATER LEVEL / WATER INFLOW	TESTS	REMARKS								
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE				CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm				
		0.00	Fill : Brown moist Gravelly SAND with some silt. - Presence of boulders.															
		1.22	Brown moist to saturated Gravelly SAND with traces of silt.															
		2.44	Brown saturated Sandy GRAVEL with traces of silt.															
		3.05	Brown saturated SAND and GRAVEL with traces of silt.															
		3.66	Brown saturated Gravelly SAND with traces of silt.															
		4.88	Brown saturated Gravelly SAND with traces of silt.															

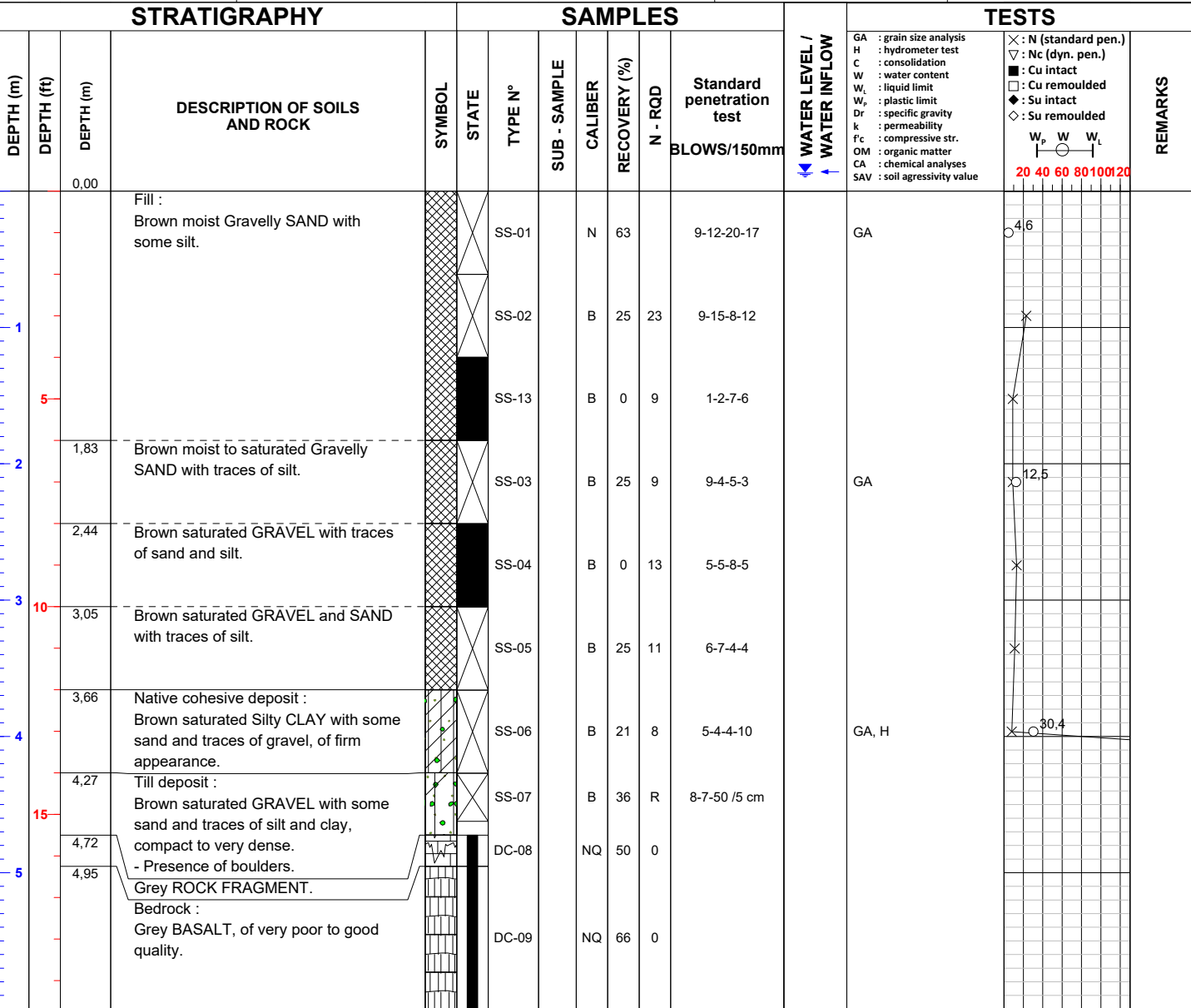
General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : T. Coulaux, ing.
	Date : 2023-04-05

STRATIGRAPHY			SAMPLES						TESTS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS	REMARKS
													GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ∇ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded 	
		6,71	Brown saturated SAND and GRAVEL with some silt and traces of clay. - Presence of wood.			SS-11	B	50	25		13-10-15-15		X	
7						SS-12	B	21	15		14-7-8-7		X	
		25				SS-13	B	13	17		5-8-9-11		X	
8						SS-14	B	8	14		15-7-7-8		X	
						SS-15	B	13	R		10-50 / 8 cm			
9		8,92	Bedrock : Grey BASALT, of fair quality.			DC-16	NQ	86	54					
30						DC-17	NQ	95	72					
10		10,52	END OF BOREHOLE											
35														
11														
12		40												
13														
14		45												
15		50												
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : X : 354 337 Y : 5 494 954 Geo. System : MTM-NAD83 Zone: 9 Type of borehole : Hollow Stem Auger + Diamond Core Equipment : CME 55 Sampling type : B, N Corer : NQ	Borehole : BH22-26 Page : 1 of 2 Start date : 2022-09-04 Inspector : A. Bogaert, tech. Depth : 8,69 m
Project No.: 158100425.500.710.6	Figure : 01	
Client: Cree Development Corporation		
Site: Grevet-Chapais Railway		

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard
	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %
			JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.

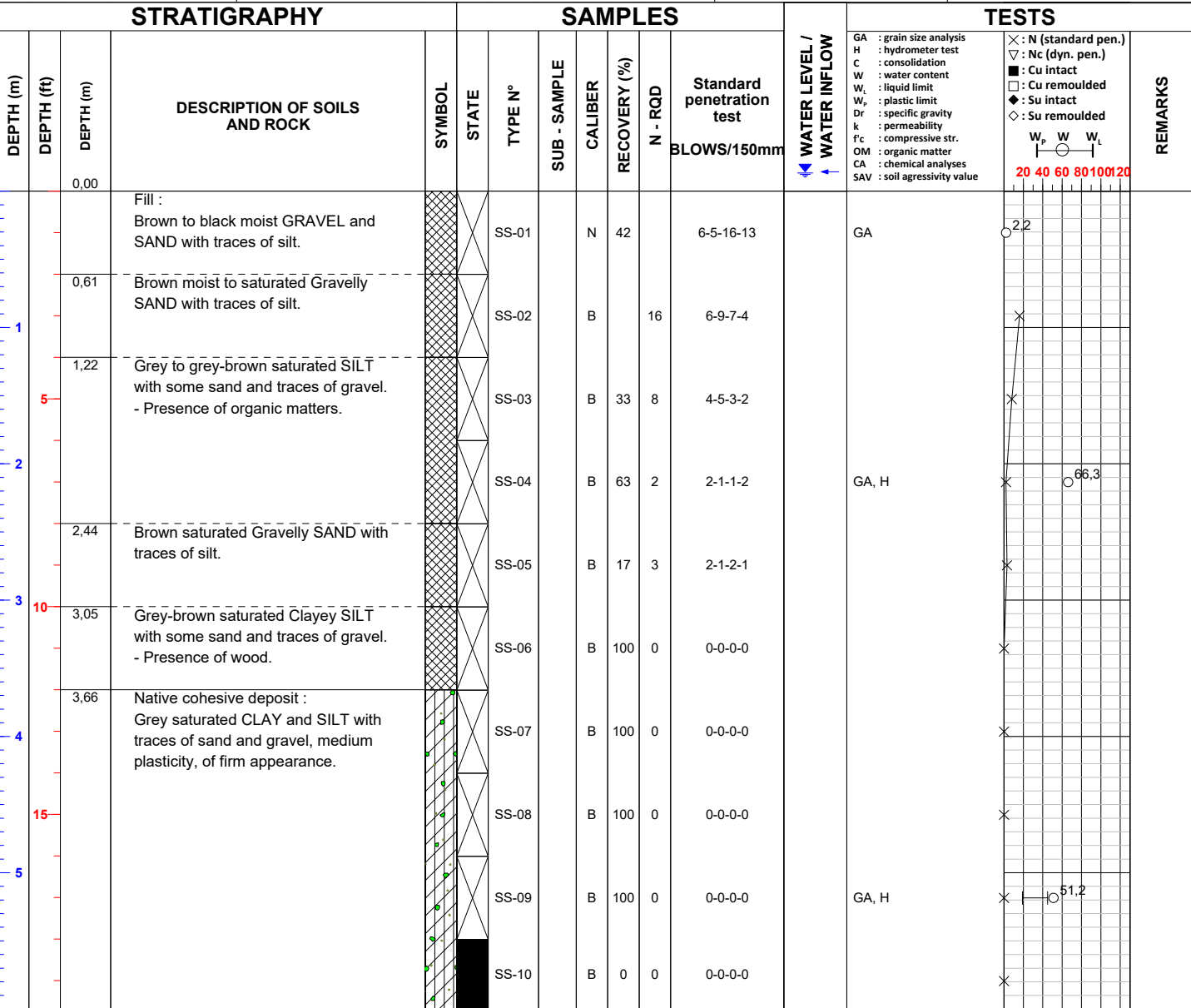
Verified by : T. Coulaux, ing.
Date : 2023-04-04

STRATIGRAPHY			SAMPLES						TESTS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ∇ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W _p W W _L 20 40 60 80 100 120	REMARKS
7														
	25						DC-10	NQ	100	20				
8							DC-11	NQ	100	0				
							DC-12	NQ	100	83				
		8.69	END OF BOREHOLE										f _c = 63,1 MPa U.W. = 28.3 kN/m ³	
9	30													
10														
	35													
11														
12	40													
13														
	45													
14														
	50													
15														
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : X : 359 877 Y : 5 496 801 Geo. System : MTM-NAD83 Zone: 9 Type of borehole : Hollow Stem Auger Equipment : CME 55 Sampling type : B, N Corer :	Borehole : BH22-27 Page : 1 of 2 Start date : 2022-09-05 Inspector : A. Bogaert, tech. Depth : 14,99 m Figure : 01
Project No.: 158100425.500.710.6	Client: Cree Development Corporation Site: Grevet-Chapais Railway	

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by : _____
 T. Coulaux, ing.
 Date : 2023-04-04

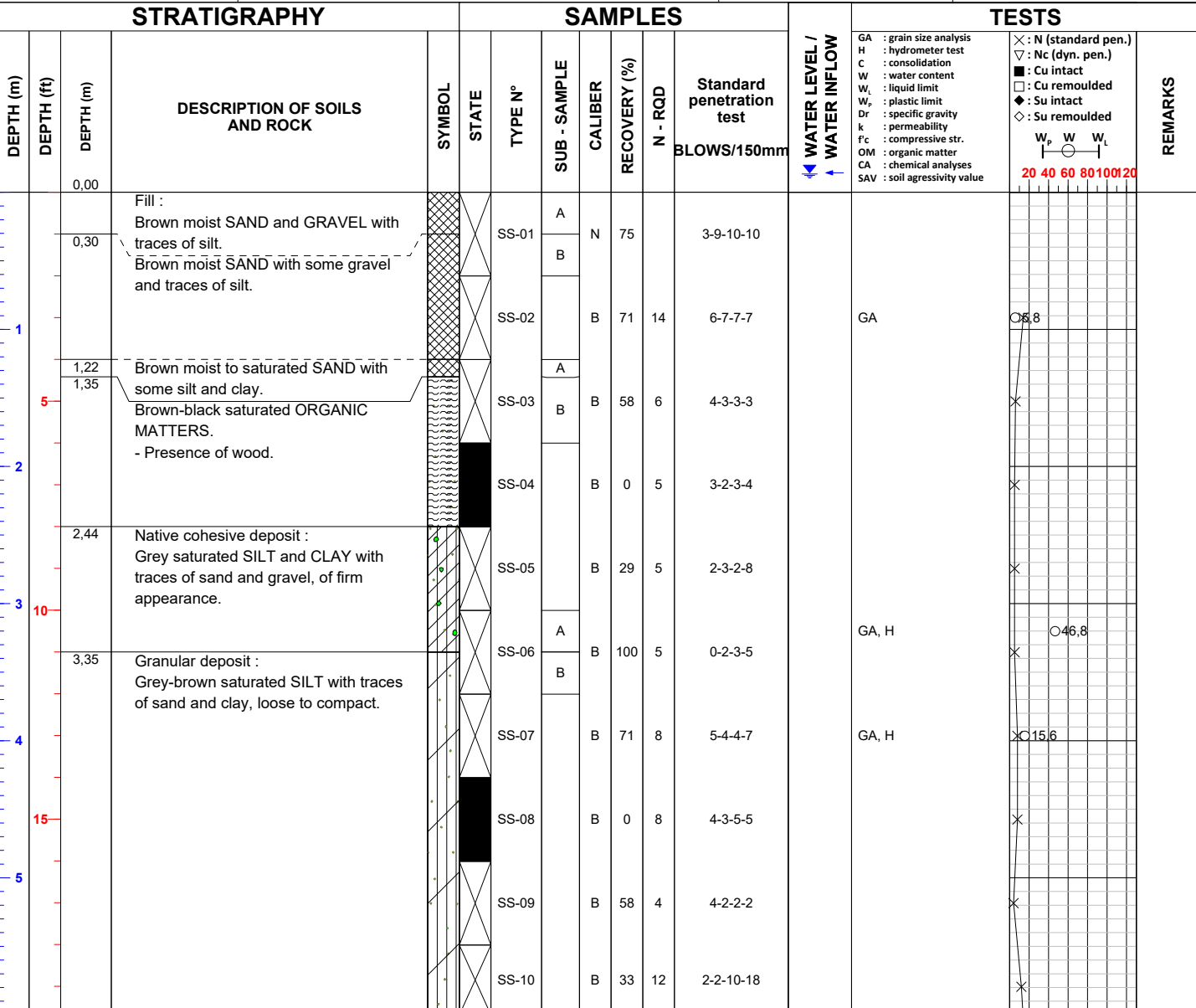
STRATIGRAPHY				SAMPLES					TESTS		REMARKS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS	
													GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W _p W W _L		
		6,71	Grey saturated CLAY with some silt and traces of gravel and sand.			SS-11	B	25	0	0	0-0-0-0				
7						SS-12	B	100	0	0	0-0-0-0				
		25				SS-13	B	100	0	0	0-0-0-0				
8															
		8,38	Grey saturated Sandy and Silty CLAY.			SS-14	B	100	0	0	0-0-0-0				
9															
		30				SS-15	B	54	0	0	0-0-0-0				
10															
		9,14	Grey saturated Sandy CLAY with some silt and traces of gravel.			SS-16	B	33	0	0	0-0-0-0				
11															
		35				SS-17	B	21	0	0	0-0-0-0				
12															
		11,43	Grey saturated Sandy and Clayey SILT with traces of gravel, loose.			SS-18	B	21	7	7	1-3-4-2				
13															
		40	Till deposit : Grey saturated SAND and GRAVEL with some clay and traces of silt, compact.			SS-19	B	25	14	14	5-8-6-6				
14															
		12,95	Grey saturated Gravelly SAND with some silt and traces of clay, compact.			SS-20	B	42	11	11	11-6-5-6				
15															
		45				SS-21	B	46	17	17	3-6-11-5				
16															
		14,33	End of sampling. Start of dynamic penetration test (Pen-Test).												
		50	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)												

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW		TESTS			
		6,25	Granular deposit : Grey saturated SILT with some sand and traces of clay, loose.				A						GA, H	<ul style="list-style-type: none"> GA : grain size analysis H : hydrometer test C : consolidation W : water content W_L : liquid limit W_p : plastic limit Dr : specific gravity k : permeability f_c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value 			
		6,86	Grey-brown saturated Silty SAND with traces of clay, loose to very loose.				SS-11	B	100	7	1-4-3-5						<ul style="list-style-type: none"> × : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded
		8,23	End of sampling. Start of dynamic penetration test (Pen-Test).				SS-12	B	50	5	1-3-2-3						
		13,72	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)	SS-13	B	54	4	2-2-2-2									

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 370 255 Y : 5 501 717	Borehole : BH22-29 Page : 1 of 2 Start date : 2022-09-03 Inspector : H. Desrochers, CPI Depth : 8,23 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
	Corer :	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard
	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %
			JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.

Verified by: T. Coulaux, ing.
Date: 2023-04-10

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW		TESTS
		6,10	Grey-brown saturated Gravelly SAND with some silt, compact.											
7					SS-11			B	42	17	13-7-10-7	GA	○154	
		25	- Presence of cobbles.		SS-12			B	25	20	14-10-10-19		×	
8				SS-13			B	33	21	5-7-14-29		×		
		8,23	END OF BOREHOLE											
9		30												
10														
		35												
11														
		40												
12														
		45												
13														
		50												
14														
		55												
15														
		60												
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 386 432 Y : 5 506 562	Borehole : BH22-30 Page : 1 of 2 Start date : 2022-09-03 Inspector : H. Desrochers, CPI Depth : 14,63 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
Corer :		Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard
	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %
			JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0.00	Fill :										
		0.61	Brown moist GRAVEL and SAND with traces of silt. - Presence of cobbles.			SS-01		N	50		14-19-20-13	GA	6.8
			Brown moist SAND with traces to some gravel and traces of silt.			SS-02		B	71	14	10-8-6-3		
						SS-03		B	42	7	2-4-3-2		
		1.83	Grey moist to saturated some to Gravelly SAND with traces of silt.			SS-04		B	42	6	5-4-2-3	GA	11.5
						SS-05		B	50	3	3-1-2-2		
						SS-06		B	42				
			- Presence of cobbles.			SS-07		B	38	14	7-7-7-5		
		4.39	Brown-black saturated ORGANIC MATTERS.			SS-08	A	B	46	4	5-2-2-3		
						SS-09	B	B	50	6	6-2-4-4		
						SS-10	B	B	75	10	4-4-6-5		

General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by: T. Coulaux, ing.
Date: 2023-04-10

STRATIGRAPHY				SAMPLES					TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W _p W W _L		
		6,10	Native cohesive deposit : Grey saturated Clayey SILT with traces of sand, of firm appearance. Grey saturated CLAY and SILT with traces of sand, average plasticity, sensitivity clay, firm.		SS-11		A	B	71	5		2-4-1-1				
		6,40					B									
7																
					SS-12			B	29	3		1-1-2-1				
8																
					SS-13			B	42	3		2-1-2-3				
8																
					SS-14			B	83	0		0-0-0-0				
9																
					ST-15			B	100							
10																
			Till deposit : Grey saturated SAND with some silt and traces of clay, loose.		SS-16			B	71	5		3-1-4-3				
11																
			Grey saturated Gravelly SAND with traces of silt, compact. - Presence of boulders.		SS-17			B	29	13		4-4-9-13				
12																
					SS-18			B	75	10		6-5-5-34				
13																
					SS-19			B	58	18		11-9-9-5				
14																
			END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)		SS-20			B	100	R		50 / 13 cm				
14																
15																
16																

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 386 503 Y : 5 506 567	Borehole : BH22-31 Page : 1 of 2 Start date : 2022-09-02 Inspector : H. Desrochers, CPI Depth : 12,45 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
Corer :		Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard
	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %
			JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW	TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER		RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	Wp	W
		0.00	Fill : Grey-brown to brown moist SAND and GRAVEL with traces of silt.												
		1	- Presence of cobbles.												
		5													
		1.83	Brown-grey moist to saturated SAND with some gravel and traces of silt.				A								
		1.93		Brown saturated Clayey and Sandy SILT with some gravel.				B							
		2.44	Grey-brown saturated Clayey SILT with some gravel and silt.												
		3	- Presence of organic matters.												
		10													
		3.66	Brown-black saturated ORGANIC MATTERS. - Presence of wood.												
		4													
		15													
		5													
		5.49	Native cohesive deposit : Grey saturated CLAY and SILT with traces of sand, high plasticity, of firm												

General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by : _____ T. Coulaux, ing.
	Date : 2023-04-10

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
			appearance.										
7		6,86	Grey saturated CLAY with some silt and sand and traces of gravel, of firm appearance. - Presence of wood.			TS-11	B		0				
		25				SS-12	B		46	3	0-0-3-10		
8		7,62	Till deposit : Grey saturated Gravelly SAND with traces of silt and clay, compact.			SS-13	B		21	16	18-9-7-3		
		30				SS-14	B		67	40	13-16-24-31		
9		9,14	Grey Silty SAND with traces of gravel and clay, dense to very dense.			SS-14	B		67	40	13-16-24-31		
10		35				SS-15	B		100	R	50 /15 cm		
11		40	- Presence of boulders.			SS-16	B		70	R	49-50 /10 cm		
12		12,45	END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)										
13		45											
14		50											
15													
16													

GA : grain size analysis
 H : hydrometer test
 C : consolidation
 W : water content
 W_L : liquid limit
 W_p : plastic limit
 Dr : specific gravity
 k : permeability
 f_c : compressive str.
 OM : organic matter
 CA : chemical analyses
 SAV : soil aggressivity value

X : N (standard pen.)
 ∇ : Nc (dyn. pen.)
 ■ : Cu intact
 □ : Cu remoulded
 ◆ : Su intact
 ◇ : Su remoulded

W_p W W_L

20 40 60 80 100 120

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 9 X : 399 987 Y : 5 509 521	Borehole : BH22-32 Page : 1 of 3 Start date : 2022-08-29 Inspector : H. Desrochers, CPI Depth : 17,37 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
Corer :		Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	
		0.00	Granular fill : Grey-brown moist Sandy GRAVEL with traces of silt.			SS-01	N	42			4-5-8-6	GA	
		0.61	Black moist Gravelly SAND with traces of silt.			SS-02	B	42	9		6-5-4-4		
		1.83	Brown moist SAND with traces of silt. - Traces of oxidation.			SS-03	B	38	6		5-3-3-2	GA	
		3.05	Grey moist to saturated GRAVEL with some sand and traces of silt.			SS-04	B	54	4		3-2-2-3		
		3.66	Brown saturated GRAVEL with traces of sand and silt.			SS-05	B	38	1		2-0-1-2		
		4.88	Brown-grey saturated SAND with some gravel and traces of silt.			SS-06	B	33	6		4-3-3-2		
		5.49	Native cohesive deposit : Brown saturated Silty and Sandy			SS-07	B	50	6		5-3-3-6		
						SS-08	B	8	5		5-4-1-1		
						SS-09	B	33	2		2-0-2-2	GA	
						SS-10	B	29	7		4-3-4-3		

General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by : T. Coulaux, ing.
Date : 2023-04-04

STRATIGRAPHY				SAMPLES					TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
			CLAY, of firm appearance. - Presence of organic matters.										
		6,86	Grey-brown saturated Clayey SILT with some sand, of firm appearance.			SS-11	B	50	3		1-2-1-2		
7						SS-12	B	79	3		1-1-2-2		
		25				SS-13	B	58	5		4-3-2-0		
8						SS-14	A						
		8,71	Grey saturated Clayey SILT with traces of sand, low plasticity, high sensitivity, firm.			SS-14	B	75	6		2-3-3-1		
9						SS-15	B	100	0		0-0-0-0		
		30				ST-16	B	100					
10						SS-17	B	100	0		0-0-0-0		
		35				SS-18	B	100	0		0-0-0-0		
11						SS-19	B	21	9		3-3-6-3		
		40				SS-20	B	25	30		13-14-16-8		
12													
		45											
13													
		50	Till deposit : Grey saturated SAND with some silt and traces of gravel and clay, dense.										
14													
		50											
15													
		15,24											
16													

STRATIGRAPHY				SAMPLES						WATER LEVEL / WATER INFLOW		TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS		
55			- Presence of boulders and cobbles.												
17						SS-21		B	17	48	32-27-21-9				
		17,37	END OF BOREHOLE												
18															
60															
19															
65															
20															
21															
70															
22															
75															
23															
80															
24															
85															
25															
26															



















Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation Project No.: 158100425.500.710.6 Client: Cree Development Corporation Site: Grevet-Chapais Railway	Coordinate: X : 400 075 Y : 5 509 514 Type of borehole: Hollow Stem Auger Equipment: CME 55 Sampling type: B, N Corer:	Geo. System: MTM-NAD83 Zone: 9 Borehole: BH22-33 Page: 1 of 3 Start date: 2022-08-28 Inspector: H. Desrochers, CPI Depth: 18,34 m Figure: 01
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SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER						
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1" style="width:100%"> <tr> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td>m</td> </tr> </table> Remarks :	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	m									

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS			ROCK QUALITY DESIGNATION		JOINTS SPACING	
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense	INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50	CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard	Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent	RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm

STRATIGRAPHY			SAMPLES					WATER LEVEL / WATER INFLOW	TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE		CALIBER	RECOVERY (%)		N - RQD	Standard penetration test BLOWS/150mm
		0.00	Fill :										
		0.61	Brown-grey moist GRAVEL and SAND with traces of silt. - Presence of organic matters.			SS-01	N	54			4-3-5-3	GA	8.0
1			Brown moist SAND with some gravel and traces of silt. - Presence of wood.			SS-02	B	42	7		2-5-2-2		
		1.22	Brown moist SAND with some silt and gravel. - Traces of oxidation.			SS-03	B	42	14		8-9-5-3		
2			 - Becoming saturated. - Traces of oxidation.			SS-04	B	46	7		4-4-3-3		
		3.05	Brown-grey saturated SAND and GRAVEL with traces of silt.			SS-05	B	38	6		5-4-2-3	GA	9.6
3						SS-06	B	33	20		4-11-9-3		
		3.81	Brown to grey saturated SAND with some gravel and some to traces of silt.			SS-07	B	50	6		5-4-2-1		
4						SS-08	B	33	20		14-10-10-6		
5			- Presence of boulders and cobbles.			SS-09	B	0	1		2-1-0-0		

General remarks: Boreholes positioned on Site with a handheld GPS of 3 m precision.	Verified by: _____ T. Coulaux, ing. Date: 2023-04-04
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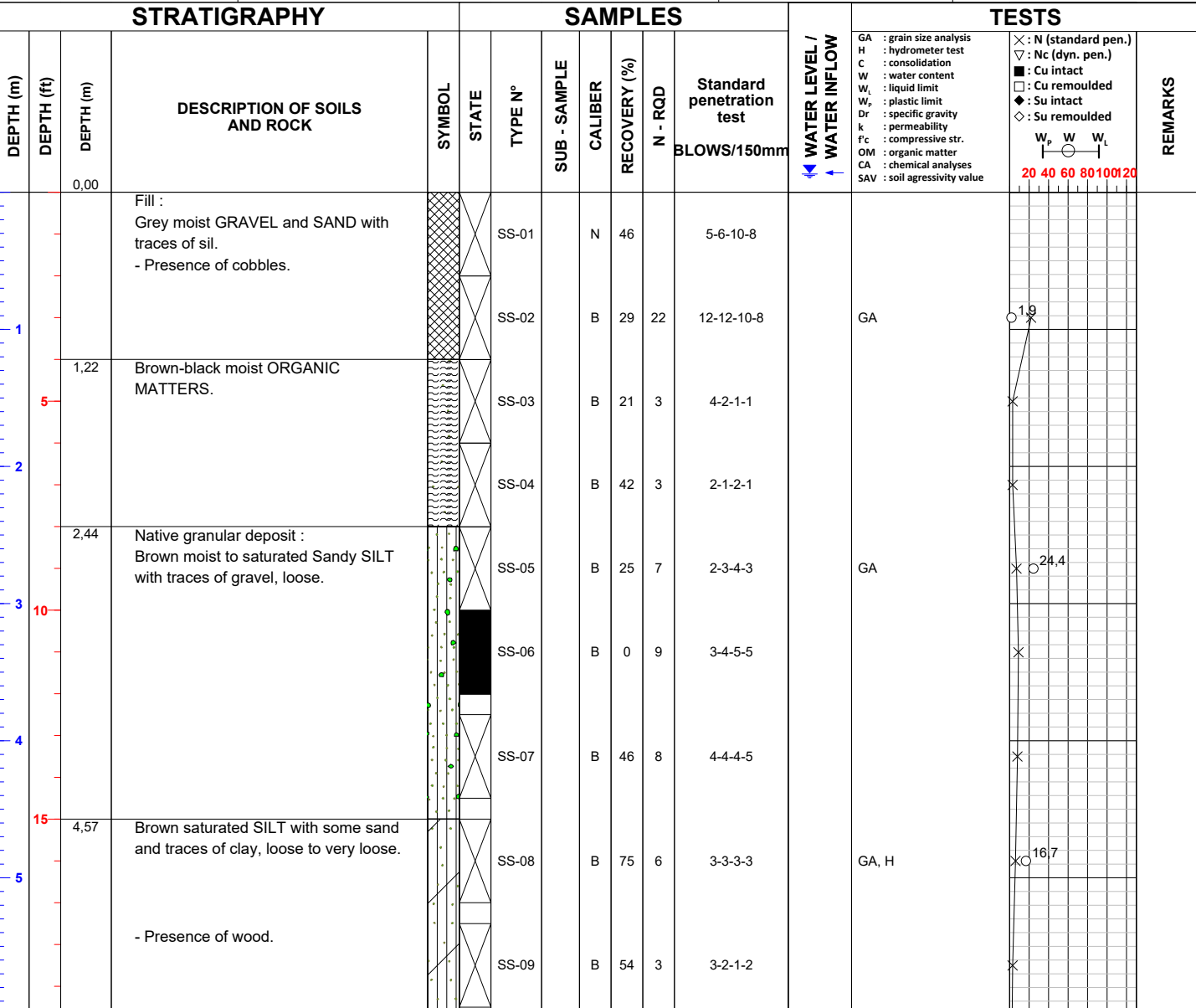
STRATIGRAPHY			SAMPLES						TESTS		REMARKS								
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value X : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded 					
		6.10 6.22	Grey saturated Gravelly SAND with traces of silt. Brown-black saturated ORGANIC MATTERS.		SS-10		A	B	54	3	7-2-1-2								
		6.86					B							42	12	1-5-7-6			
7			Native cohesive deposit : Brown-grey to grey saturated SILT with some to traces of clay and traces of sand, of firm appearance.		SS-11			B	42	12	1-5-7-6	GA	 23,9						
														SS-12	B	58	7	2-3-4-3	
8														SS-13	B	63	14	6-7-7-9	
		10,67	Grey saturated CLAY and SILT with traces of sand, medium plasticity, of firm appearance.		SS-14			B	100	0	0-0-0-0								
11														SS-15	B	100	0	0-0-0-0	
			Till deposit : Grey saturated Clayey and Silty SAND with some clay, loose to compact.		ST-16			B	100		0-0-0-0	GA, H	 59,4  2,2  61  30,9						
13														SS-17	B	58	4	2-2-2-2	
		13,72			SS-18			B	58	10	6-6-4-6	U.W = 19.0 kN/m³							
14														SS-18	B	58	10	6-6-4-6	
15																			
16																			

STRATIGRAPHY			SAMPLES						TESTS						
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW	TESTS	REMARKS	
55	17	16,76	Grey saturated SAND with some silt and gravel and traces of clay, compact.			SS-19	B	63	17	7-8-9-11			<ul style="list-style-type: none"> GA : grain size analysis H : hydrometer test C : consolidation W : water content W_L : liquid limit W_p : plastic limit Dr : specific gravity k : permeability f_c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value 	<ul style="list-style-type: none"> × : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded 	
60	19	18,29 18,34	Grey saturated Sandy GRAVEL with traces of silt and clay. - Presence of cobbles. END OF BOREHOLE (Refusal on inferred bedrock, very dense soil and/or boulders)			SS-20	B	100	R	50 /5 cm			<p>20 40 60 80 100 120</p>		
65	20														
70	21														
75	22														
80	23														
85	24														
	25														
	26														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate: X: 412 177 Y: 5 513 314	Geo. System : MTM-NAD83 Zone: 9	Borehole : BH22-34
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger + Diamond Core		Page : 1 of 2
Client: Cree Development Corporation	Equipment : CME 55		Start date : 2022-09-01
Site: Grevet-Chapais Railway	Sampling type : B, N		Inspector : H. Desrochers, CPI
	Corer : NQ	Figure : 01	Depth : 11,58 m

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION INDEX "N" Very loose 0 - 4 Loose 4 - 10 Compact 10 - 30 Dense 30 - 50 Very dense > 50	CONSISTENCY Very soft < 12 Soft 12 - 25 Firm 25 - 50 Stiff 50 - 100 Very stiff 100 - 200 Hard > 200	QUALIFICATIVE RQD Very poor < 25 % Poor 25 - 50 % Fair 50 - 75 % Good 75 - 90 % Excellent 90 - 100 %



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

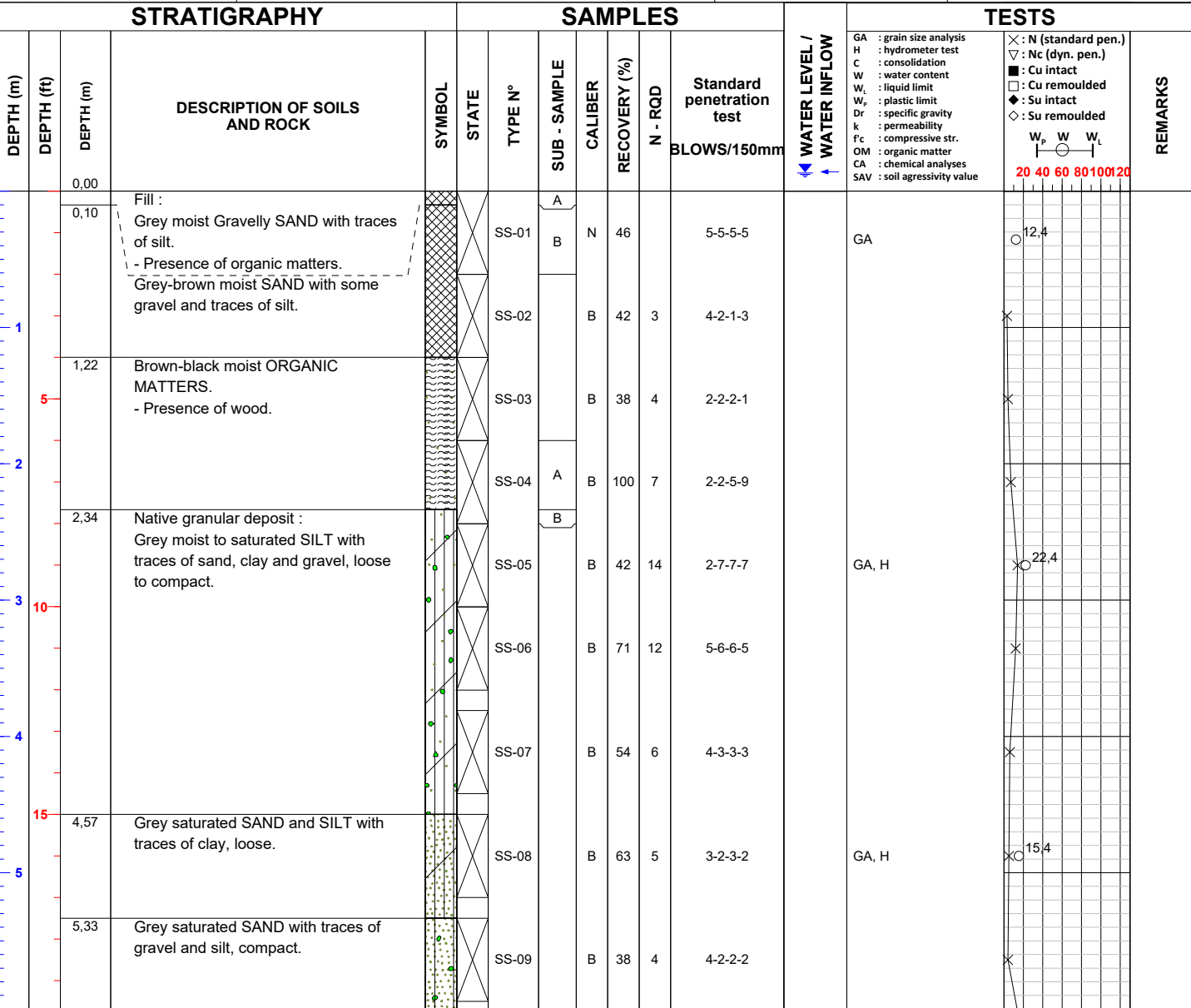
Verified by : T. Coulaux, ing.
Date : **2023-04-05**

STRATIGRAPHY				SAMPLES					WATER LEVEL / WATER INFLOW		TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW		TESTS
		6,10	Brown saturated SAND with some silt and gravel, very loose.			SS-10	B	50	2		2-1-1-3		<ul style="list-style-type: none"> GA : grain size analysis H : hydrometer test C : consolidation W : water content W_L : liquid limit W_p : plastic limit Dr : specific gravity k : permeability f_c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value 	<ul style="list-style-type: none"> × : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded
7						SS-11	B	50	3		2-2-1-1			
		7,62	Grey saturated SAND with traces of silt, very loose.			SS-12	B	54	2		1-1-1-1			
8						SS-13	B	50	21		15-11-10-14			
		9,14	Till deposit : Grey saturated GRAVEL and SAND with some silt, compact. - Presence of boulders and cobbles.			SS-13	B	50	21		15-11-10-14			
9						DC-14	NQ	100	52					
		9,98	Bedrock : Grey BASALT, of fair quality.			DC-14	NQ	100	52					
10														
		11,58	END OF BOREHOLE											
11														
		40												
12														
		45												
13														
		50												
14														
		50												
15														
		50												
16														

Project: La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation	Coordinate : Geo. System : MTM-NAD83 Zone: 8 X : 197 458 Y : 5 514 172	Borehole : BH22-35 Page : 1 of 2 Start date : 2022-08-31 Inspector : H. Desrochers, CPI Depth : 9,19 m
Project No.: 158100425.500.710.6	Type of borehole : Hollow Stem Auger + Diamond Core	
Client: Cree Development Corporation	Equipment : CME 55	
Site: Grevet-Chapais Railway	Sampling type : B, N	
	Corer : NQ	Figure : 01

SAMPLE TYPE	QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	SYMBOLS	GROUNDWATER									
SS Split spoon CS Continuous sampling DC Diamond rock core AS Auger TW Thin wall sampler ST Shelby tube MA Manual sample	Clay < 0.002 mm Silt 0.002 - 0.08 mm Sand 0.08 - 5 mm Gravel 5 - 80 mm Cobbles 80 - 200 mm Boulders > 200 mm	Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	N Standard penetration value (ASTM D 1586) Nc Dynamic cone penetration value (BNQ 2501-145) RQD Rock Quality Designation (%)	<table border="1"> <thead> <tr> <th>Reading</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td>Reading 1</td> <td></td> <td>m</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>m</td> </tr> </tbody> </table>	Reading	Date	Depth	Reading 1		m	Reading 2		m
Reading	Date	Depth											
Reading 1		m											
Reading 2		m											

SAMPLE STATE	MECHANIC CHARACTERISTICS OF SOILS	ROCK QUALITY DESIGNATION	JOINTS SPACING
Remoulded Intact (thin wall sampler) Lost Core (diamond rock core)	COMPACTION Very loose Loose Compact Dense Very dense INDEX "N" 0 - 4 4 - 10 10 - 30 30 - 50 > 50 CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	QUALIFICATIVE Very poor Poor Fair Good Excellent RQD < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm



General remarks: **Boreholes positioned on Site with a handheld GPS of 3 m precision.**

Verified by : T. Coulaux, ing.
Date : **2023-04-05**

STRATIGRAPHY				SAMPLES					TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
												GA : grain size analysis H : hydrometer test C : consolidation W : water content W _L : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses SAV : soil agressivity value	× : N (standard pen.) ∇ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded
7			- Presence of cobbles.		SS-10		B	54	24	7-14-10-12		 	
8	7,67		Bedrock : Grey-greenish BASALT, of poor quality.				DC-12	NQ	100	48			
9	30	9,19	END OF BOREHOLE										
10													
11	35												
12	40												
13													
14	45												
15	50												
16													

Appendix D Laboratory Test Results



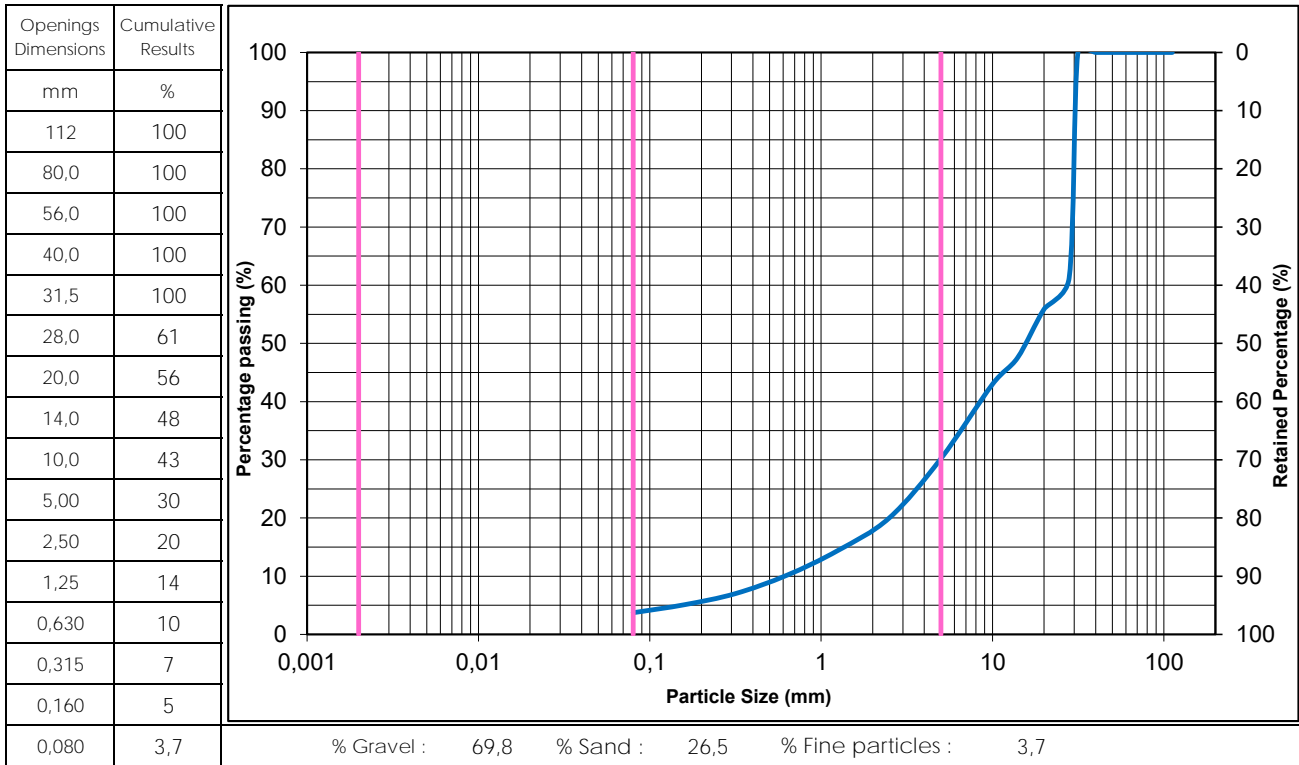
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 30, 2022

Project No : 158100425.500.710.6
Sample No : BH22-01 SS-01
Depth : 0,00 - 0,61m

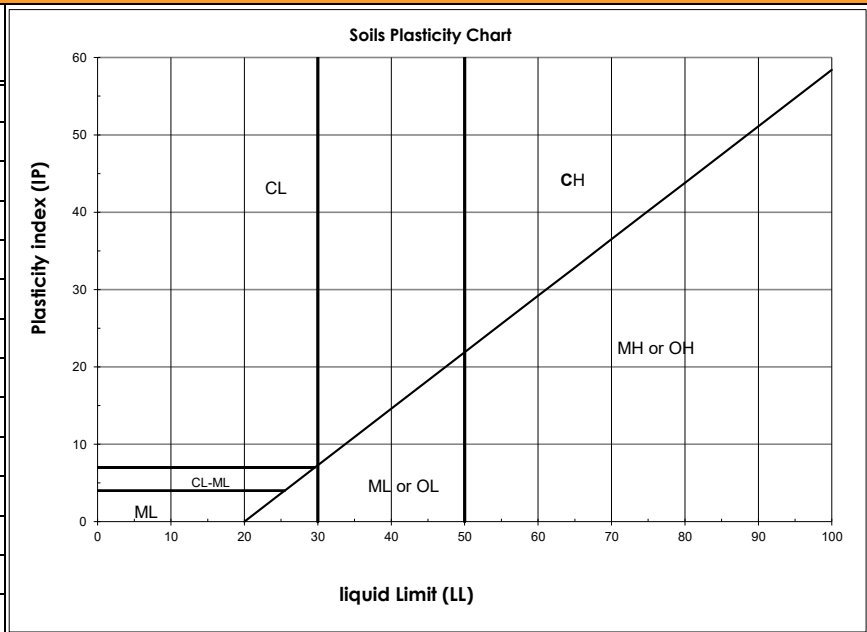
Material Description : Sandy Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	3,0



Remarks :

Prepared by : Benoit Cyr, Geo. *Bj*

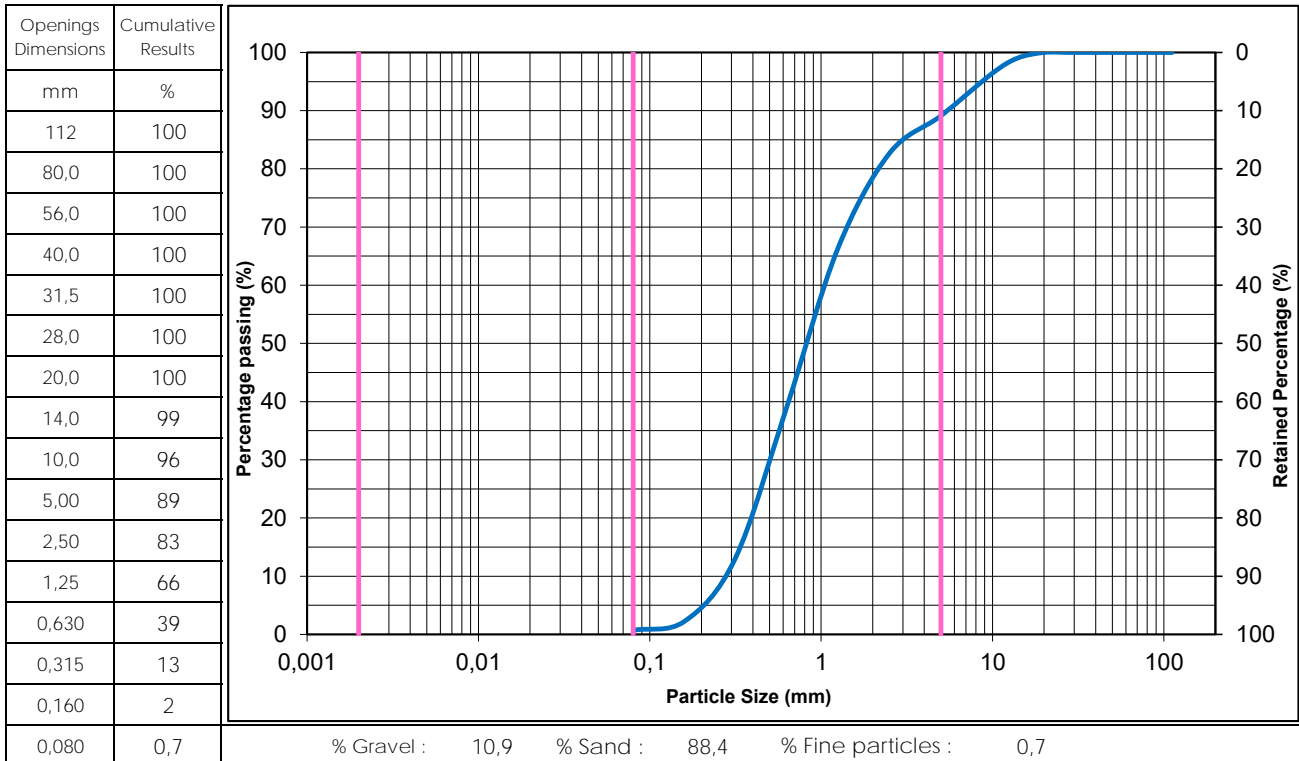
Date : October 26, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

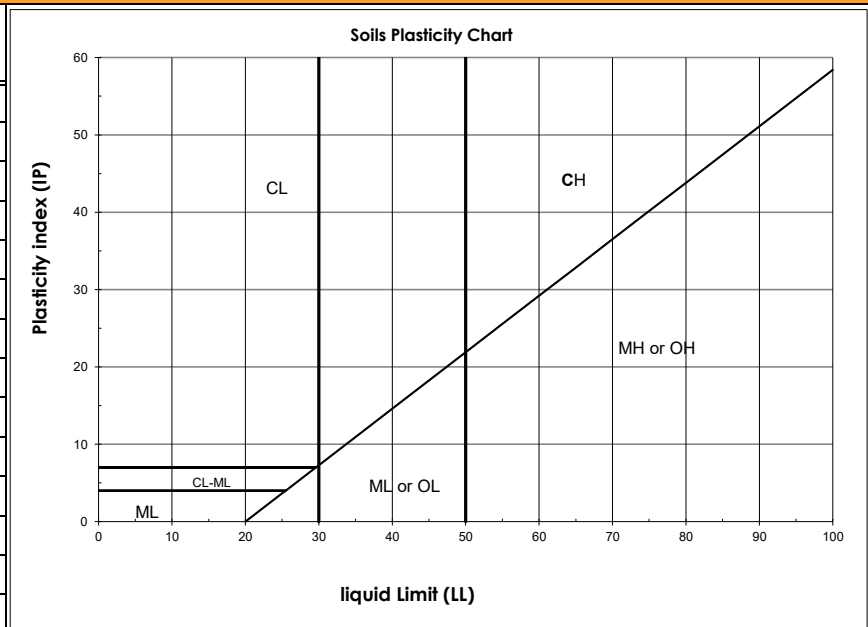
 Sampled by : Hugo Desrochers
 Sampling Date : August 30, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-01 SS-07
 Depth : 3,66 - 4,27m

 Material Description : Sand, some Gravel, traces of
 fine particles

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	15,5



Remarks :

Prepared by :

 Benoit Cyr, Geo. *BC*

Date : December 05, 2022

Client : Cree Development Corporation (CDC)

Sampled by : Hugo Desrochers

Project : LGA - Grevet-Chapais Railway

Sampling Date : August 30, 2022

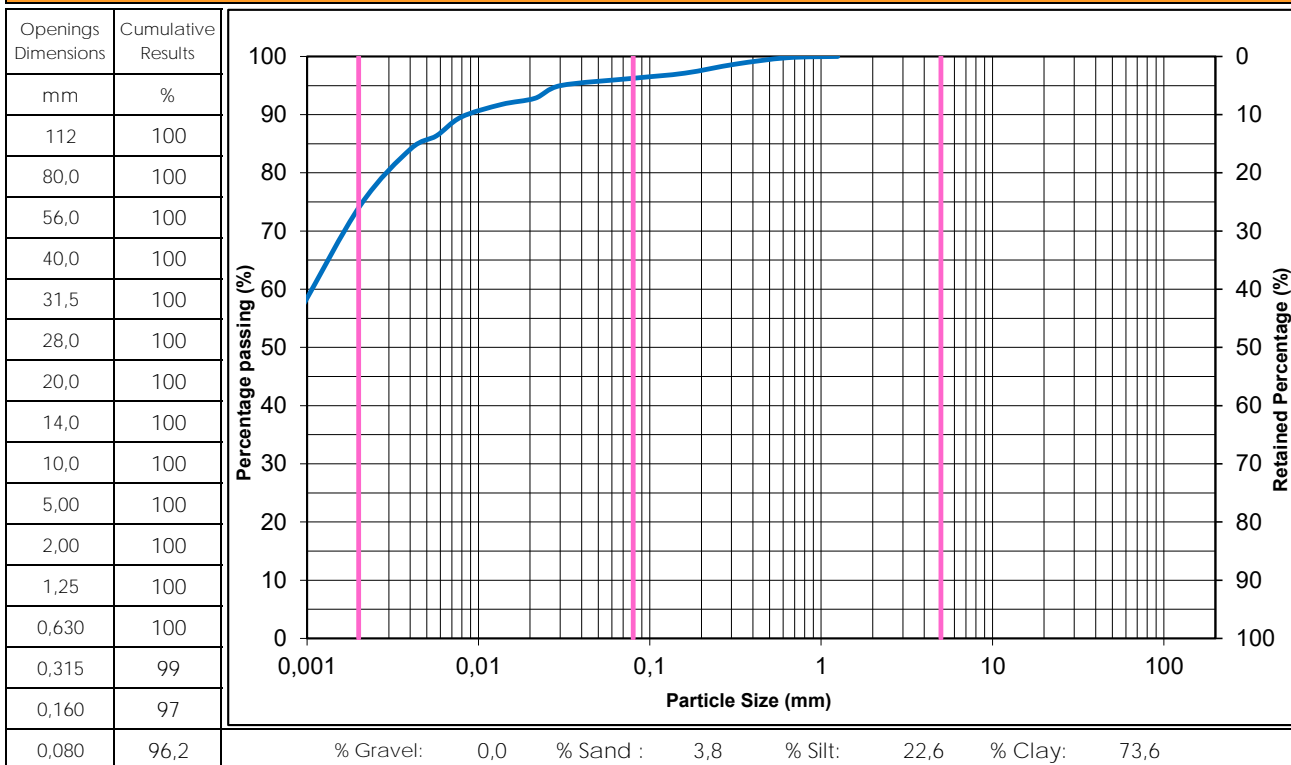
Project No : 158100425.500.710.6

Sample No : BH22-01 SS-11

Material Description : Silty Clay, traces of Sand, high plasticity (CH)

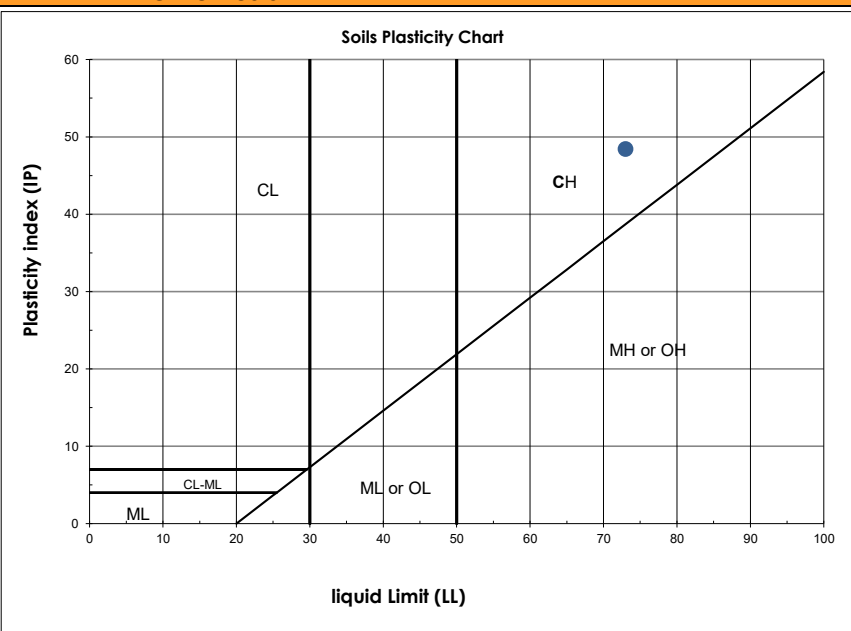
Depth : 3,66 - 4,27m

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	71,9
Liquid Limit (BNQ 2501-092)	73
Plastic Limit (BNQ 2501-092)	25
Plasticity Index (BNQ 2501-092)	48



Remarks :

Prepared by :

Benoit Cyr, Geo.



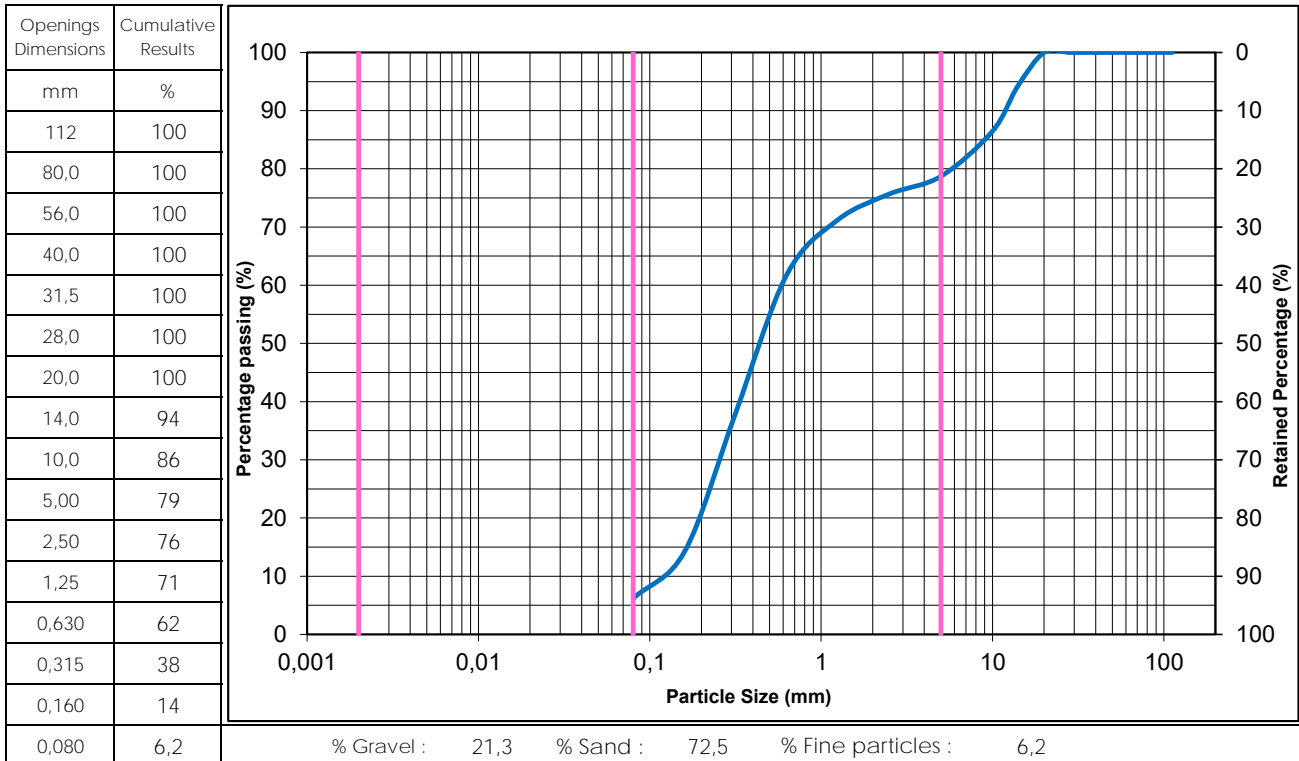
Date : December 05, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

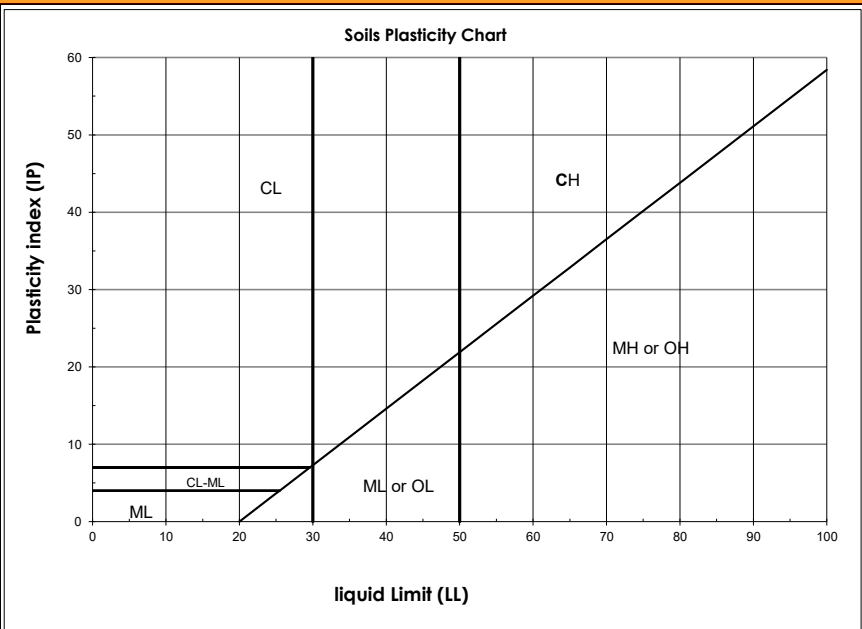
 Sampled by : Hugo Desrochers
 Sampling Date : August 30, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-02 SS-02
 Depth : 0,61 - 1,22m

Material Description : Gravely Sand, traces of fine particles

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	9,1



Remarks : _____

 Prepared by : Benoit Cyr, Geo. 

Date : December 05, 2022

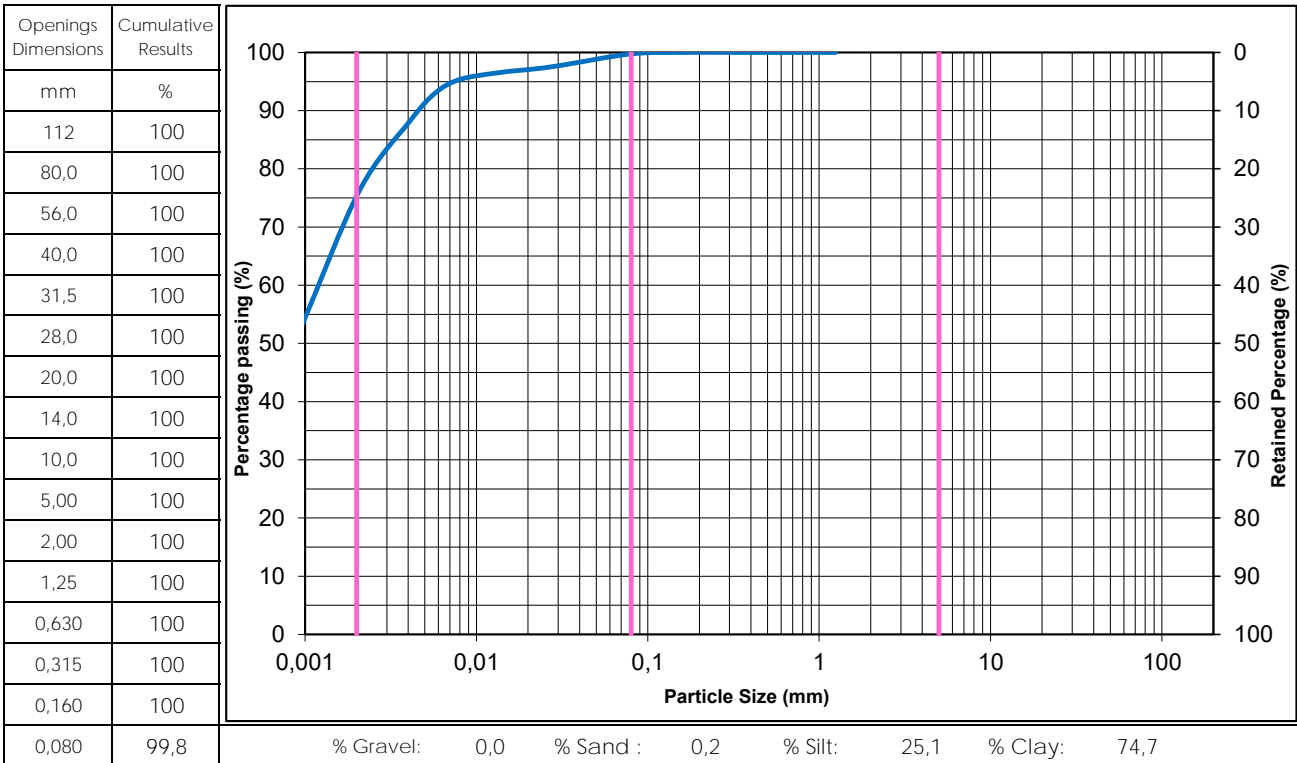
Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 30, 2022

Project No : 158100425.500.710.6
Sample No : BH22-02 SS-08
Depth : 4,27 - 4,88m

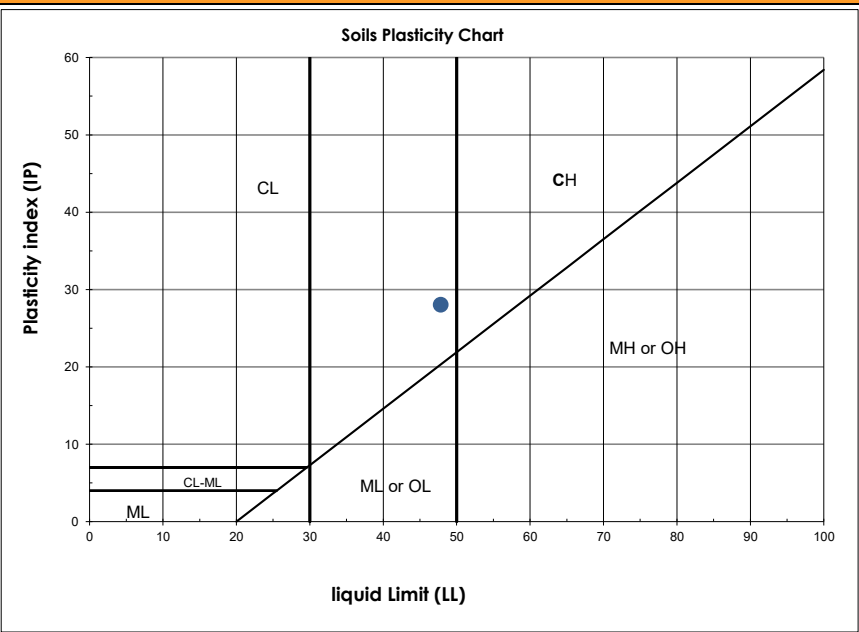
Material Description : Silty Clay, traces of Sand,
medium plasticity (CL)

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	71,0
Liquid Limit (BNQ 2501-092)	48
Plastic Limit (BNQ 2501-092)	20
Plasticity Index (BNQ 2501-092)	28



Remarks :

Prepared by : Benoit Cyr, Geo. *BC*

Date : December 05, 2022

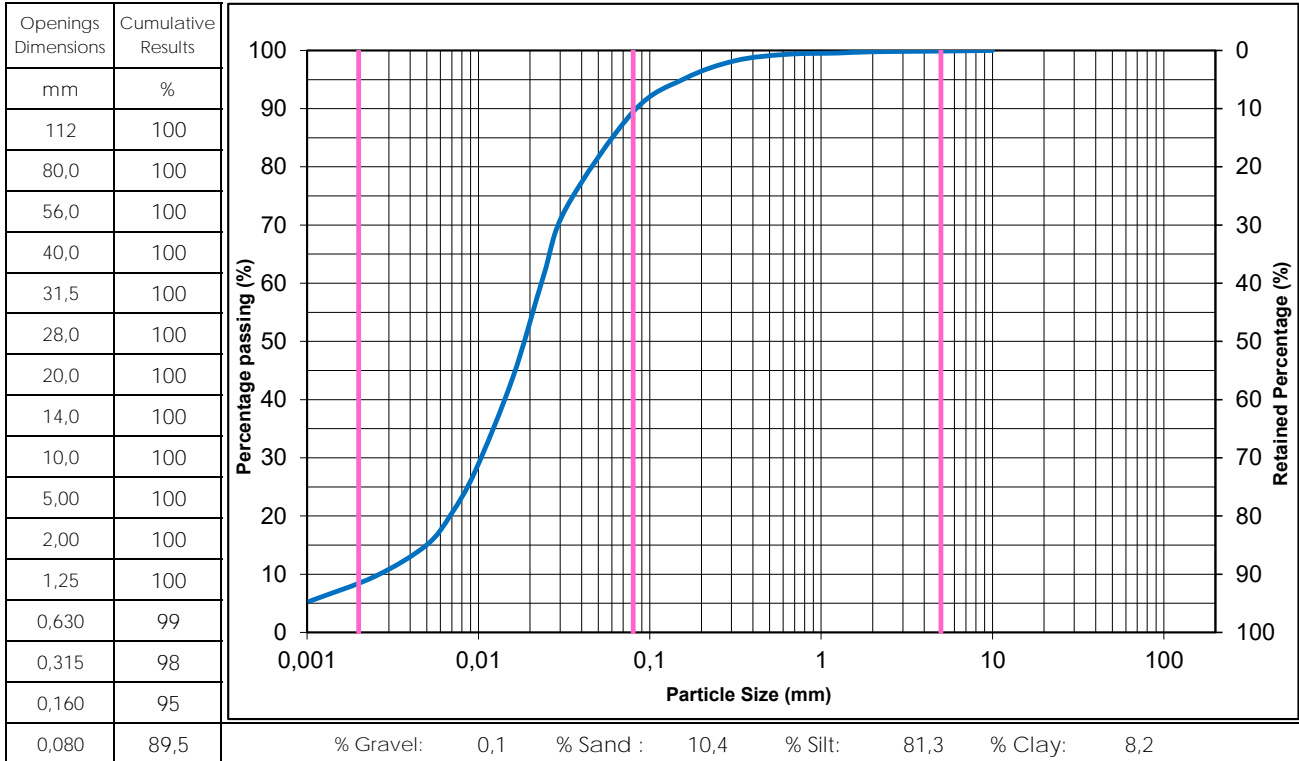
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 30, 2022

Project No : 158100425.500.710.6
Sample No : BH22-02 SS-12
Depth : 7,62 - 8,23m

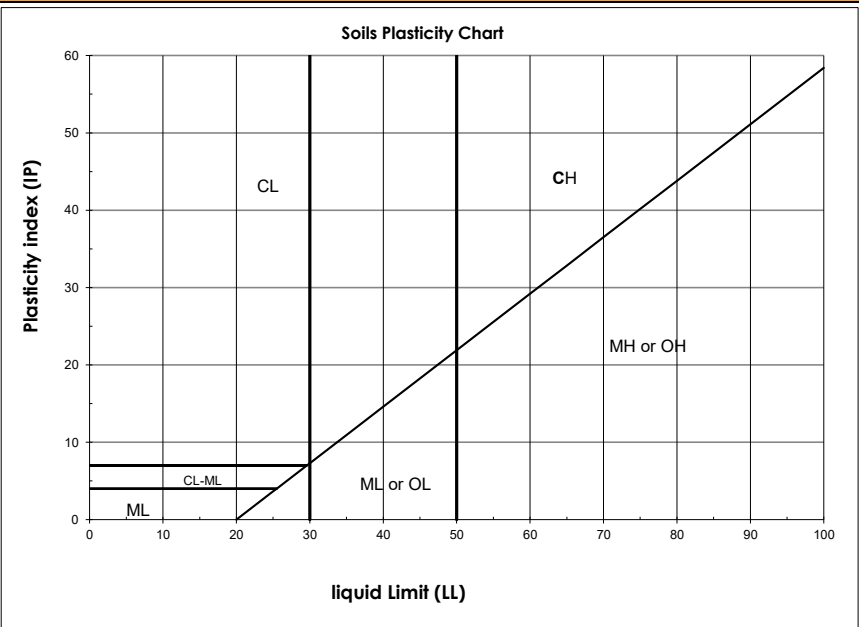
Material Description : Silt, some Sand, traces of Clay, traces of Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	25,9



Remarks :

Prepared by : Benoit Cyr, Geo. *BC* Date : December 05, 2022

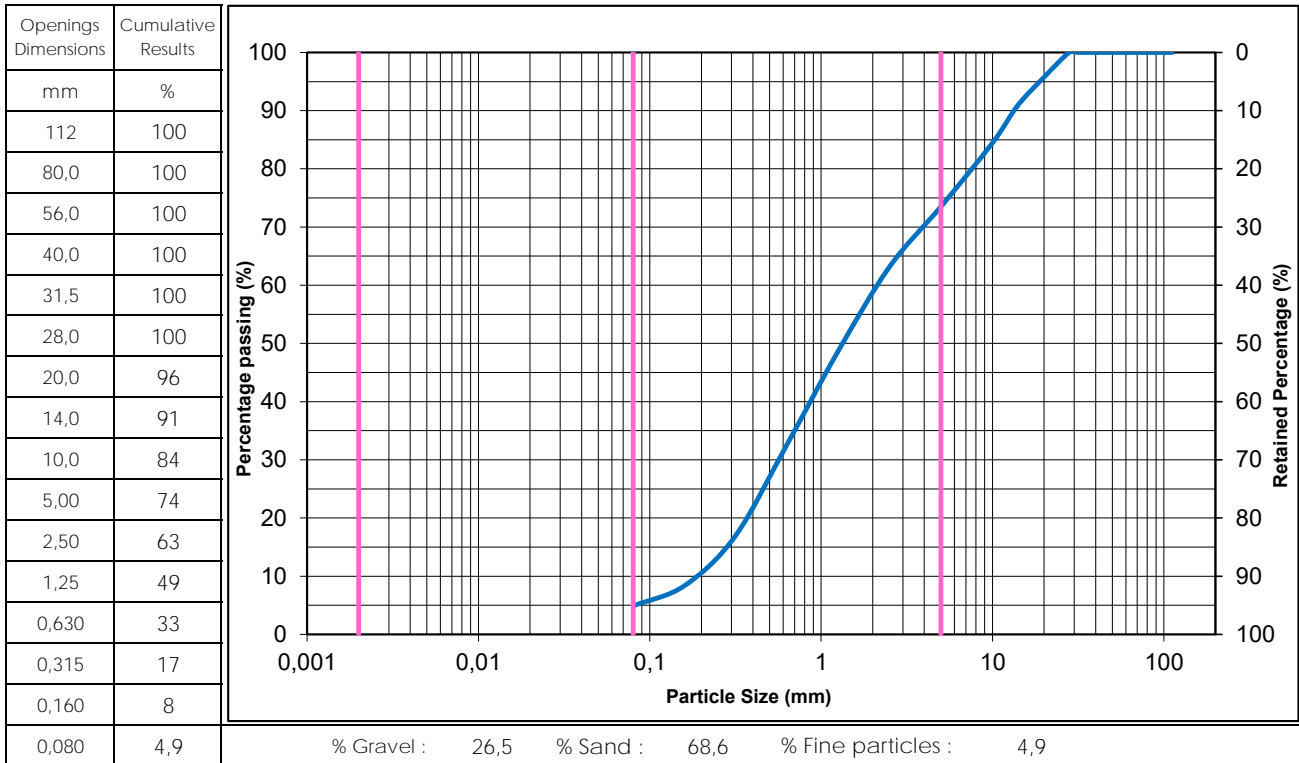
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 29, 2022

Project No : 158100425.500.710.6
Sample No : BH22-03 SS-01
Depth : 0,00 - 0,61m

Material Description : Gravely Sand, traces of fine particles

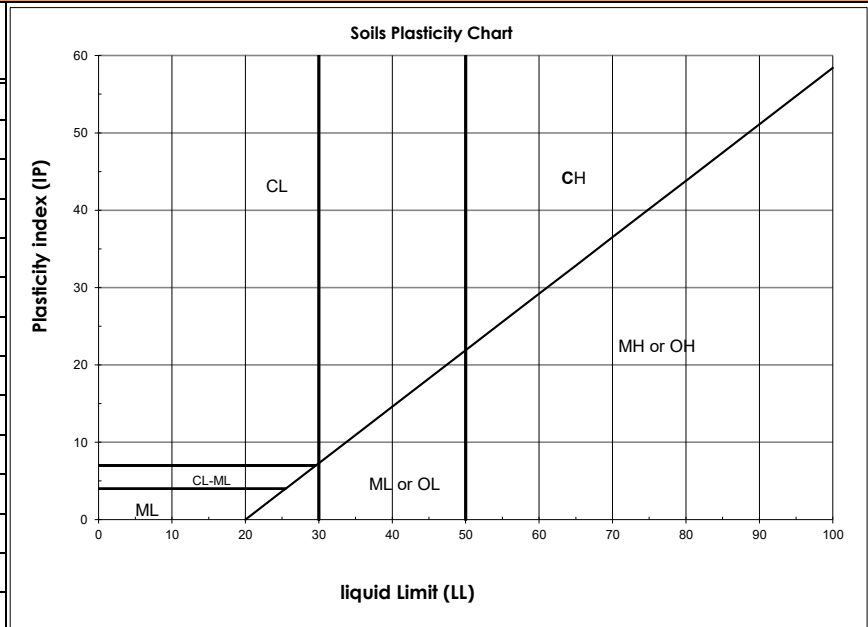
Grain Size Analysis (BNQ 2501-025)



% Gravel : 26,5 % Sand : 68,6 % Fine particles : 4,9

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	4,2



Remarks :

Prepared by : Benoit Cyr, Geo. *BC* Date : December 05, 2022

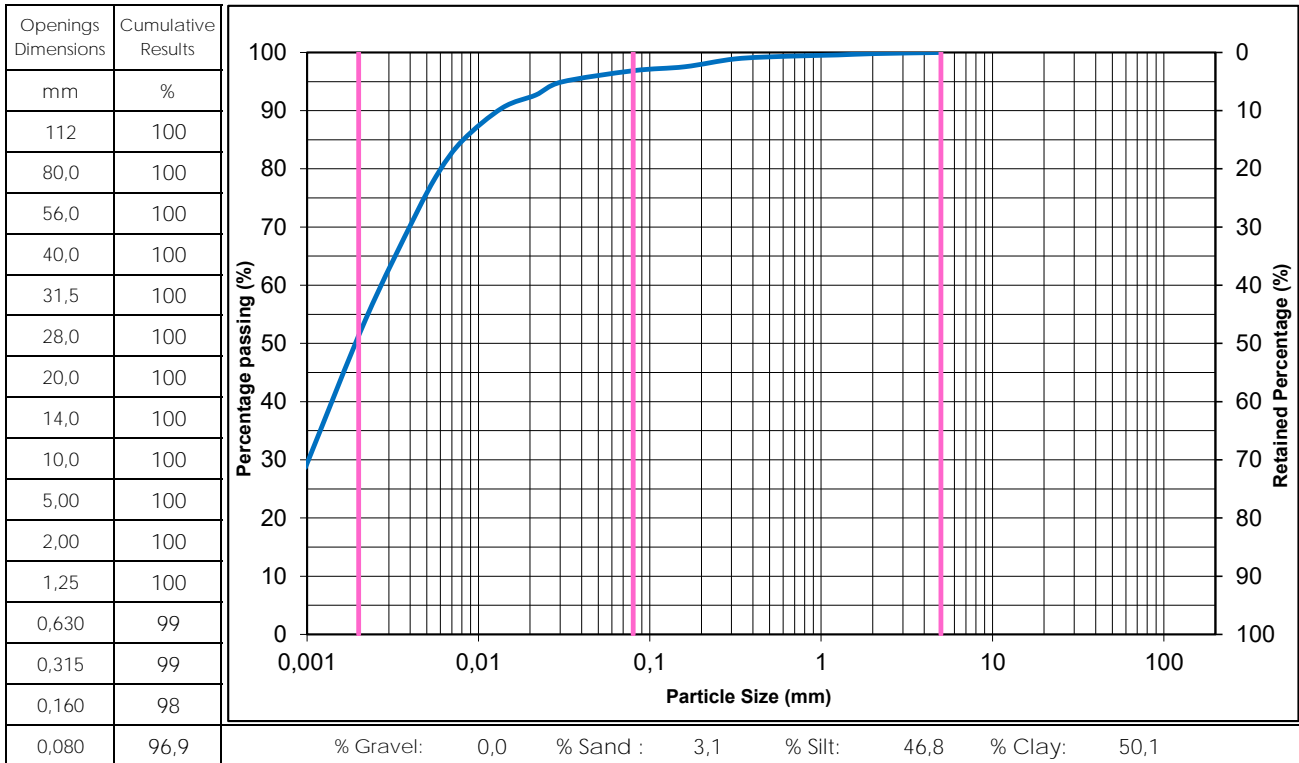
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 29, 2022

Project No : 158100425.500.710.6
Sample No : BH22-03 SS-03
Depth : 1,22 - 1,83m

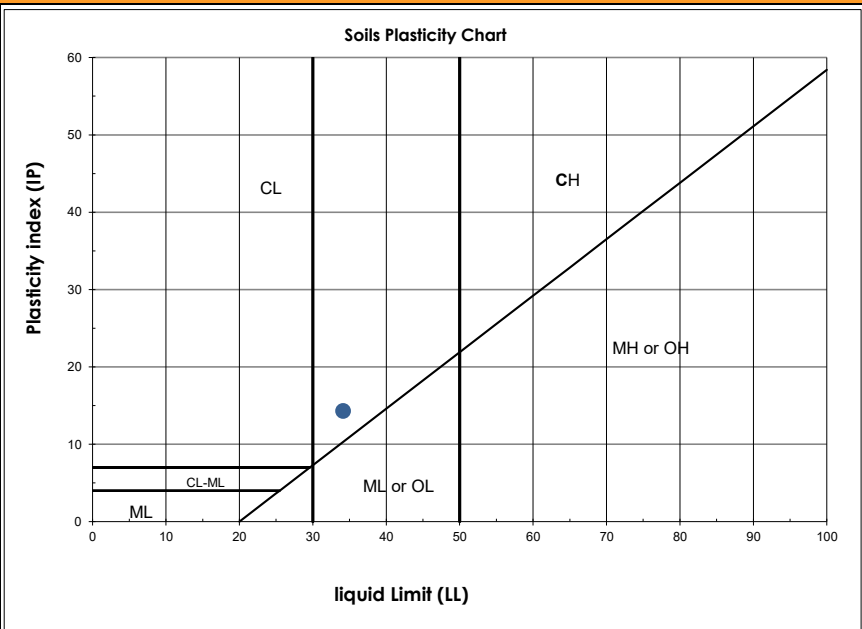
Material Description : Clay and Silt, traces of Sand,
medium plasticity (CL)

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	29,9
Liquid Limit (BNQ 2501-092)	34
Plastic Limit (BNQ 2501-092)	20
Plasticity Index (BNQ 2501-092)	14



Remarks :

Prepared by :

Benoit Cyr, Geo.

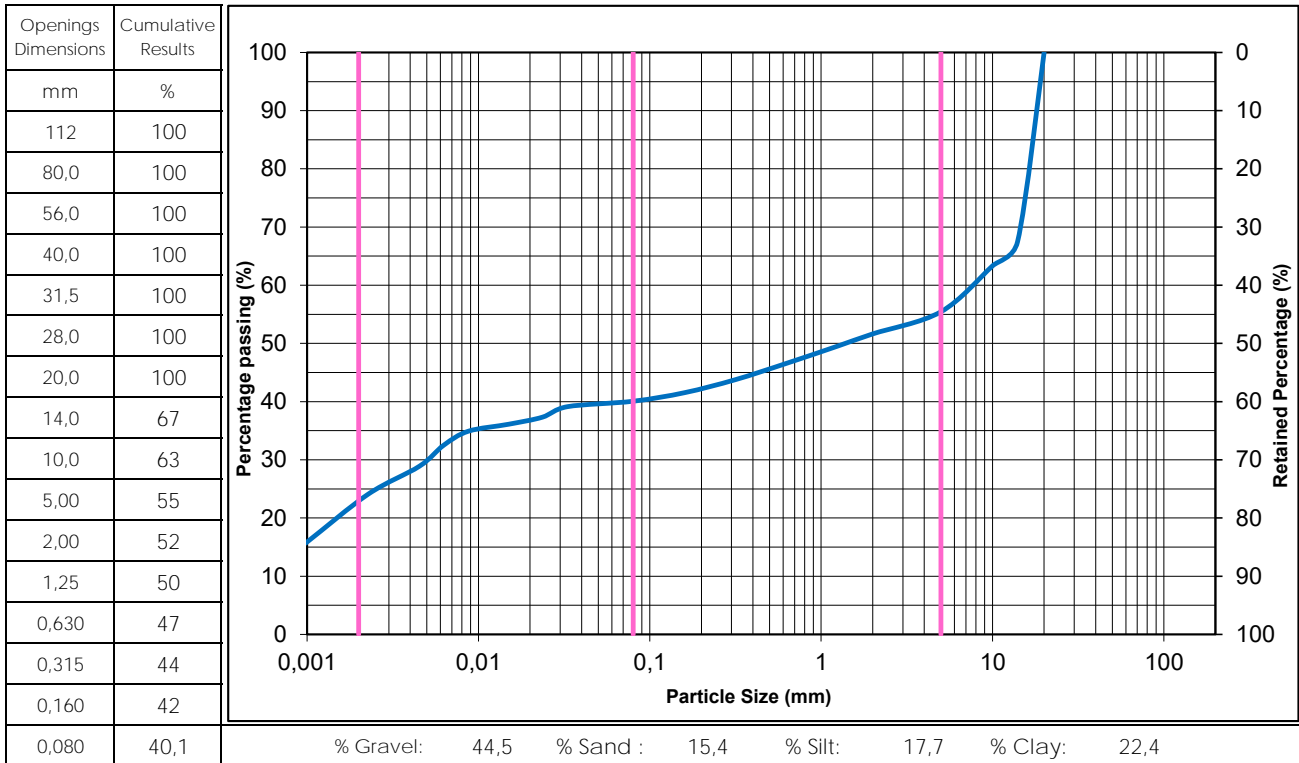
Date : December 05, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

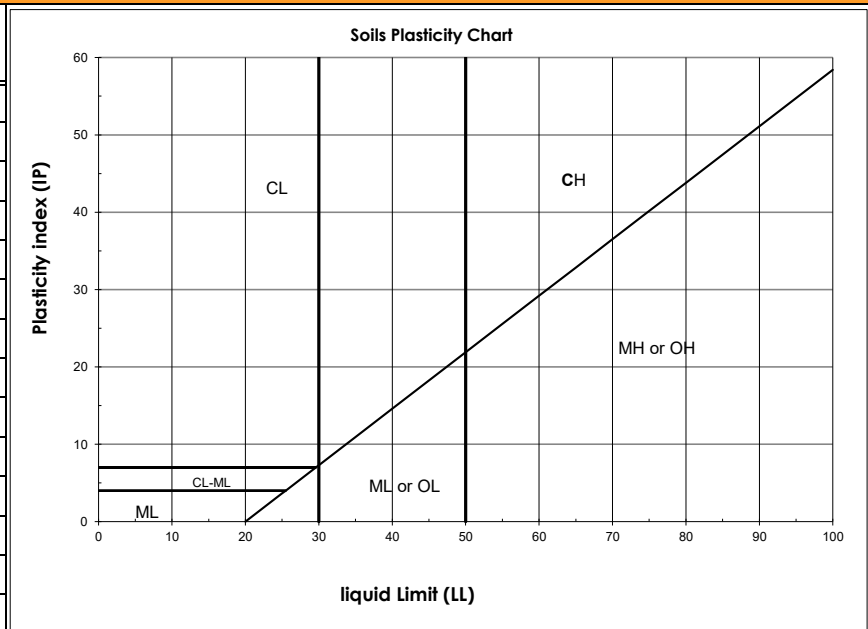
 Sampled by : Hugo Desrochers
 Sampling Date : August 29, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-03 SS-05
 Depth : 2,44 - 3,05m

 Material Description : Clayey Gravel, some Silt,
 some Sand

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	22,5



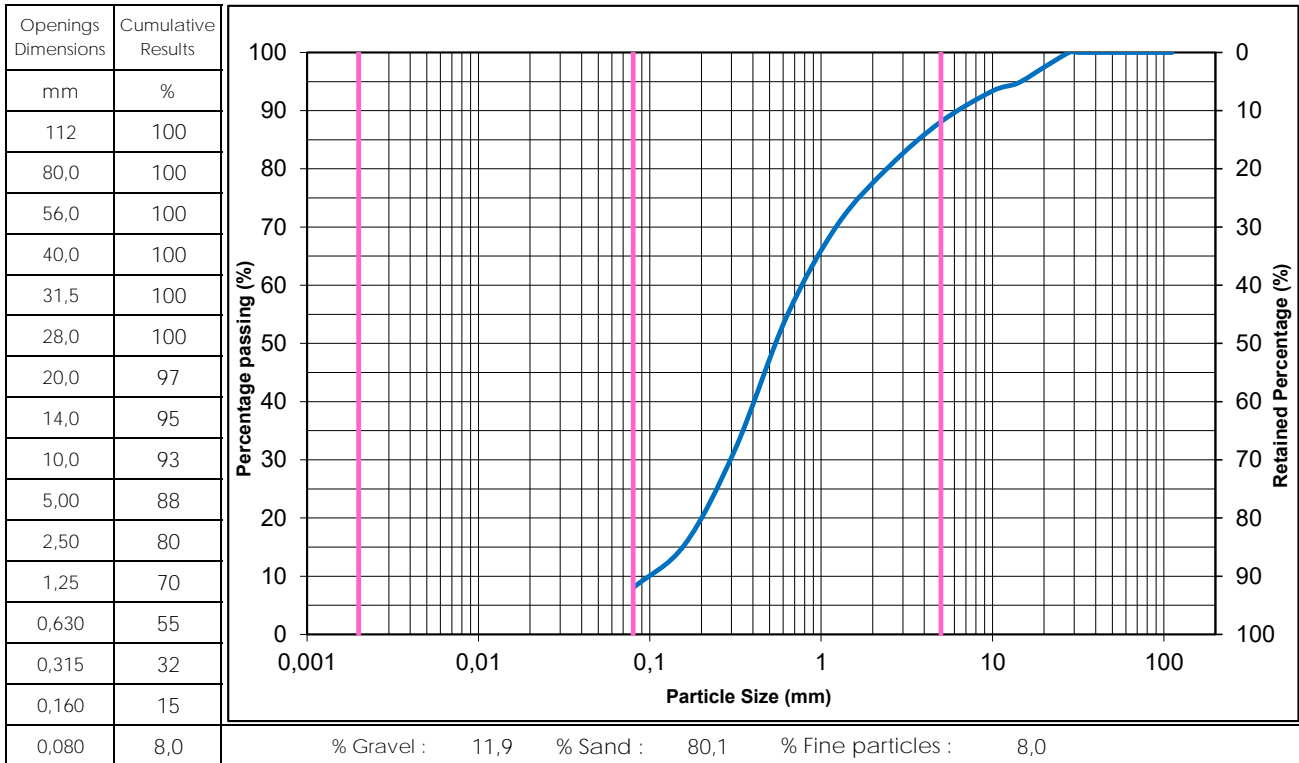
Remarks :

Prepared by :

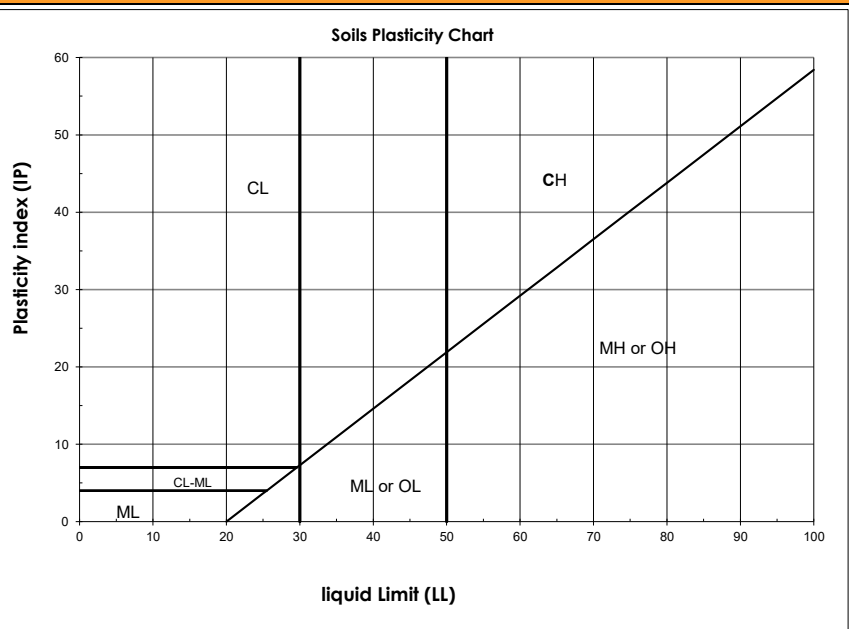
 Benoit Cyr, Geo. *Bj*

Date : December 05, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 28, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-04 SS-02	Material Description : Sand, some Gravel, traces of fine particles
Depth : 0,61 - 1,22m	

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	3,2



Remarks : _____

Prepared by : Benoit Cyr, Geo. Date : December 05, 2022

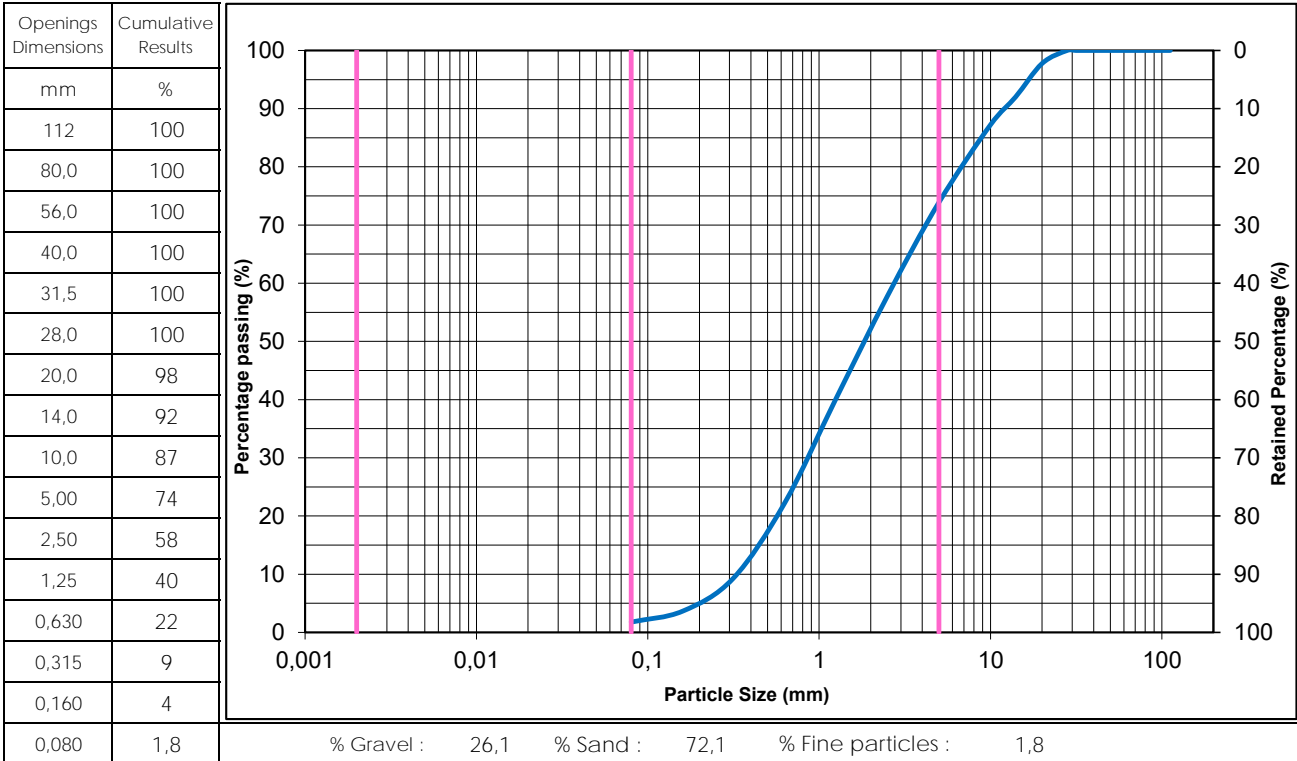
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 28, 2022

Project No : 158100425.500.710.6
Sample No : BH22-04 SS-04
Depth : 1,83 - 2,44m

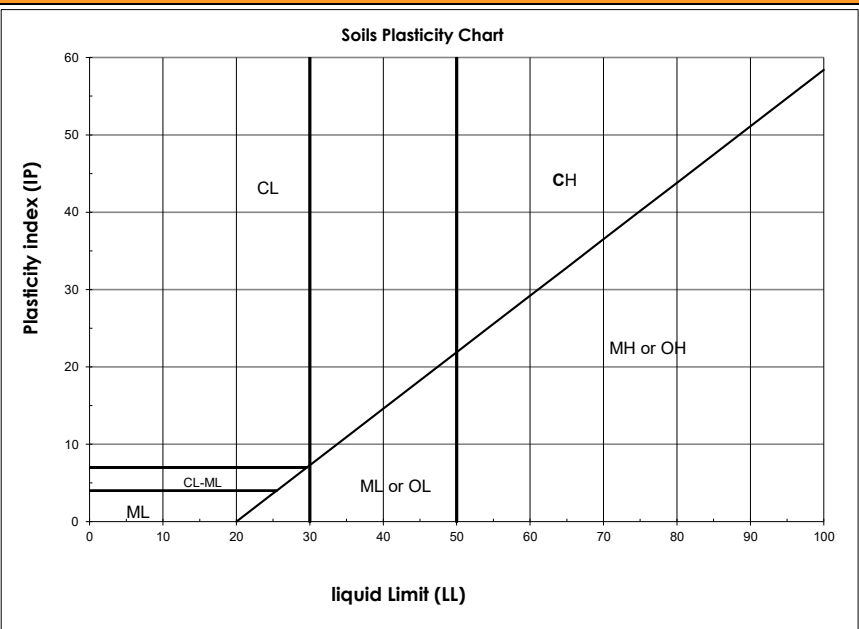
Material Description : Gravely Sand, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	11,7



Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC*

Date : December 05, 2022

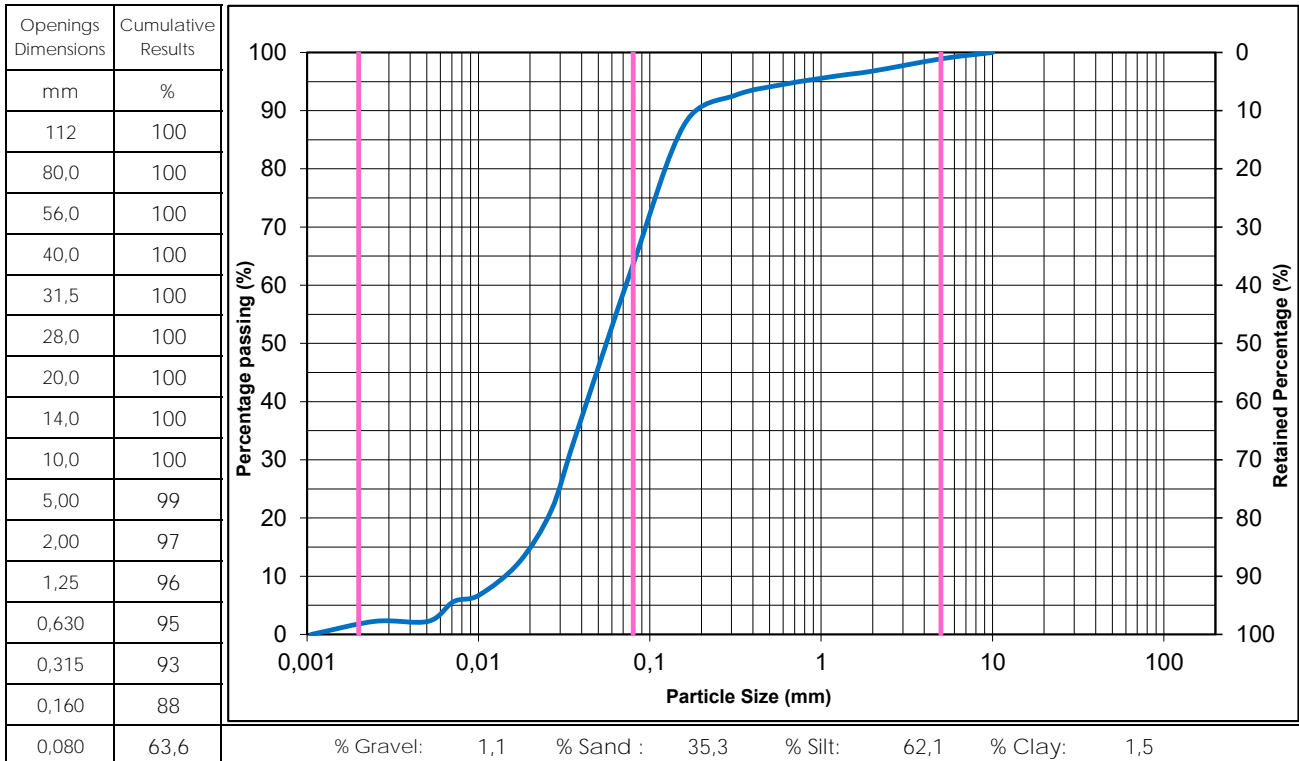
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 28, 2022

Project No : 158100425.500.710.6
Sample No : BH22-04 SS-09
Depth : 6,71 - 7,32m

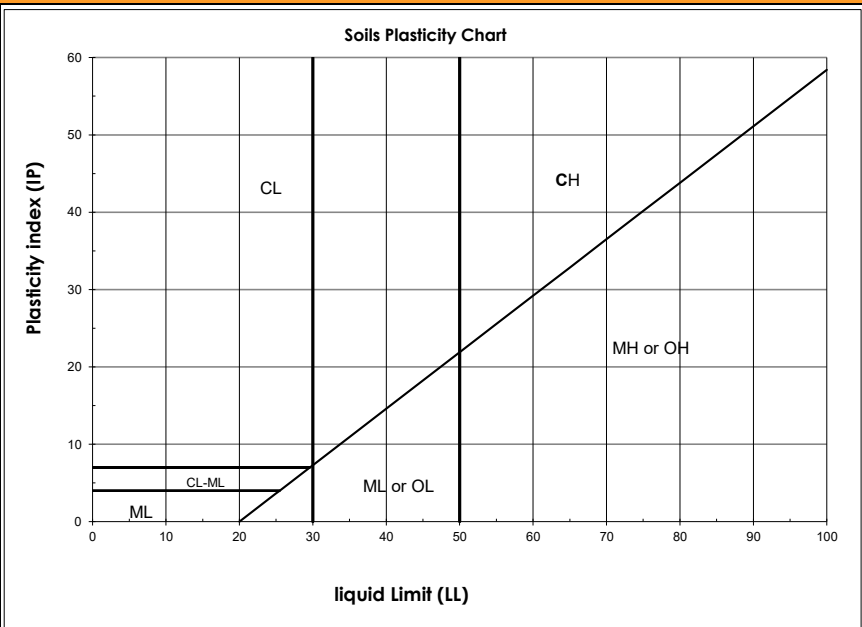
Material Description : Silt and Sand, traces of Clay,
traces of Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	24,7



Remarks :

Prepared by :

Benoit Cyr, Geo.



Date : December 05, 2022

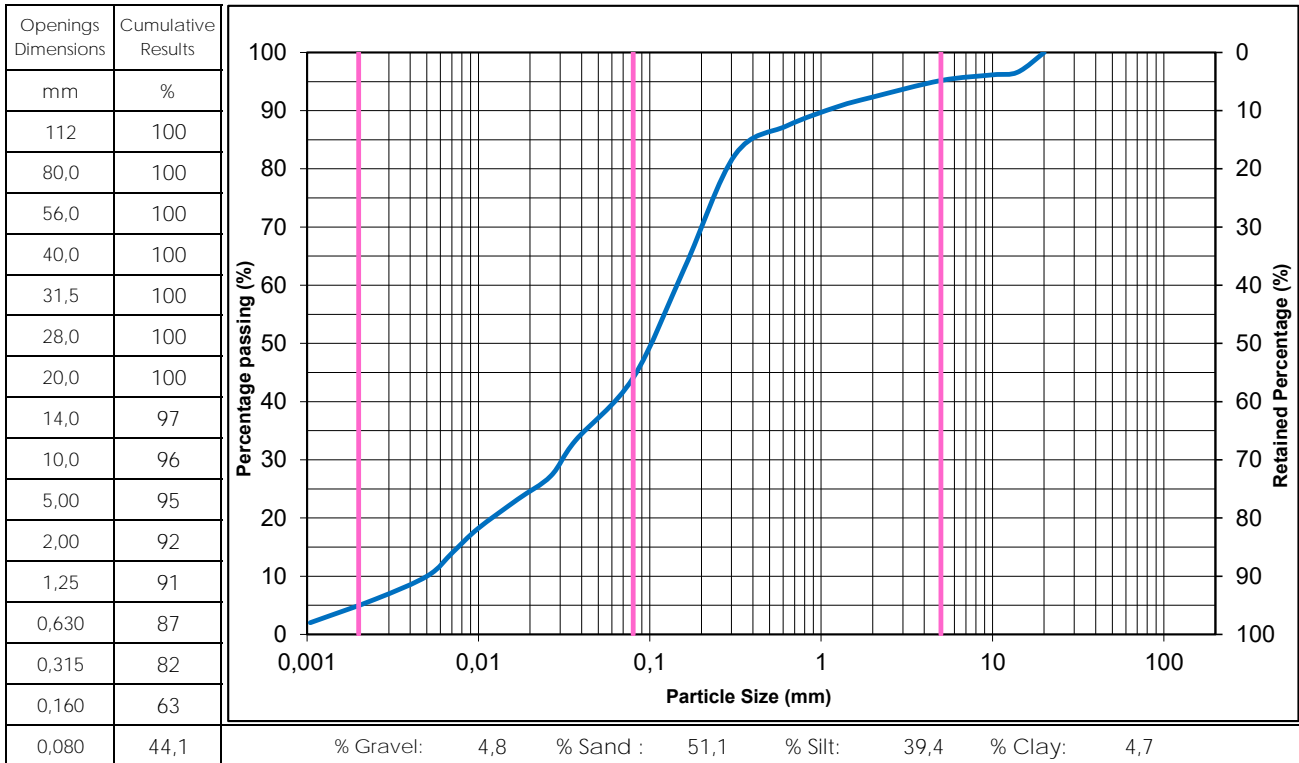
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 28, 2022

Project No : 158100425.500.710.6
Sample No : BH22-04 SS-12
Depth : 9,14 - 9,75m

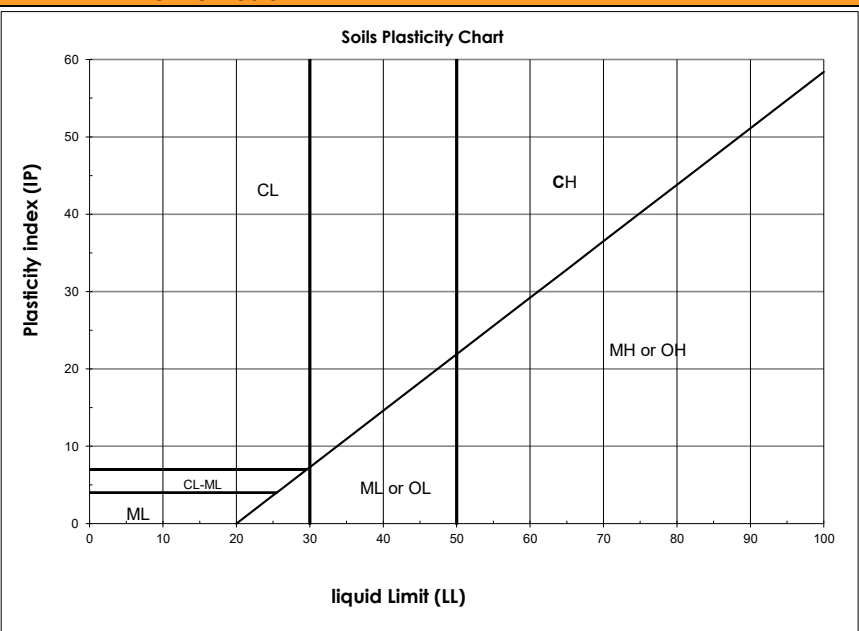
Material Description : Sand and Silt, traces of
Gravel, traces of Clay

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	17,2



Remarks :

Prepared by :

Benoit Cyr, Geo.



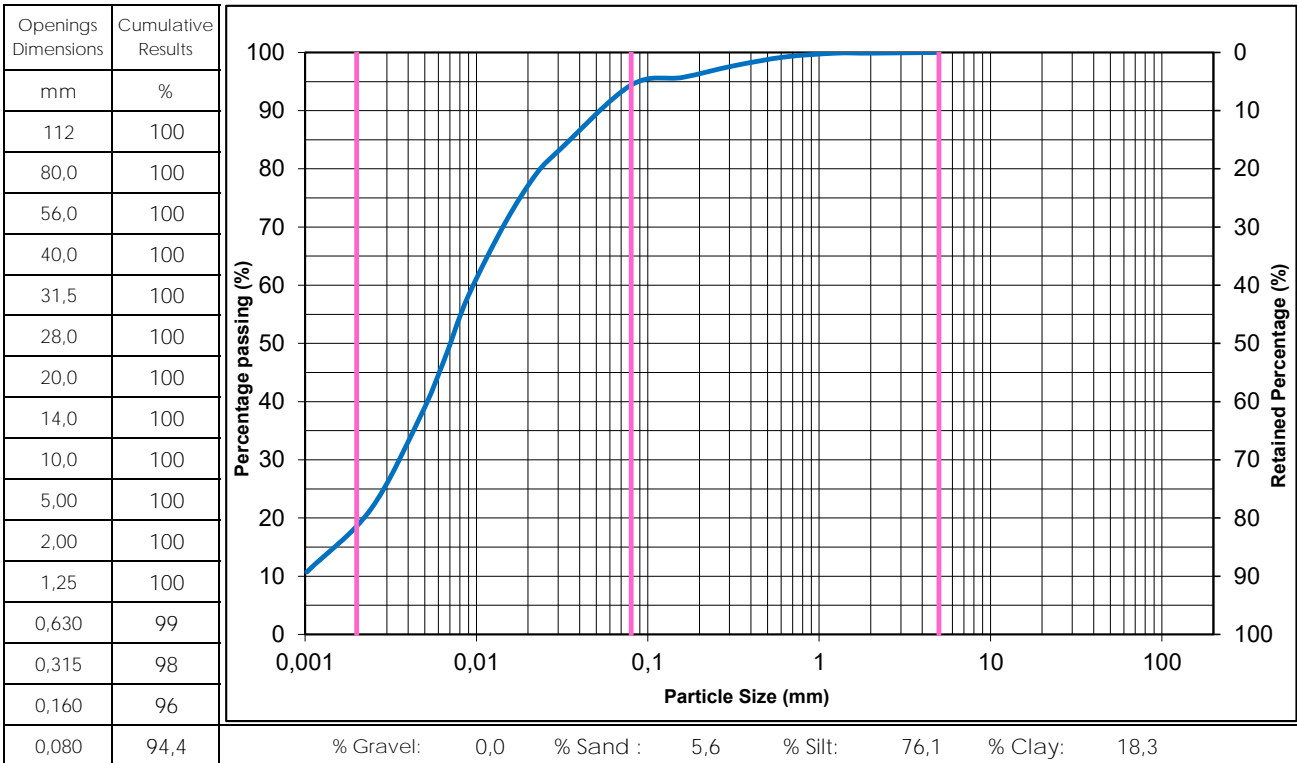
Date : December 05, 2022

Client : Cree Developpement Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

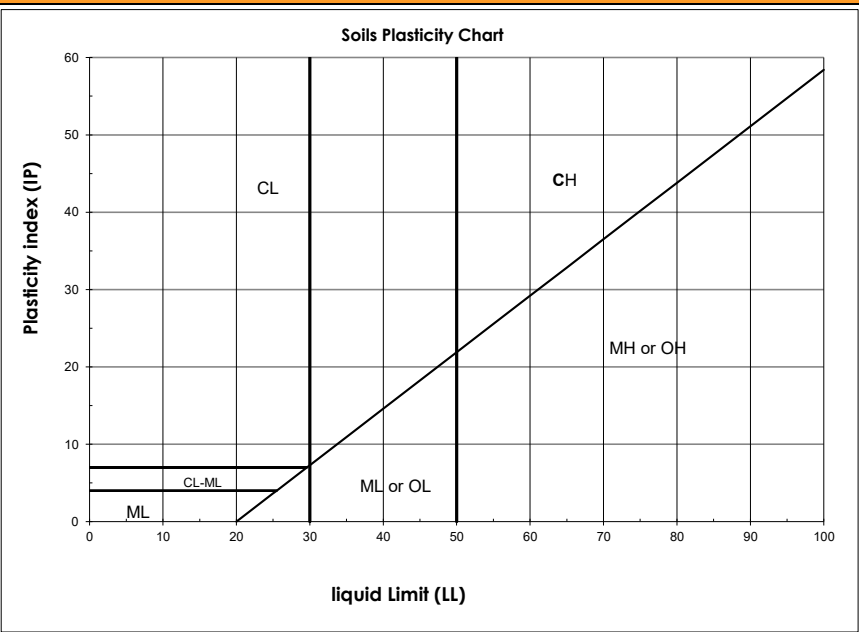
 Sampled by : Hugo Desrochers
 Sampling Date : August 28, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-05 SS-02B
 Depth : 1,02 - 1,22m

Material Description : Silt, some Clay, traces of Sand

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	45,5

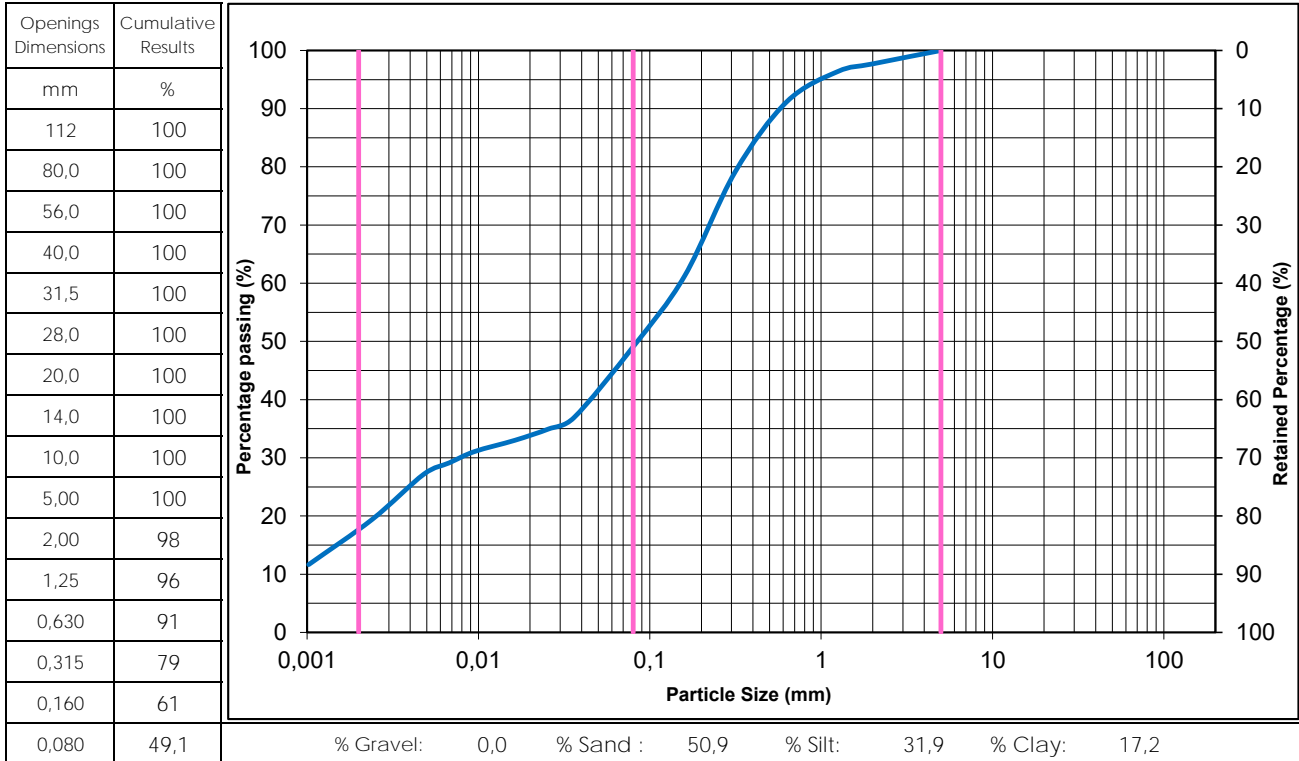

Remarks : _____

Prepared by : Benoit Cyr, Geo.

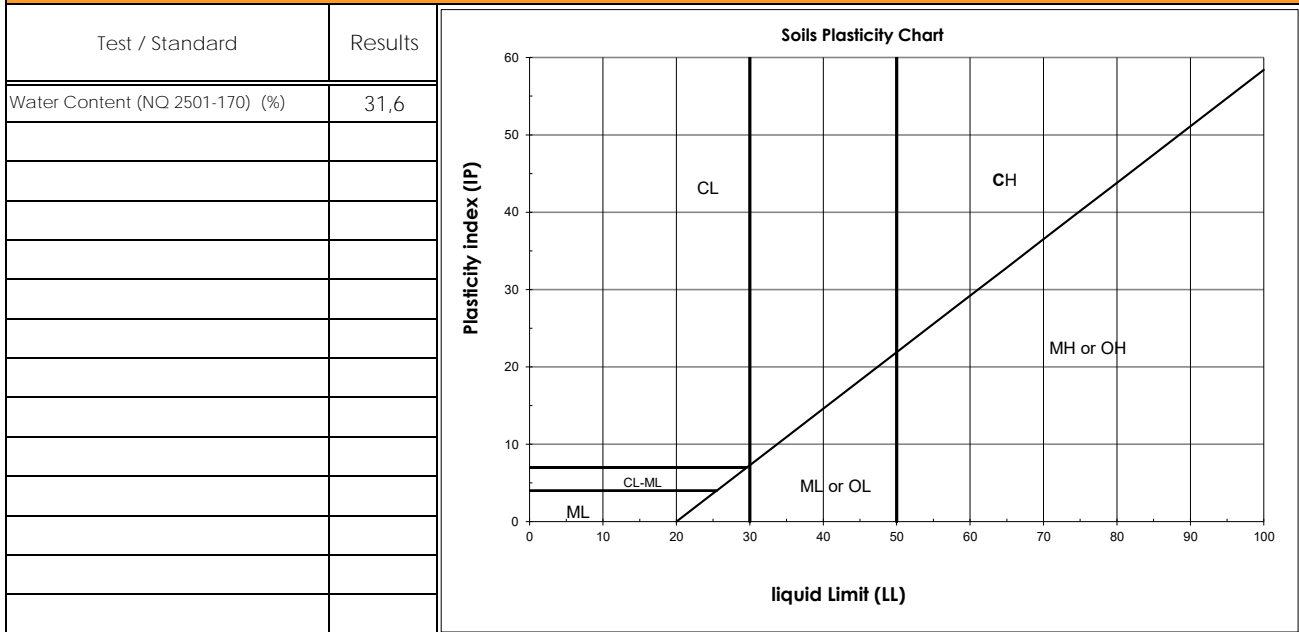
Date : December 05, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 28, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-05 SS-06	Material Description : Silty Sand, some Clay
Depth : 3,05 - 3,66m	

Grain Size Analysis (BNQ 2501-025)



Other tests

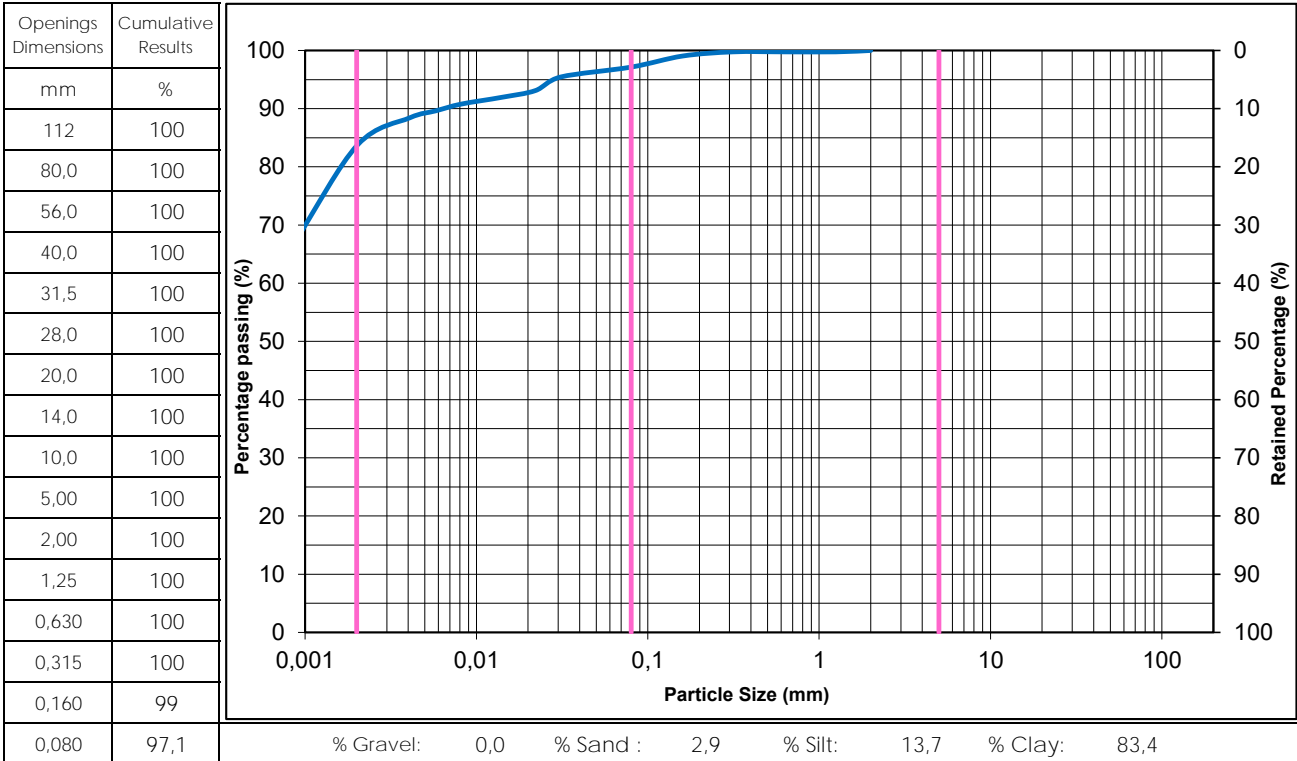


Remarks : _____

Prepared by : Benoit Cyr, Geo. *Bj* **Date :** December 05, 2022

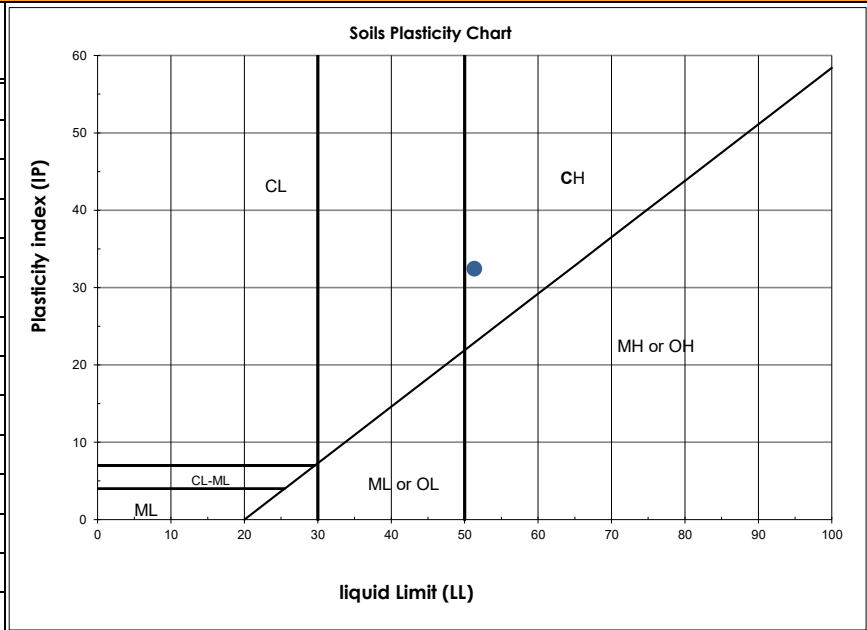
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 28, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-05 SS-10	Material Description : Clay, some Silt, traces of Sand, high plasticity (CH)
Depth : 6,10 - 6,71m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	78,7
Liquid Limit (BNQ 2501-092)	51
Plastic Limit (BNQ 2501-092)	19
Plasticity Index (BNQ 2501-092)	32



Remarks : _____

Prepared by : Benoit Cyr, Geo. Date : December 05, 2022

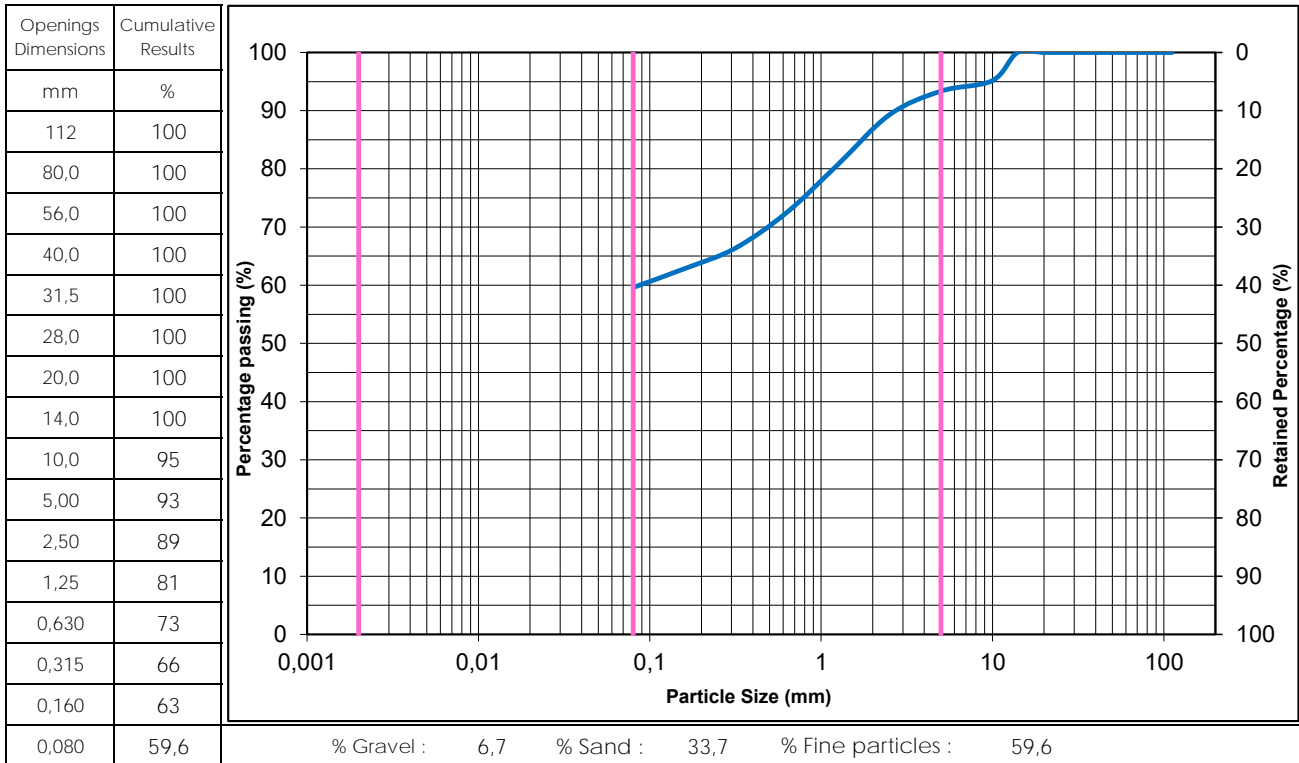
Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 28, 2022

Project No : 158100425.500.710.6
Sample No : BH22-05 SS-16
Depth : 11,43 - 12,04m

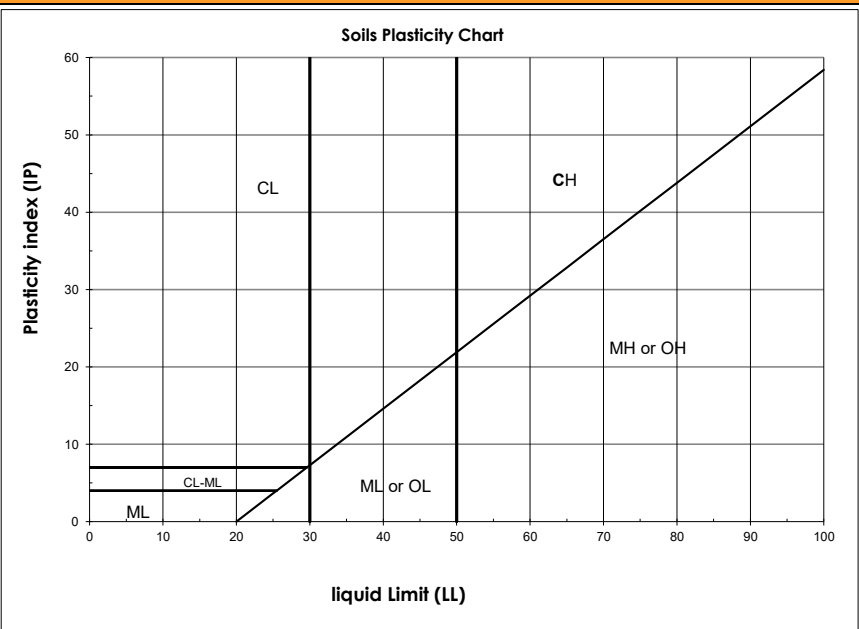
Material Description : Sandy fine particles, traces of Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	38,6



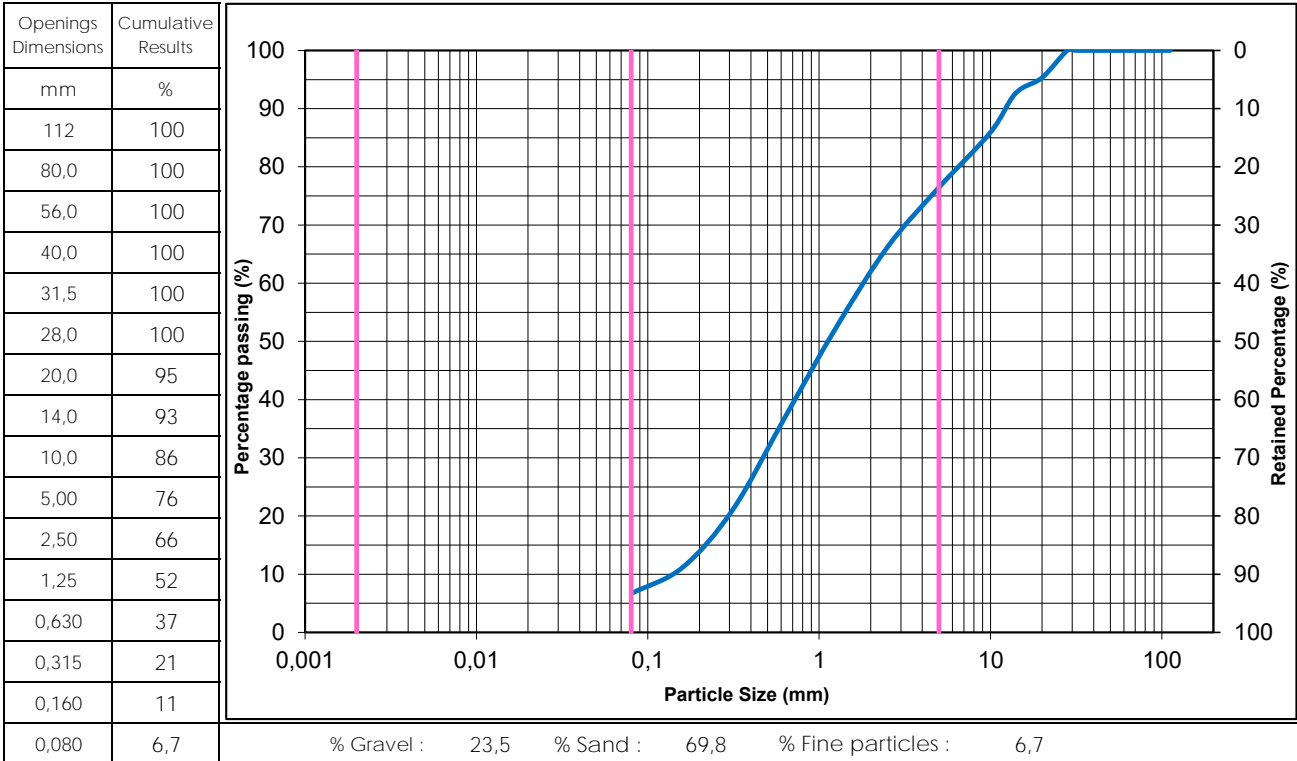
Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC*

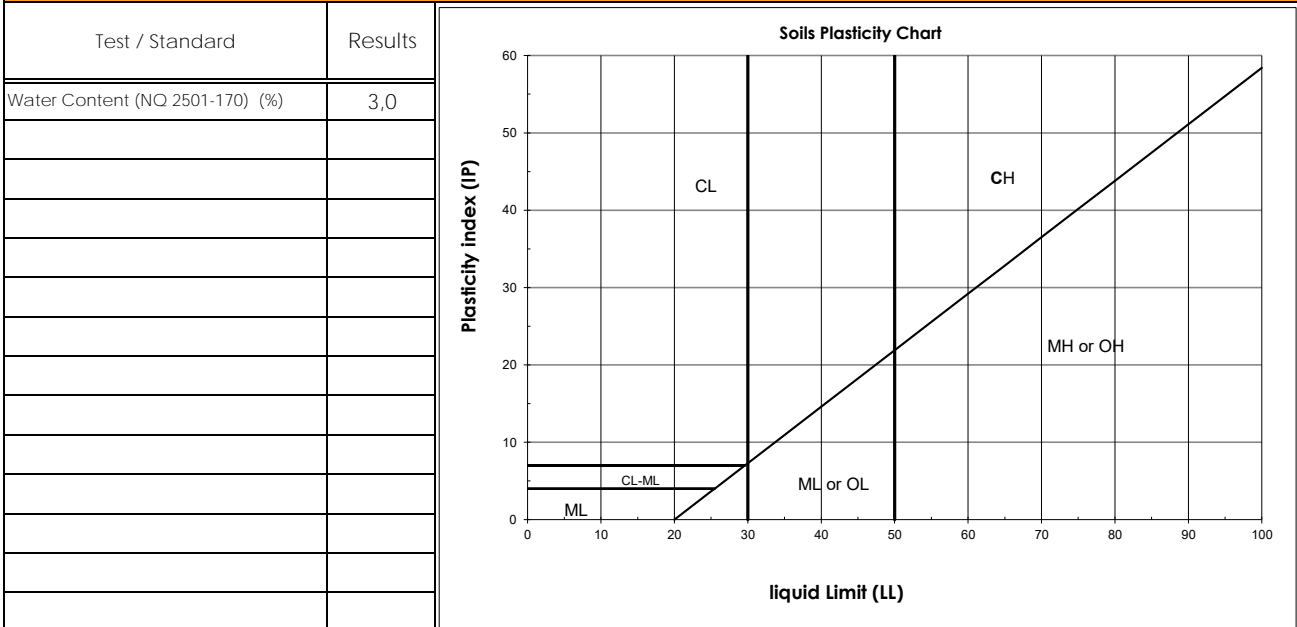
Date : December 05, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 27, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-06 SS-01	Material Description : Gravely Sand, traces of fine particles
Depth : 0,00 - 0,61m	

Grain Size Analysis (BNQ 2501-025)



Other tests



Remarks : _____

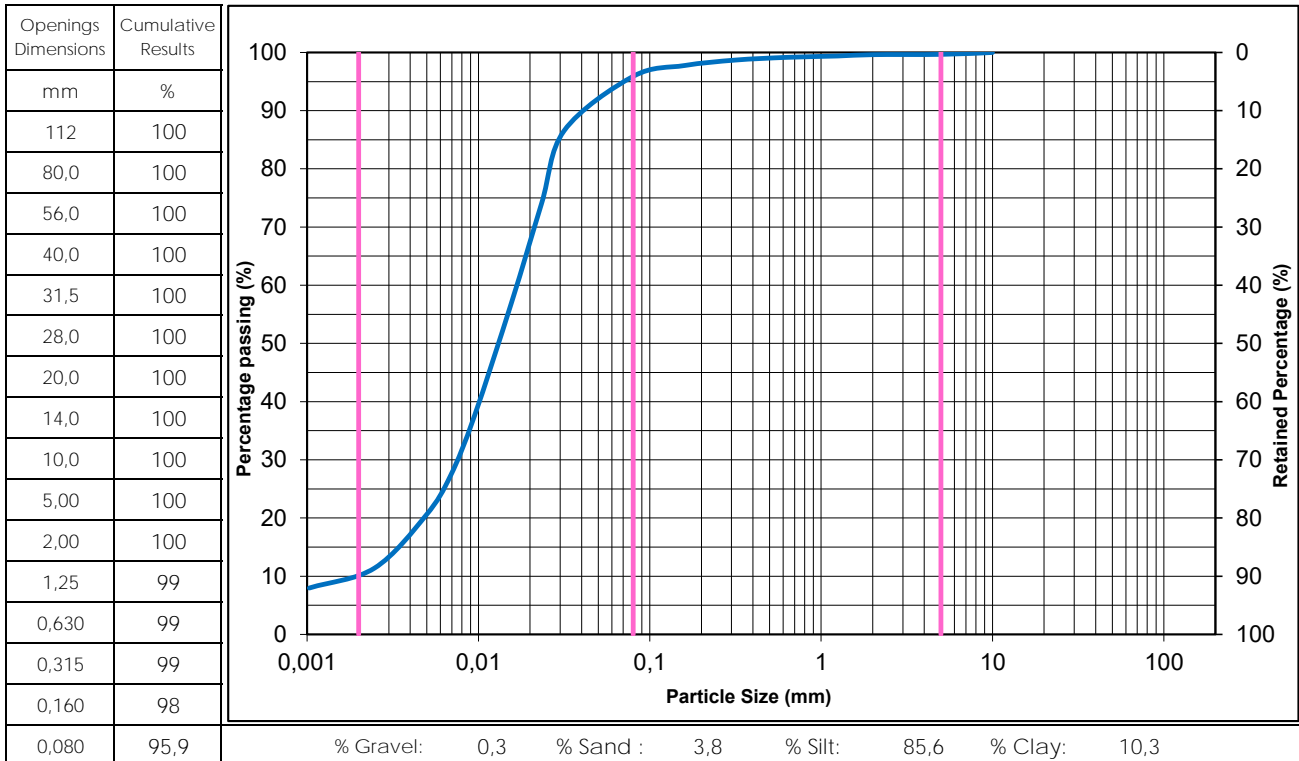
Prepared by : Benoit Cyr, Geo. *Bj* **Date :** December 05, 2022

Client : Cree Developpement Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

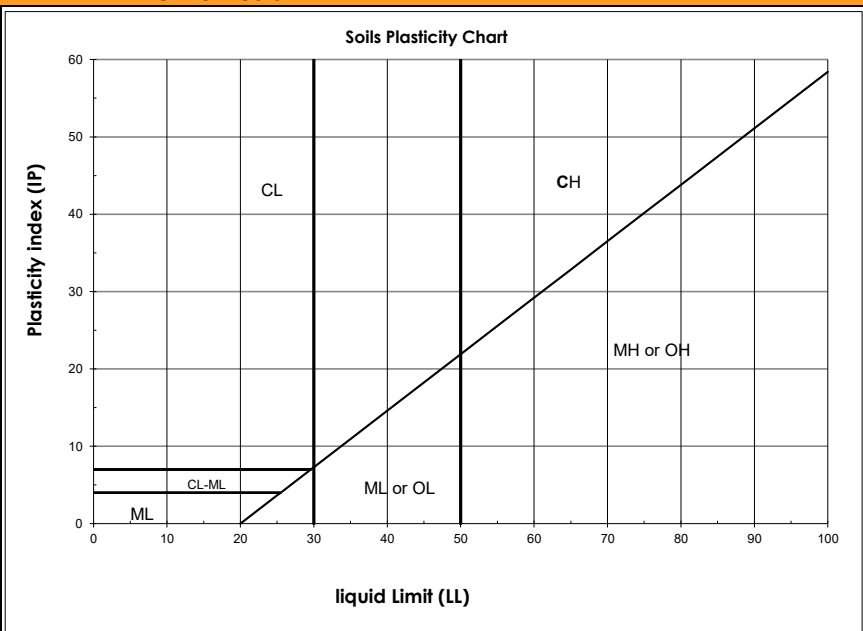
 Sampled by : Hugo Desrochers
 Sampling Date : August 27, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-06 SS-19
 Depth : 15,24 - 15,85m

 Material Description : Silt, some Clay, traces of
 Sand, traces of Gravel

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	28,6



Remarks :

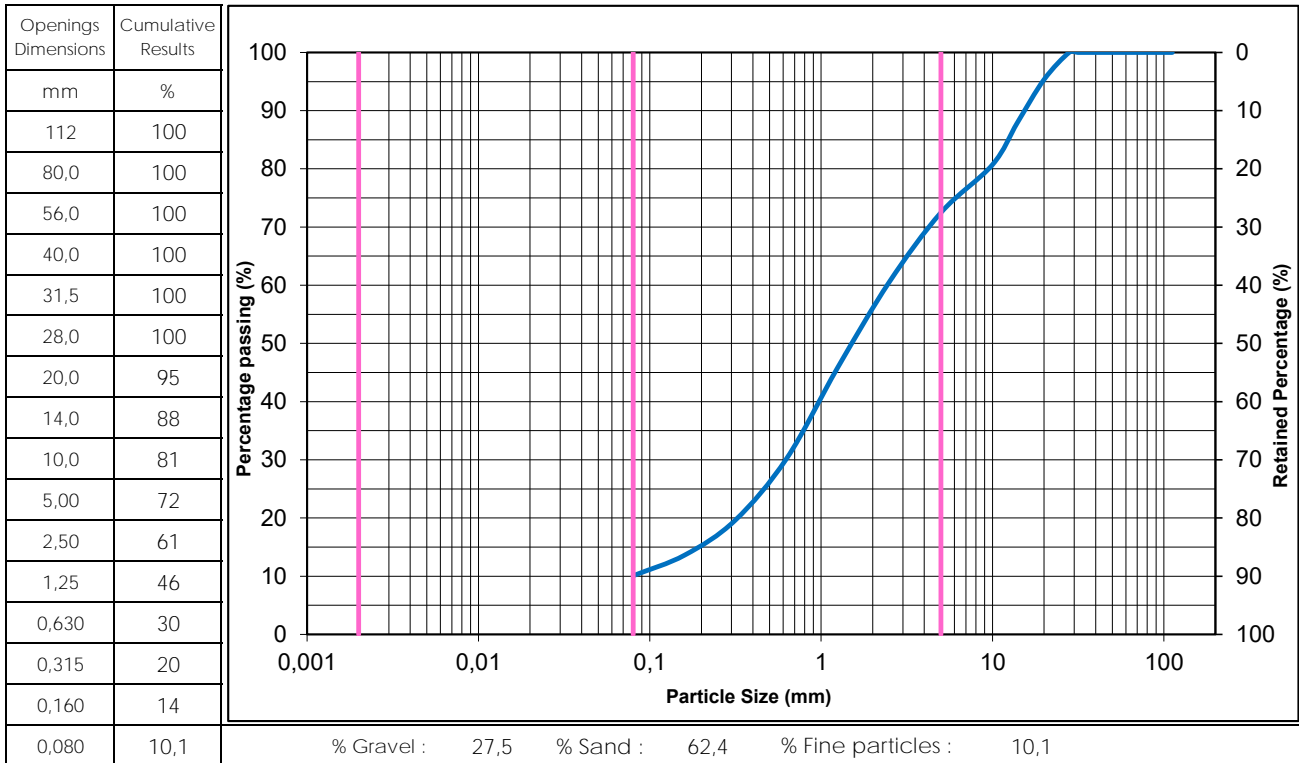
Prepared by :

 Benoit Cyr, Geo. *BJ*

Date : December 05, 2022

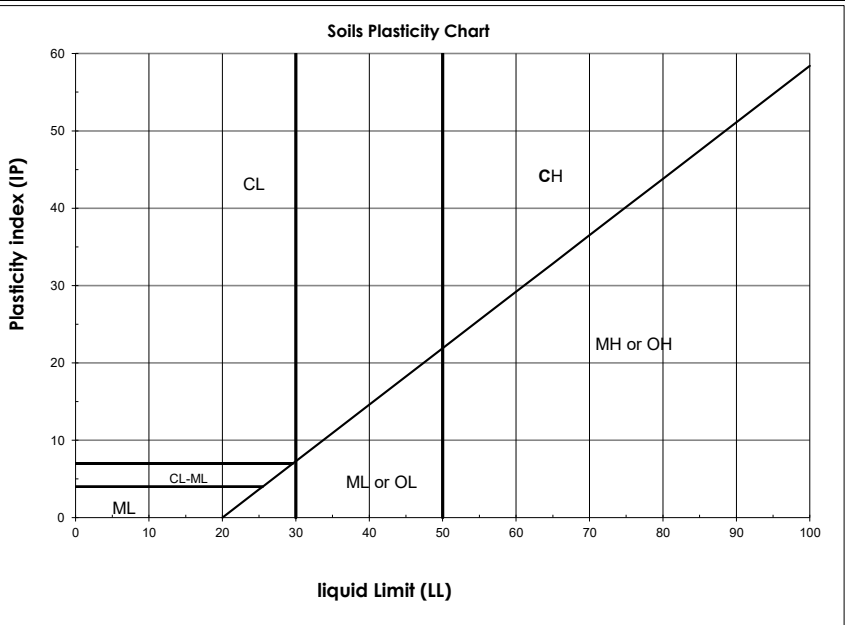
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 26, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-07 SS-02	Material Description : Gravely Sand, some fine particles
Depth : 0,61 - 1,22m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	2,6



Remarks : _____

Prepared by : Benoit Cyr, Geo. Date : December 05, 2022

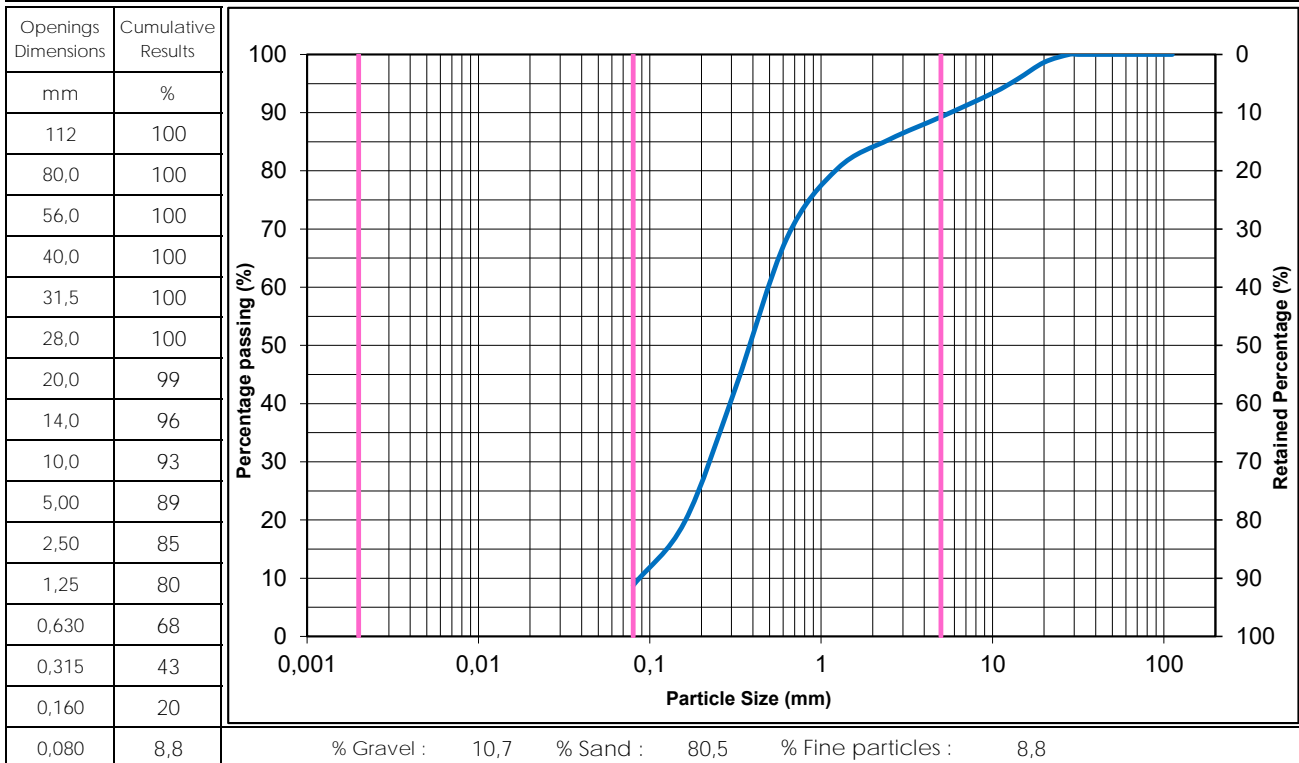
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 26, 2022

Project No : 158100425.500.710.6
Sample No : BH22-07 SS-06
Depth : 3,05 - 3,66m

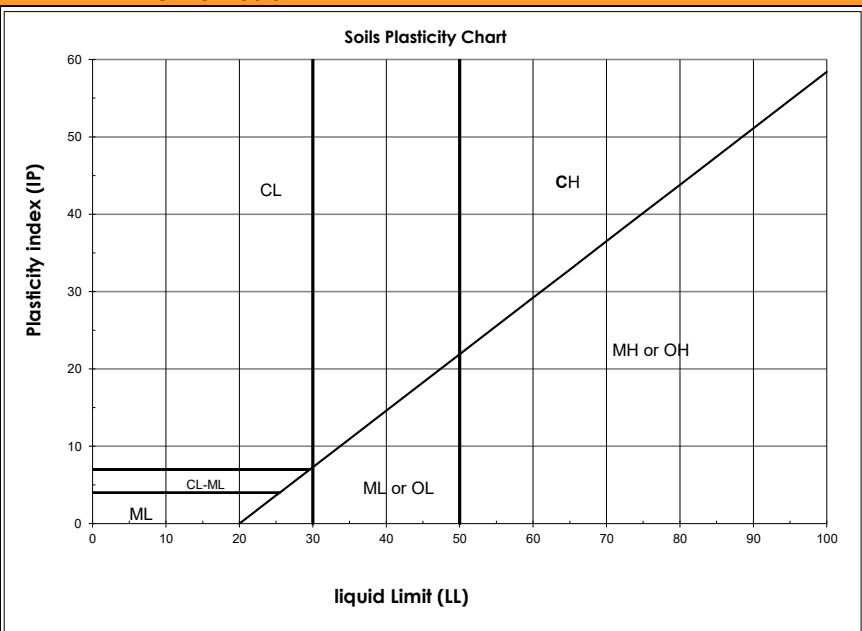
Material Description : Sand, some Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	15,7



Remarks :

Prepared by :

Benoit Cyr, Geo.



Date : December 09, 2022

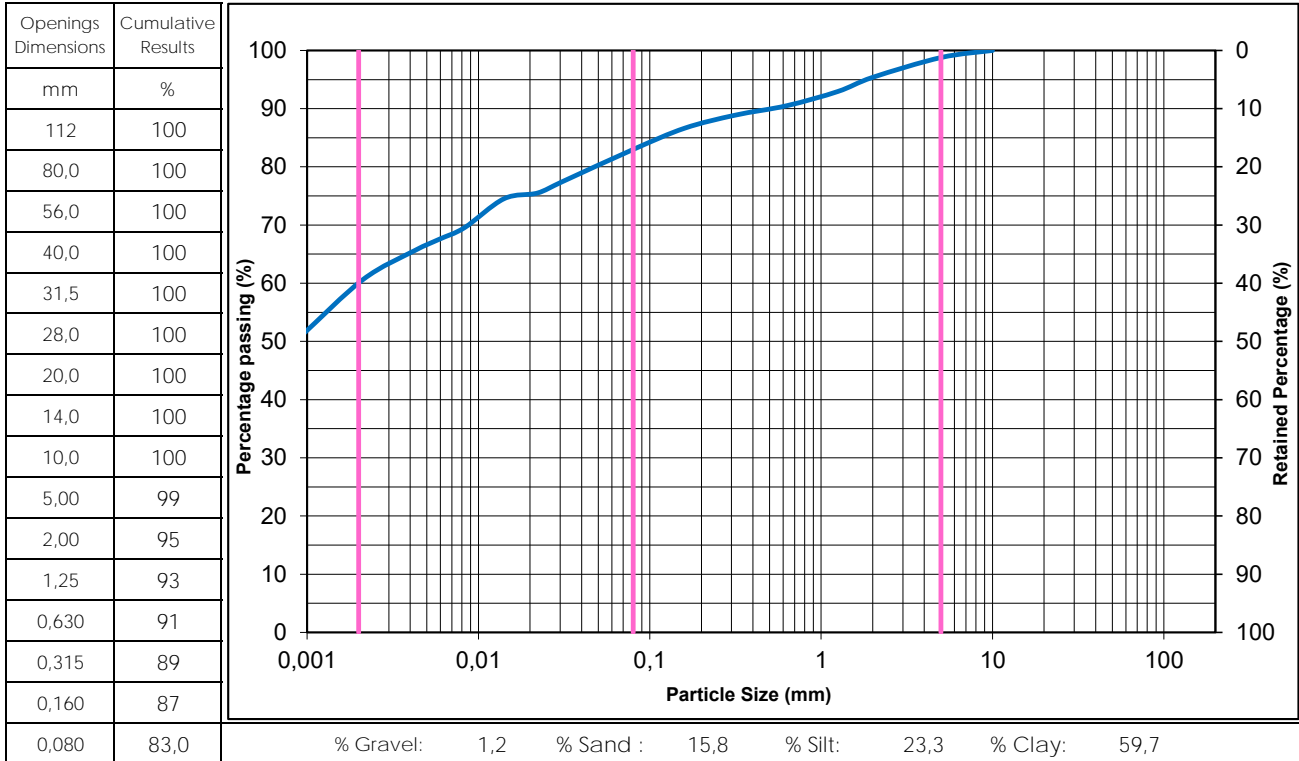
Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 26, 2022

Project No : 158100425.500.710.6
Sample No : BH22-07 SS-10
Depth : 5,49 - 6,10m

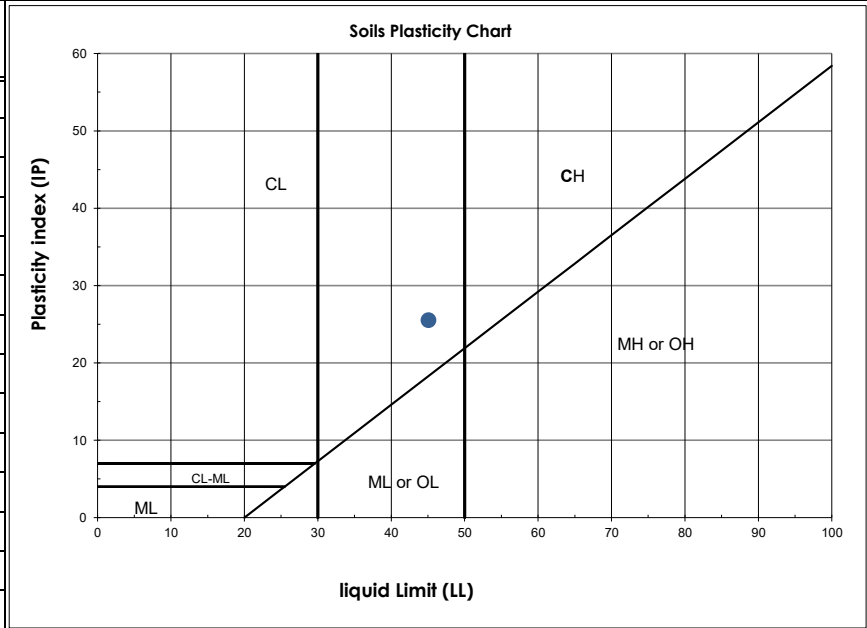
Material Description : Silty Clay, some Sand, traces of
Gravel, medium plasticity (CL)

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	33,4
Liquid Limit (BNQ 2501-092)	45
Plastic Limit (BNQ 2501-092)	19
Plasticity Index (BNQ 2501-092)	26



Remarks :

Prepared by : Benoit Cyr, Geo. *BC* Date : December 09, 2022

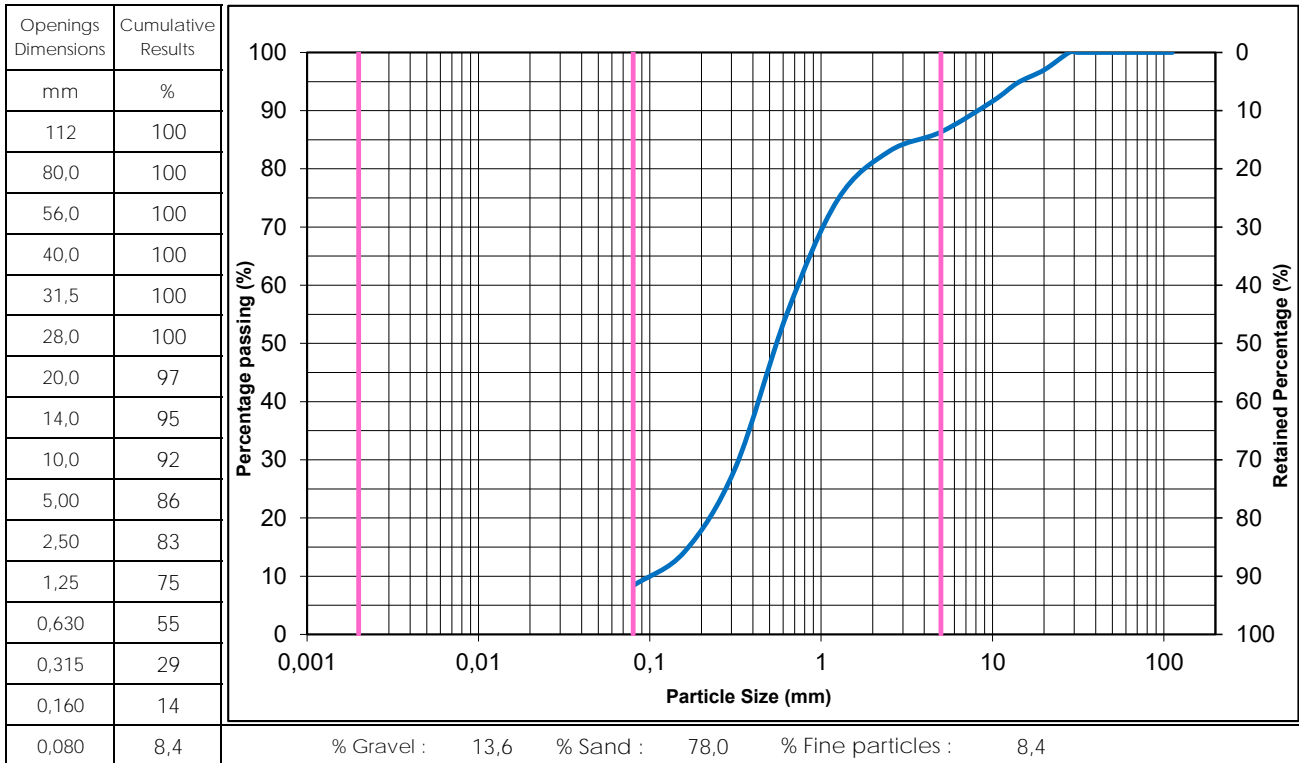
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 26, 2022

Project No : 158100425.500.710.6
Sample No : BH22-08 SS-01
Depth : 0,00 - 0,61m

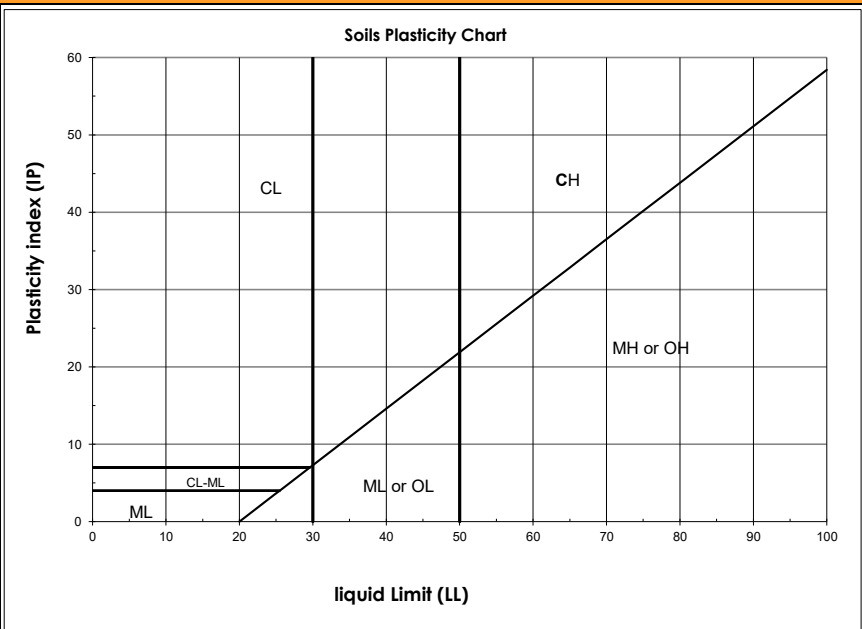
Material Description : Sand, some Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	3,6



Remarks :

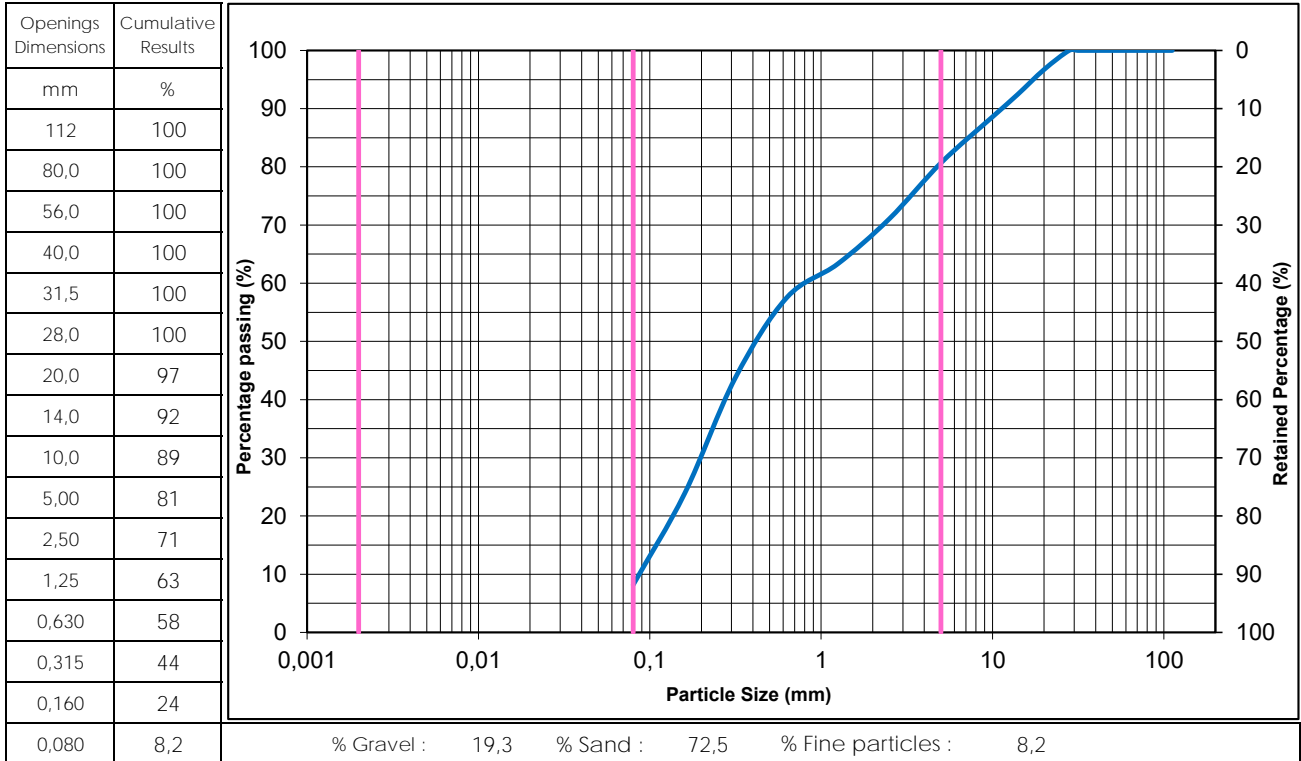
Prepared by :

Benoit Cyr, Geo. *BC*

Date : December 09, 2022

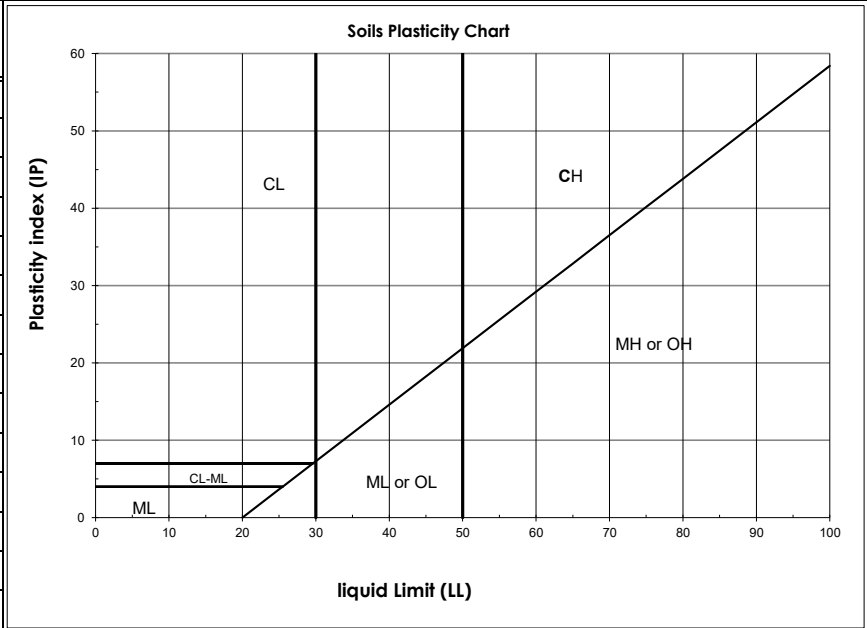
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 26, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-08 SS-04	Material Description : Sand, some Gravel, traces of fine particles
Depth : 1,83 - 2,44m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	14,5

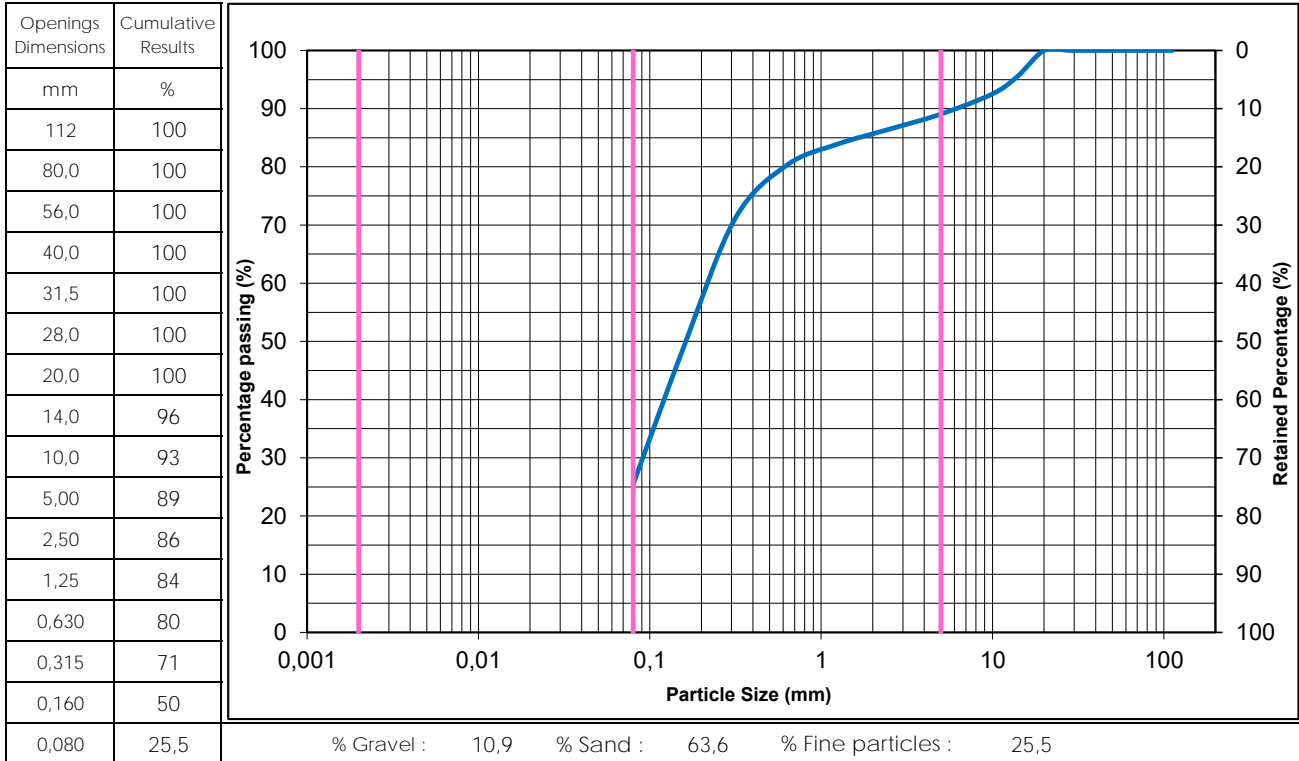


Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC* Date : December 09, 2022

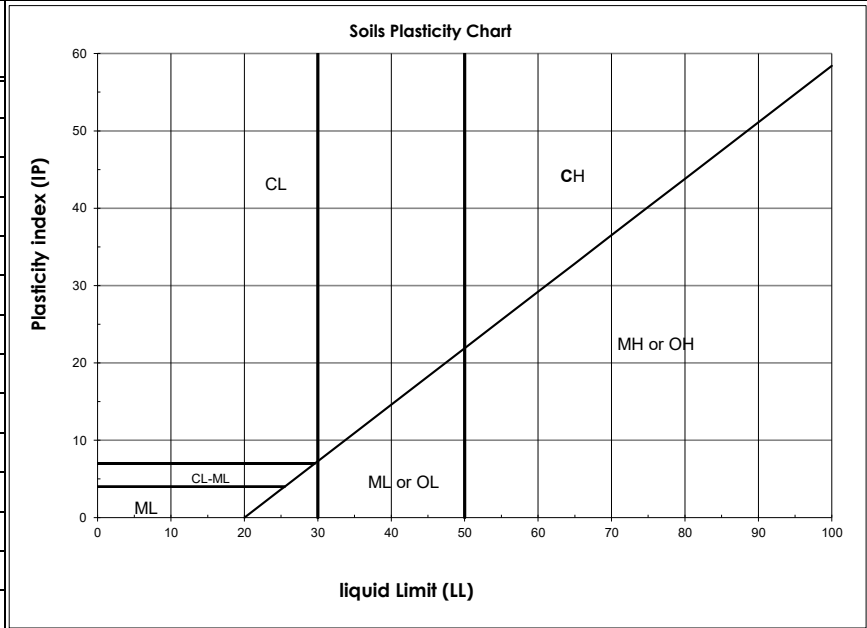
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 26, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-08 SS-08	Material Description : Silty Sand, some Gravel
Depth : 4,27 - 4,88m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	13,2

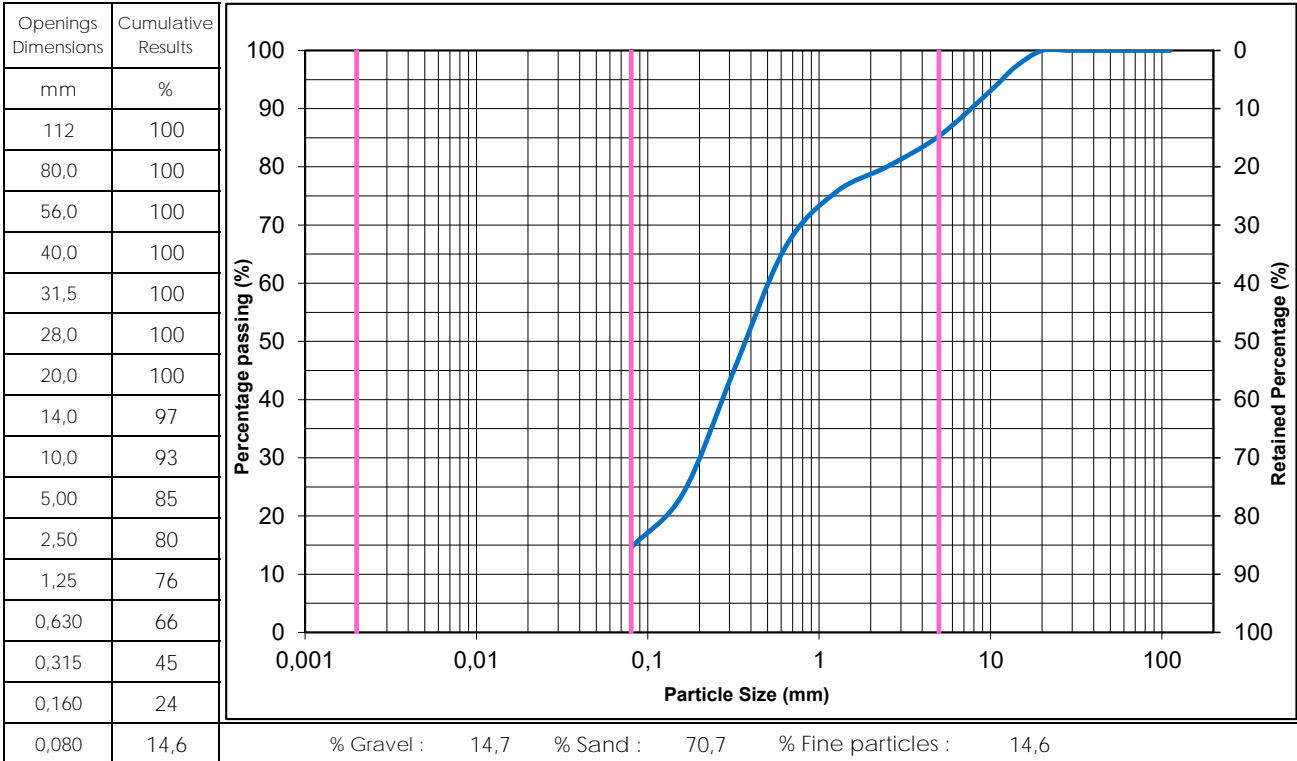


Remarks : _____

Prepared by : Benoit Cyr, Geo. _____ Date : December 09, 2022

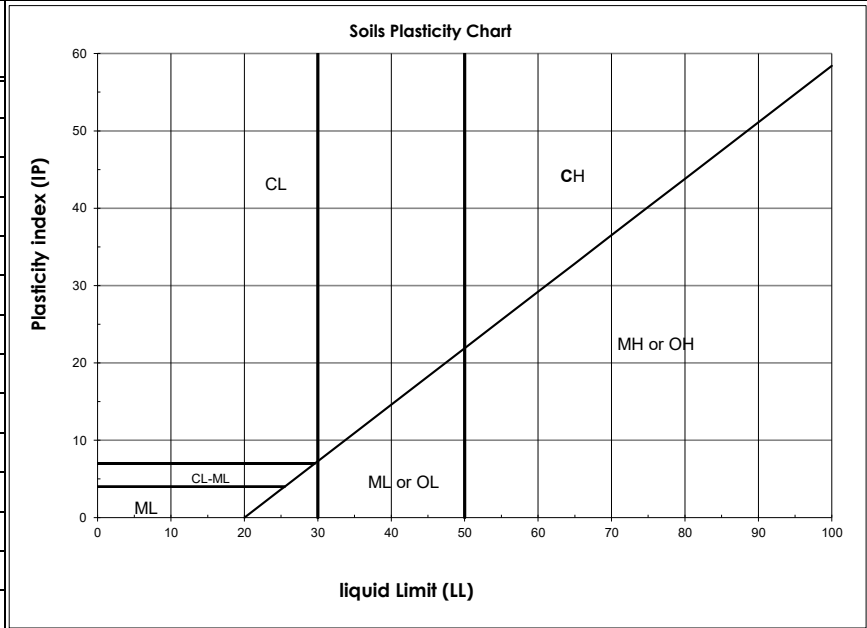
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 25, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-09 SS-02	Material Description : Sand, some Gravel, some fine particles
Depth : 0,61 - 1,22m	

Grain Size Analysis (BNQ 2501-025)




Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	6,2



Remarks : _____

Prepared by : Benoit Cyr, Geo.  Date : December 09, 2022

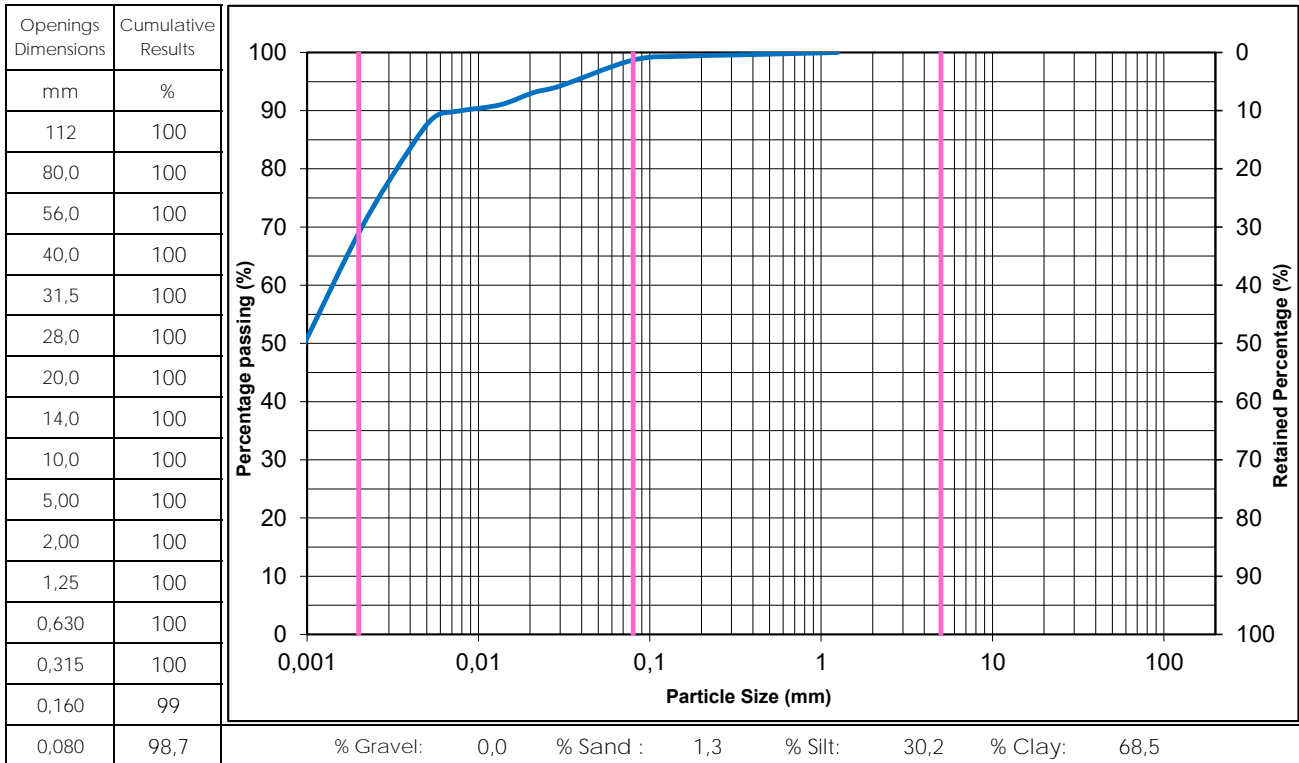
Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

 Sampled by : Hugo Desrochers
 Sampling Date : August 25, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-09 SS-03
 Depth : 1,22 - 1,83m

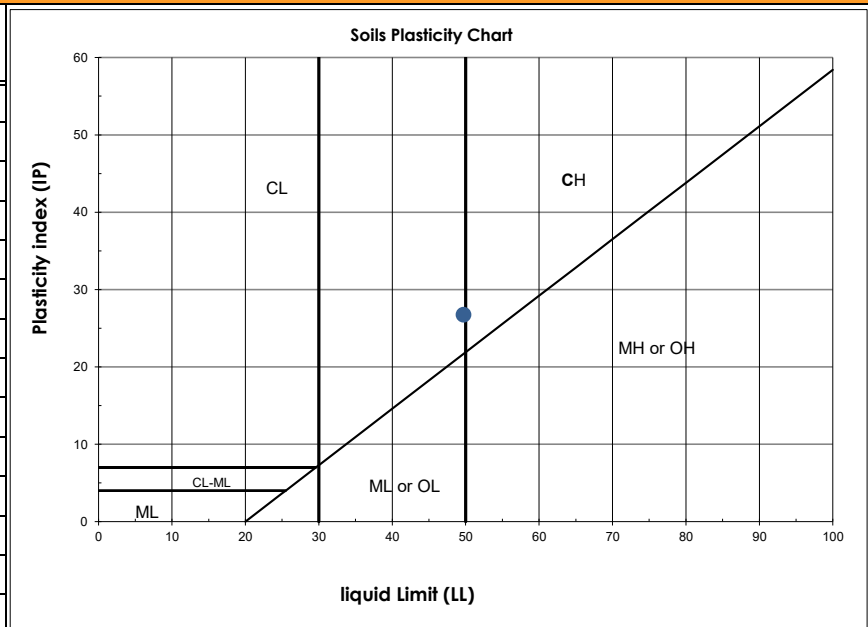
 Material Description : Silty Clay, traces of Sand,
 medium plasticity (CL)

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	41,1
Liquid Limit (BNQ 2501-092)	50
Plastic Limit (BNQ 2501-092)	23
Plasticity Index (BNQ 2501-092)	27



Remarks :

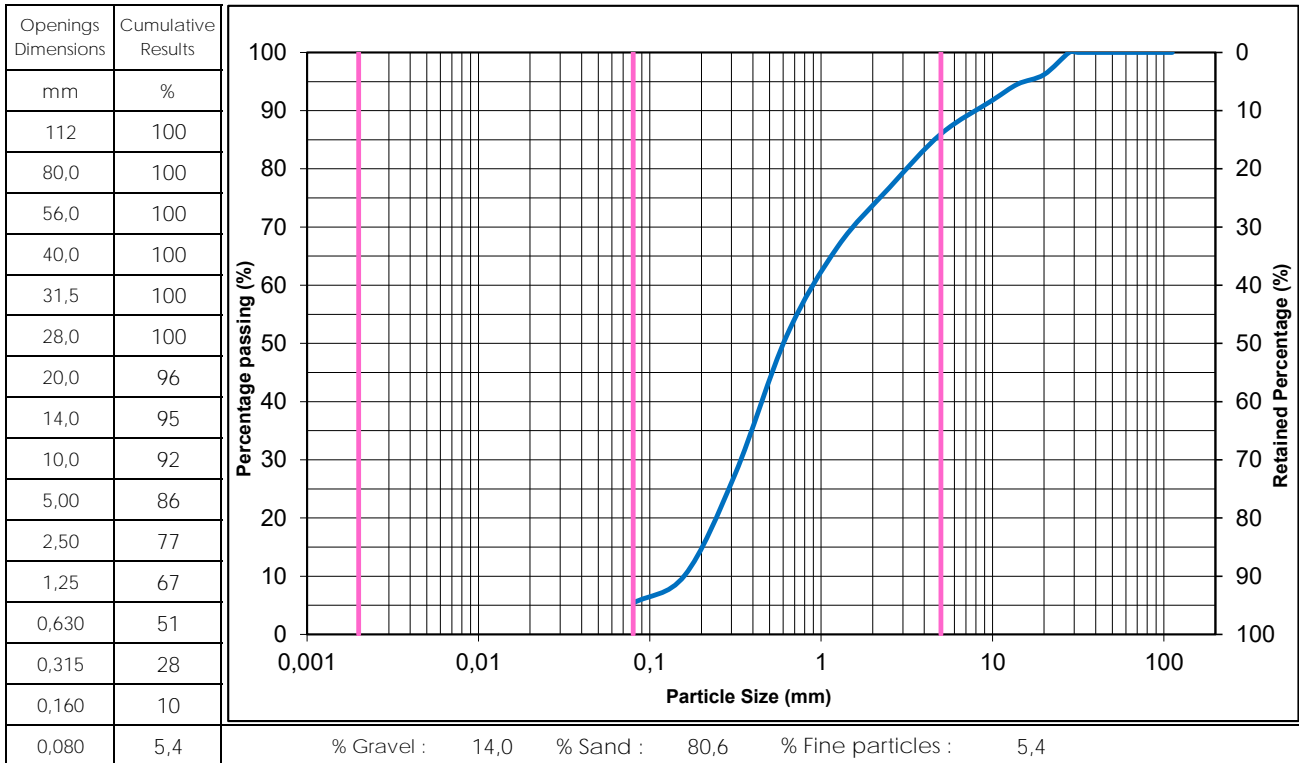
Prepared by :

 Benoit Cyr, Geo. 

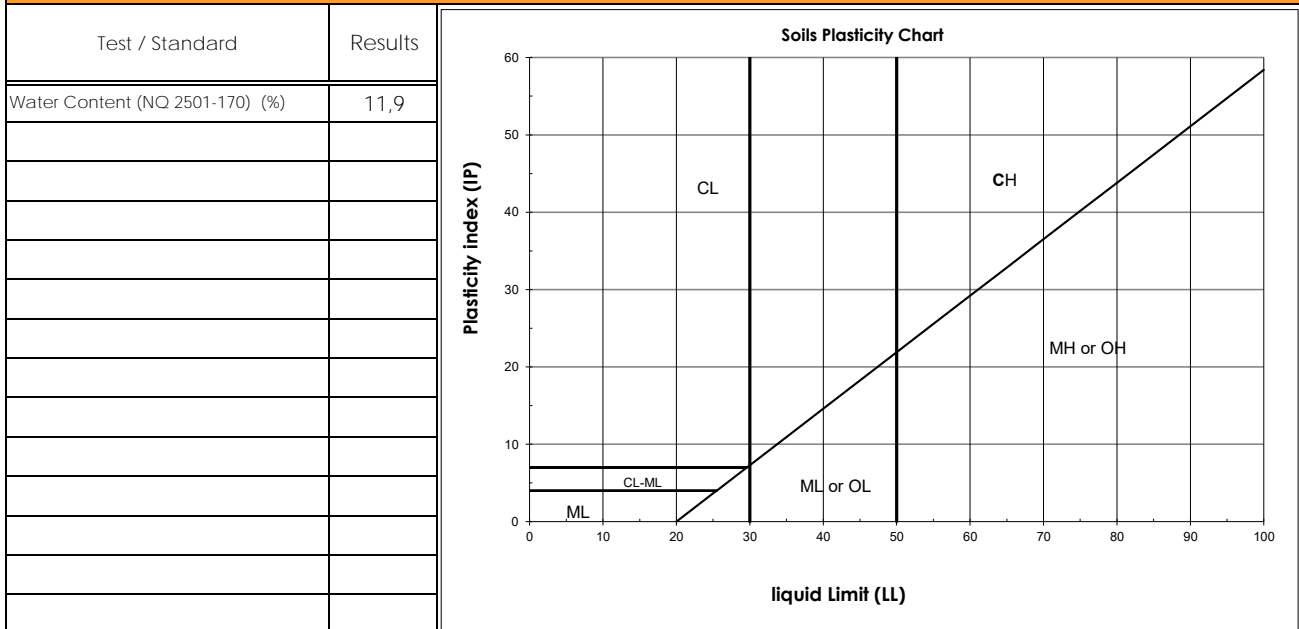
Date : December 09, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 25, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-09 SS-11	Material Description : Sand, some Gravel, traces of fine particles
Depth : 7,62 - 7,85m	

Grain Size Analysis (BNQ 2501-025)



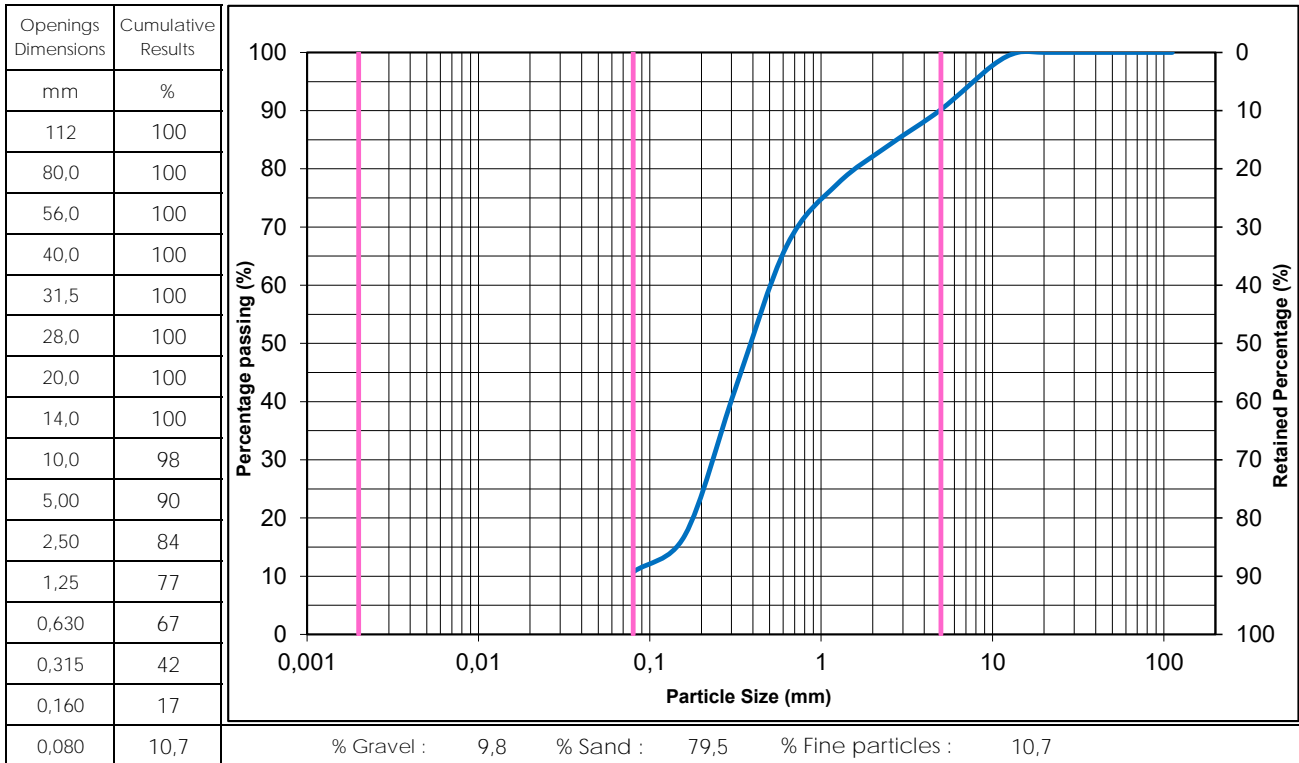
Other tests



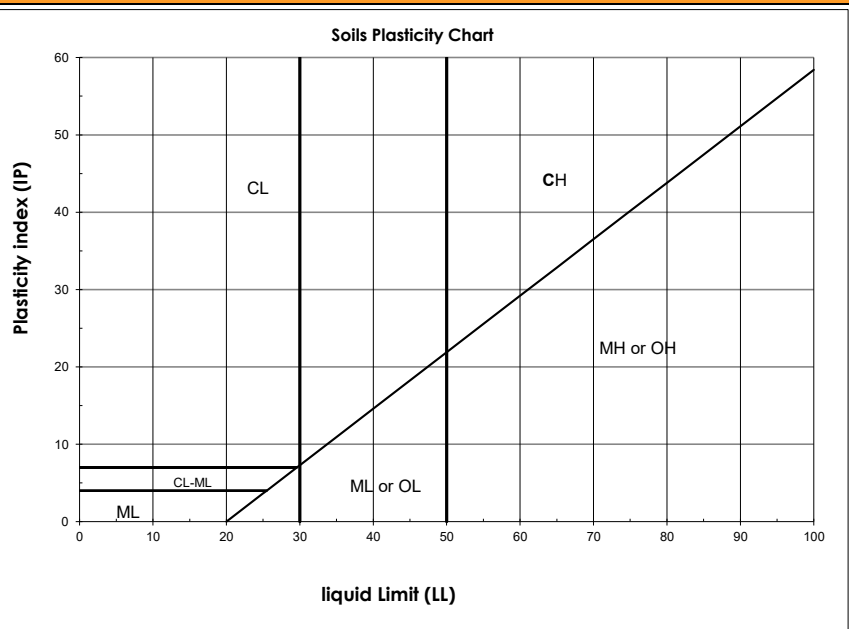
Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC* _____ Date : December 09, 2022

Client :	Cree Development Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	August 25, 2022
Project No :	158100425.500.710.6		
Sample No :	BH22-10 SS-04	Material Description :	Sand, some fine particles, traces of Gravel
Depth :	1,83 - 2,44m		

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	17,1

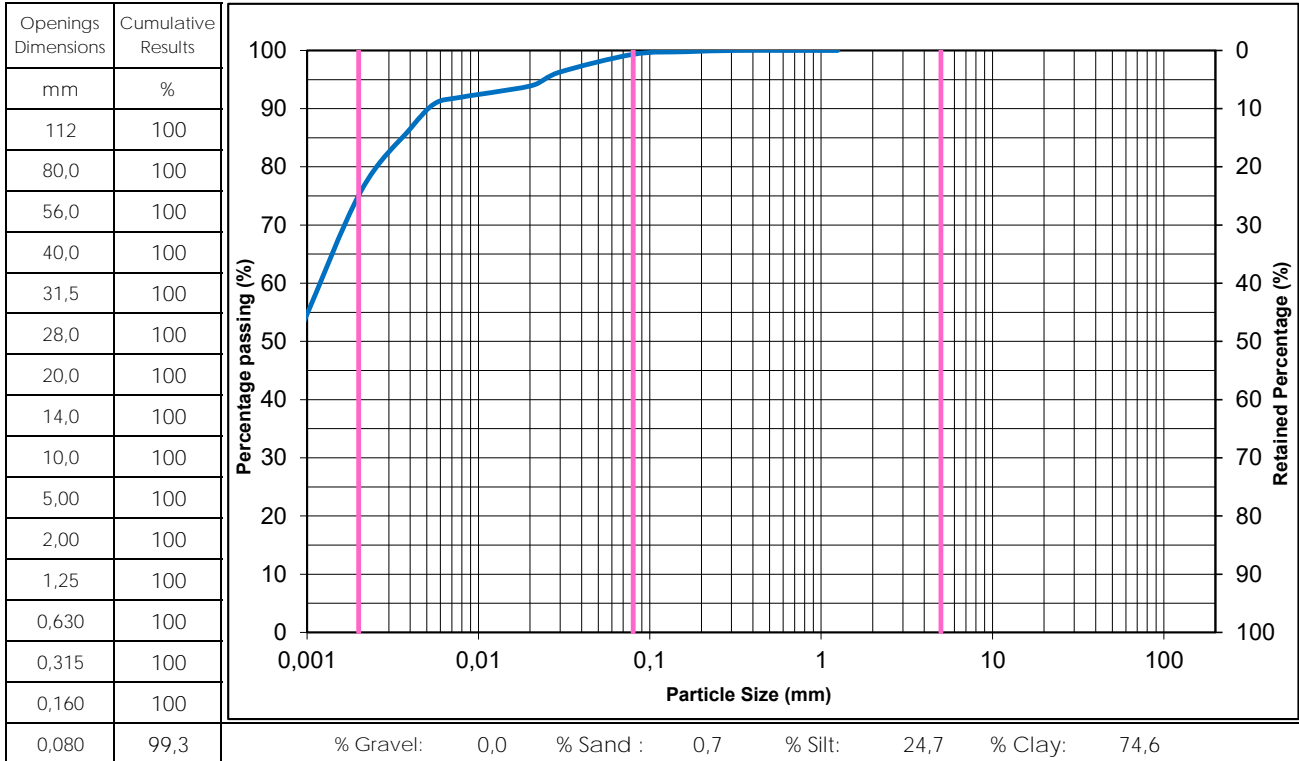


Remarks : _____

 Prepared by : Benoit Cyr, Geo. *Bj* Date : December 09, 2022

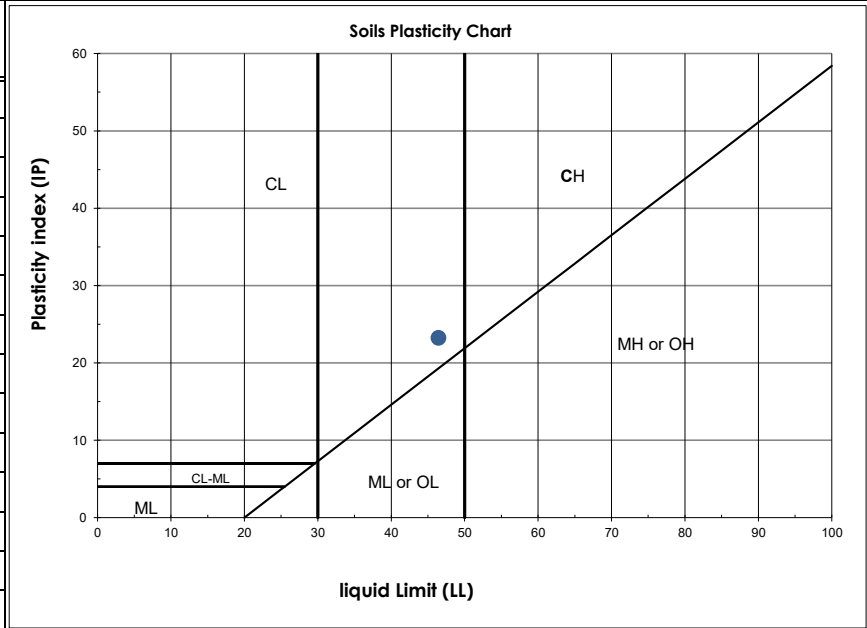
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 25, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-10 SS-07	Material Description : Silty Clay, traces of Sand, medium plasticity (CL)
Depth : 3,81 - 4,42m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	31,3
Liquid Limit (BNQ 2501-092)	46
Plastic Limit (BNQ 2501-092)	23
Plasticity Index (BNQ 2501-092)	23



Remarks : _____

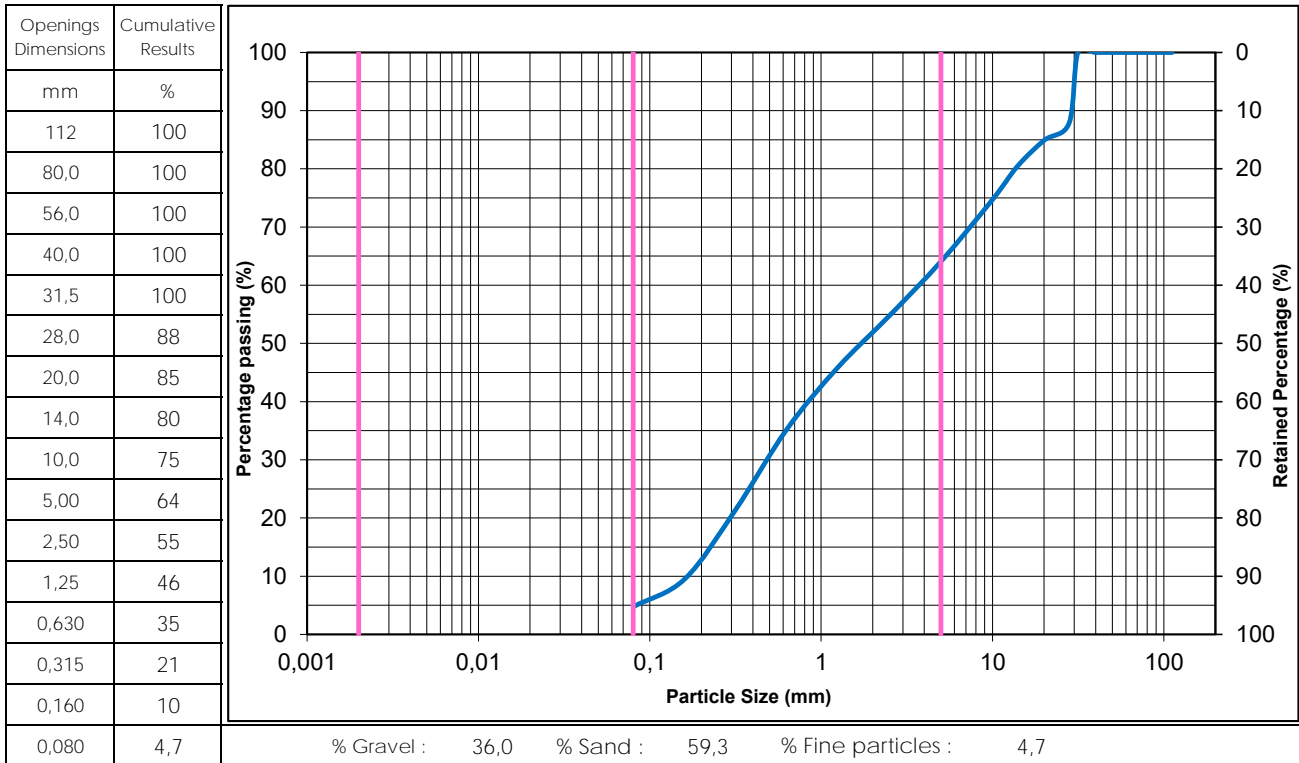
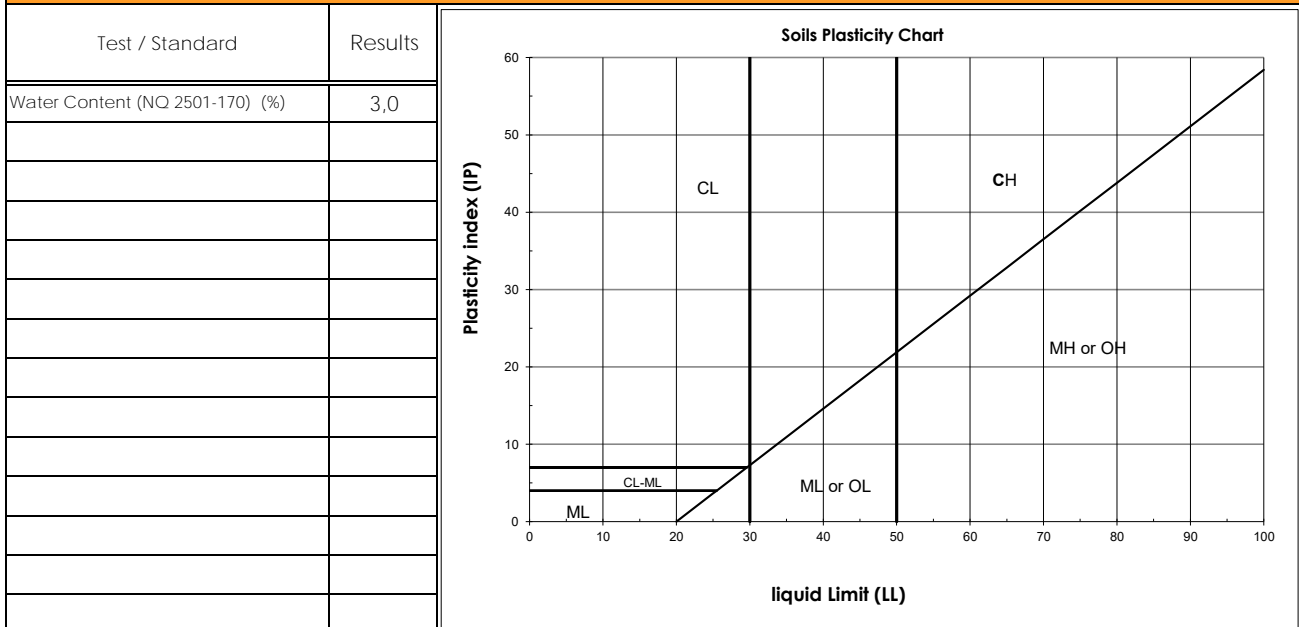
Prepared by : Benoit Cyr, Geo. *BC* Date : December 09, 2022

Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 09, 2022

Project No : 158100425.500.710.6
Sample No : BH22-11 SS-01
Depth : 0,00 - 0,61m

Material Description : Sand and Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)**Other tests**

Remarks :

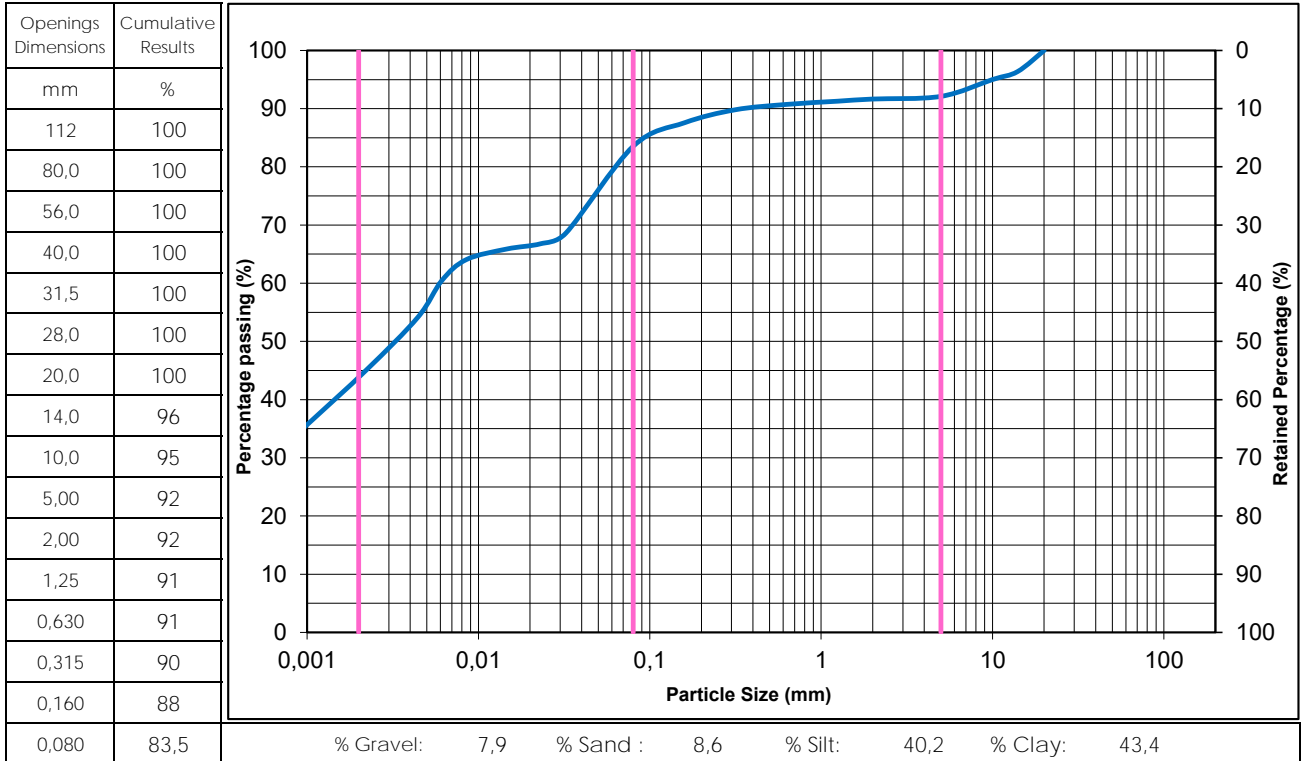
Prepared by :

Benoit Cyr, Geo.

Date : October 26, 2022

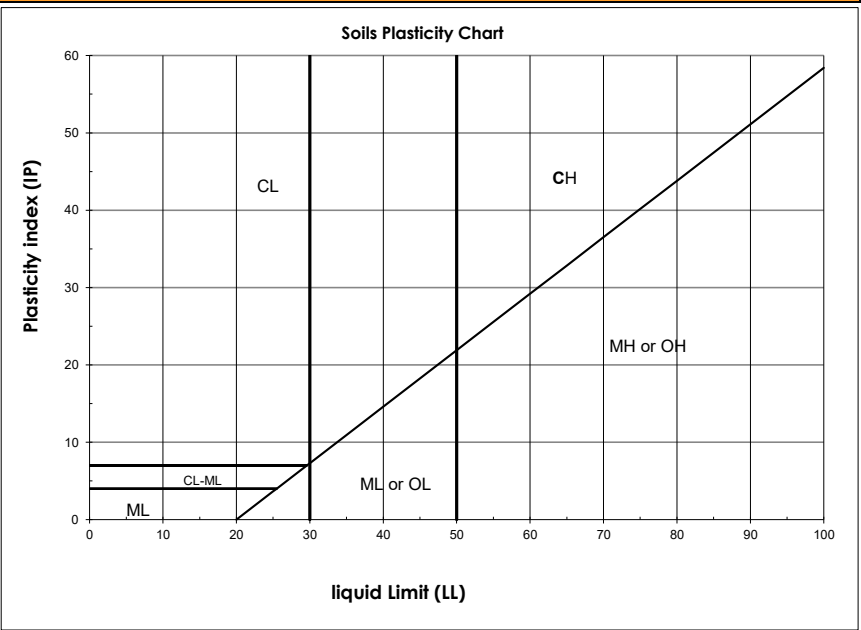
Client :	Cree Developpment Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	August 09, 2022
Project No :	158100425.500.710.6		
Sample No :	BH22-11 SS-08	Material Description :	Clay and Silt, traces of Sand, traces of Gravel
Depth :	4,57 - 5,18m		

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	51,0

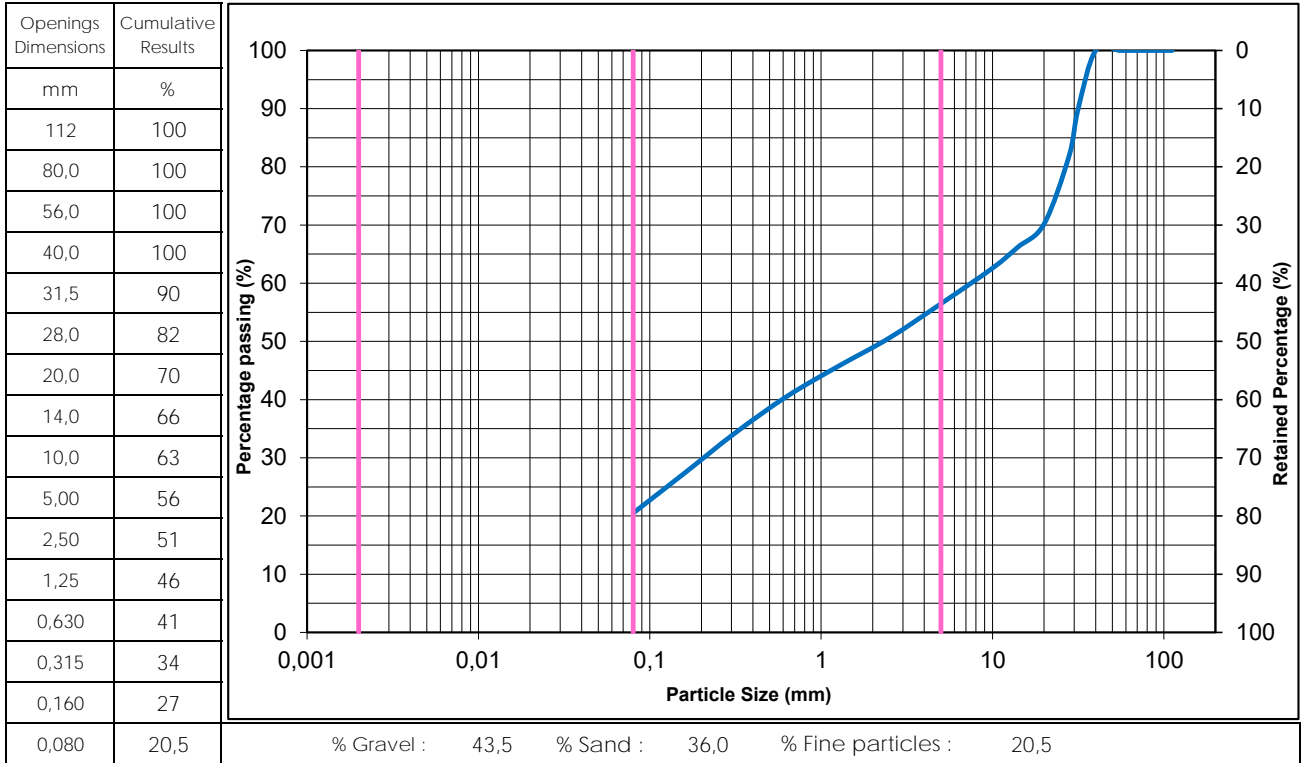


Remarks :

Prepared by : Benoit Cyr, Geo. *BC* Date : October 26, 2022

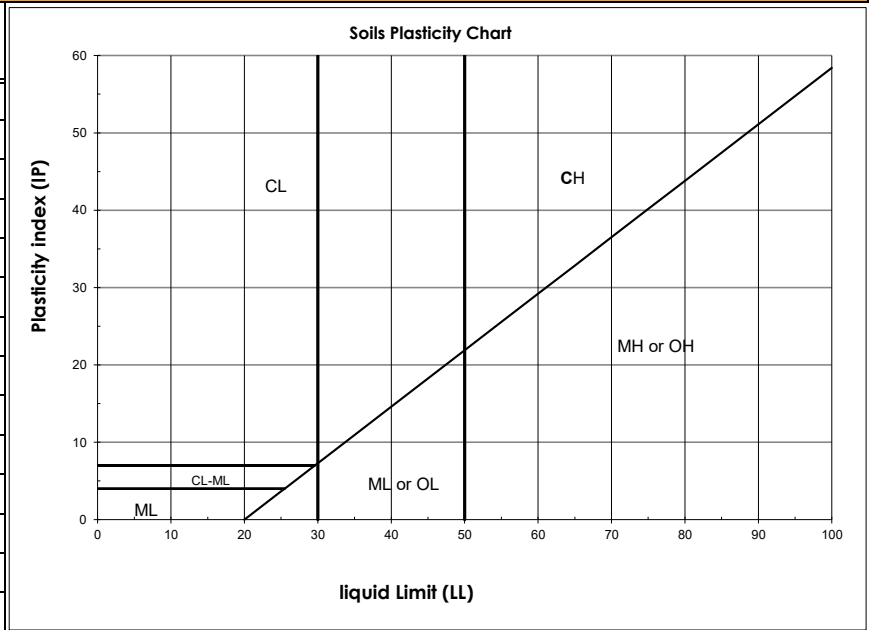
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 09, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-11 SS-12	Material Description : Gravel and Sand, some fine particles
Depth : 7,62 - 8,23m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	6,4



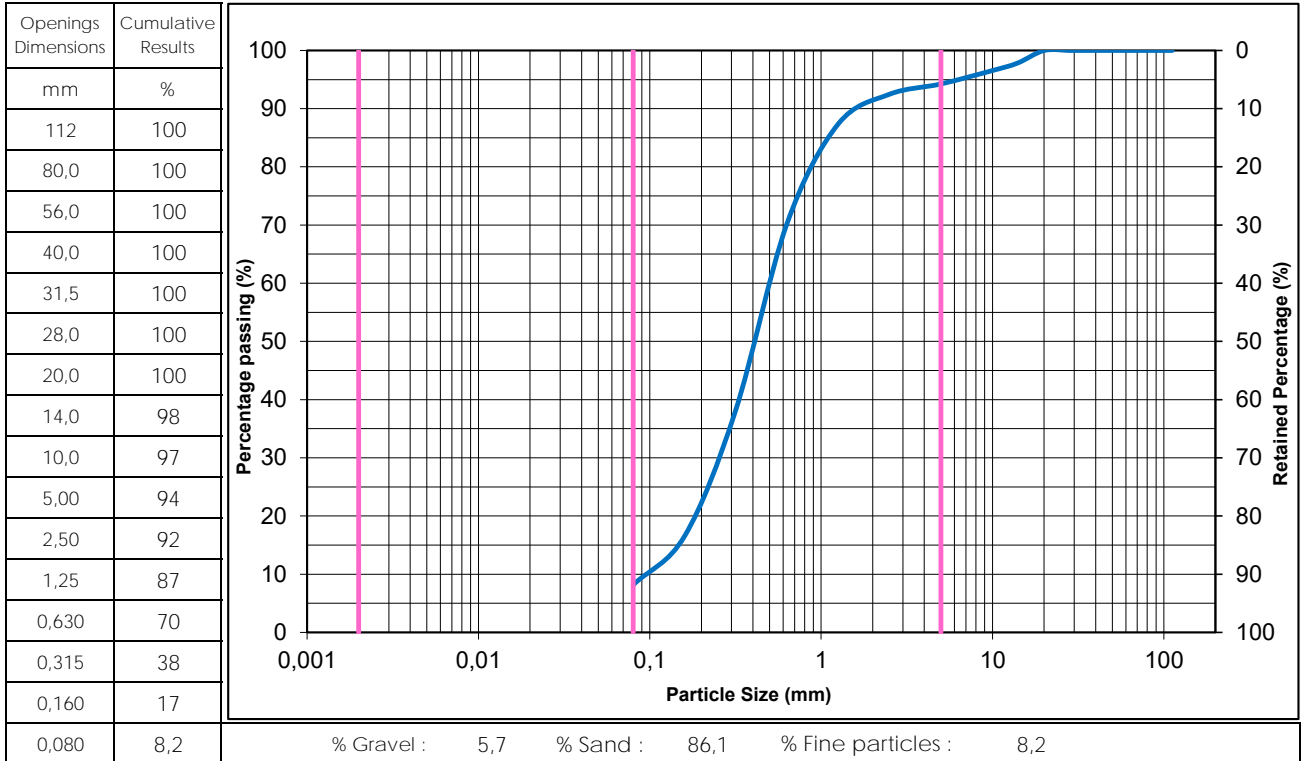
Remarks :

Prepared by : Benoit Cyr, Geo.

Date : October 26, 2022

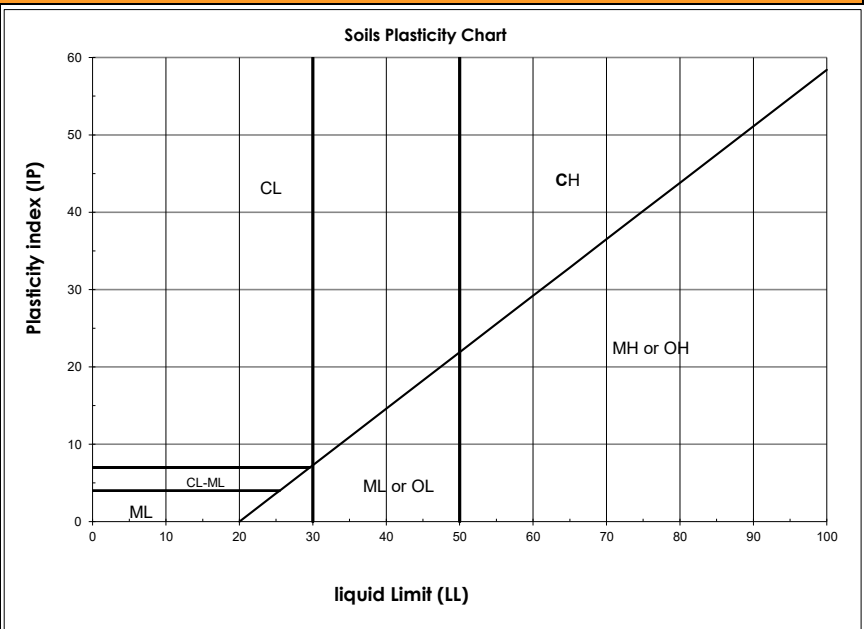
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 10, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-12 SS-02	Material Description : Sand, traces of fine particles, traces of Gravel
Depth : 0,61 - 1,22m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	5,0



Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : October 26, 2022

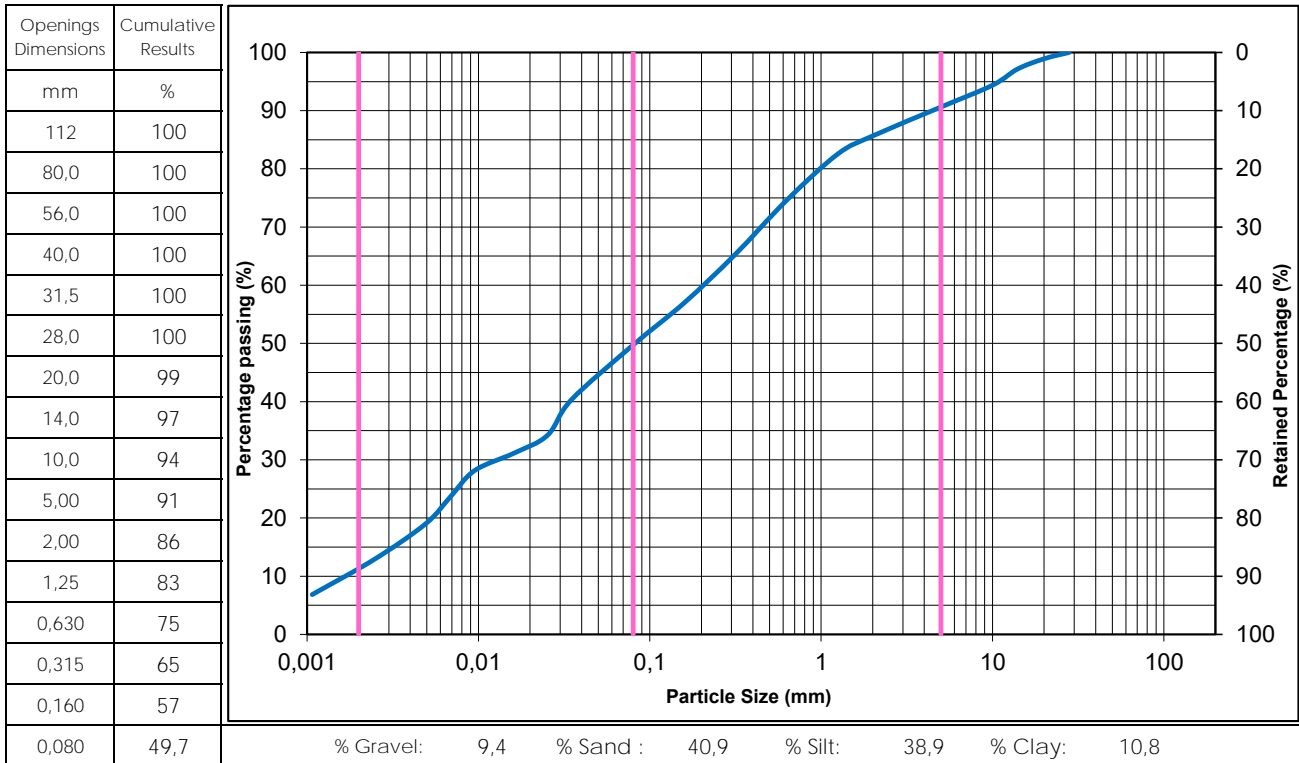
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 10, 2022

Project No : 158100425.500.710.6
Sample No : BH22-12 SS-06
Depth : 3,05 - 3,66m

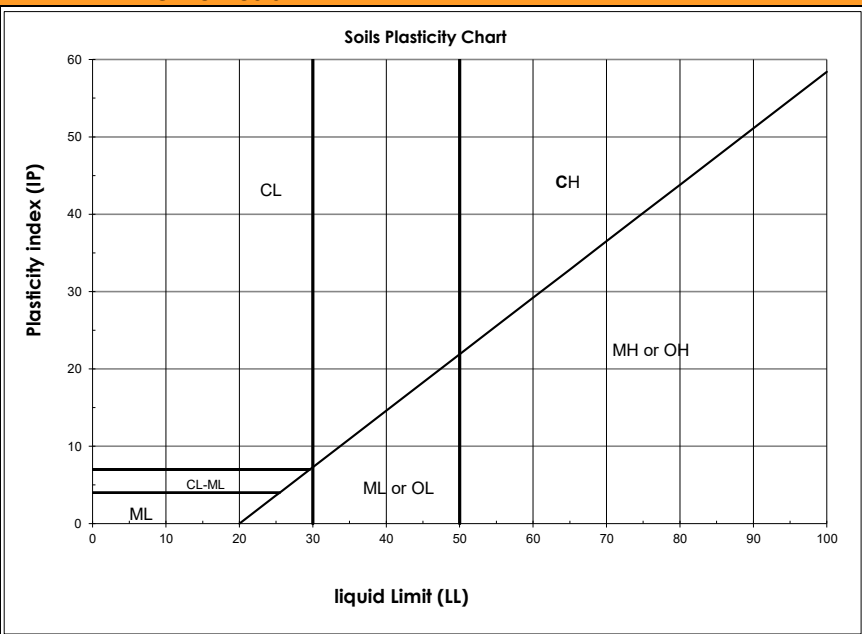
Material Description : Sand and Silt, some Clay,
traces of Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	19,5



Remarks :

Prepared by :

Benoit Cyr, Geo.



Date : October 26, 2022

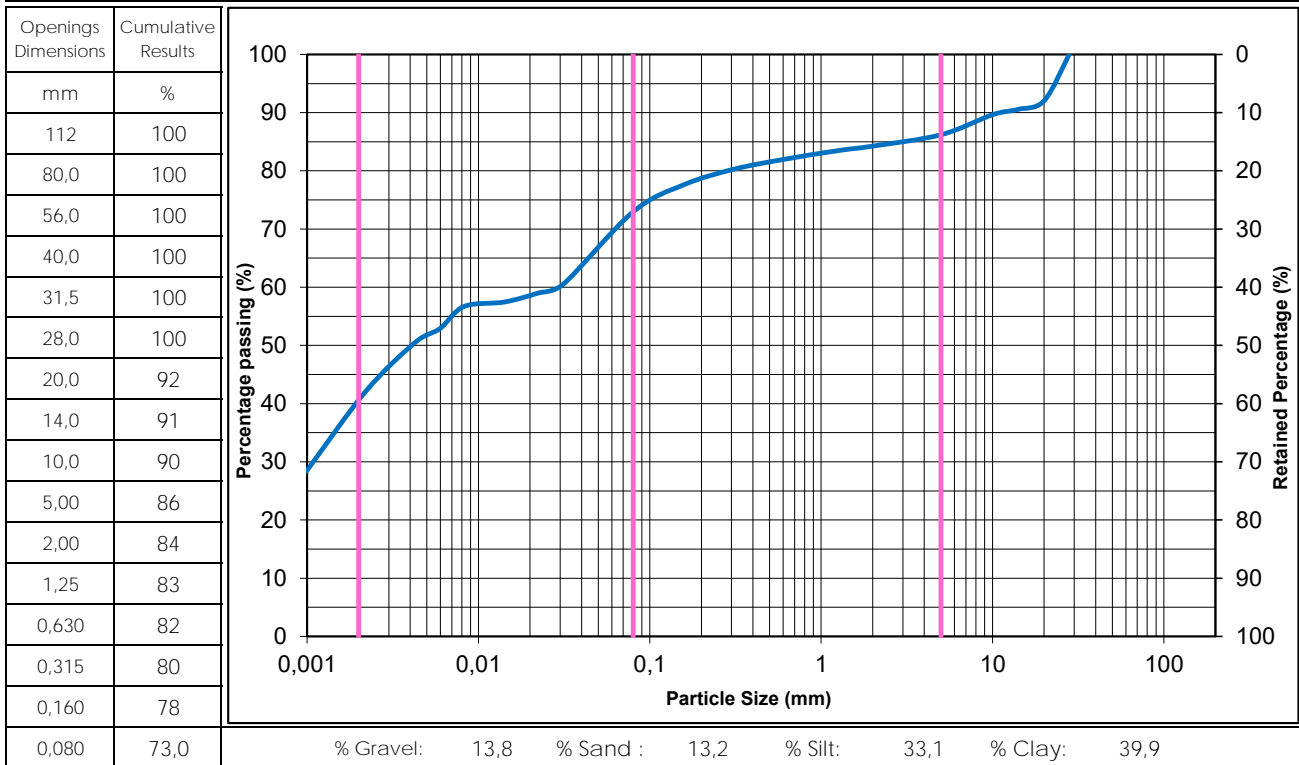
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 10, 2022

Project No : 158100425.500.710.6
Sample No : BH22-12 SS-08
Depth : 4,57 - 5,18m

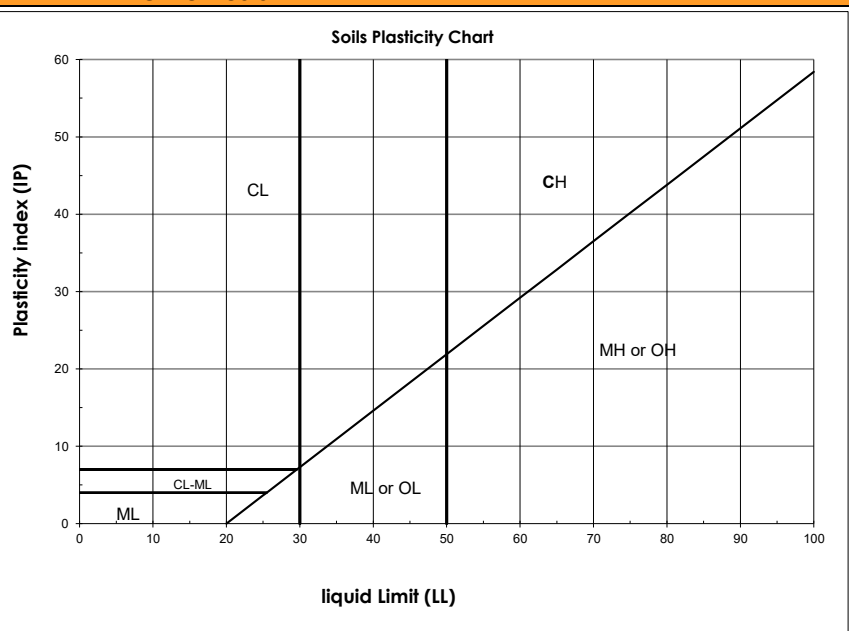
Material Description : Silty Clay, some Sand, some Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	37,5



Remarks :

Prepared by :

Benoit Cyr, Geo.

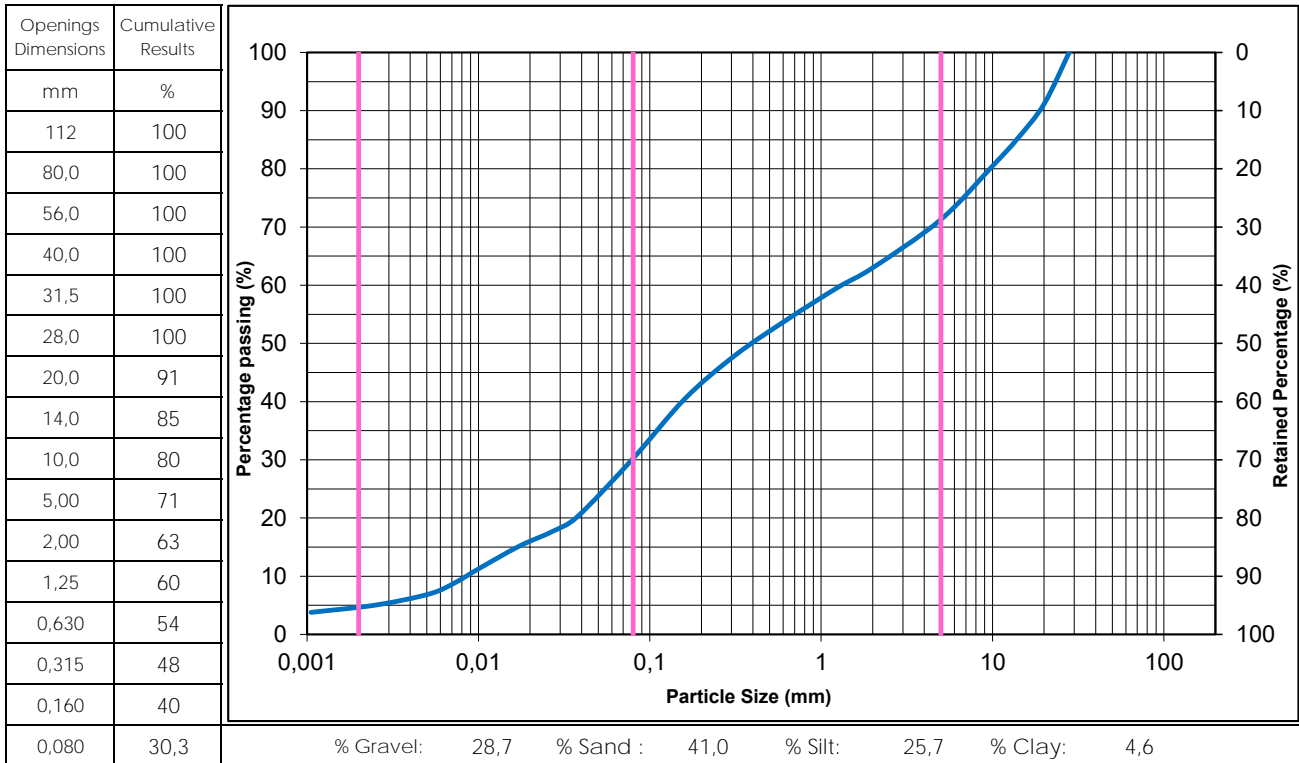
Date : October 26, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

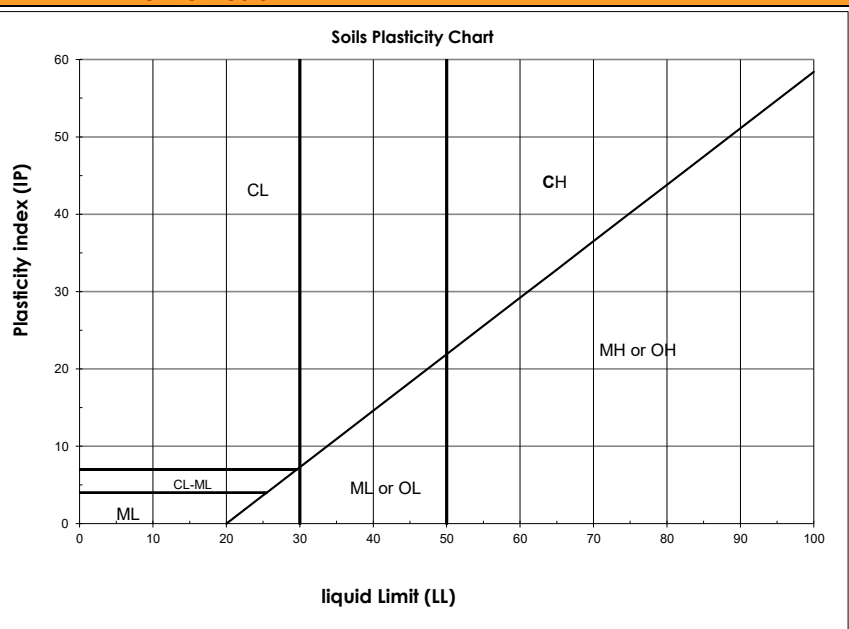
 Sampled by : Hugo Desrochers
 Sampling Date : August 10, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-12 SS-10
 Depth : 6,10 - 6,71m

Material Description : Silty, Gravelly Sand, traces of Clay

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	8,9



Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : October 26, 2022

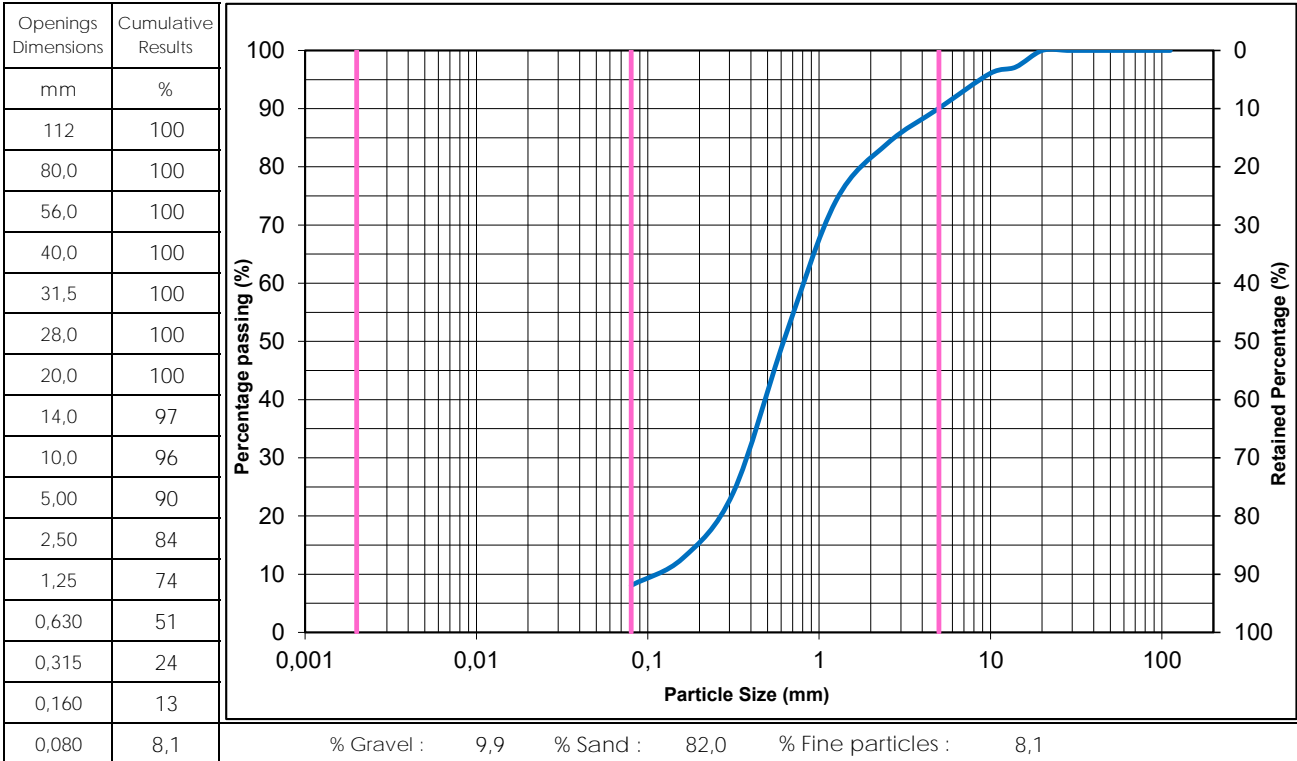
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 11, 2022

Project No : 158100425.500.710.6
Sample No : BH22-13 SS-02
Depth : 0,61 - 1,22m

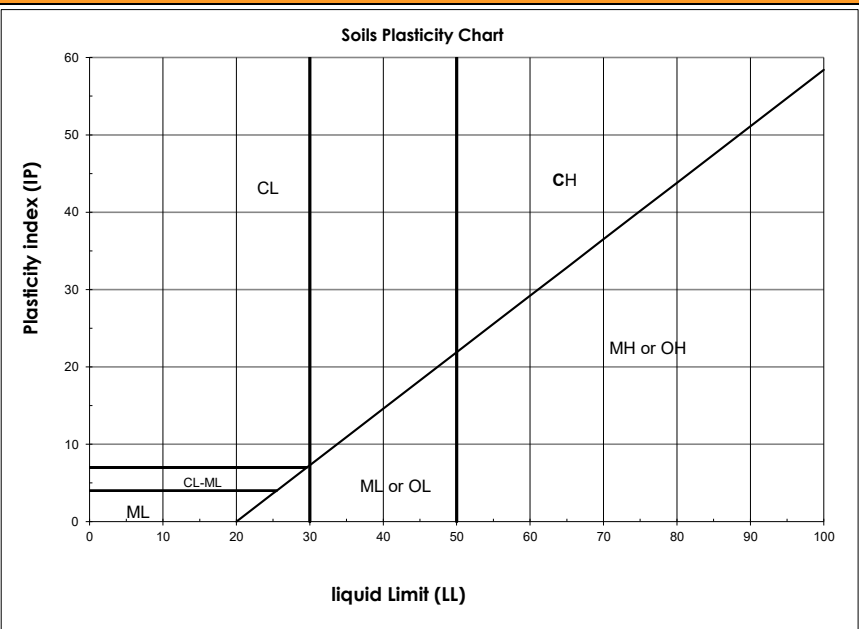
Material Description : Sand, traces of Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	4,0



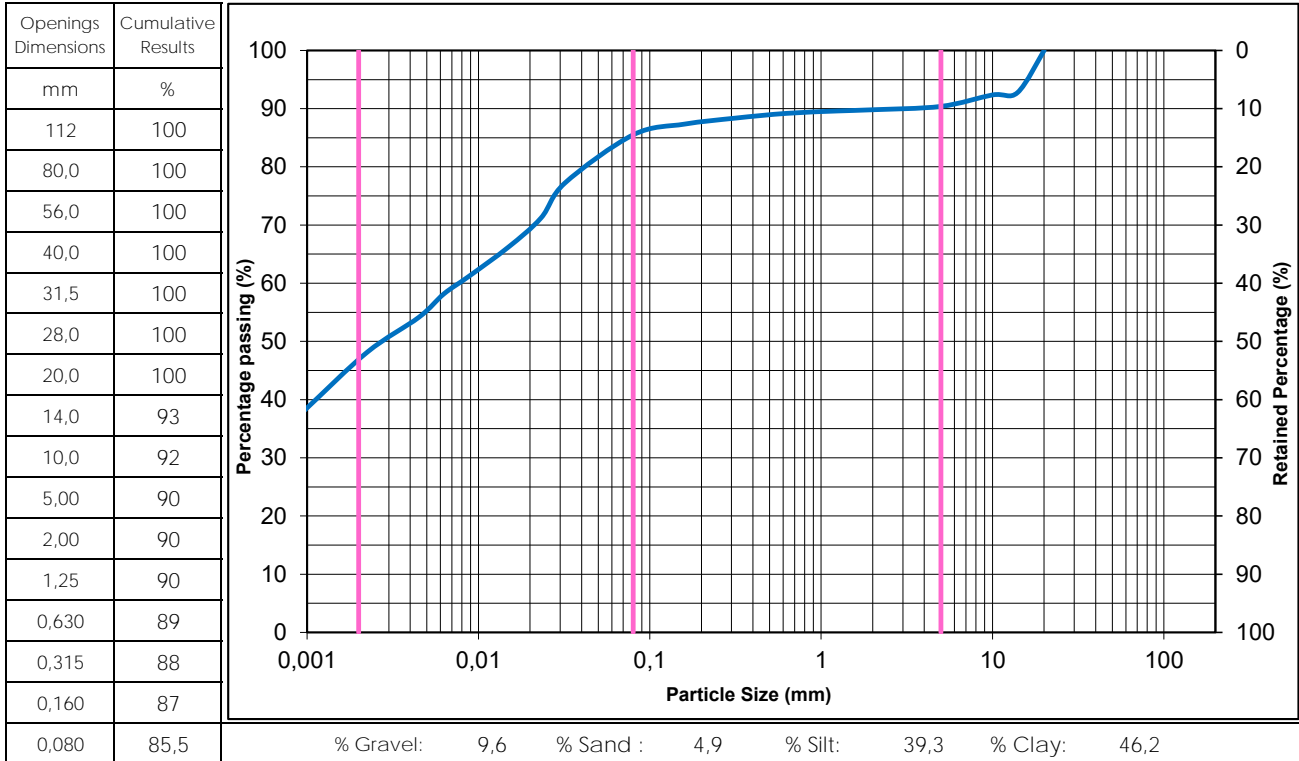
Remarks :

Prepared by : Benoit Cyr, Geo. *Bj*

Date : October 26, 2022

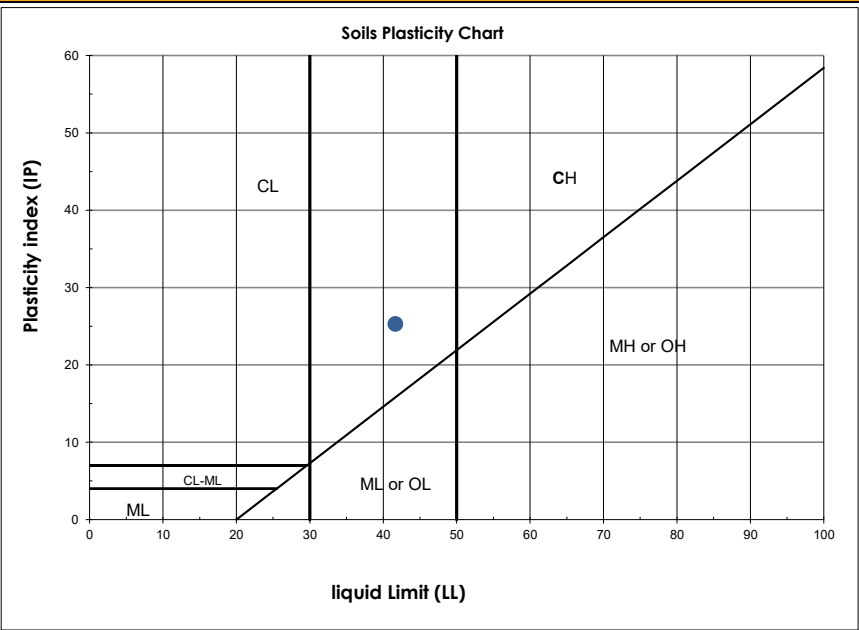
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 11, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-13 SS-06	Material Description : Clay and Silt, traces of Gravel, traces of Sand, medium plasticity (CL)
Depth : 3,05 - 3,66m	

Grain Size Analysis (BNQ 2501-025)




Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	33,1
Liquid Limit (BNQ 2501-092)	42
Plastic Limit (BNQ 2501-092)	17
Plasticity Index (BNQ 2501-092)	25

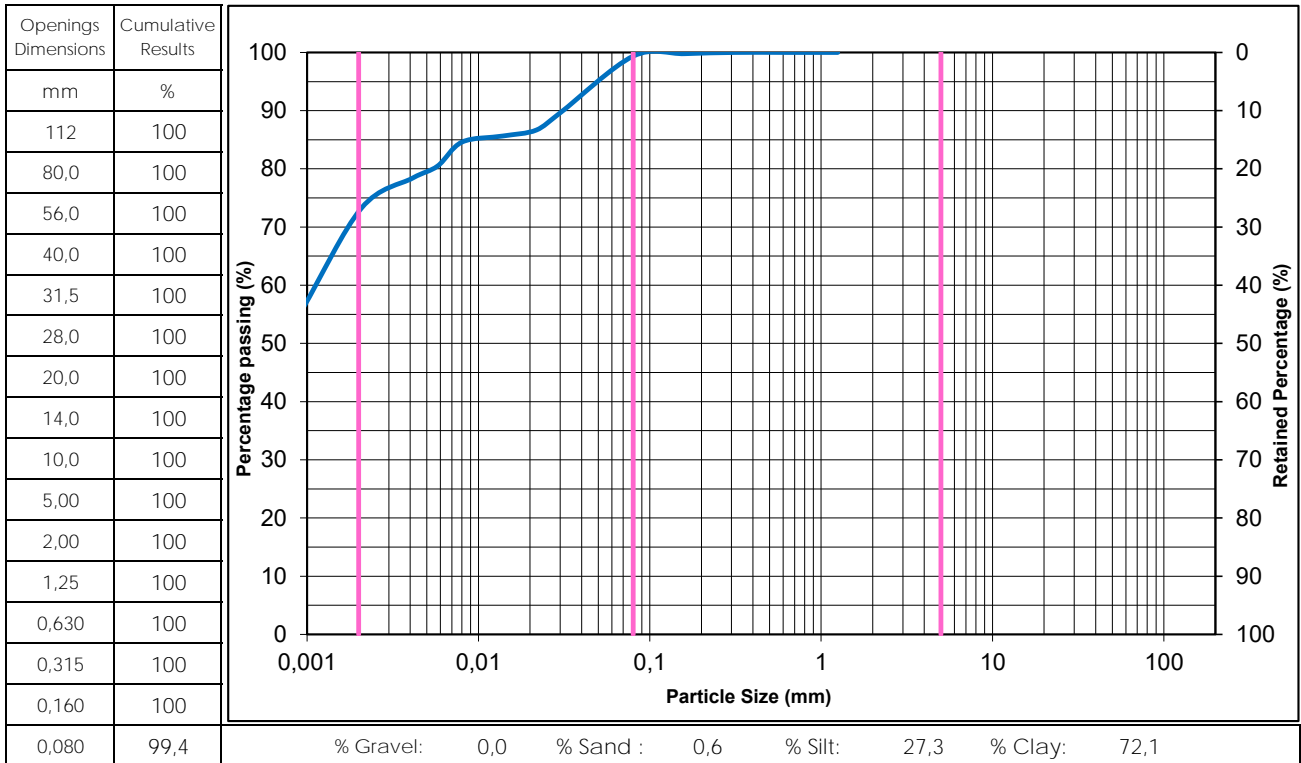


Remarks : _____

Prepared by : Benoit Cyr, Geo.  **Date :** October 26, 2022

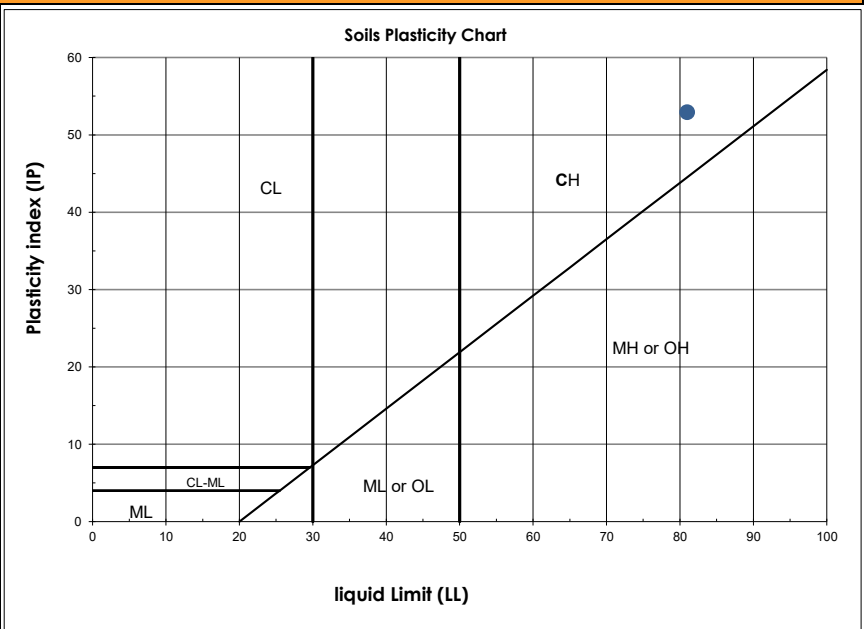
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 11, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-13 SS-12	Material Description : Silty Clay, traces of Sand, high plasticity (CH)
Depth : 7,62 - 8,23m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	99,7
Liquid Limit (BNQ 2501-092)	81
Plastic Limit (BNQ 2501-092)	28
Plasticity Index (BNQ 2501-092)	53



Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC* Date : October 26, 2022

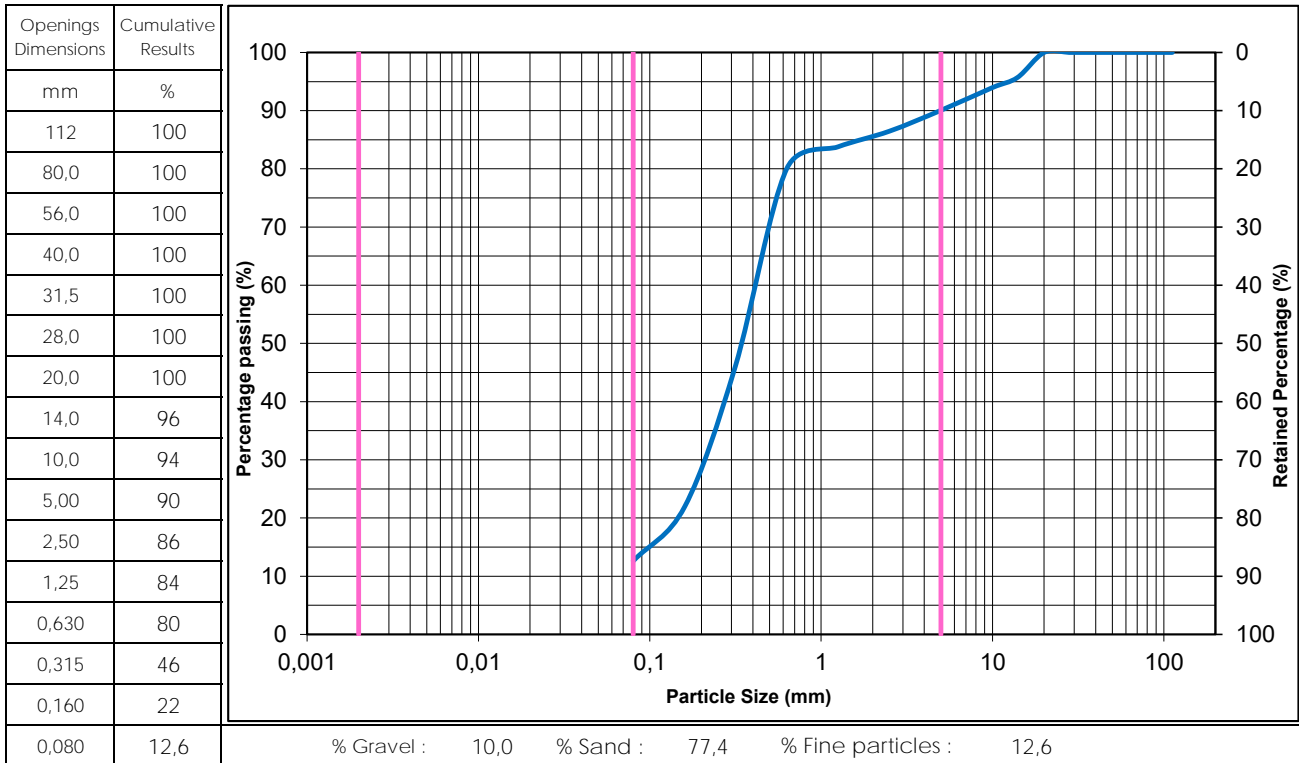
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 11, 2022

Project No : 158100425.500.710.6
Sample No : BH22-13 SS-17
Depth : 15,24 - 15,85m

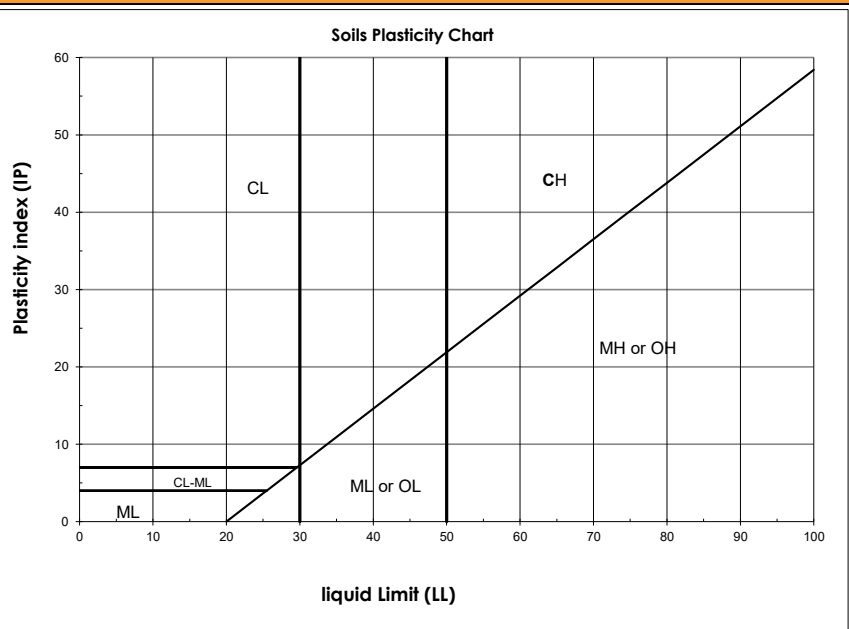
Material Description : Sand, some fine particles,
traces of Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	11,5



Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : October 26, 2022

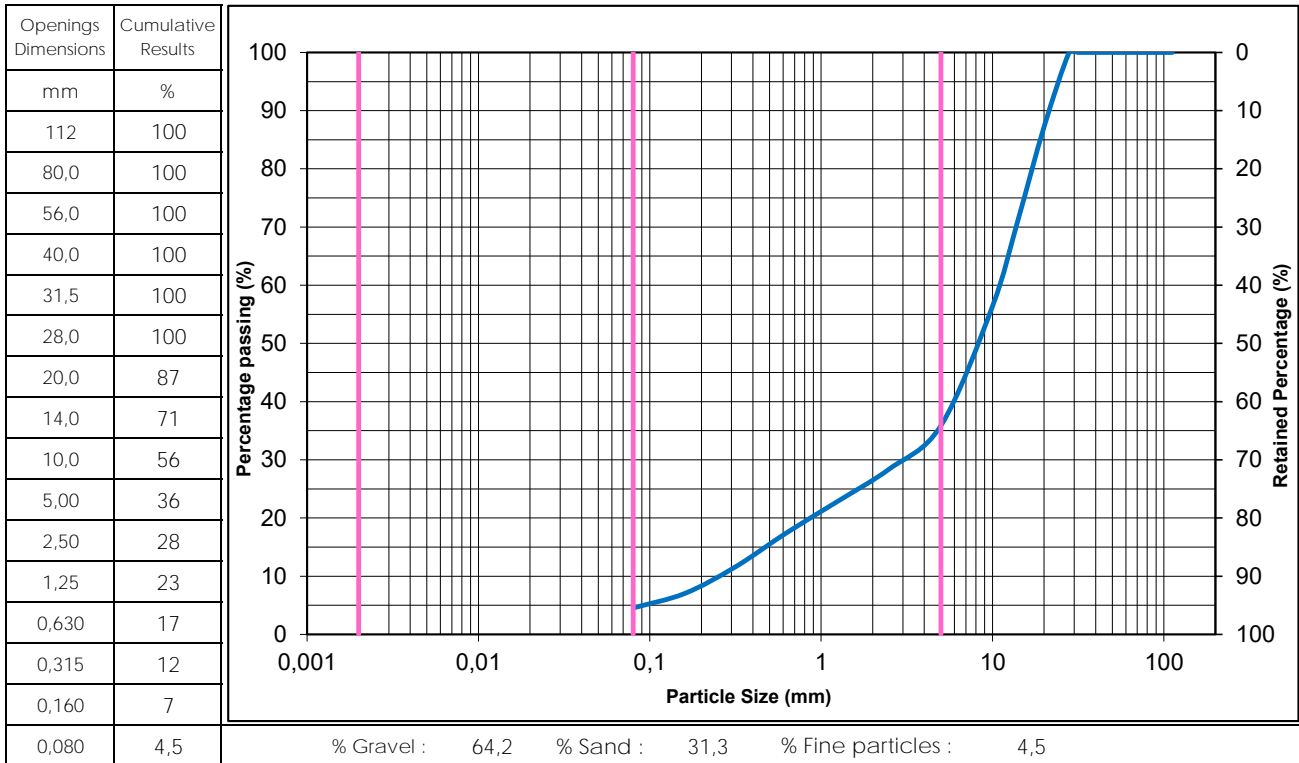
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 11, 2022

Project No : 158100425.500.710.6
Sample No : BH22-14 SS-01A
Depth : 0,00 -0,18 m

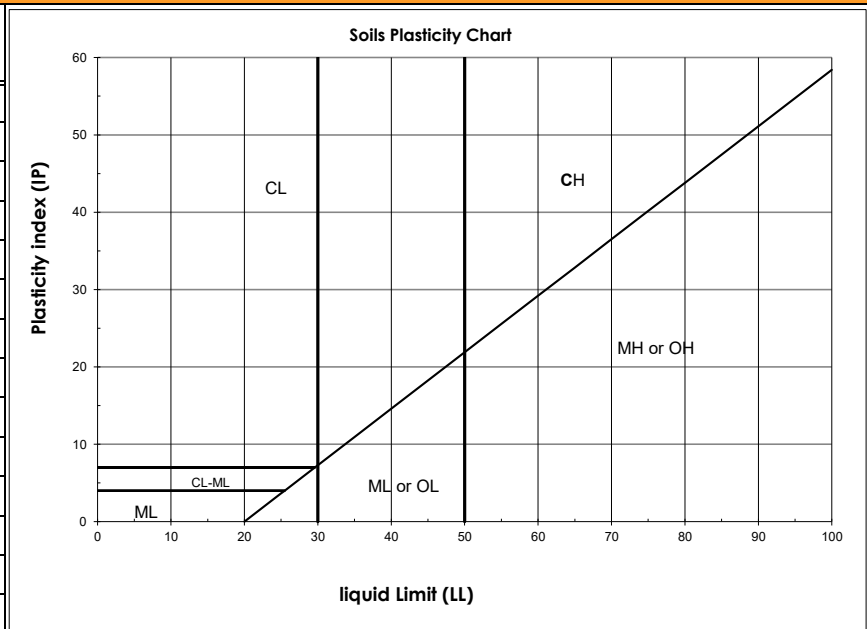
Material Description : Sandy Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	4,1



Remarks :

Prepared by :

Benoit Cyr, Geo.

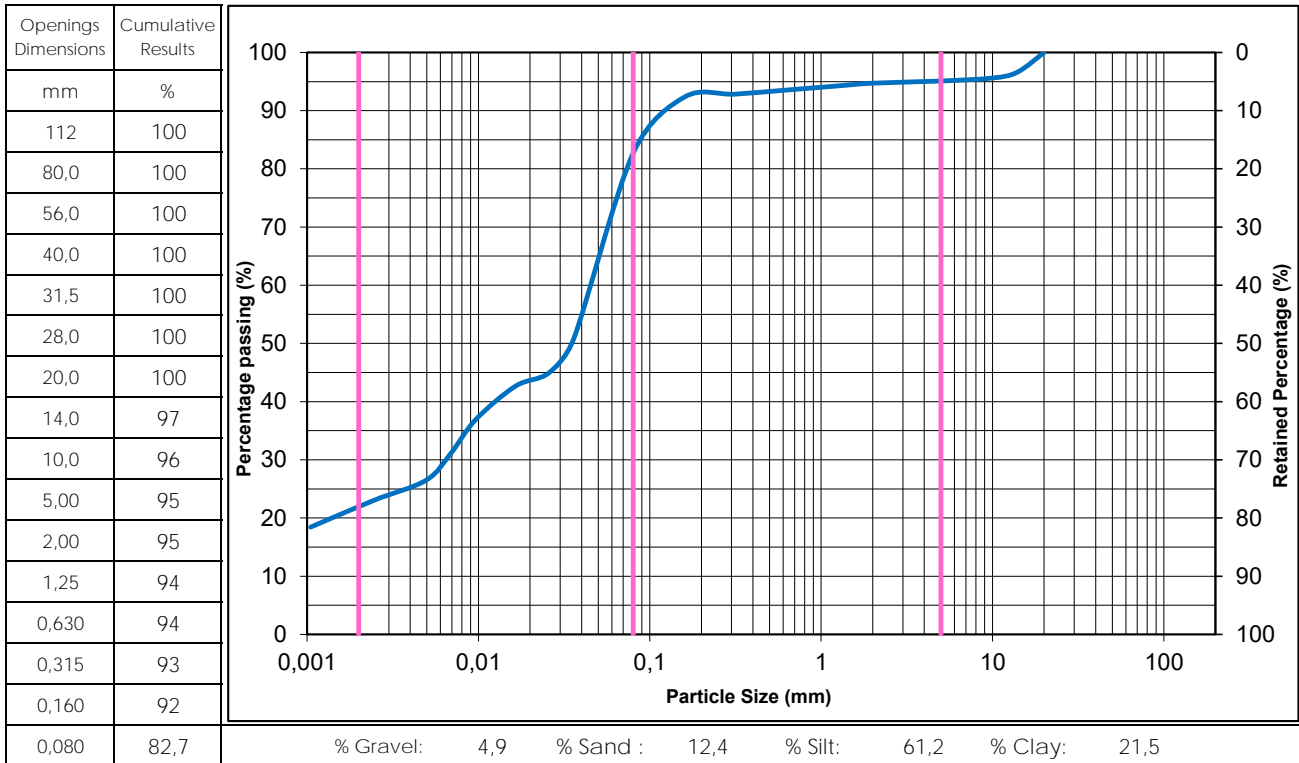
Date : October 26, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

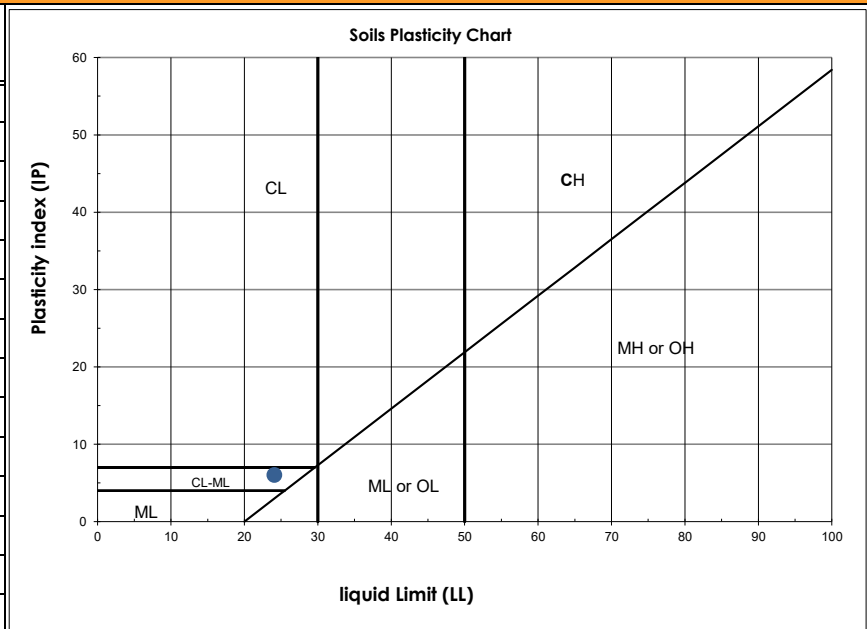
 Sampled by : Hugo Desrochers
 Sampling Date : August 12, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-14 SS-05
 Depth : 2,44 - 3,05m

 Material Description : Clayey Silt, some Sand, traces of
Gravel, low pasticity (CL-ML)

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	27,2
Liquid Limit (BNQ 2501-092)	24
Plastic Limit (BNQ 2501-092)	18
Plasticity Index (BNQ 2501-092)	6



Remarks : _____

Prepared by : Benoit Cyr, Geo.

Date : October 26, 2022

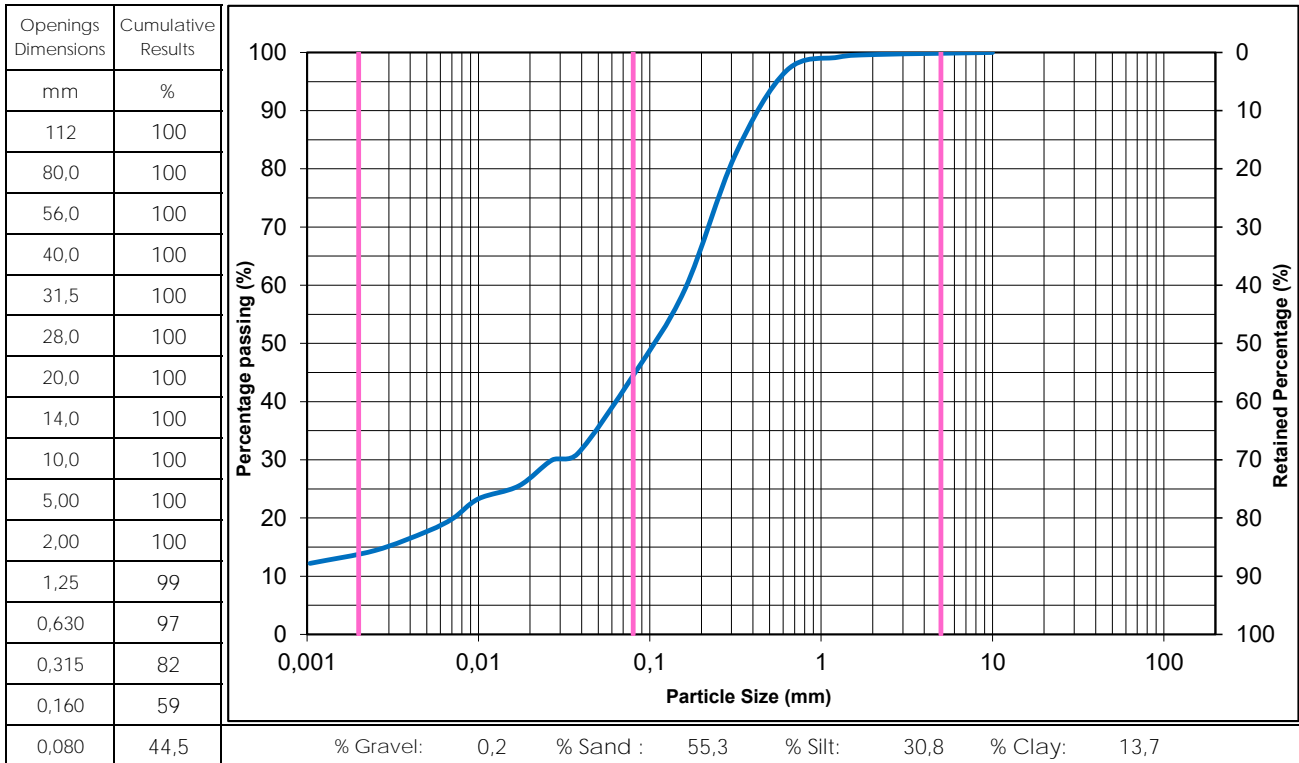
Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

 Sampled by : Hugo Desrochers
 Sampling Date : August 12, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-14 SS-08
 Depth : 4,57 - 5,18m

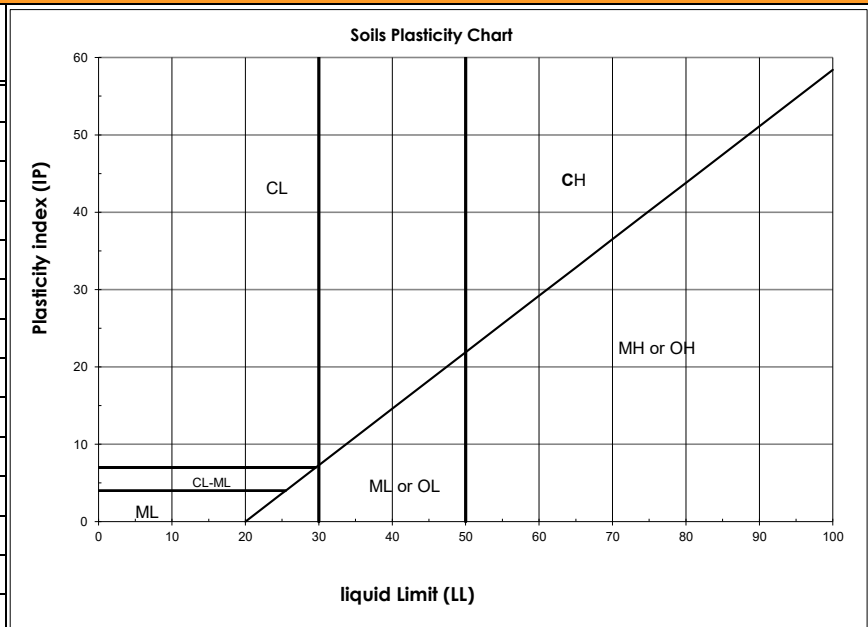
 Material Description : Silty Sand, some Clay, traces
 of Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	33,9



Remarks :

Prepared by :

 Benoit Cyr, Geo. *Bj*

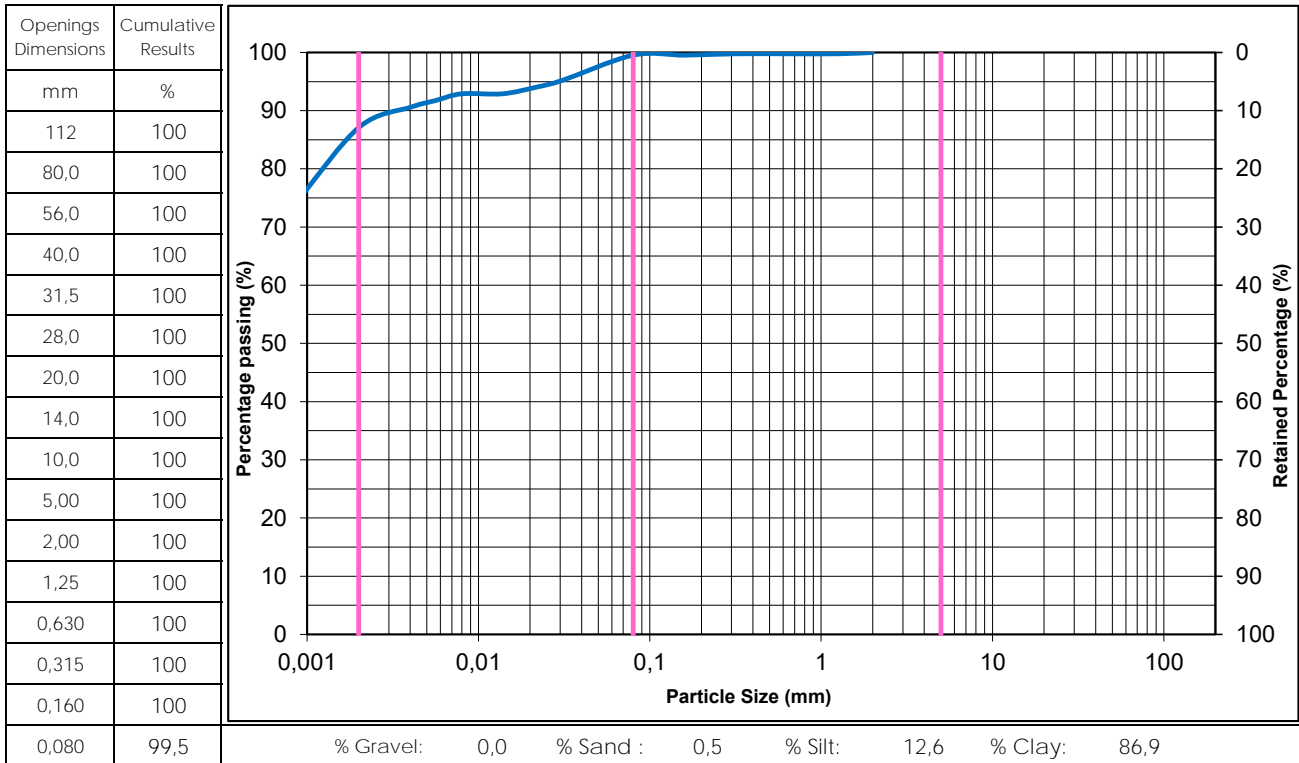
Date : October 26, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

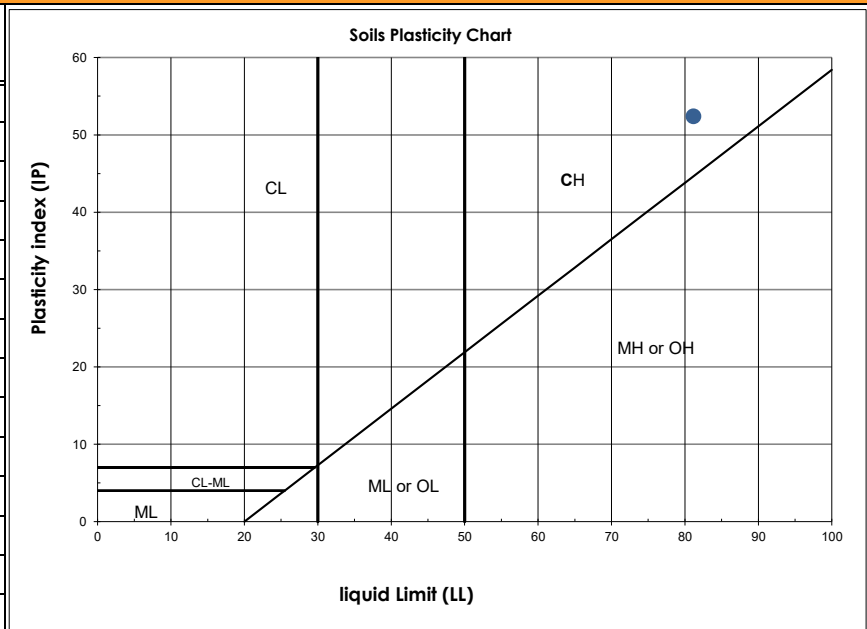
 Sampled by : Hugo Desrochers
 Sampling Date : August 12, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-14 SS-13
 Depth : 9,14 - 9,75m

Material Description : Clay, some Silt, traces of Sand, high plasticity (CH)

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	88,8
Liquid Limit (BNQ 2501-092)	81
Plastic Limit (BNQ 2501-092)	29
Plasticity Index (BNQ 2501-092)	52



Remarks :

Prepared by :

 Benoit Cyr, Geo. 

Date : October 26, 2022

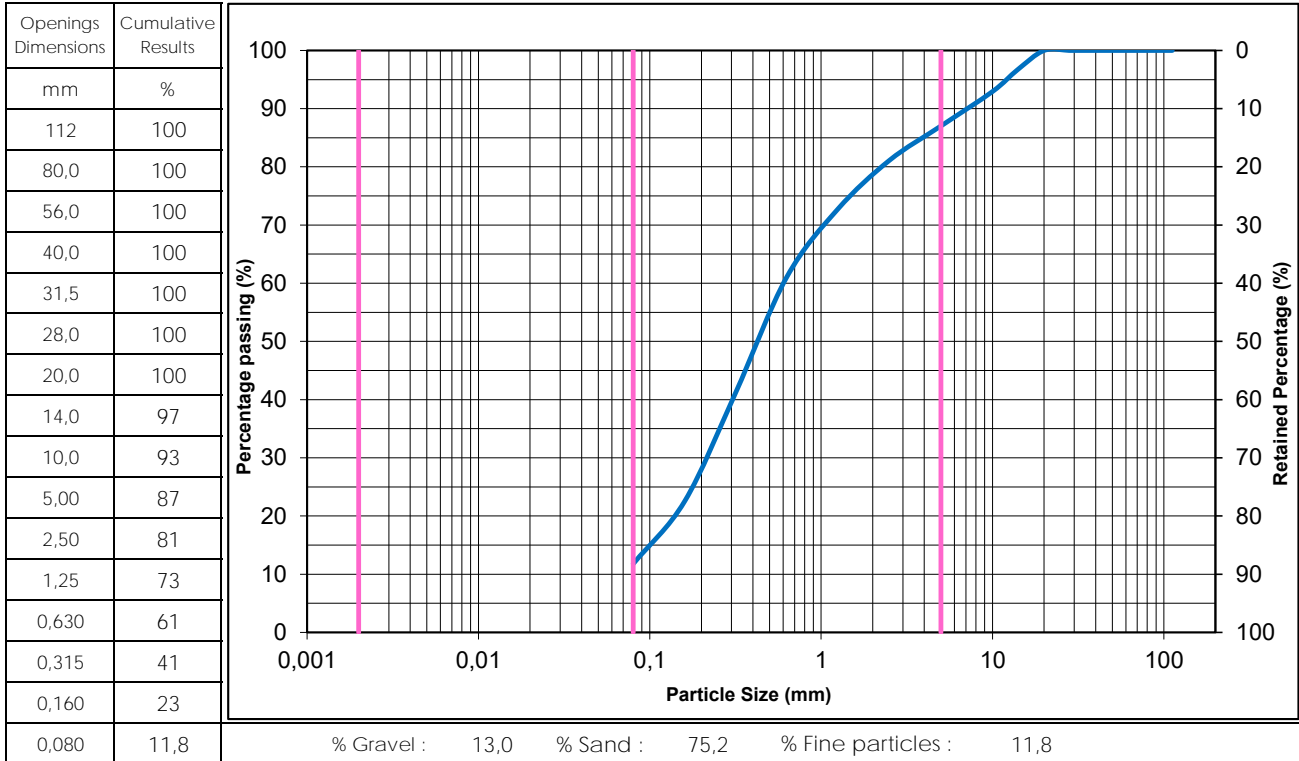
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 13, 2022

Project No : 158100425.500.710.6
Sample No : BH22-15 SS-02
Depth : 0,61 - 1,22m

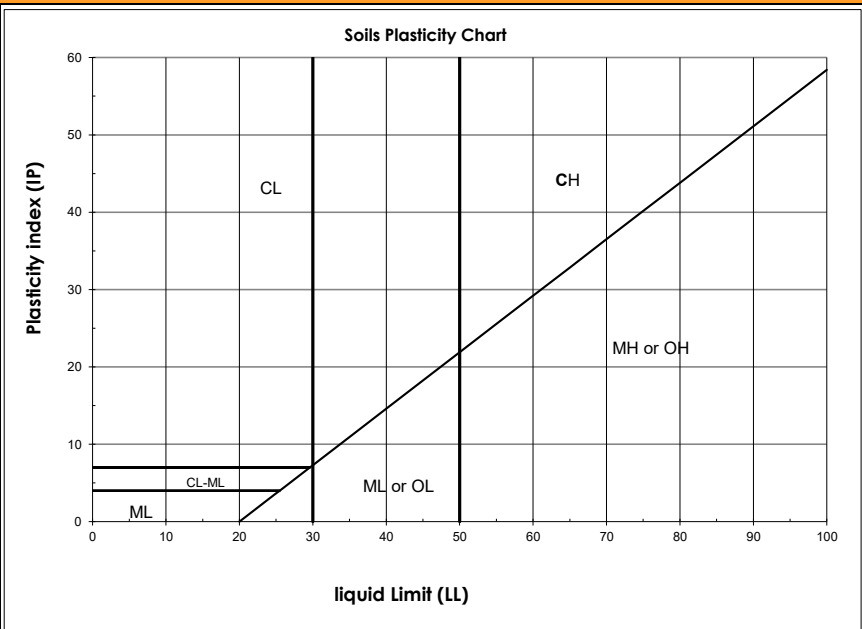
Material Description : Sand, some Gravel, some fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	5,3



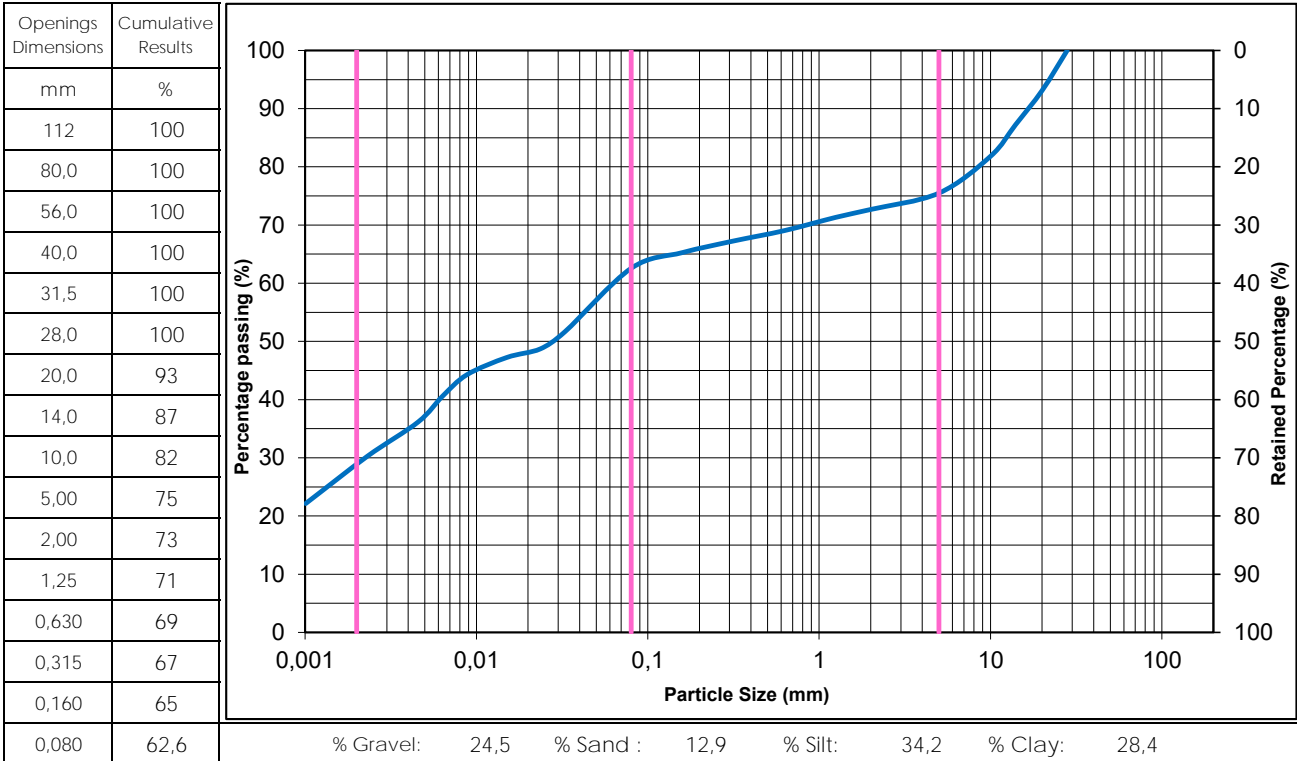
Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC*

Date : October 26, 2022

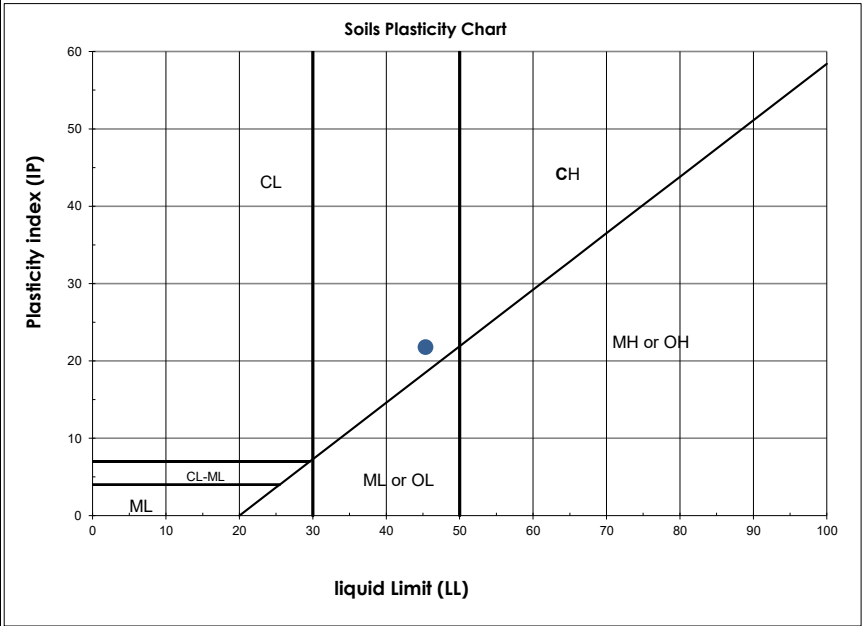
Client :	Cree Development Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	August 13, 2022
Project No :	158100425.500.710.6		
Sample No :	BH22-15 SS-06	Material Description : Gravely, clayey Silt, some Sand, medium plasticity (CL)	
Depth :	3,05 - 3,66m		

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	31,4
Liquid Limit (BNQ 2501-092)	45
Plastic Limit (BNQ 2501-092)	23
Plasticity Index (BNQ 2501-092)	22



Remarks : _____

Prepared by : Benoit Cyr, Geo. *Bj*

Date : October 26, 2022

Client : Cree Developpement Corporation (CDC)

Sampled by : Hugo Desrochers

Project : LGA - Grevet-Chapais Railway

Sampling Date : August 13, 2022

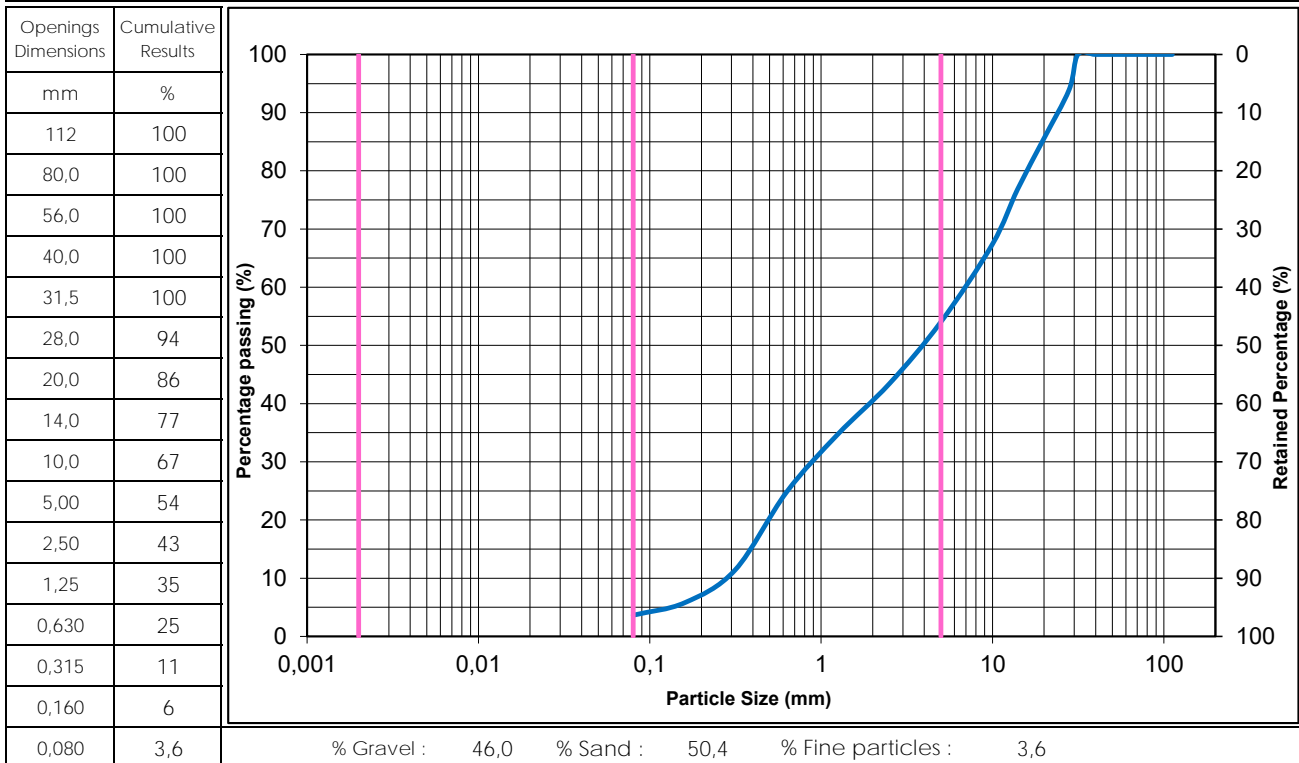
Project No : 158100425.500.710.6

Sample No : BH22-15 SS-12

Material Description : Sand and Gravel, traces of fine particles

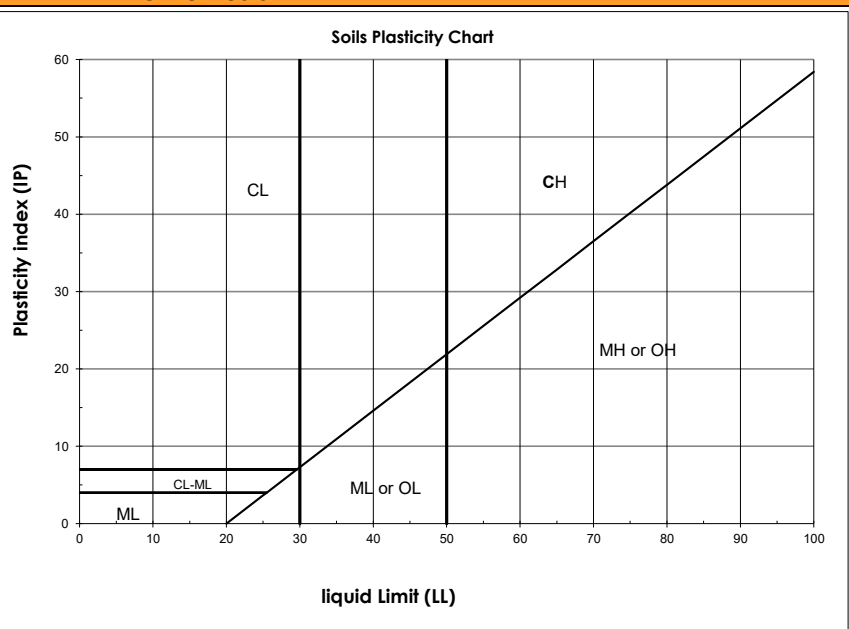
Depth : 7,62 - 8,23m

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	7,5



Remarks : _____

Prepared by : Benoit Cyr, Geo. 

Date : October 26, 2022

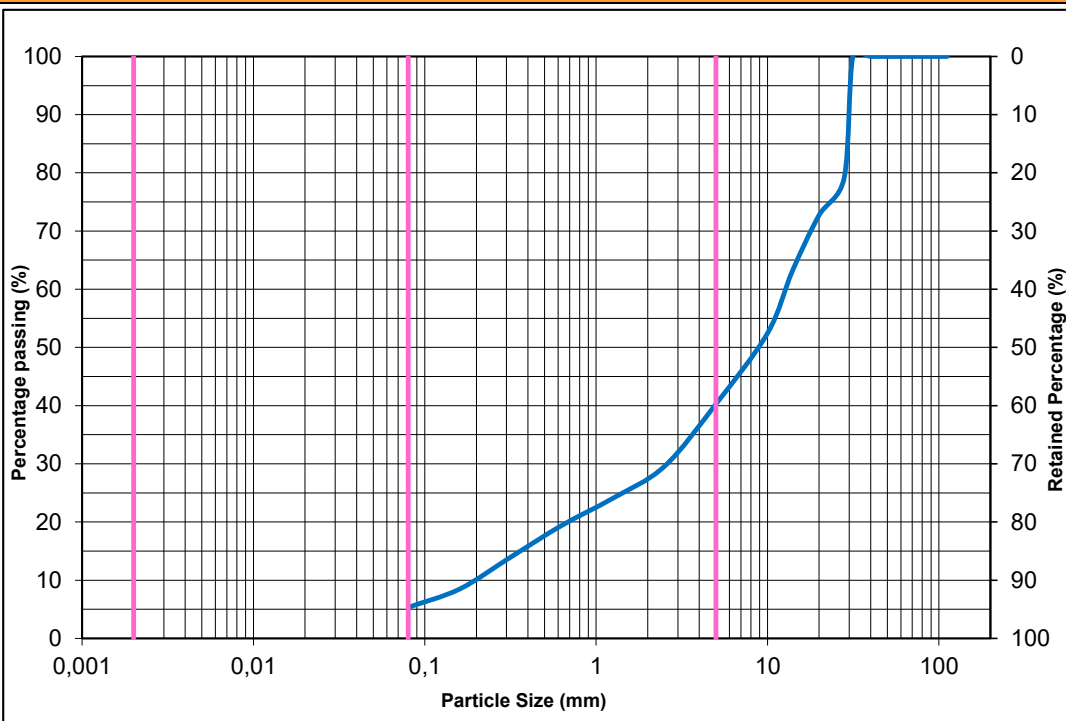
Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway
Project No : 158100425.500.710.6
Sample No : BH22-16 SS-01A
Depth : 0,00 - 0,13m

Sampled by : Hugo Desrochers
Sampling Date : August 14, 2022

Material Description : Sandy Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)

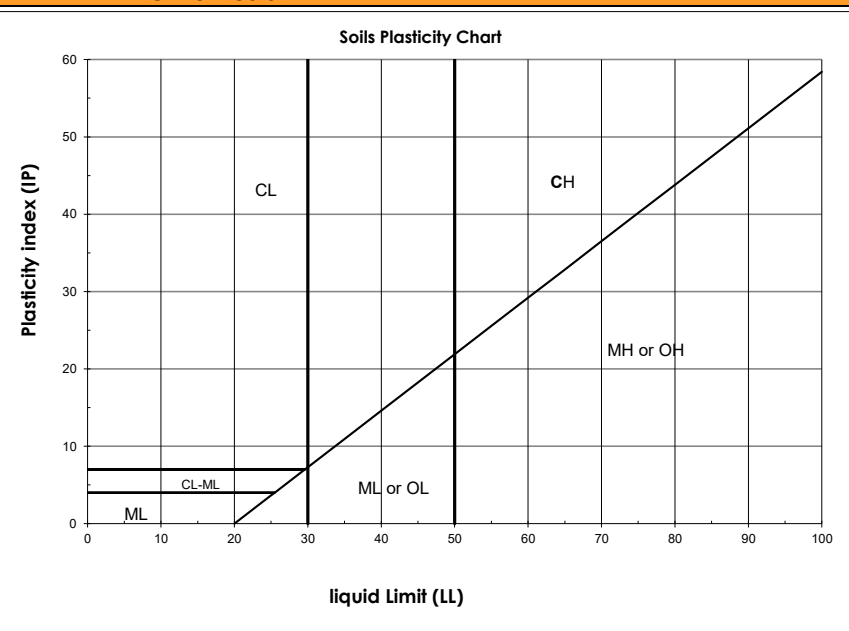
Openings Dimensions	Cumulative Results
mm	%
112	100
80,0	100
56,0	100
40,0	100
31,5	100
28,0	79
20,0	73
14,0	63
10,0	52
5,00	40
2,50	30
1,25	24
0,630	19
0,315	14
0,160	8
0,080	5,3



% Gravel : 58,8 % Sand : 34,9 % Fine particles : 5,3

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	5,7



Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : October 26, 2022

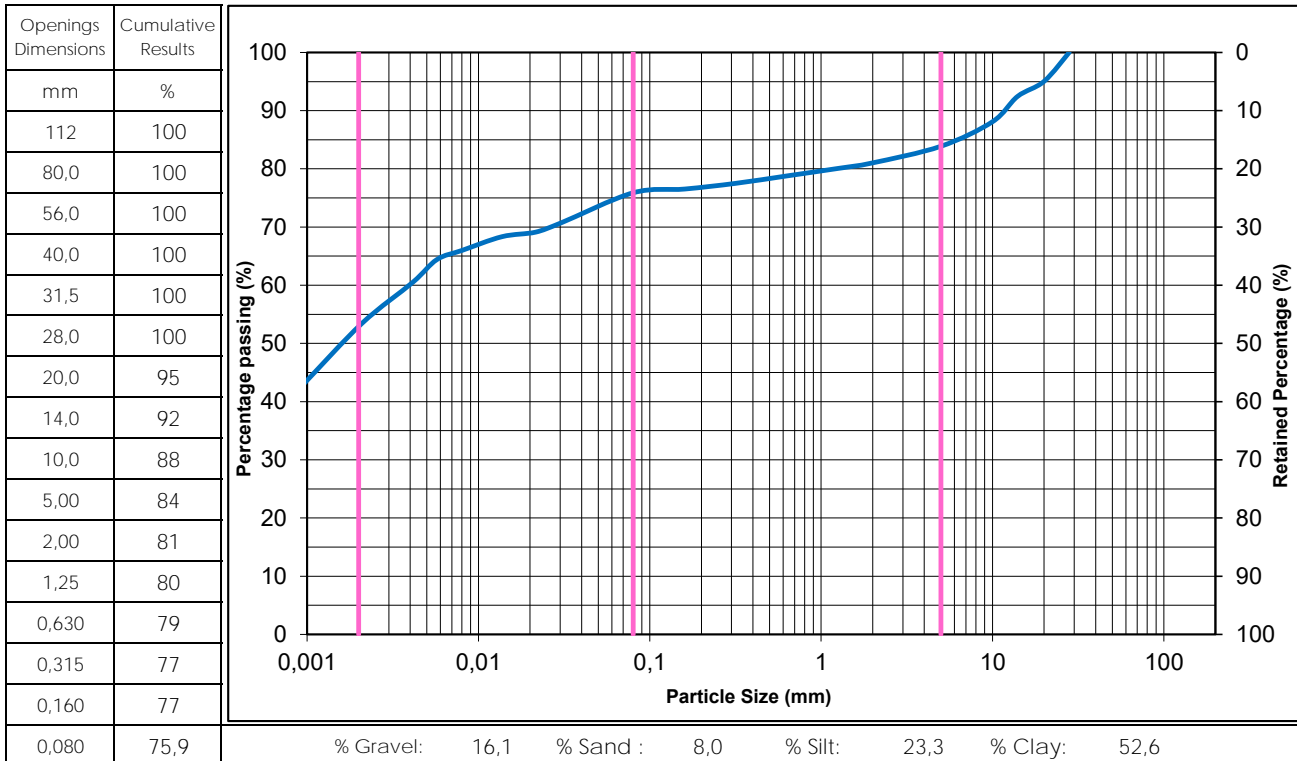
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 14, 2022

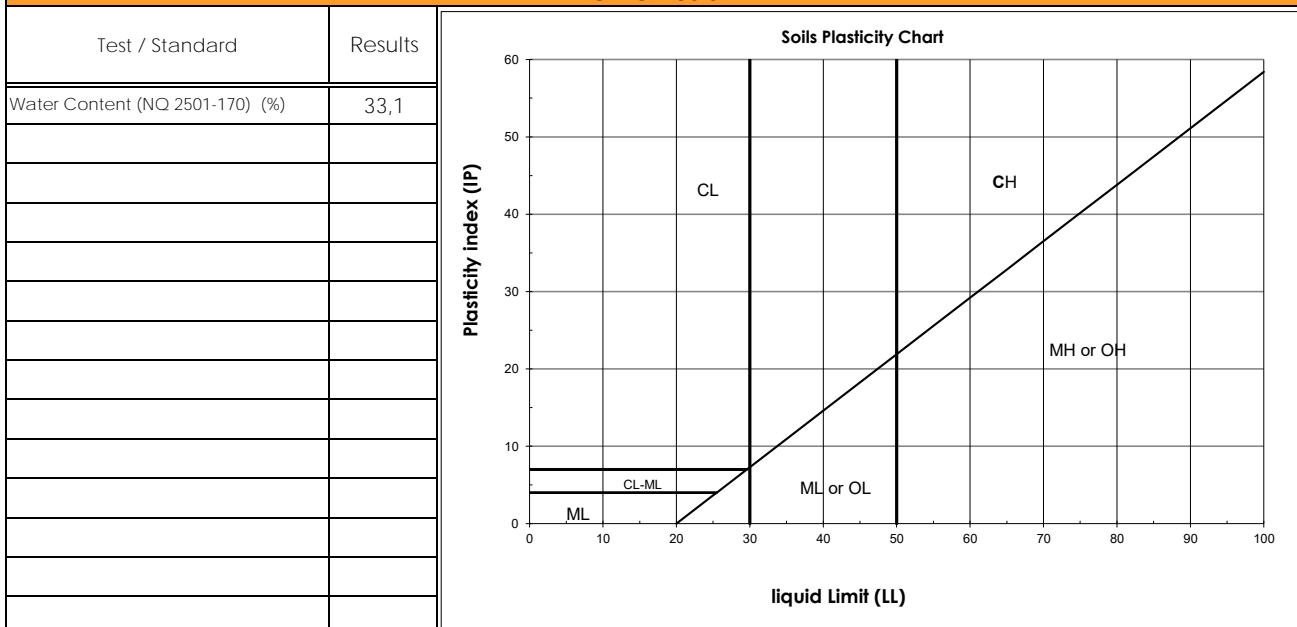
Project No : 158100425.500.710.6
Sample No : BH22-16 SS-04
Depth : 1,83 - 2,44m

Material Description : Silty Clay, some Gravel, traces of Sand

Grain Size Analysis (BNQ 2501-025)



Other tests



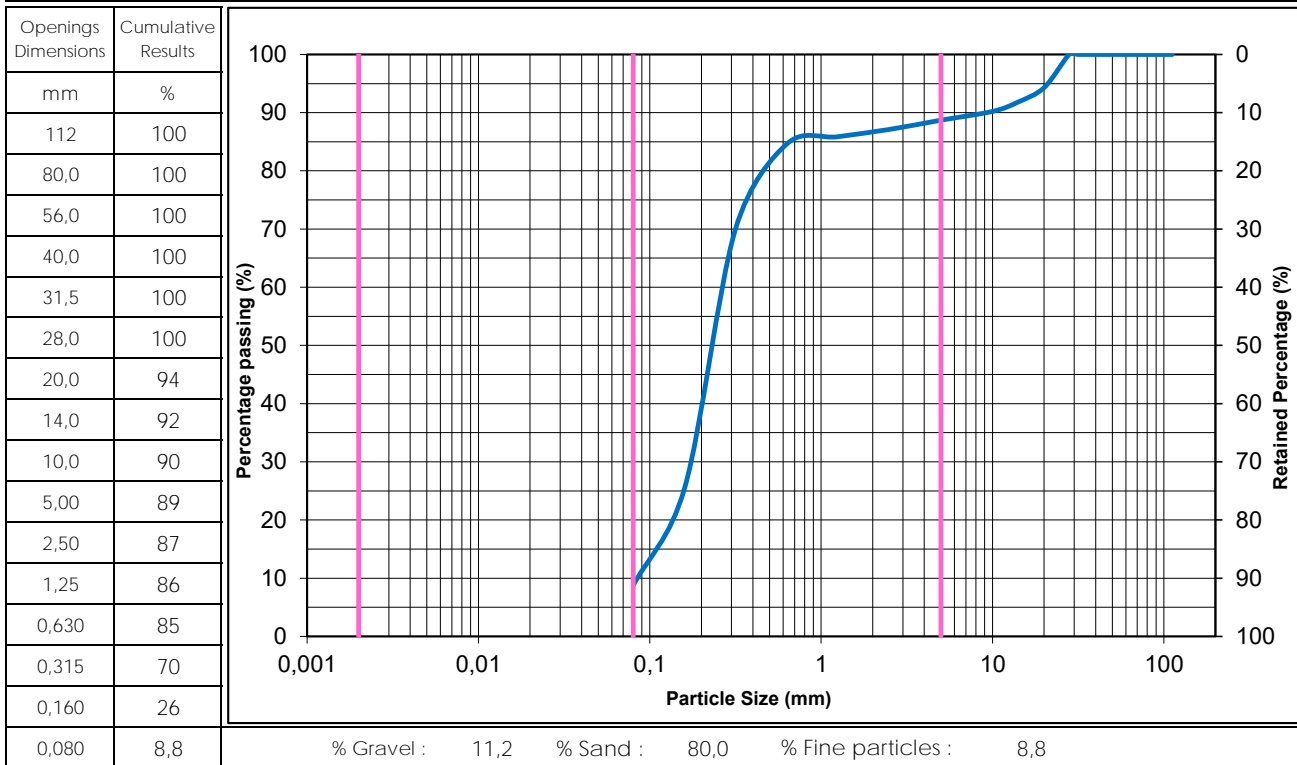
Remarks : _____

Prepared by : Benoit Cyr, Geo. *BJ*

Date : October 26, 2022

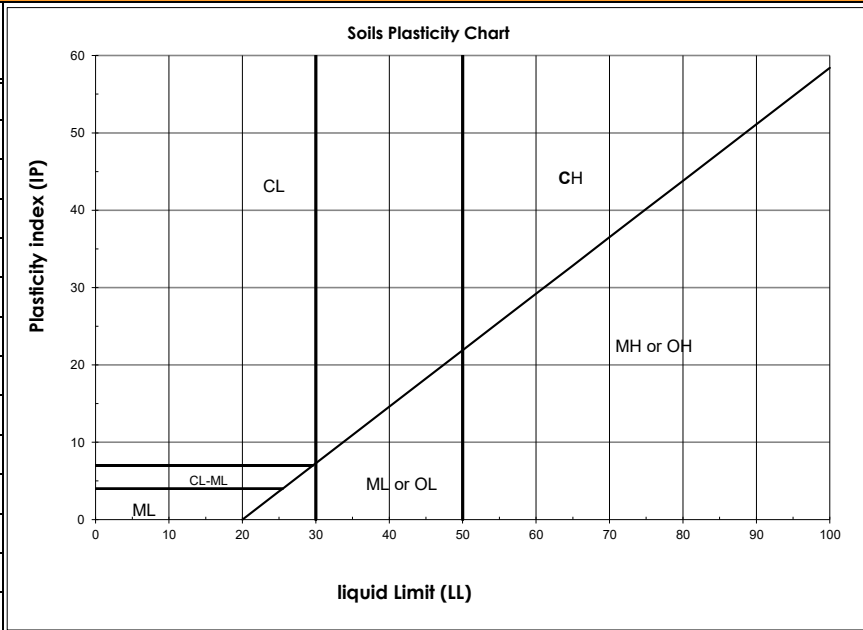
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 14, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-16 SS-09	Material Description : Sand, some Gravel, traces of fine particles
Depth : 4,88 - 5,49m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	14,7



Remarks : _____

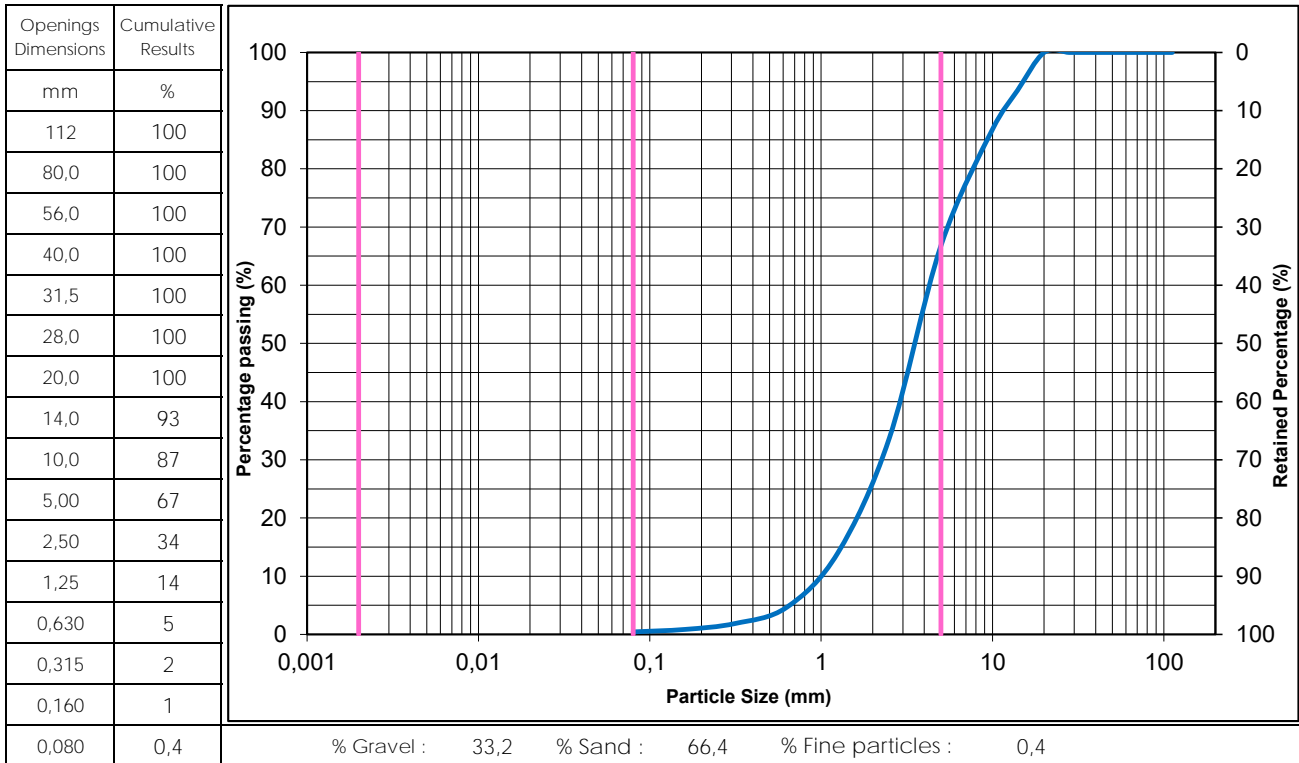
Prepared by : Benoit Cyr, Geo. _____ Date : October 26, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

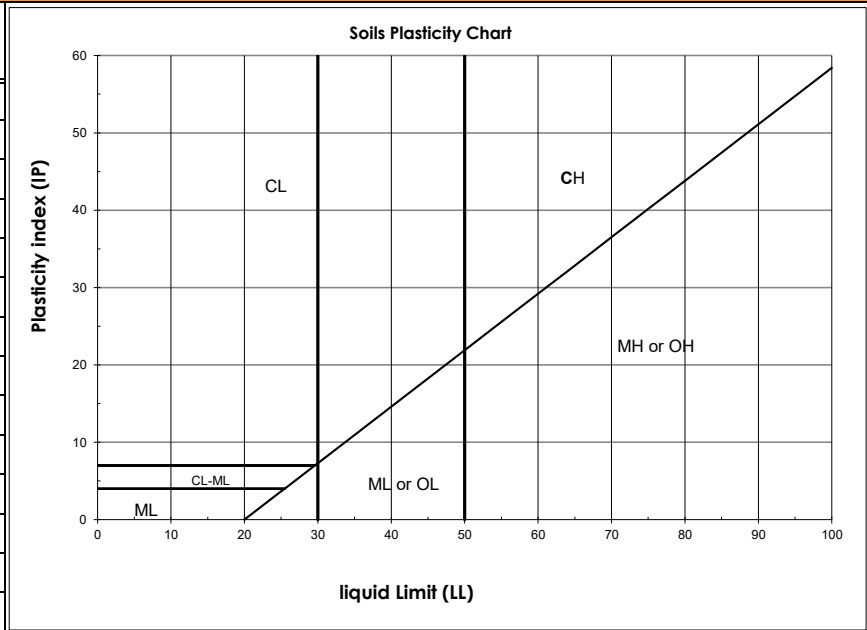
 Sampled by : Hugo Desrochers
 Sampling Date : August 14, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-16 SS-15
 Depth : 10,67 - 11,28m

Material Description : Gravely Sand, traces of fine particles

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	9,1



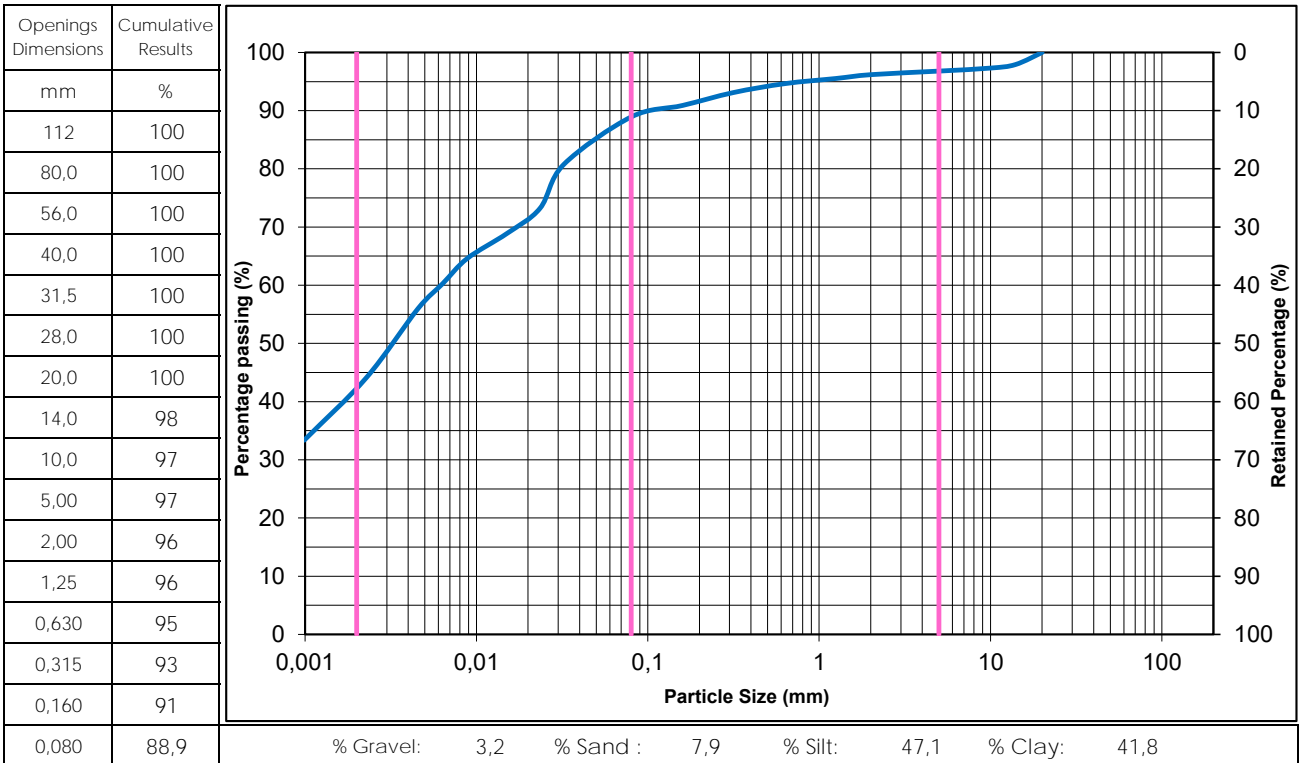
Remarks :

 Prepared by : Benoit Cyr, Geo. *BC*

Date : October 26, 2022

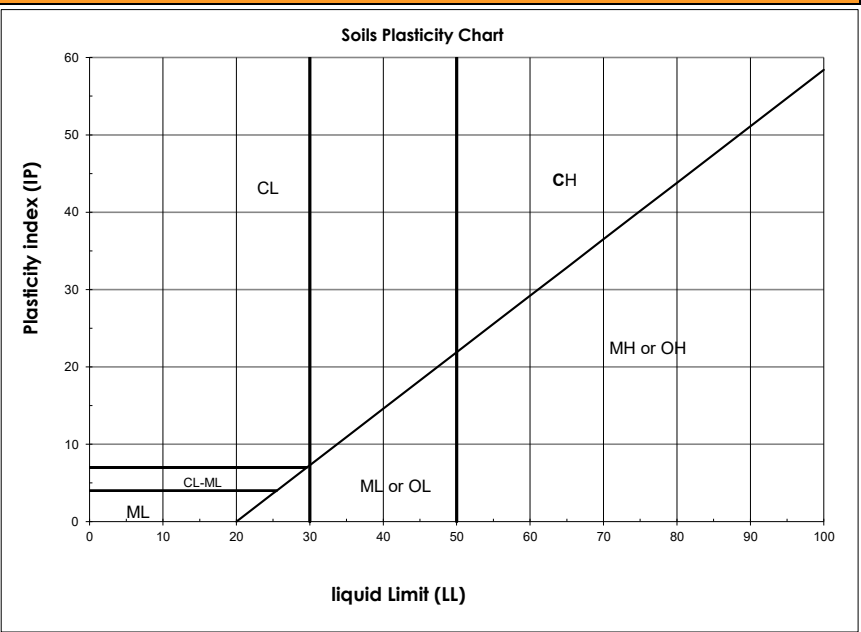
Client :	Cree Developpment Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	August 14, 2022
Project No :	158100425.500.710.6		
Sample No :	BH22-17 SS-02	Material Description :	Silt and Clay, traces of Sand, traces of Gravel
Depth :	0,61 - 1,22m		

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	20,9



Remarks :

Prepared by : Benoit Cyr, Geo. Date : December 09, 2022

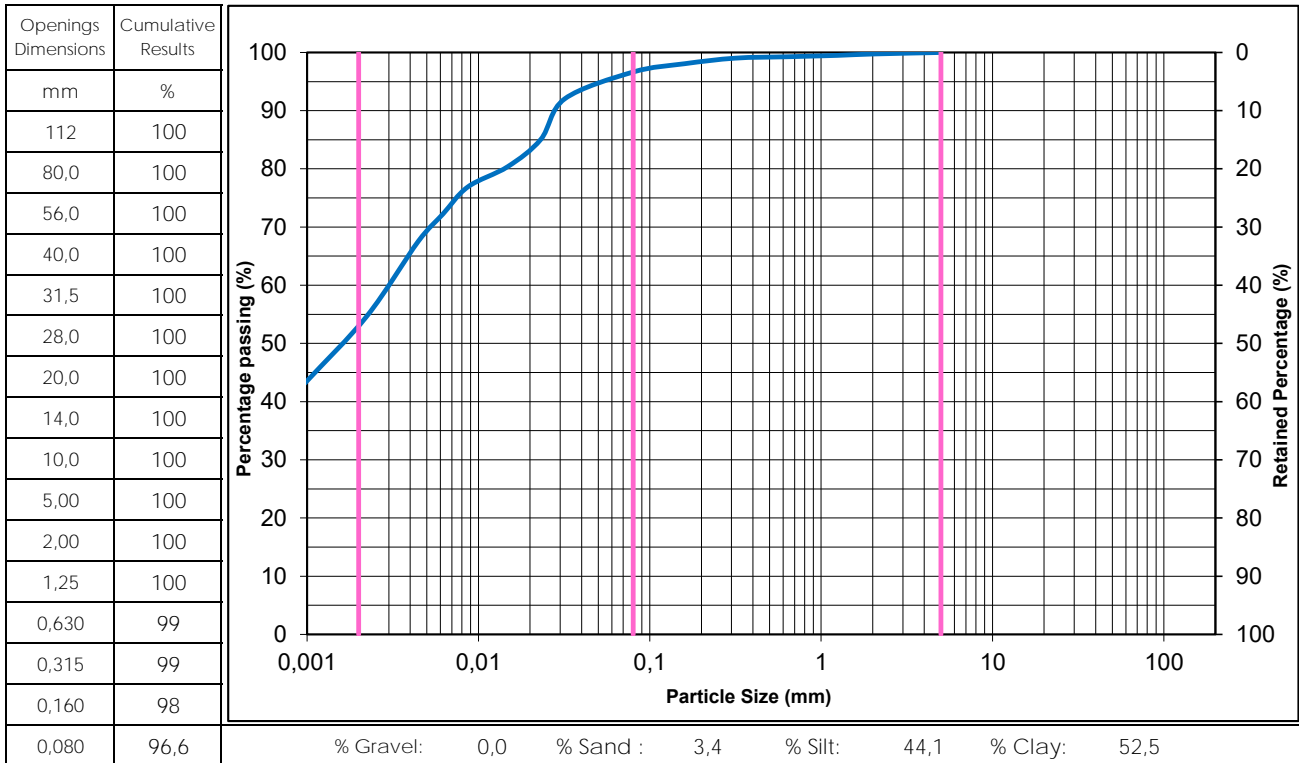
Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 14, 2022

Project No : 158100425.500.710.6
Sample No : BH22-17 SS-05
Depth : 2,44 - 3,05m

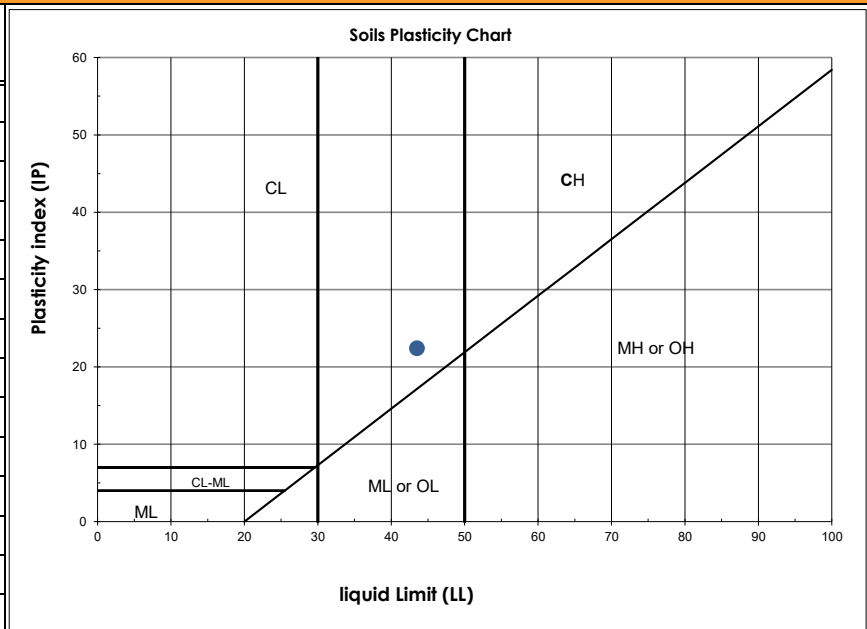
Material Description : Clay and Silt, traces of Sand,
medium plasticity (CL)

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	30,3
Liquid Limit (BNQ 2501-092)	44
Plastic Limit (BNQ 2501-092)	22
Plasticity Index (BNQ 2501-092)	22



Remarks :

Prepared by :

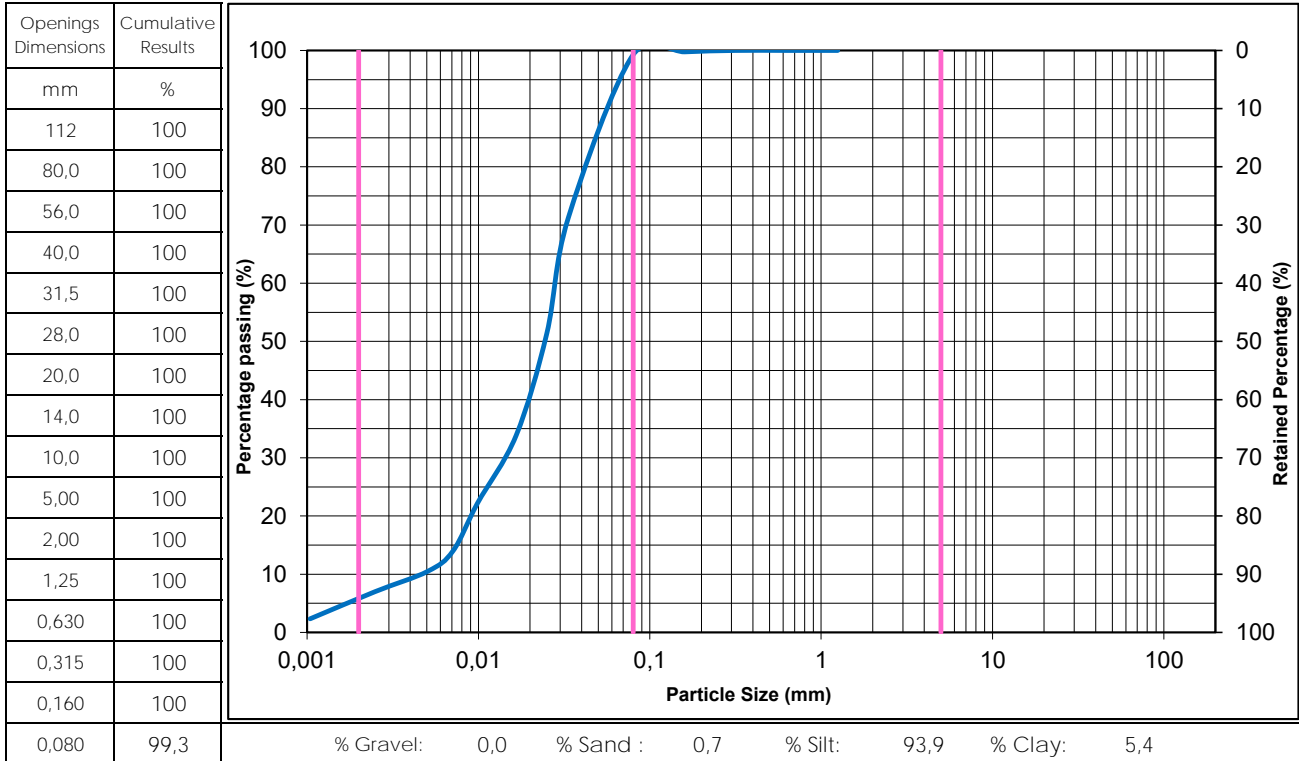
Benoit Cyr, Geo.



Date : December 09, 2022

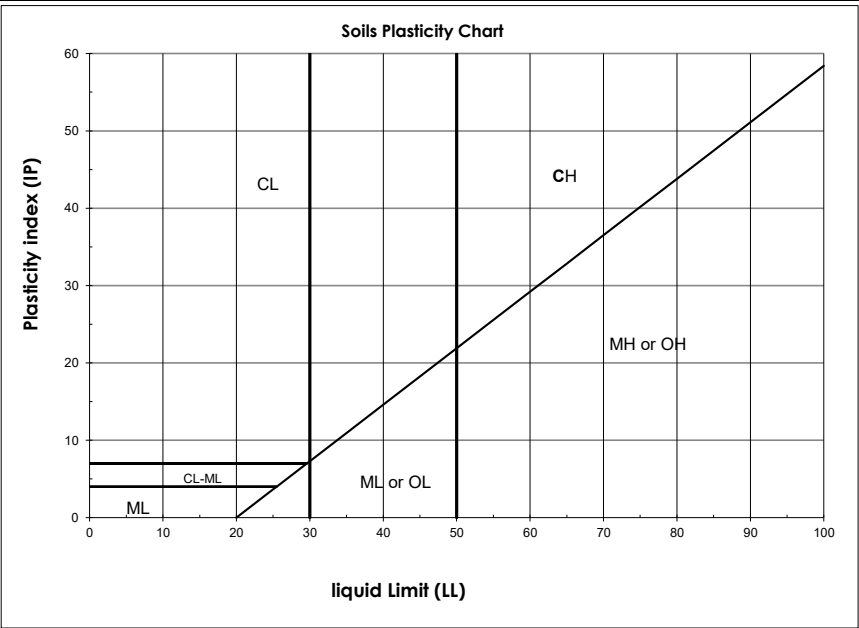
Client :	Cree Developpement Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	August 14, 2022
Project No :	158100425.500.710.6		
Sample No :	BH22-17 SS-12	Material Description :	Silt, traces of Clay, traces of Sand
Depth :	7,62 - 8,23m		

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	22,8

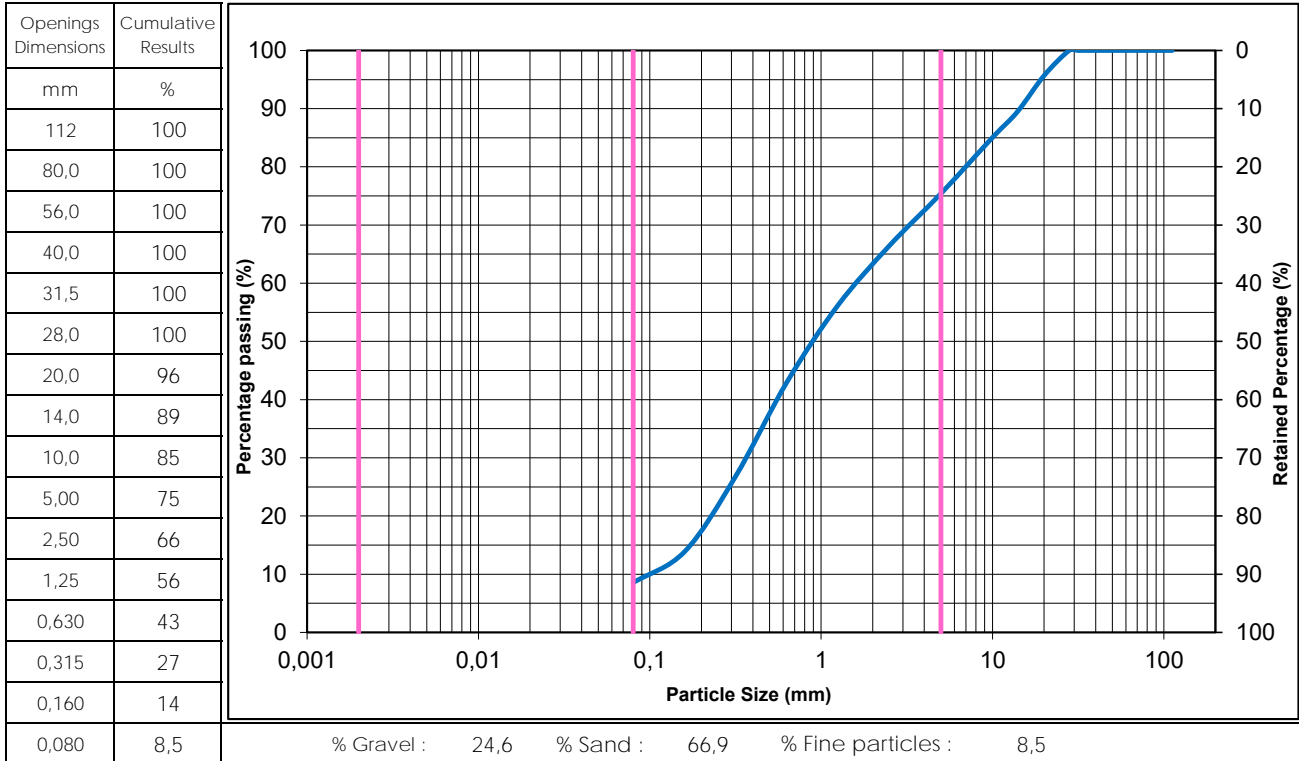


Remarks : _____

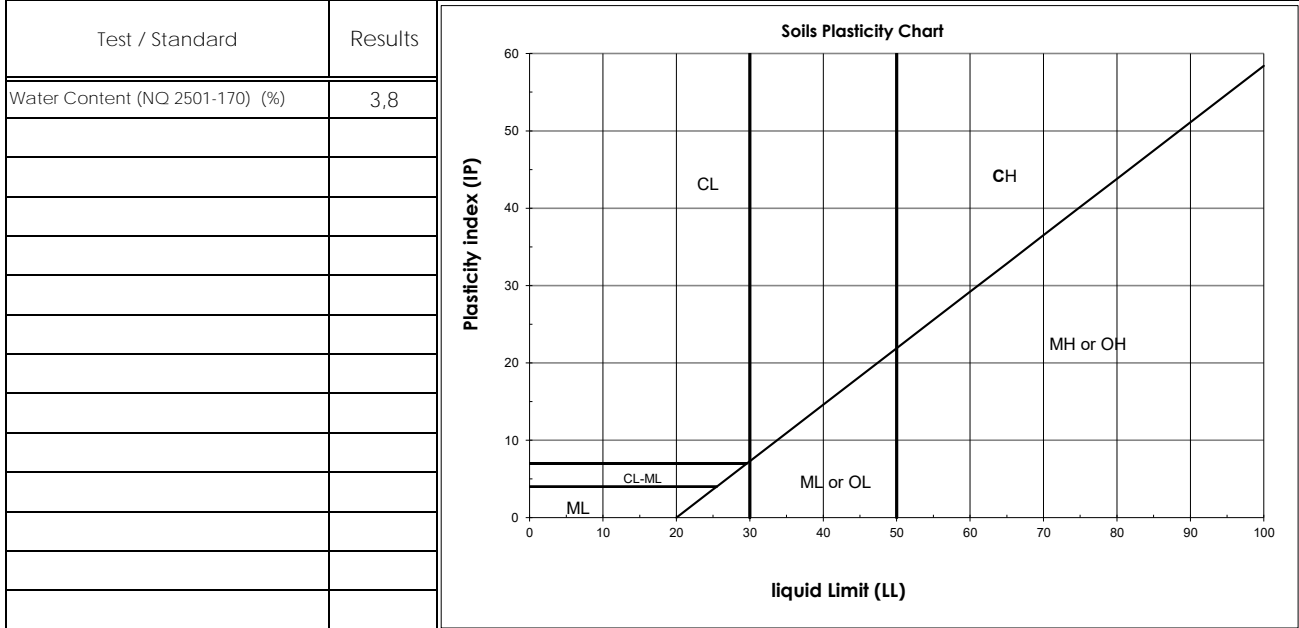
Prepared by : Benoit Cyr, Geo. *BJ* _____ **Date :** December 09, 2022 _____

Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 31, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-18 SS-01	Material Description : Gravely Sand, traces of fine particles
Depth : 0,00 - 0,61m	

Grain Size Analysis (BNQ 2501-025)



Other tests

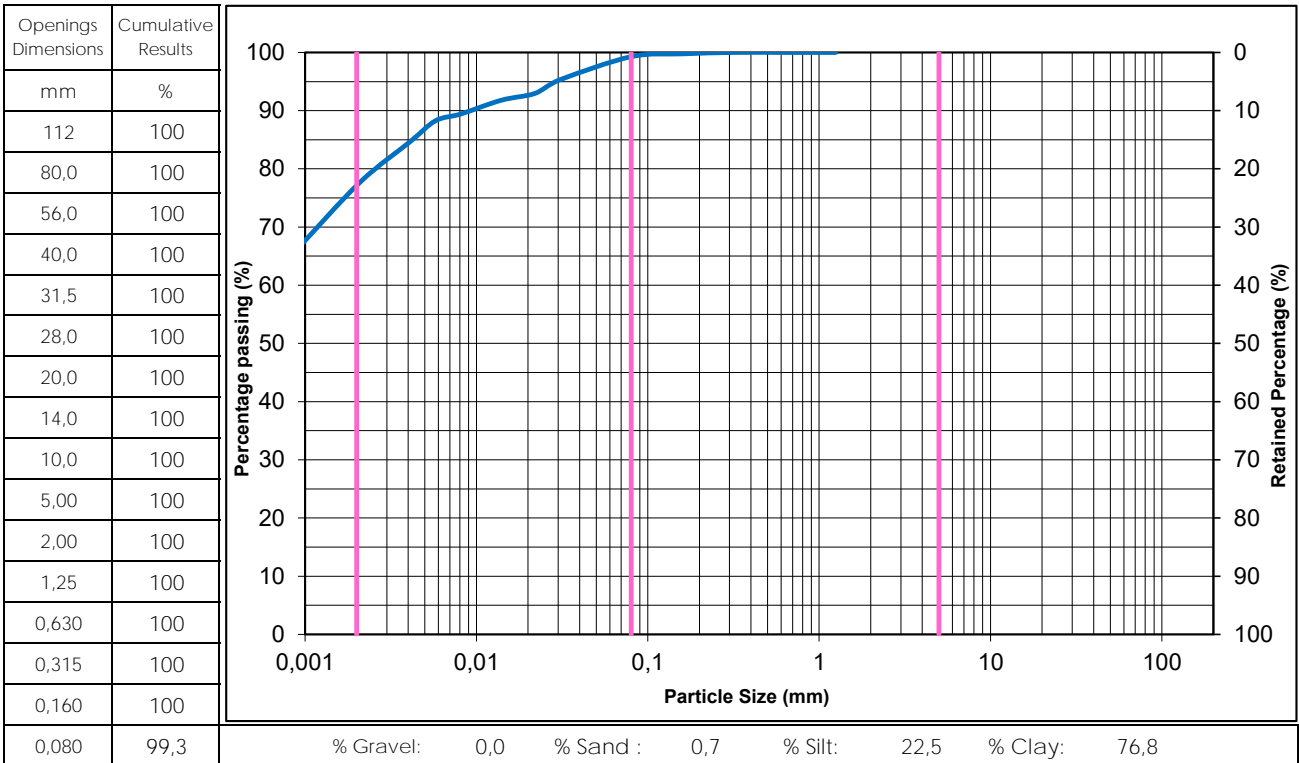


Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC* _____ **Date :** December 09, 2022

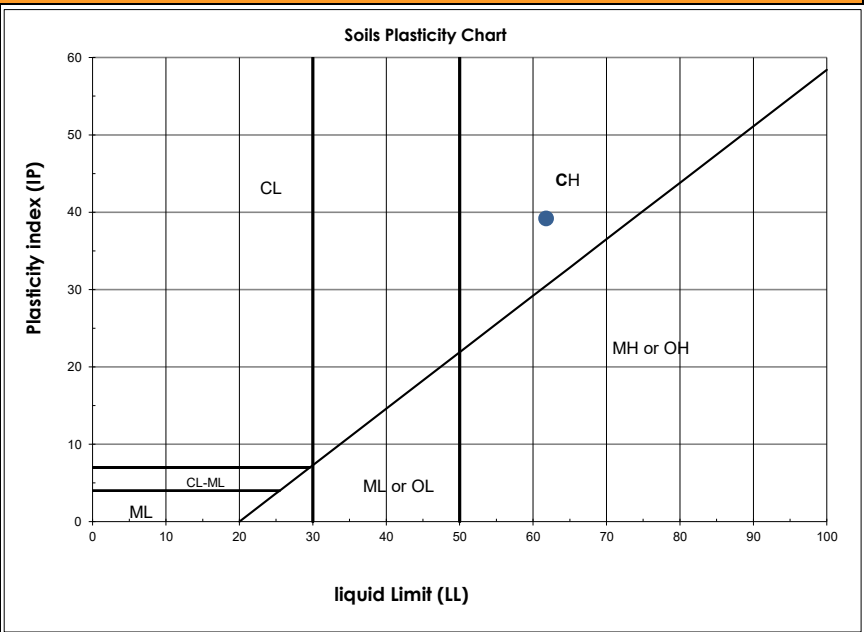
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 31, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-18 SS-07	Material Description : Silty Clay, traces of Sand, high plasticity (CH)
Depth : 3,66 - 4,27m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	62,1
Liquid Limit (BNQ 2501-092)	62
Plastic Limit (BNQ 2501-092)	23
Plasticity Index (BNQ 2501-092)	39



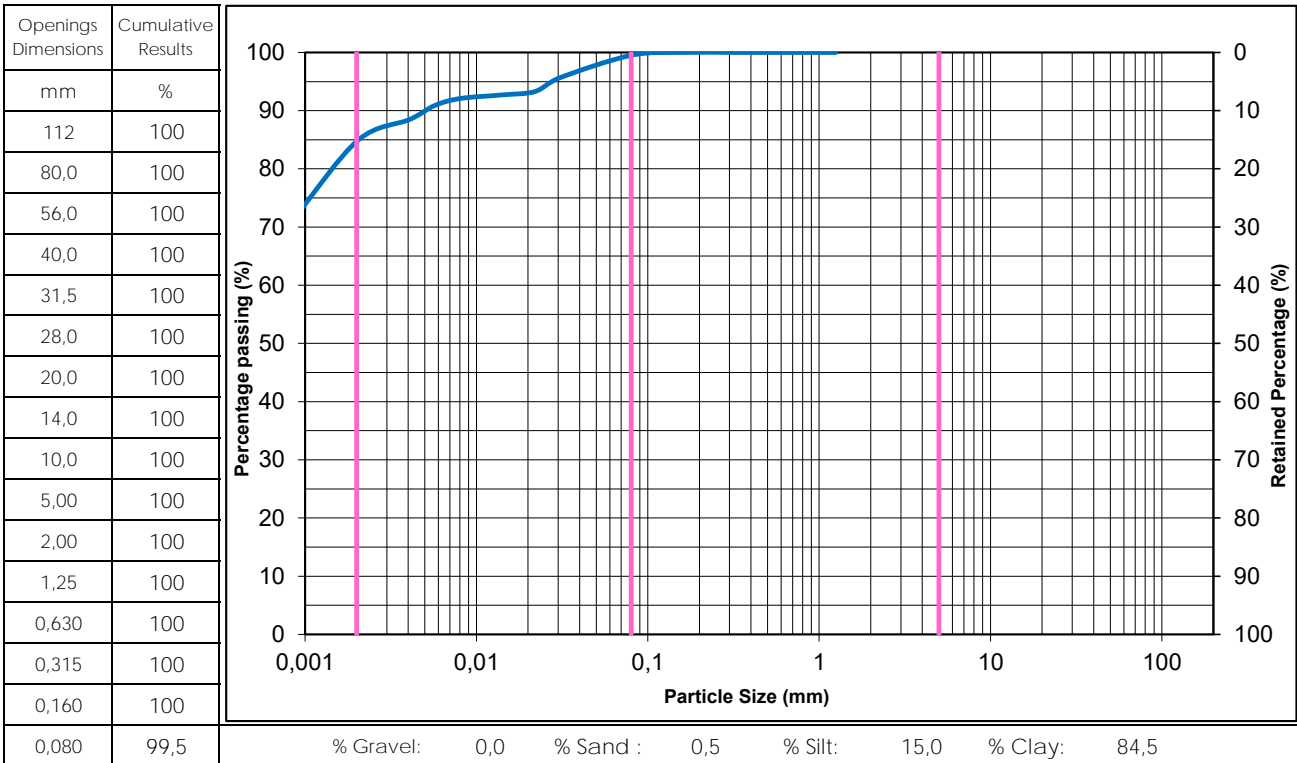
Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC* Date : December 09, 2022

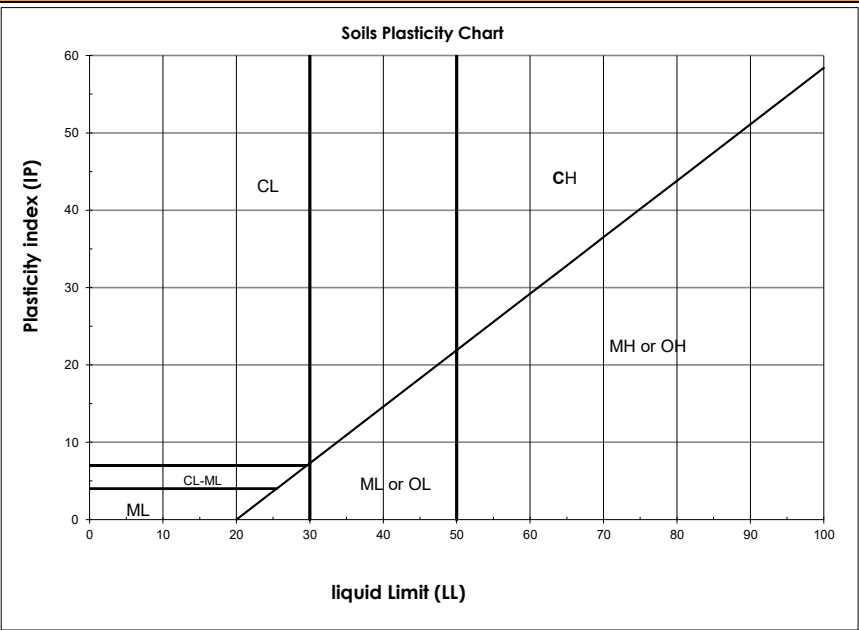
Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway
 Project No : 158100425.500.710.6
 Sample No : BH22-18 SS-17
 Depth : 10,67 - 11,28m

Sampled by : Hugo Desrochers
 Sampling Date : August 31, 2022

Material Description : Clay, some Silt, traces of Sand

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	77,8



Remarks :

Prepared by : Benoit Cyr, Geo. *Bj*

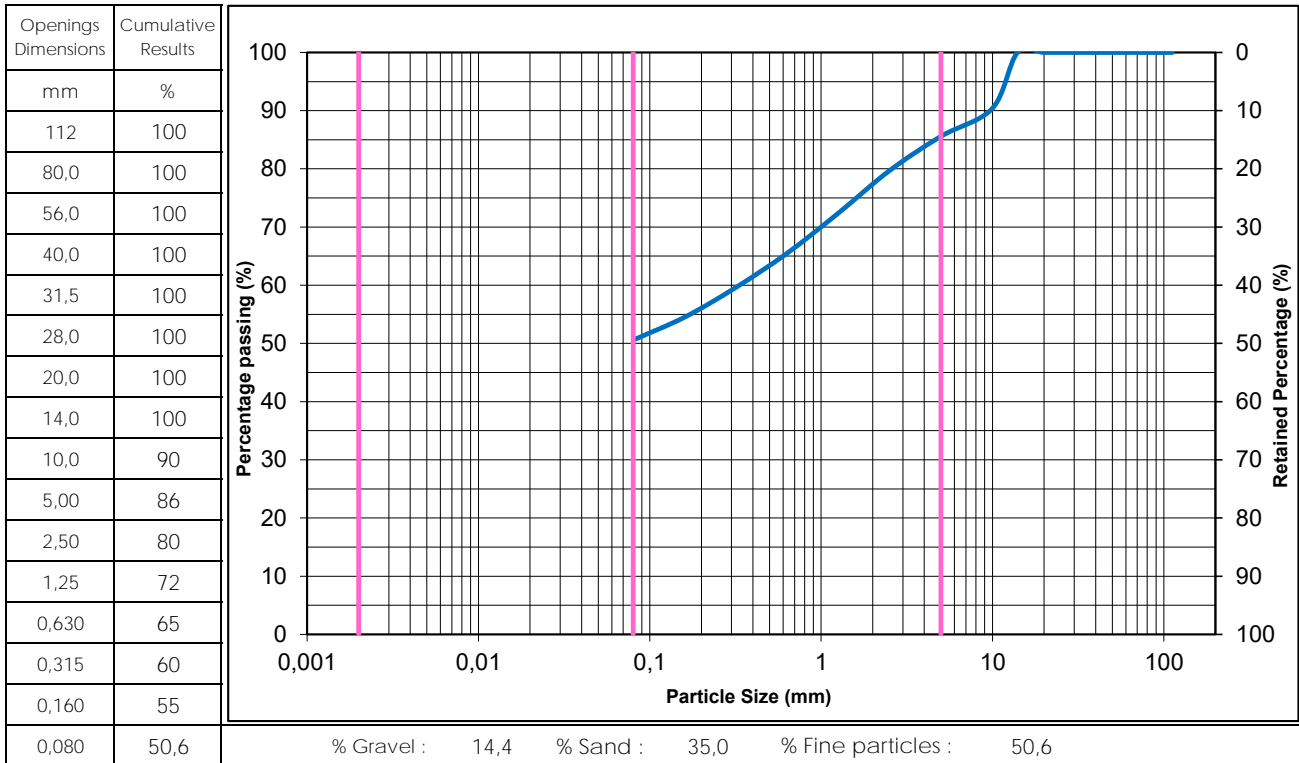
Date : December 09, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

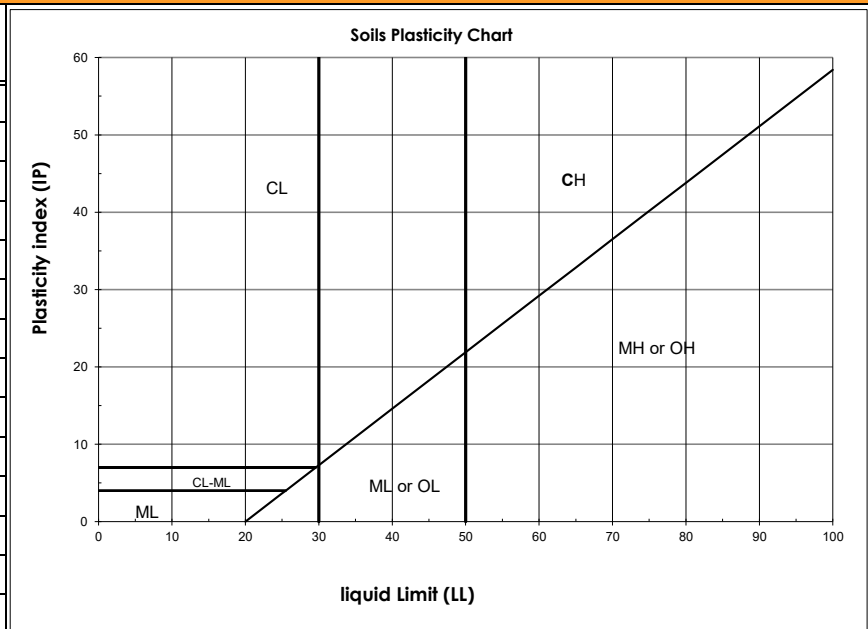
 Sampled by : Hugo Desrochers
 Sampling Date : August 31, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-19 SS-02
 Depth : 0,00 - 0,61m

Material Description : Fine particles and Sand, some Gravel

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	17,1



Remarks :

Prepared by :

 Benoit Cyr, Geo. *BC*

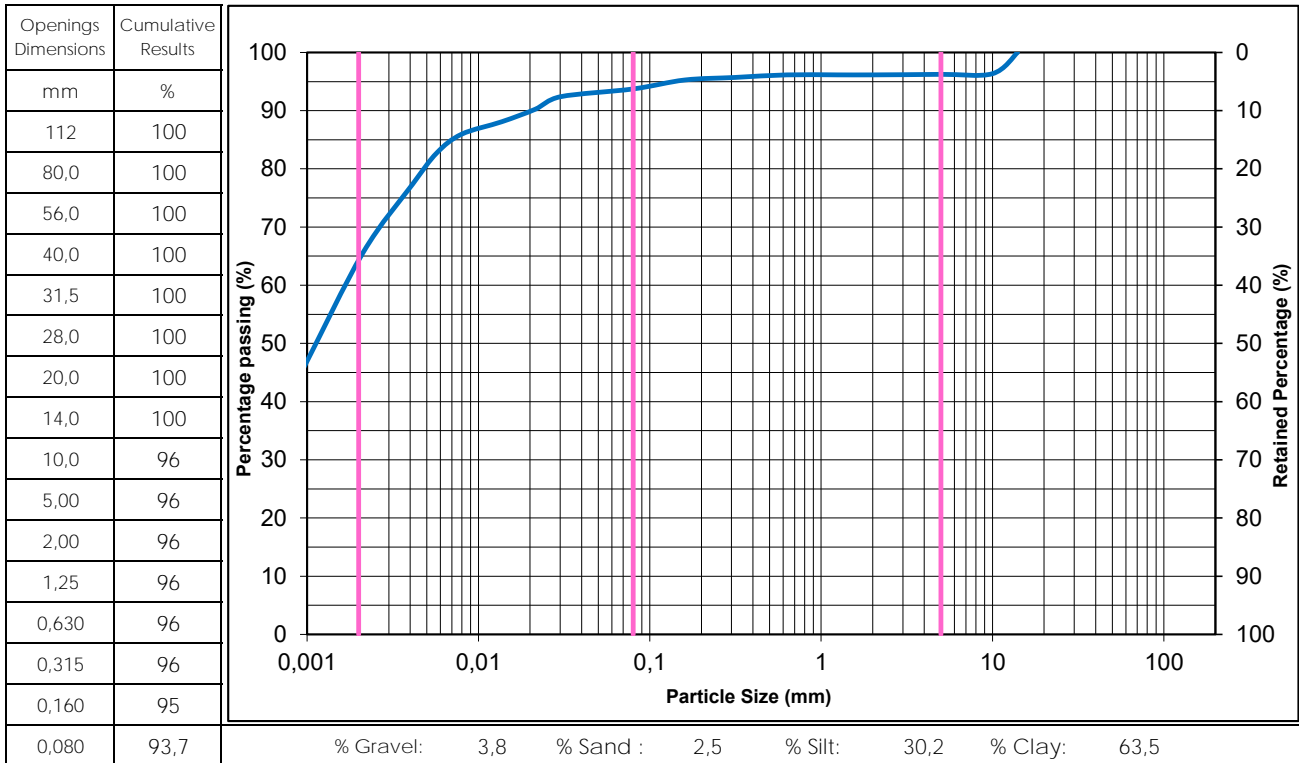
Date : December 09, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

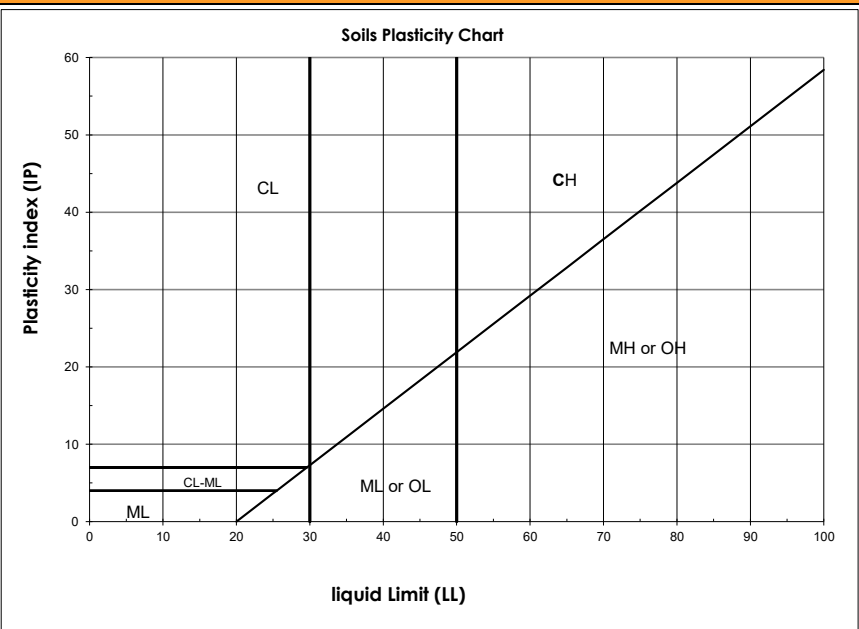
 Sampled by : Hugo Desrochers
 Sampling Date : August 31, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-19 SS-04
 Depth : 1,83 - 2,44m

 Material Description : Silty Clay, traces of Gravel,
 traces of Sand

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	30,7


Remarks :
Prepared by :

Benoit Cyr, Geo.

Date : December 09, 2022

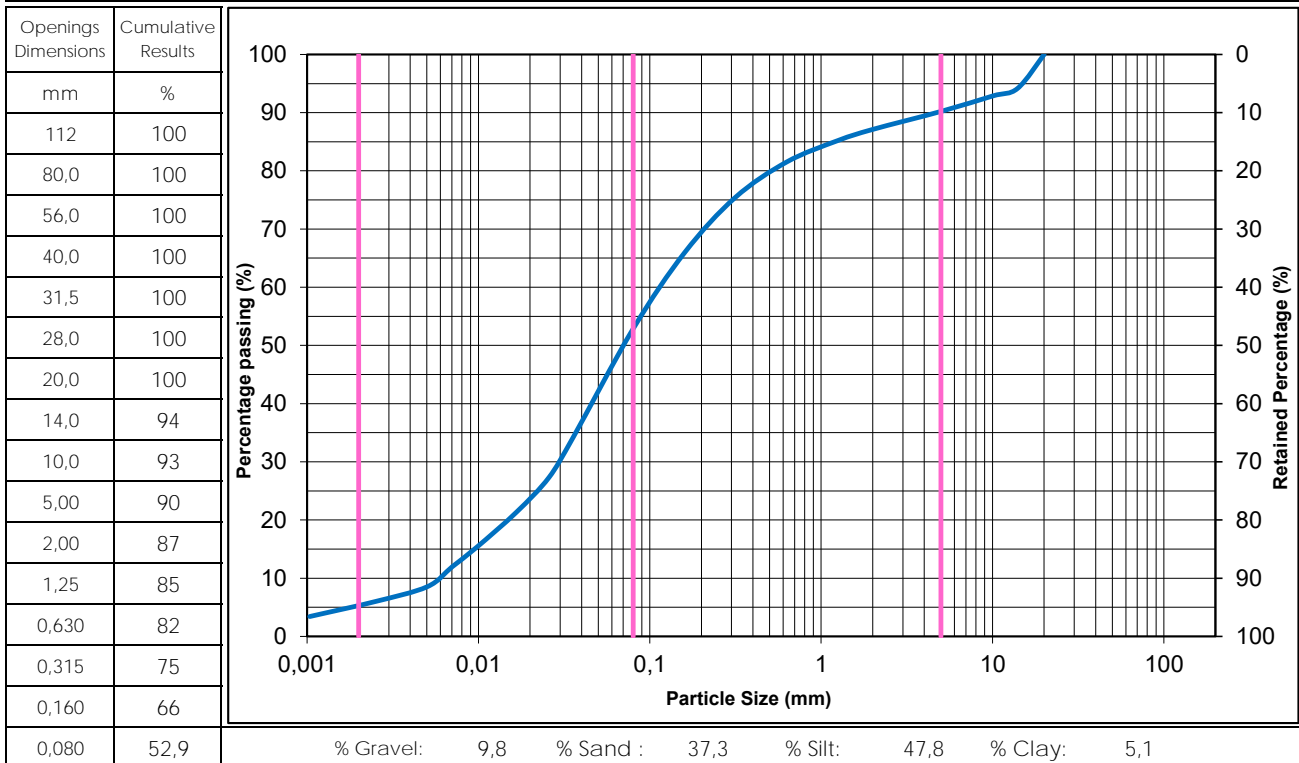
Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : August 31, 2022

Project No : 158100425.500.710.6
Sample No : BH22-19 SS-09
Depth : 4,88 - 5,49m

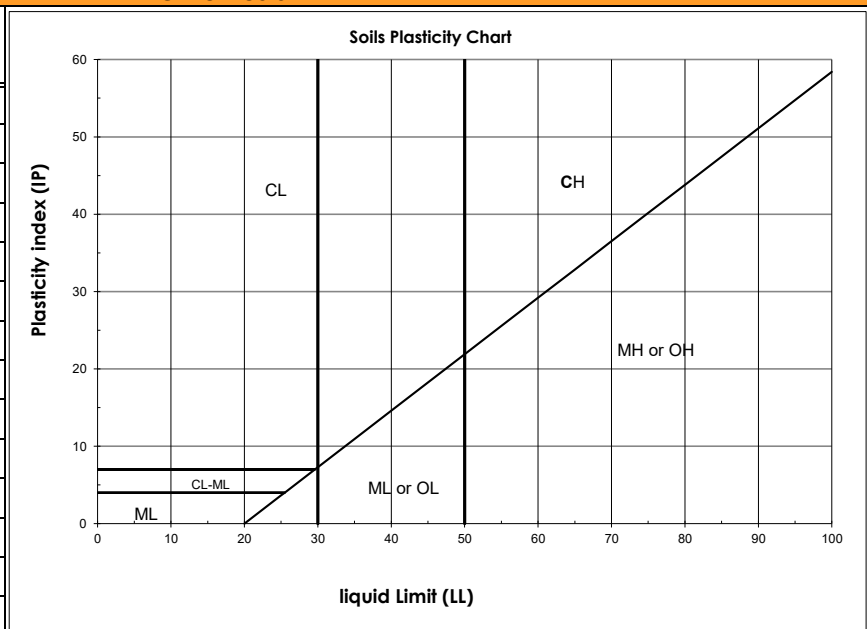
Material Description : Silt and Sand, traces of
Gravel, traces of Clay

Grain Size Analysis (BNQ 2501-025)




Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	14,3



Remarks :

Prepared by : Benoit Cyr, Geo. 

Date : December 09, 2022

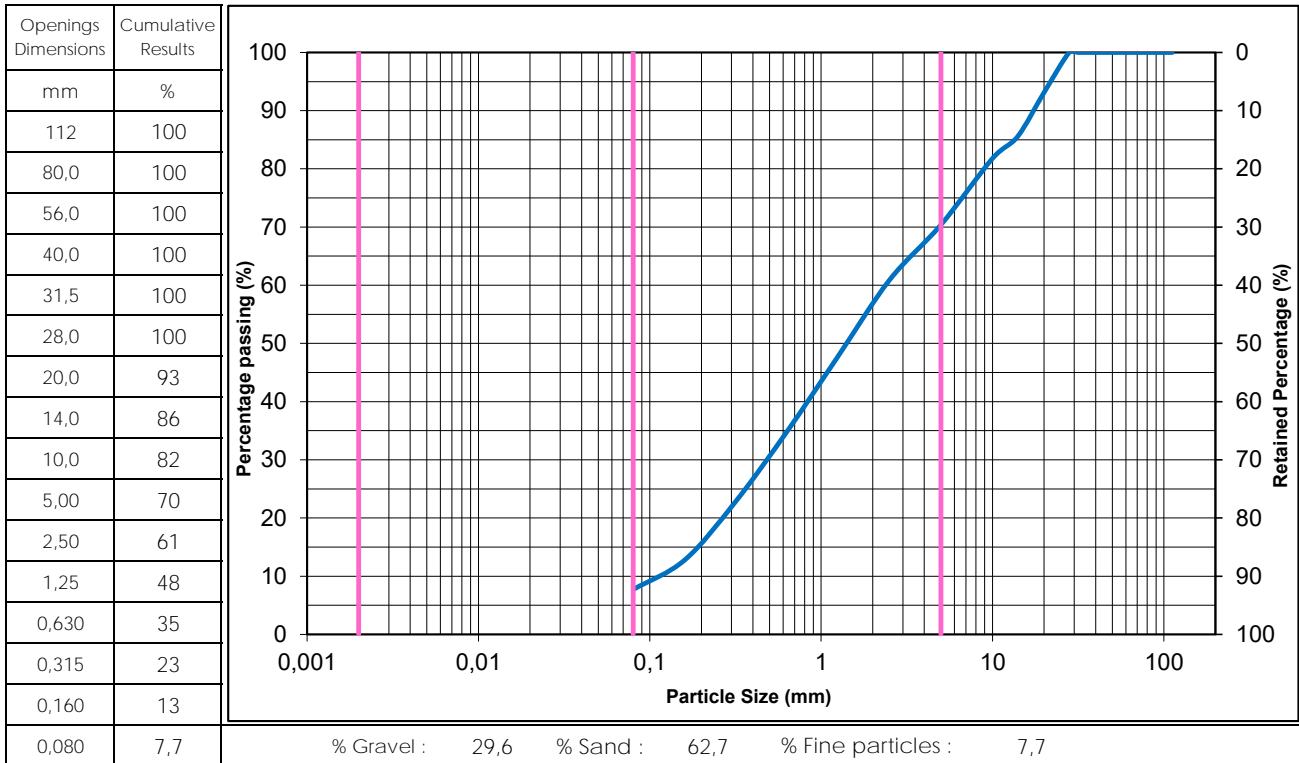
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 01, 2022

Project No : 158100425.500.710.6
Sample No : BH22-20 SS-01
Depth : 0,00 - 0,61m

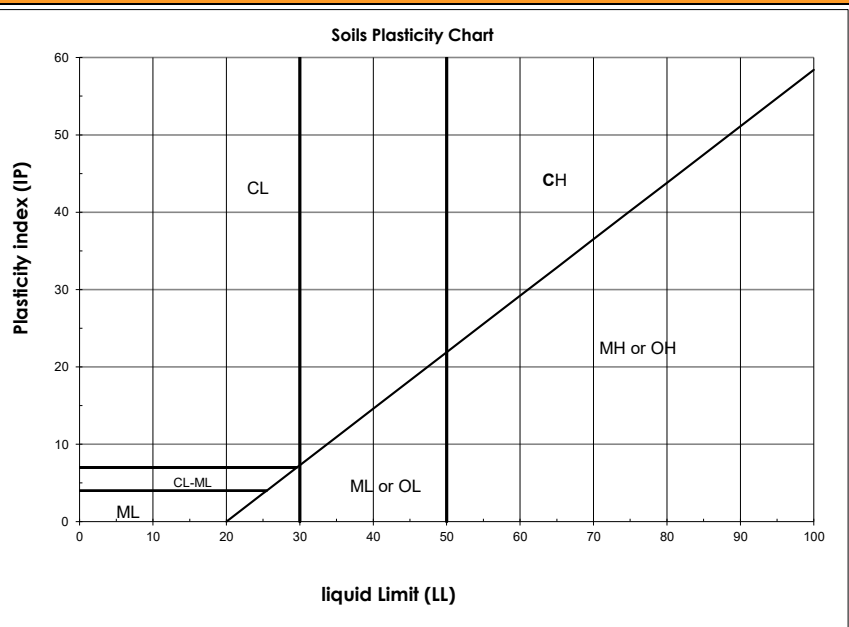
Material Description : Gravely Sand, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	5,0



Remarks : _____

Prepared by : Benoit Cyr, Geo.

Date : December 09, 2022

Client : Cree Development Corporation (CDC)

Sampled by : Hugo Desrochers

Project : LGA - Grevet-Chapais Railway

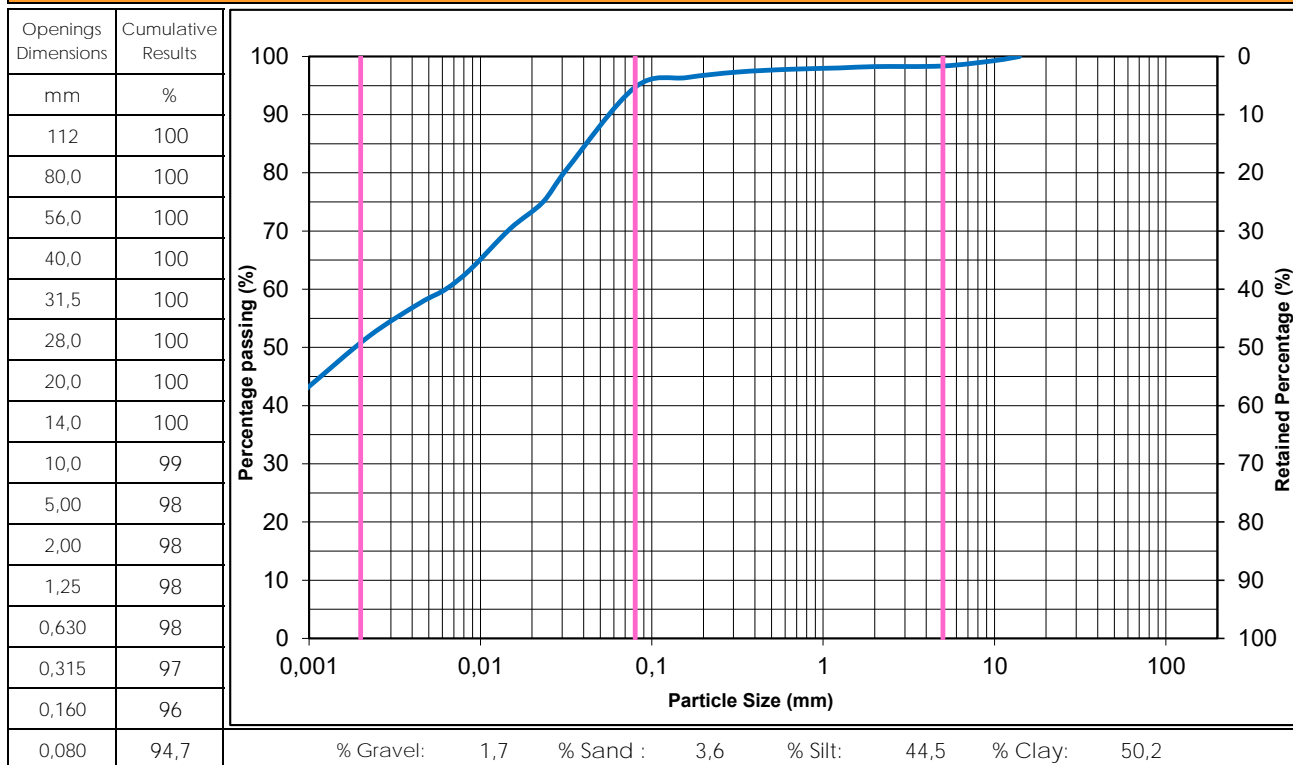
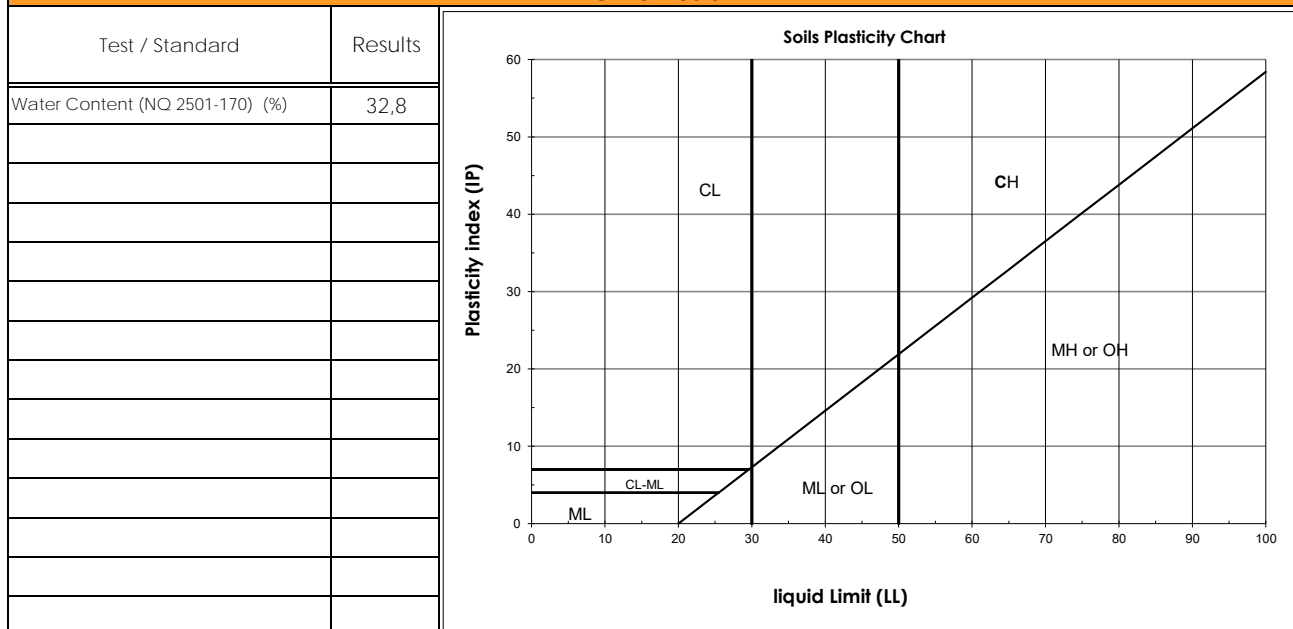
Sampling Date : September 01, 2022

Project No : 158100425.500.710.6

Sample No : BH22-20 SS-06

 Material Description : Clay and Silt, traces of Sand,
 traces of Gravel

Depth : 3,05 - 3,66m

Grain Size Analysis (BNQ 2501-025)

Other tests


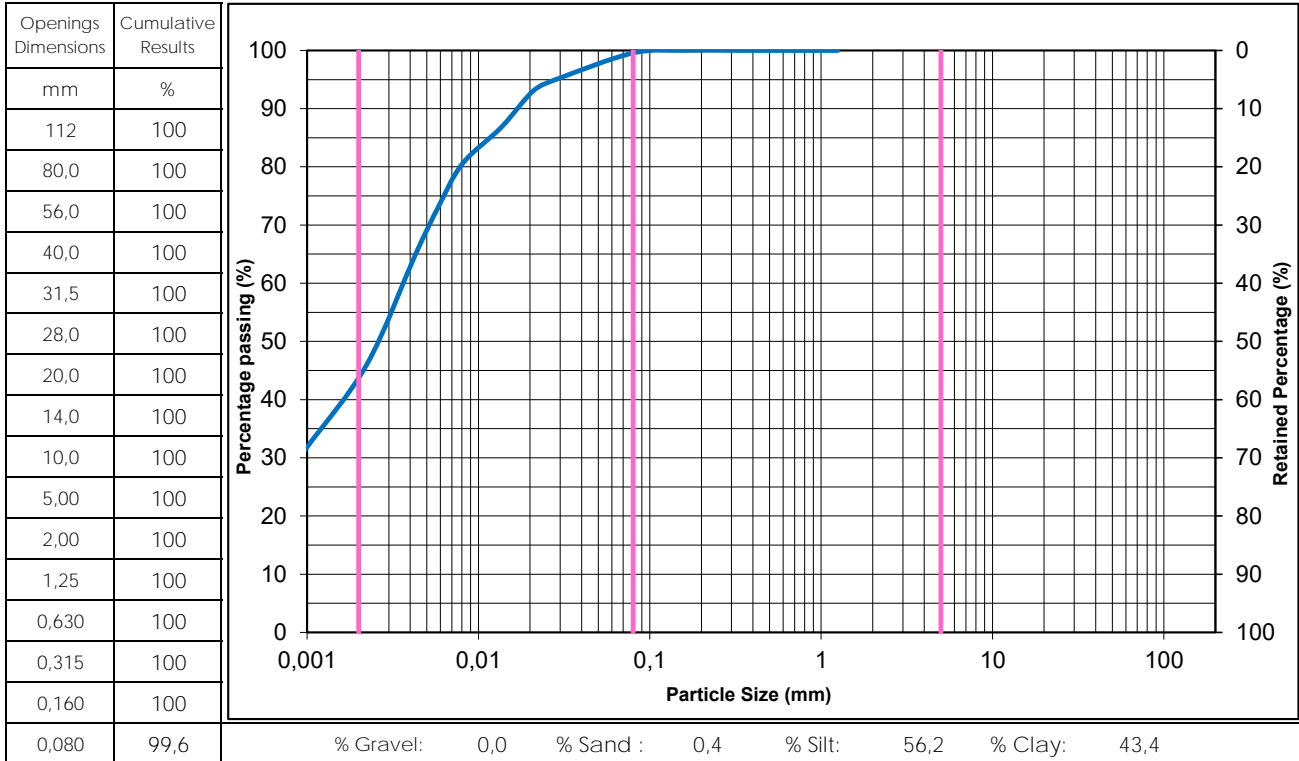
Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC*

Date : December 09, 2022

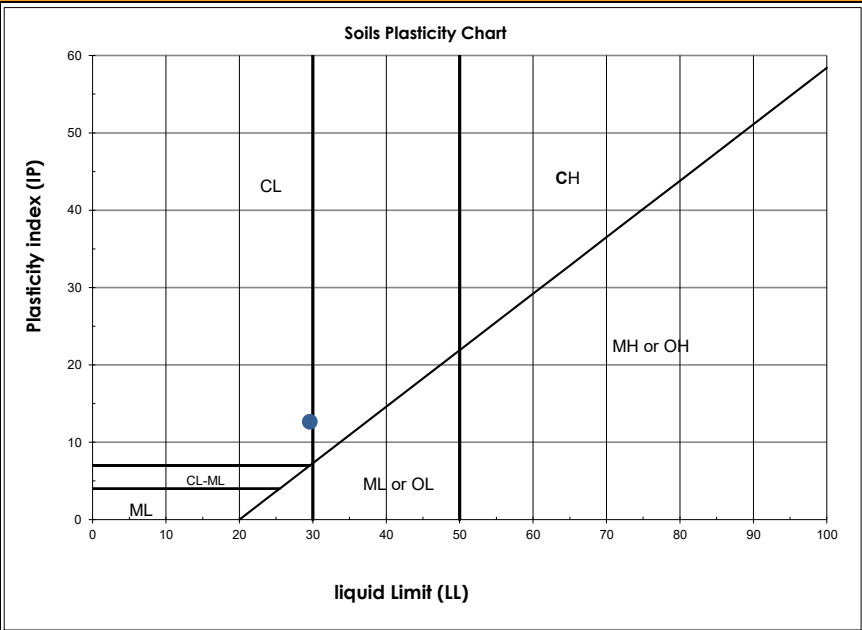
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 01, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-20 SS-13	Material Description : Silt and Clay, traces of Sand, low plasticity (CL)
Depth : 7,32 - 7,92m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	48,9
Liquid Limit (BNQ 2501-092)	30
Plastic Limit (BNQ 2501-092)	17
Plasticity Index (BNQ 2501-092)	13



Remarks :

Prepared by : Benoit Cyr, Geo. *BH* Date : December 14, 2022

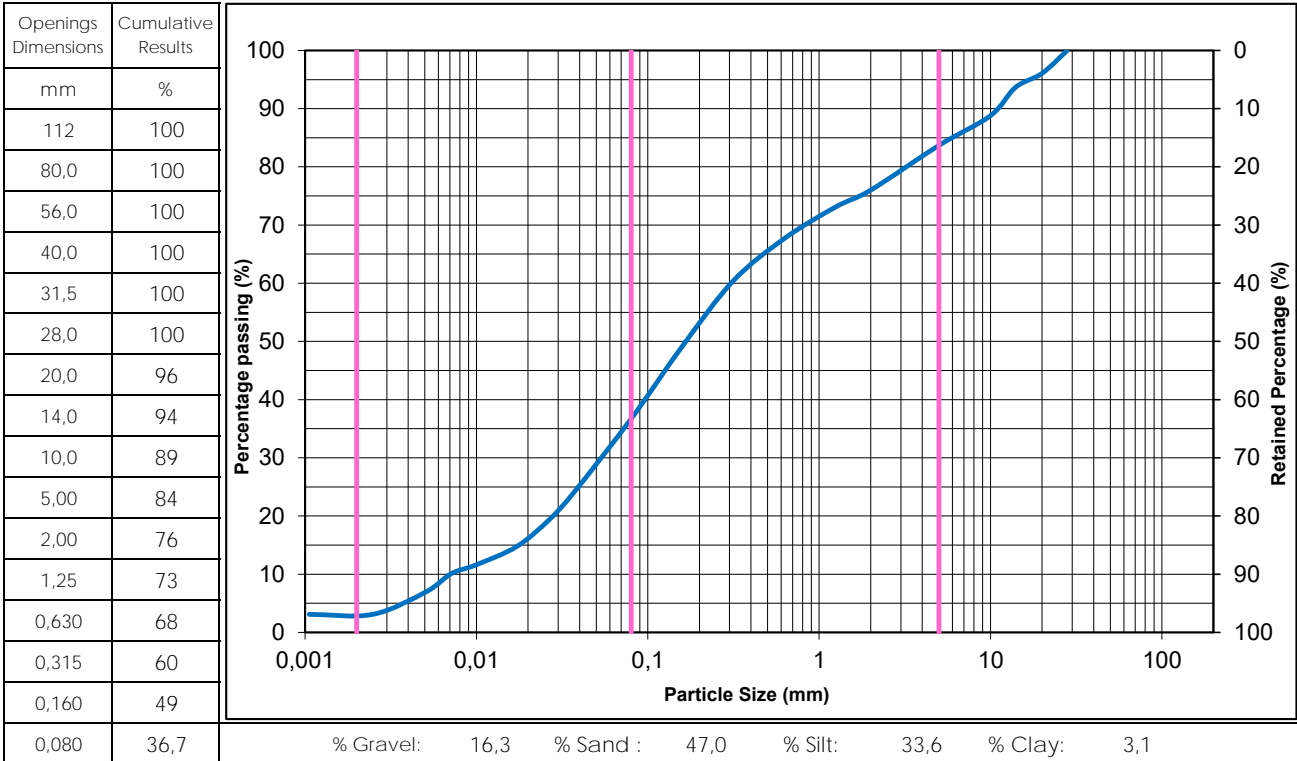
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 01, 2022

Project No : 158100425.500.710.6
Sample No : BH22-20 SS-16
Depth : 9,91 - 10,52m

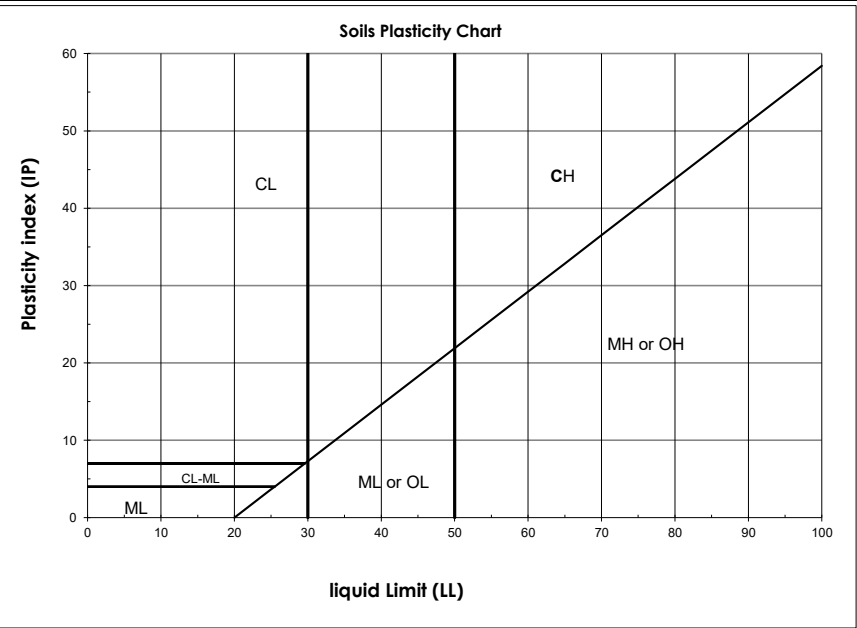
Material Description : Silty Sand, some Gravel,
traces of Clay

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	9,9



Remarks :

Prepared by : Benoit Cyr, Geo. 

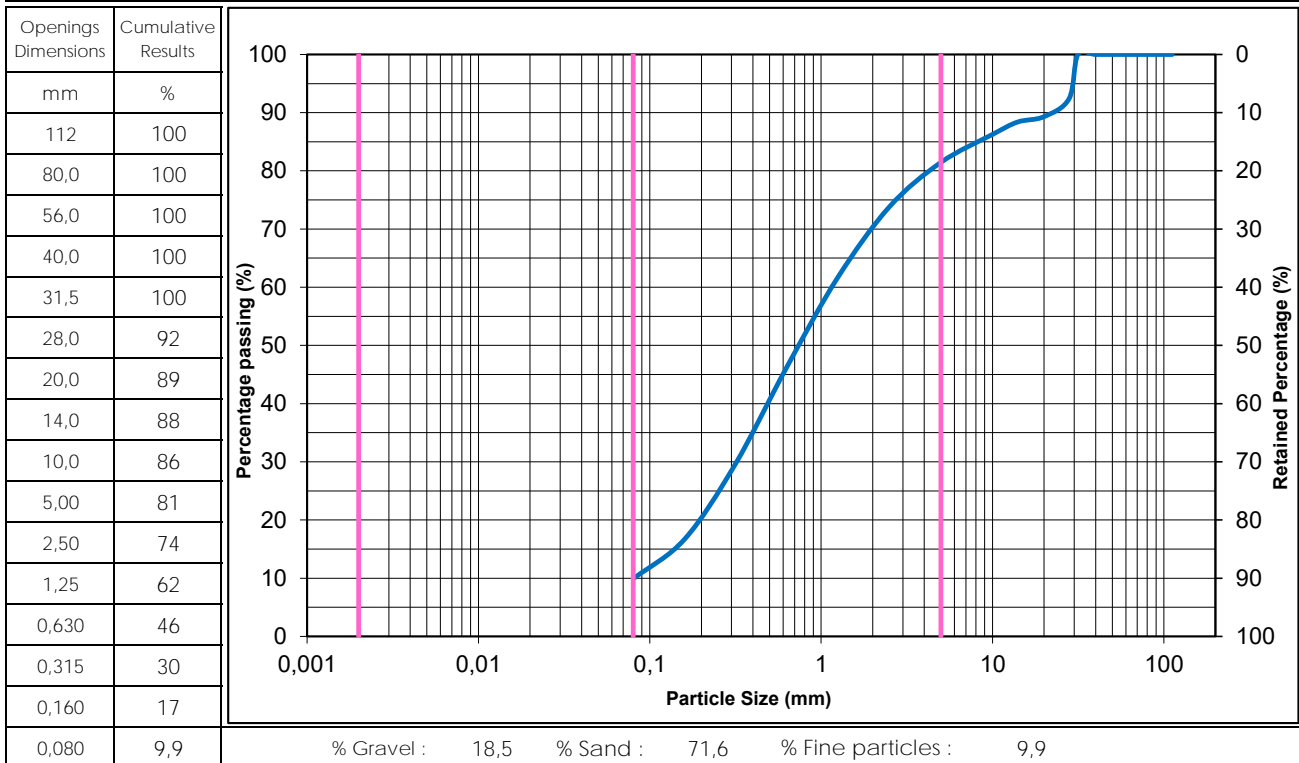
Date : December 14, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

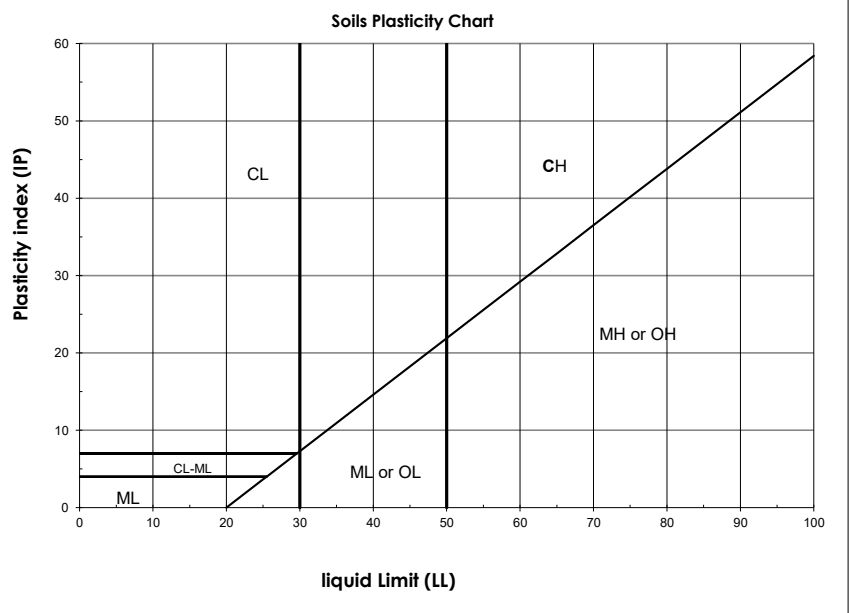
 Sampled by : Hugo Desrochers
 Sampling Date : September 01, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-21 SS-02
 Depth : 0,61 - 1,22m

 Material Description : Sand, some Gravel, traces of
 fine particles

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	5,2



Remarks :

Prepared by : Benoit Cyr, Geo.

Date : December 14, 2022

Client : Cree Development Corporation (CDC)

Sampled by : Hugo Desrochers

Project : LGA - Grevet-Chapais Railway

Sampling Date : September 01, 2022

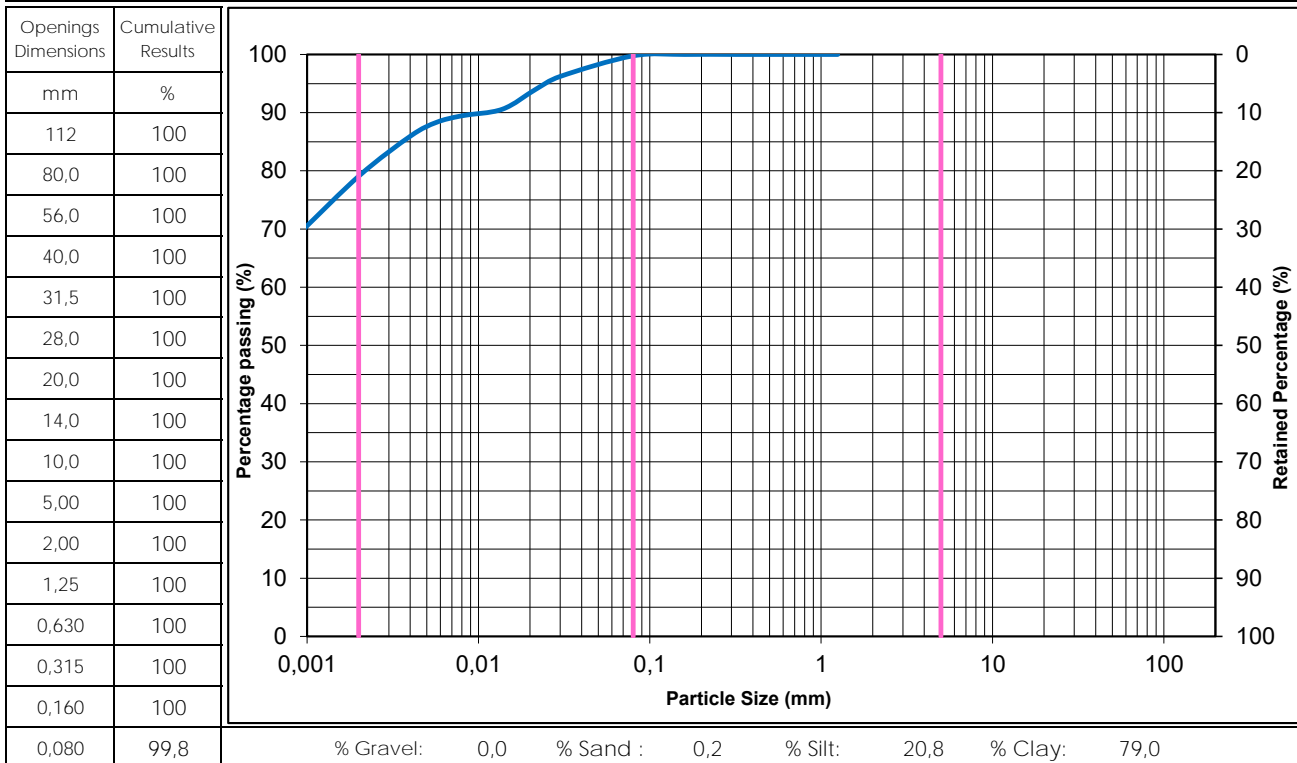
Project No : 158100425.500.710.6

Sample No : BH22-21 SS-06

Material Description : Silty Clay, traces of Sand, high plasticity (CH)

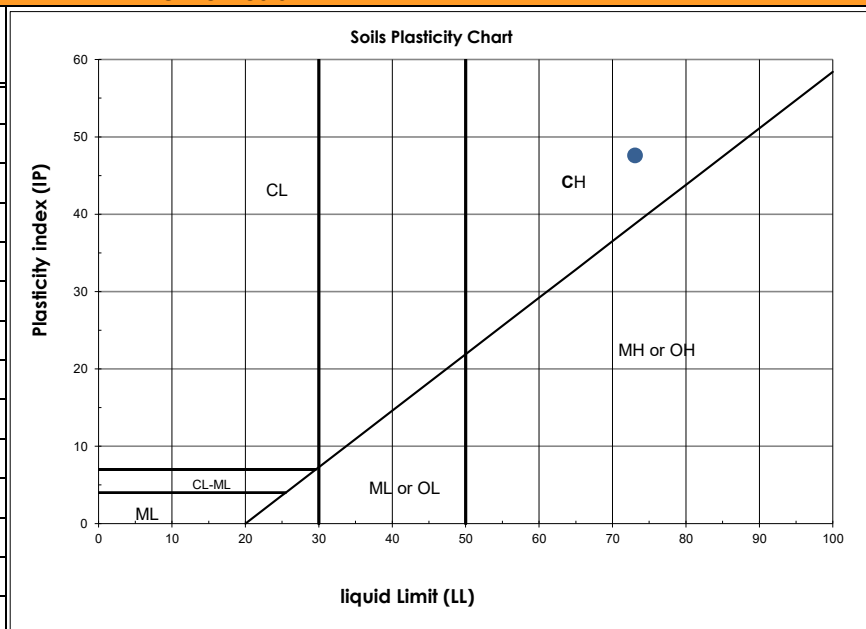
Depth : 3,66 - 4,27m

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	84,0
Liquid Limit (BNQ 2501-092)	73
Plastic Limit (BNQ 2501-092)	25
Plasticity Index (BNQ 2501-092)	48



Remarks :

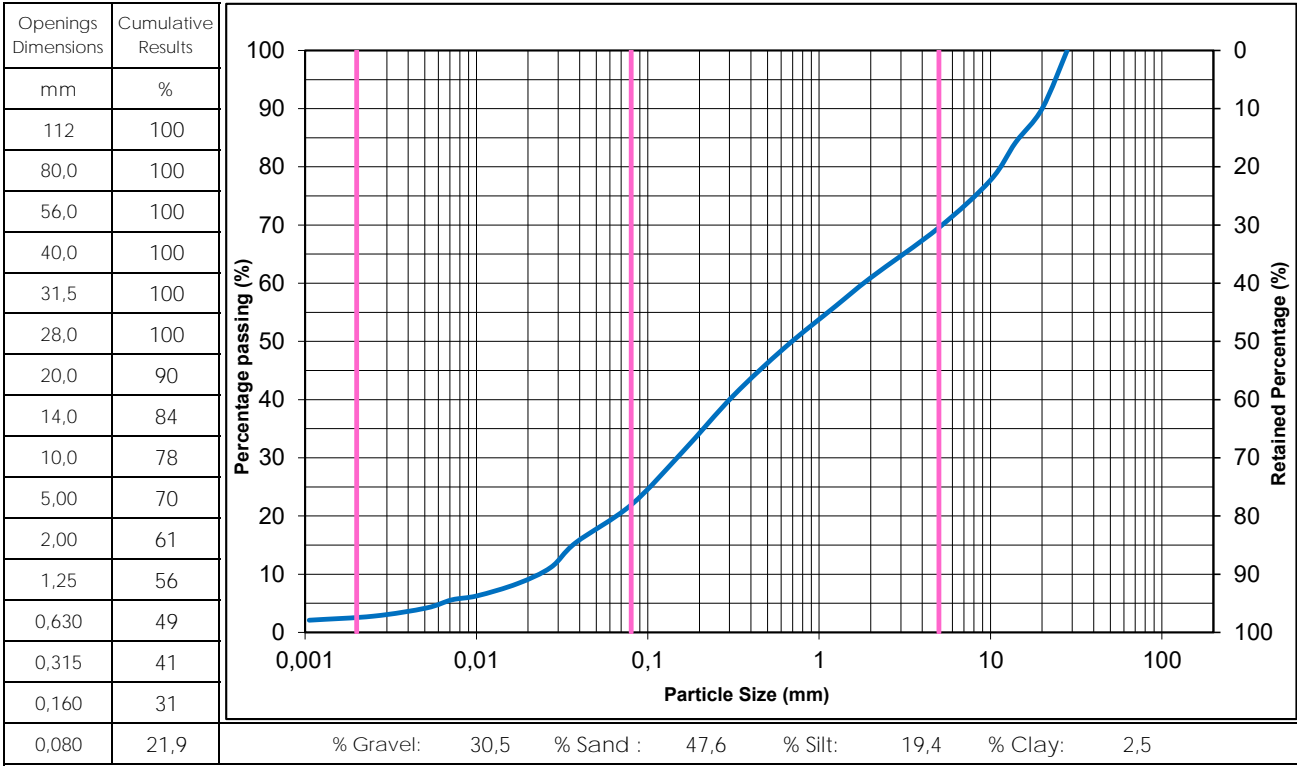
Prepared by :

Benoit Cyr, Geo. *BC*

Date : December 14, 2022

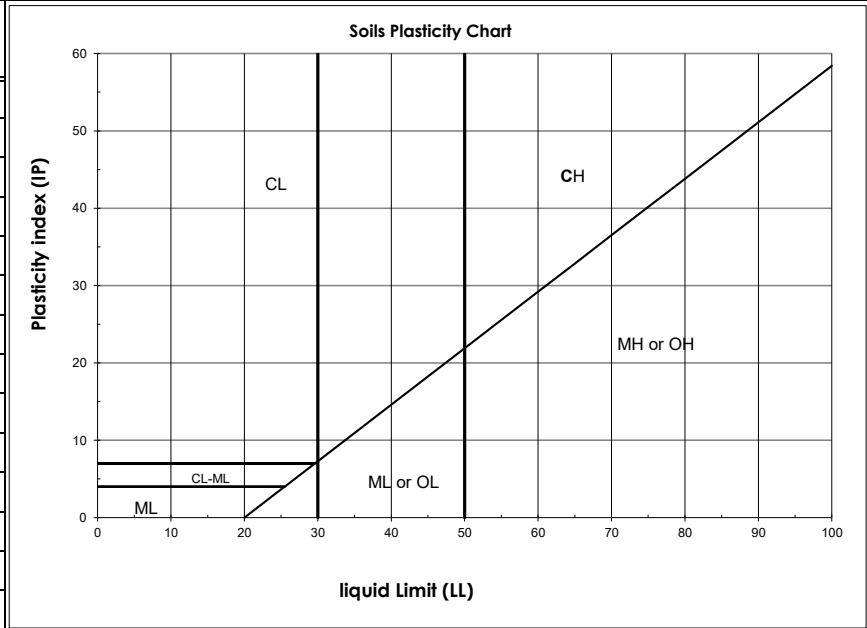
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 01, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-21 SS-13	Material Description : Gravely Sand, some Silt, traces of Clay
Depth : 9,14 - 9,75m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	8,1



Remarks :

Prepared by : Benoit Cyr, Geo. *Bj* Date : December 14, 2022

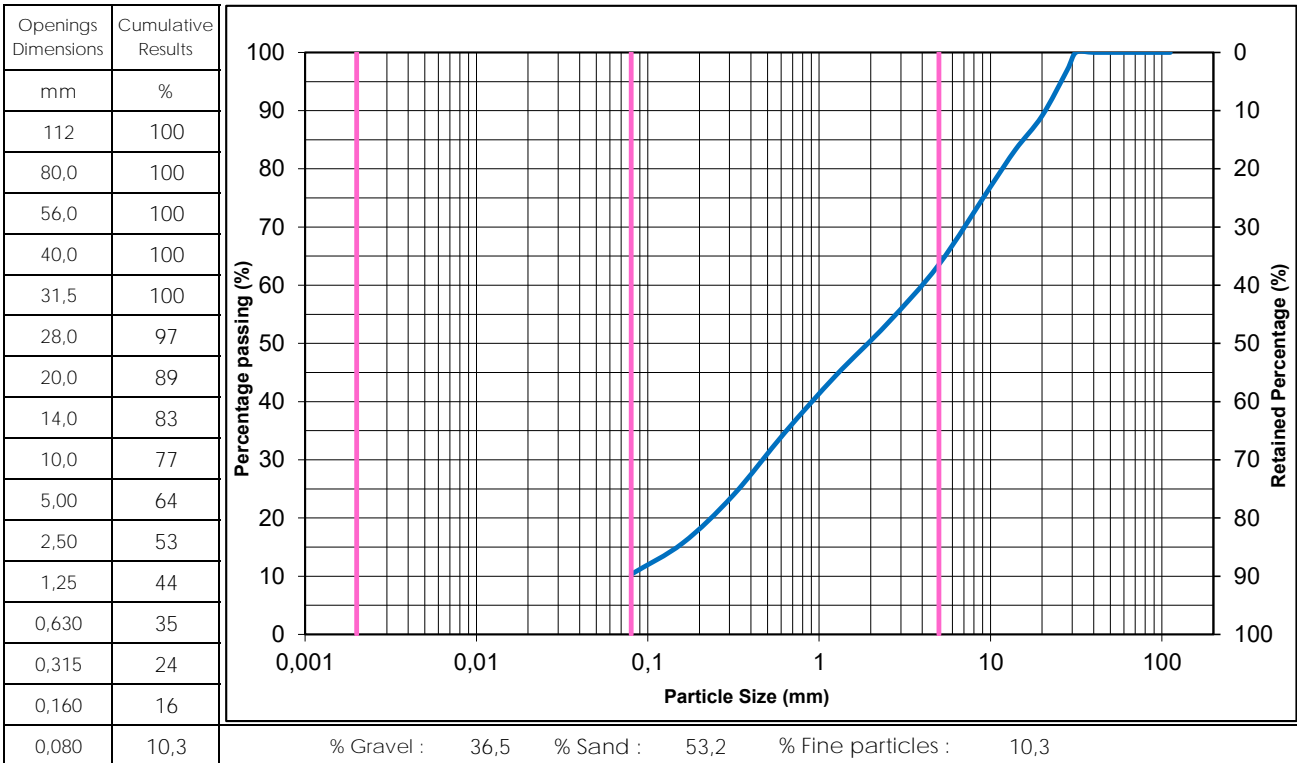
Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 02, 2022

Project No : 158100425.500.710.6
Sample No : BH22-22 SS-01
Depth : 0,00 - 0,61m

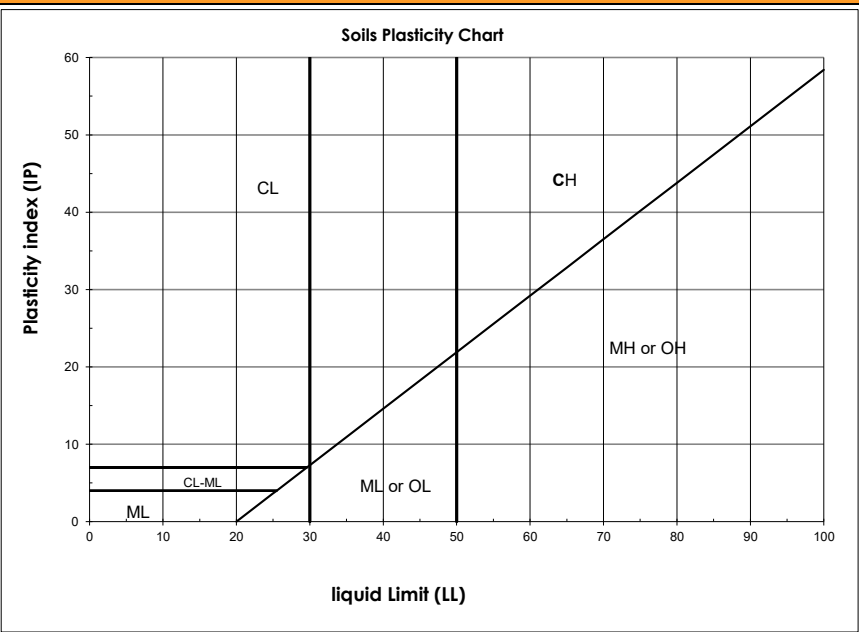
Material Description : Sand and Gravel, some fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	3,8



Remarks :

Prepared by : Benoit Cyr, Geo. *BC*

Date : December 14, 2022

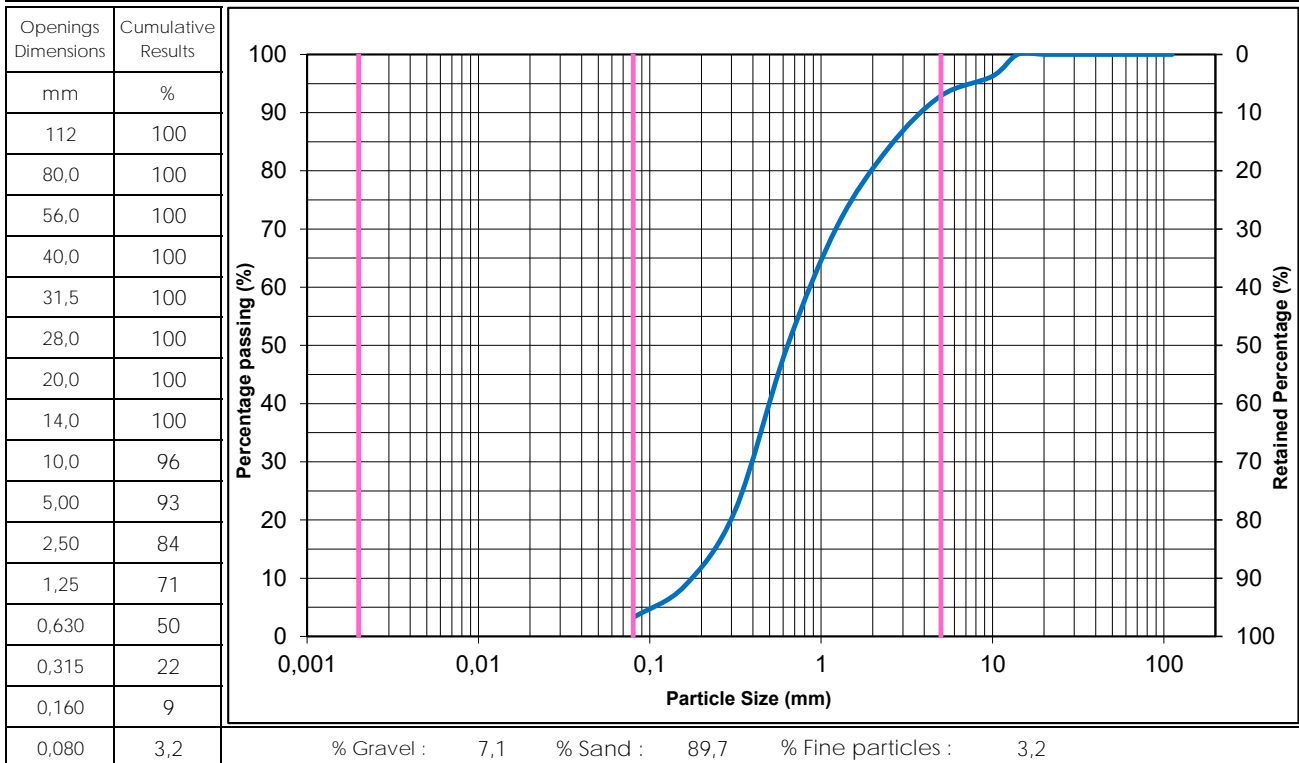
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 02, 2022

Project No : 158100425.500.710.6
Sample No : BH22-22 SS-04
Depth : 1,83 - 2,44m

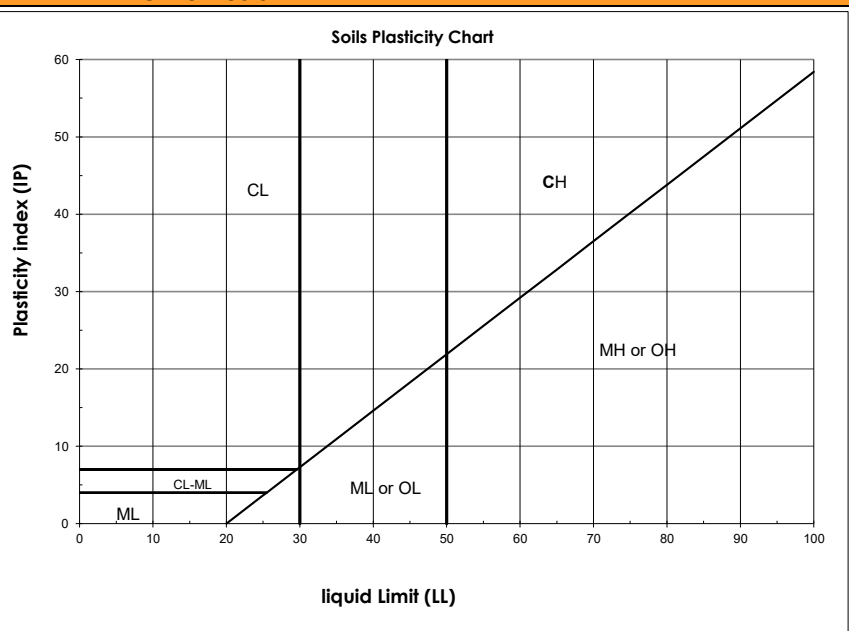
Material Description : Sand, traces of Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	14,7



Remarks :

Prepared by :

Benoit Cyr, Geo. 

Date : December 14, 2022

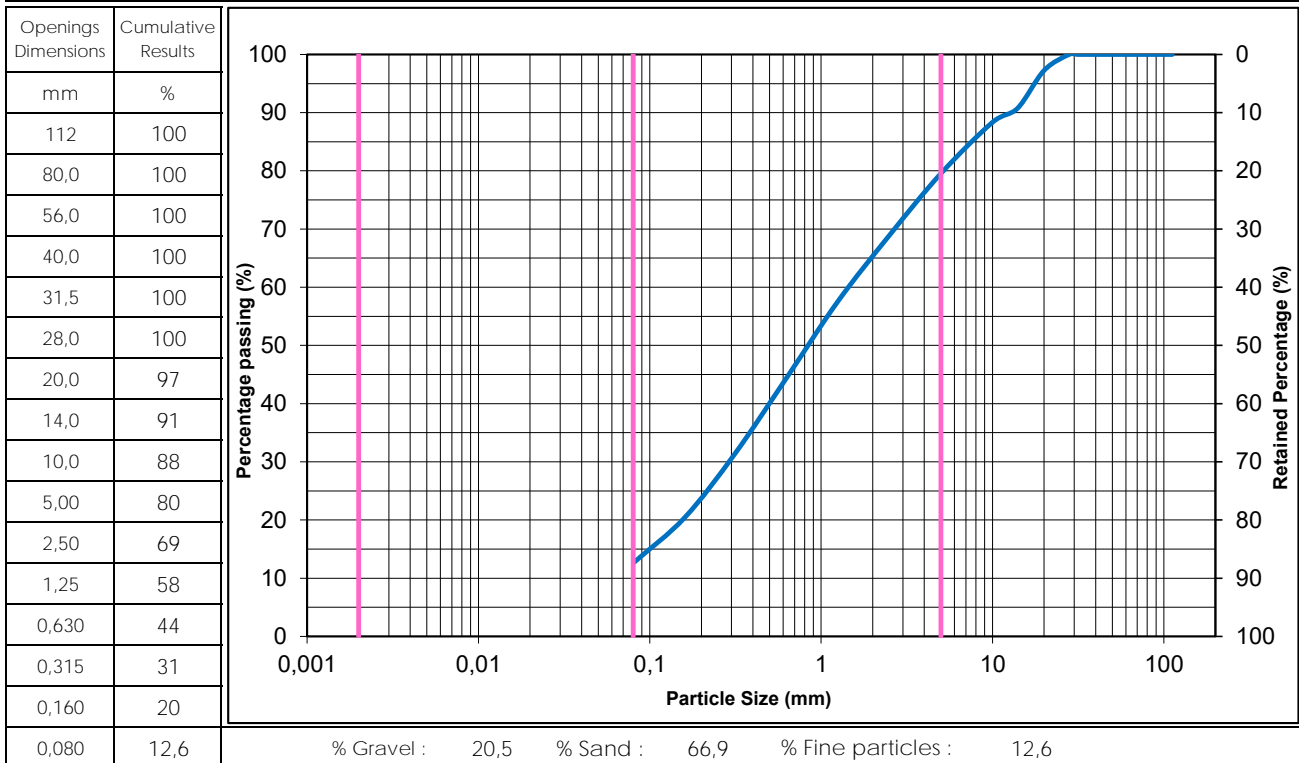
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 02, 2022

Project No : 158100425.500.710.6
Sample No : BH22-22 SS-08
Depth : 4,27 - 4,88m

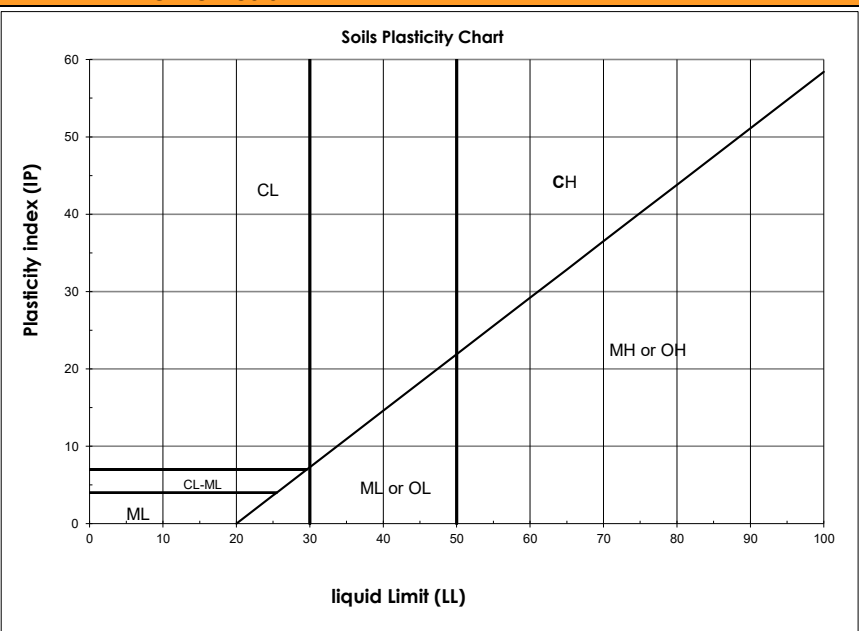
Material Description : Gravely Sand, some fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	14,5



Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : December 14, 2022

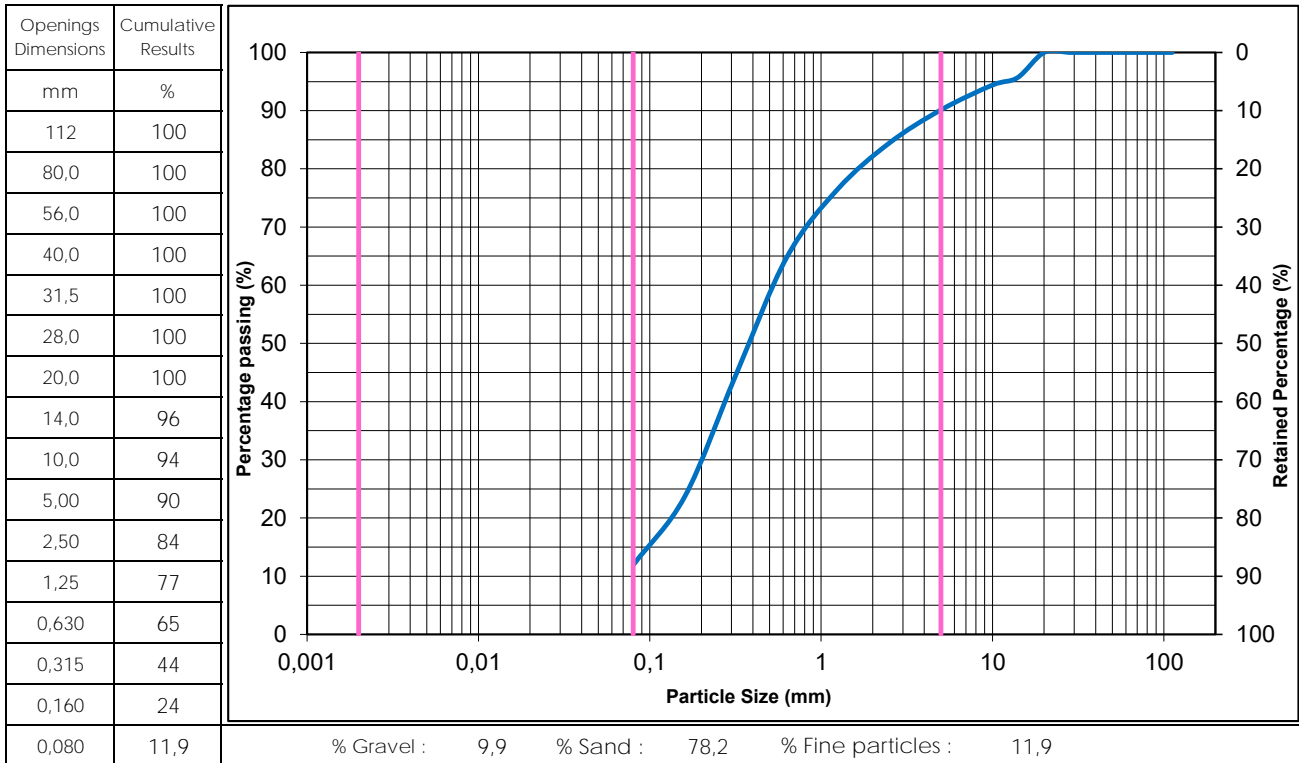
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 03, 2022

Project No : 158100425.500.710.6
Sample No : BH22-23 SS-02
Depth : 0,61 - 1,22m

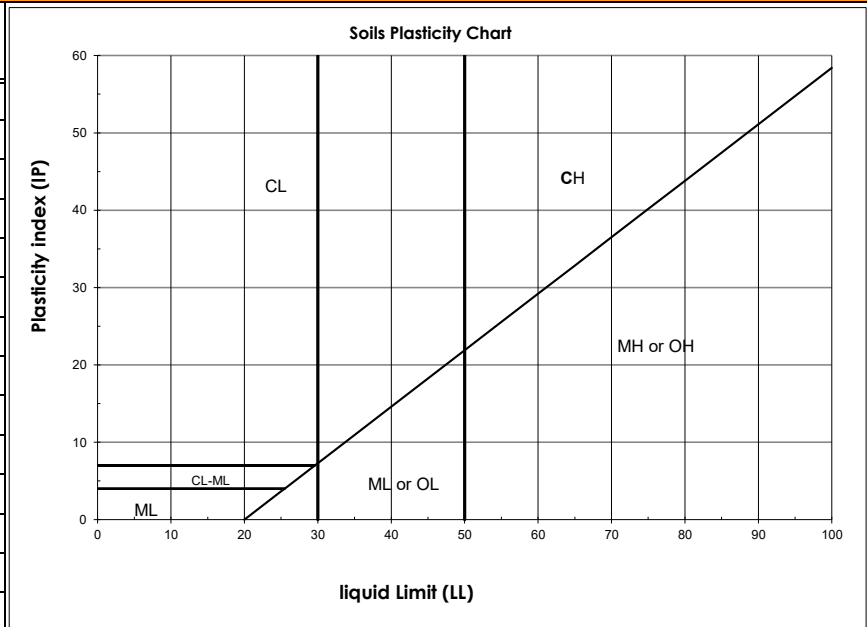
Material Description : Sand, some fine particles,
traces of Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	3,4



Remarks :

Prepared by :

Benoit Cyr, Geo. *BJ*

Date : December 14, 2022

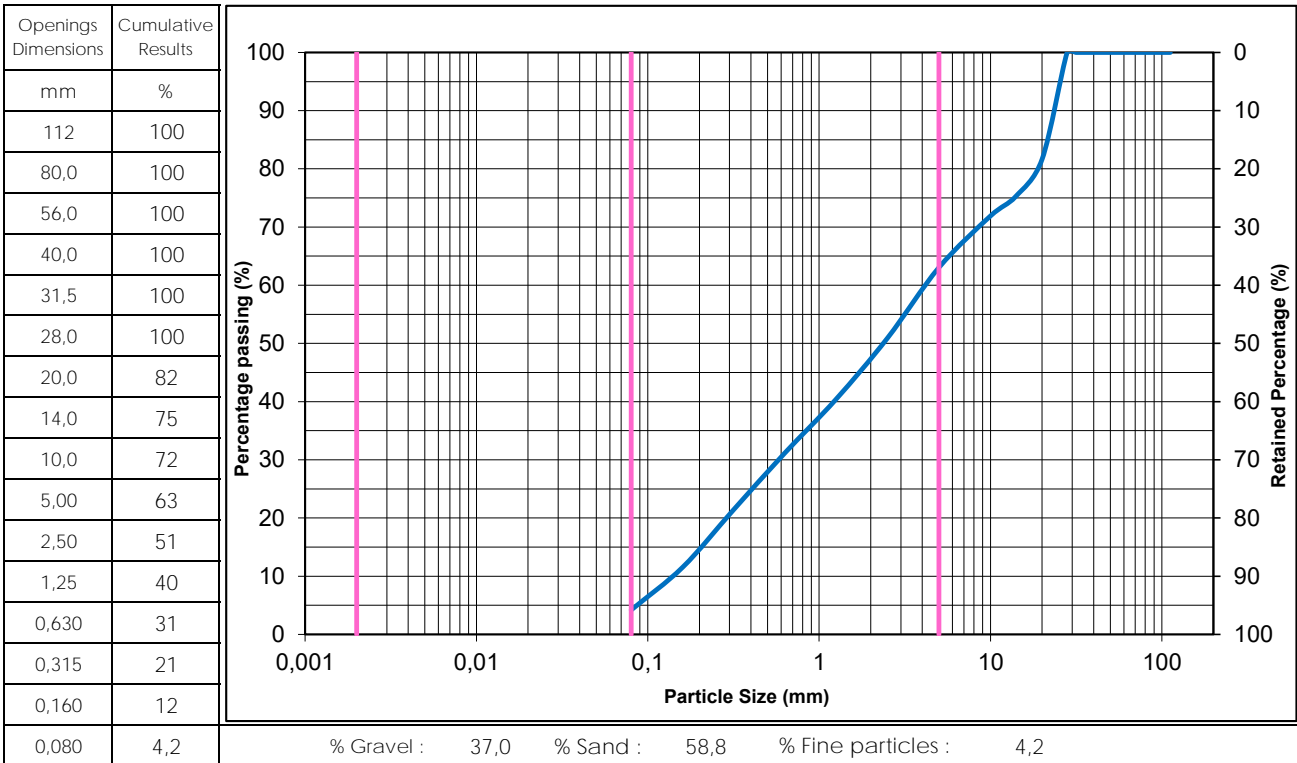
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 03, 2022

Project No : 158100425.500.710.6
Sample No : BH22-23 SS-06
Depth : 3,05 - 3,66m

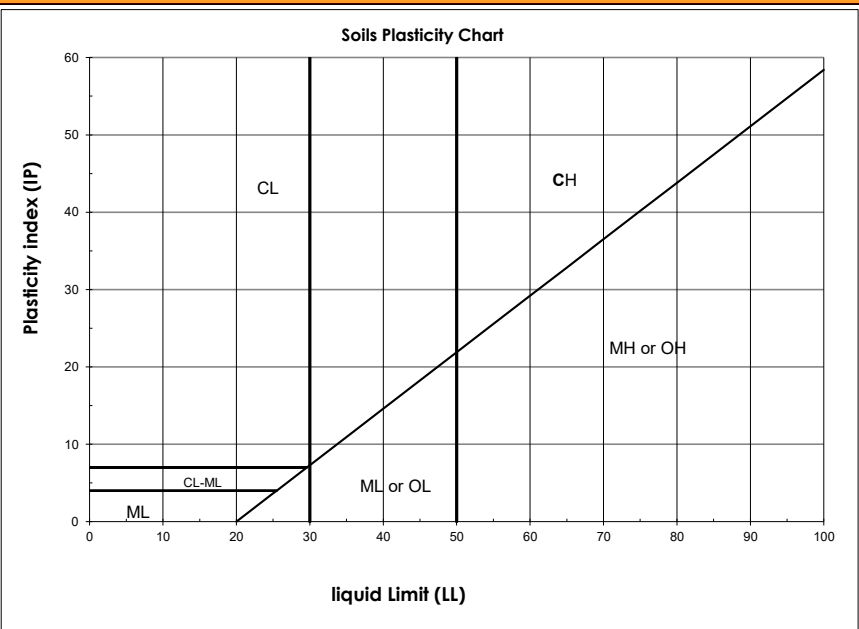
Material Description : Sand and Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	8,5



Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : December 14, 2022

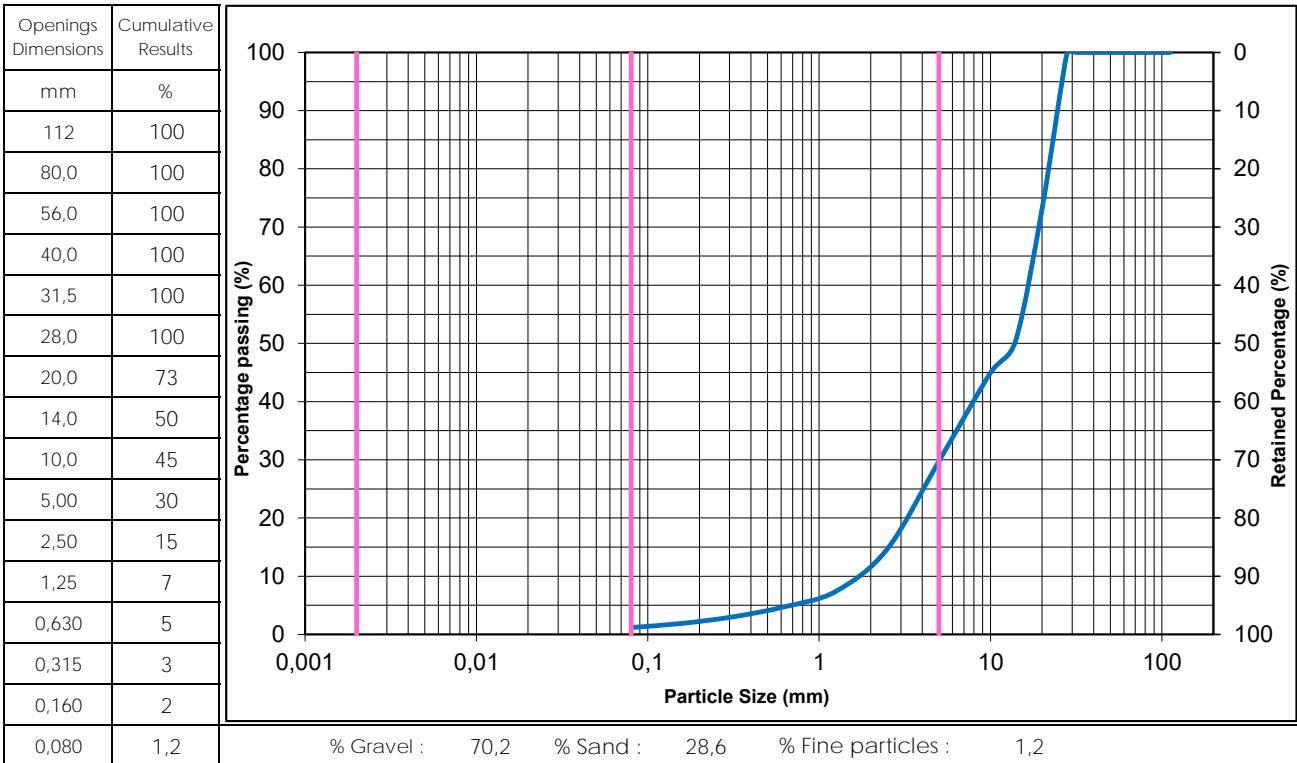
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 03, 2022

Project No : 158100425.500.710.6
Sample No : BH22-23 SS-09
Depth : 4,88 - 5,18m

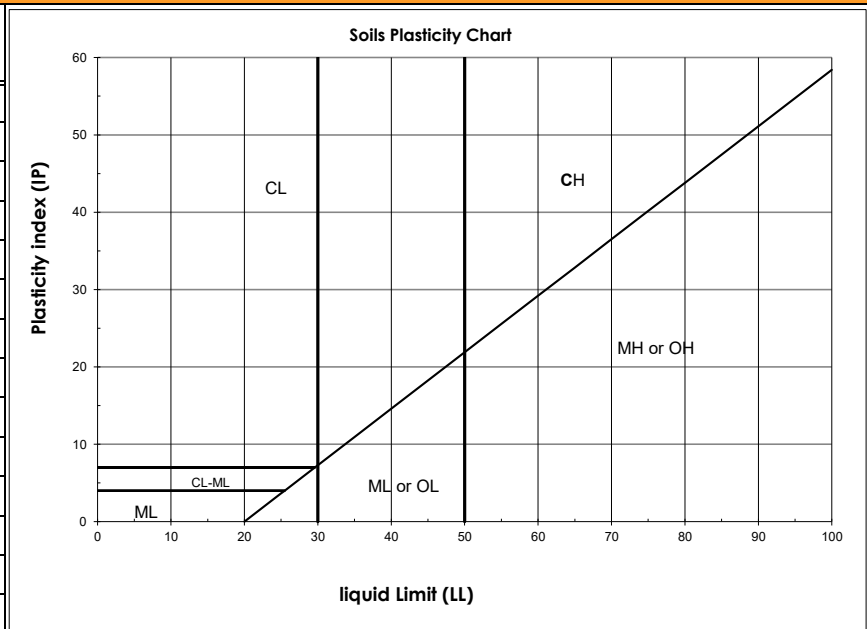
Material Description : Sandy Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	6,2



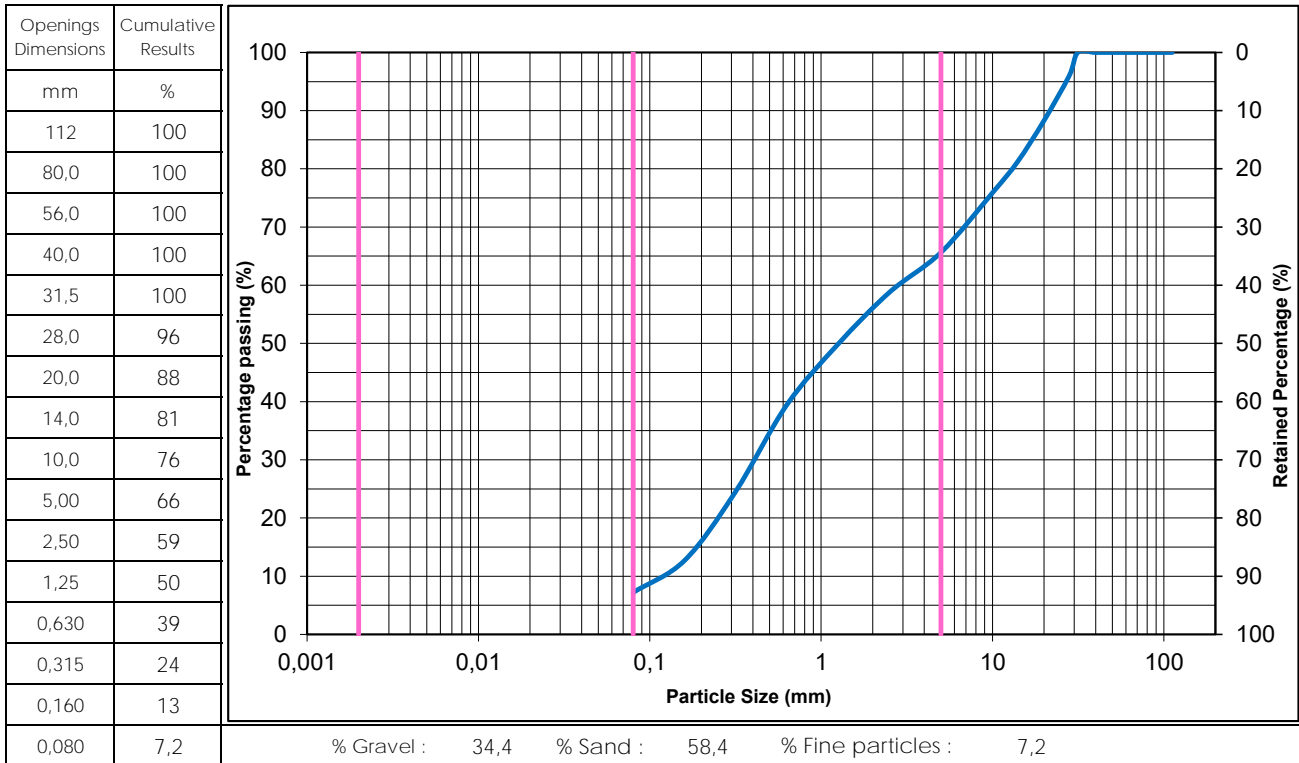
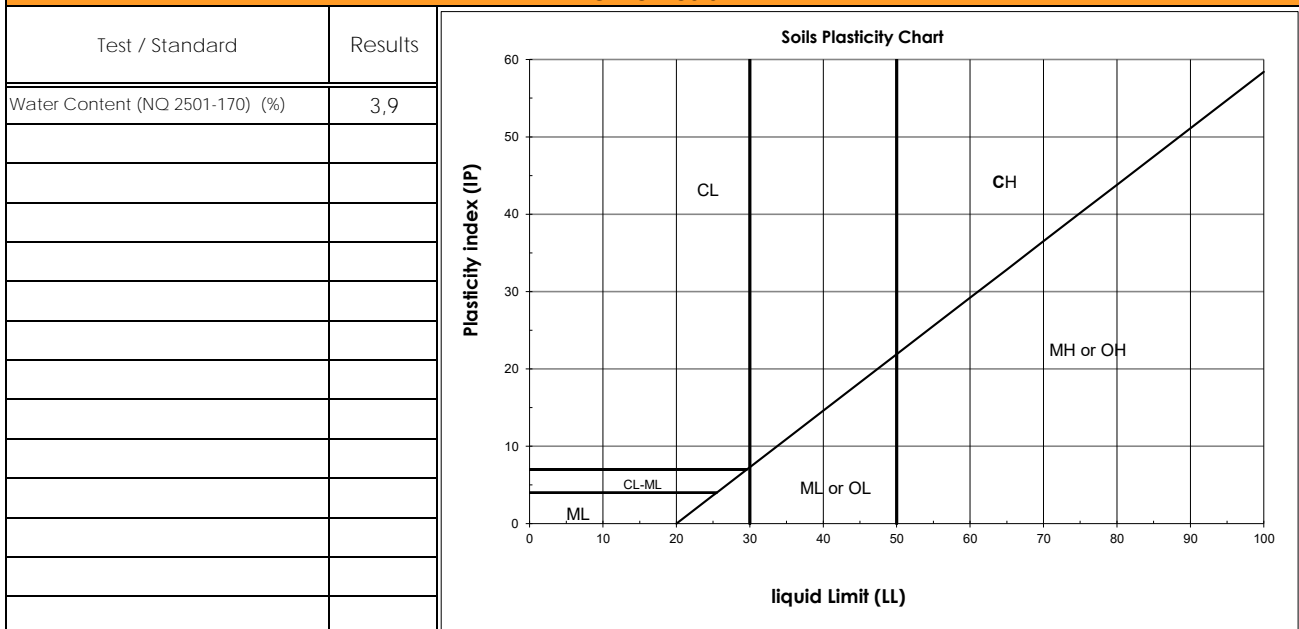
Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : December 14, 2022

Client :	Cree Developpement Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	September 03, 2022
Project No :	158100425.500.710.6		
Sample No :	BH22-24 SS-01	Material Description :	Gravelly Sand, traces of fine particles
Depth :	0,00 - 0,61m		

Grain Size Analysis (BNQ 2501-025)

Other tests


Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC* Date : December 14, 2022

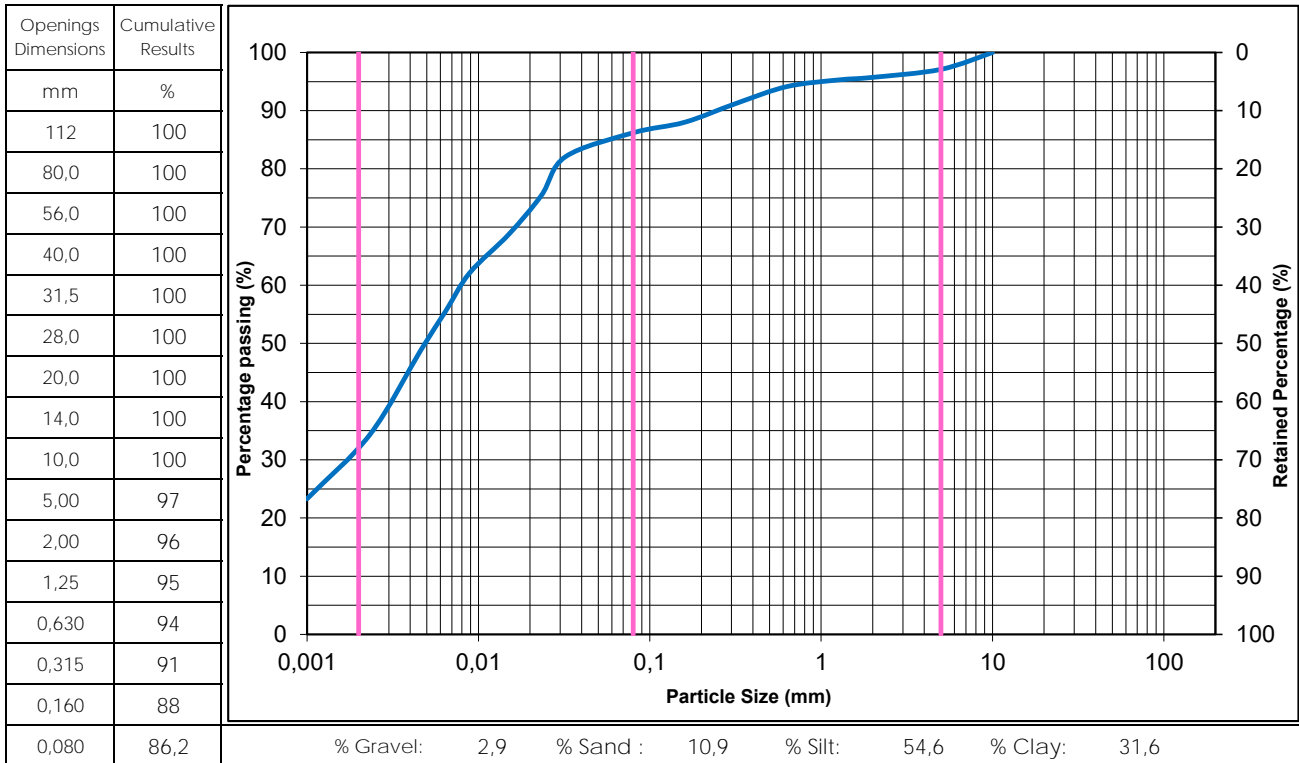
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 03, 2022

Project No : 158100425.500.710.6
Sample No : BH22-24 SS-04
Depth : 1,83 - 2,44m

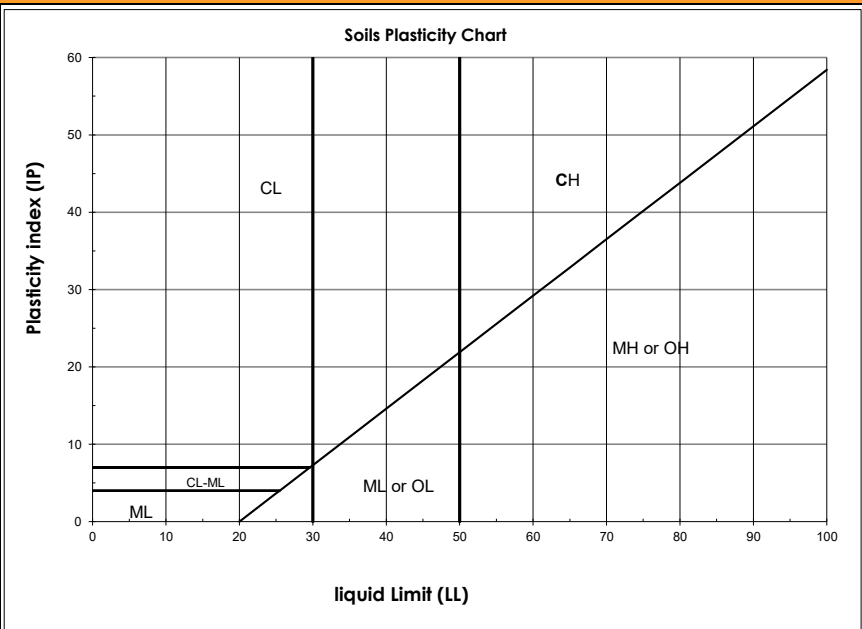
Material Description : Clayey Silt, some Sand, traces of Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	74,0



Remarks : _____

Prepared by : Benoit Cyr, Geo. 

Date : December 14, 2022

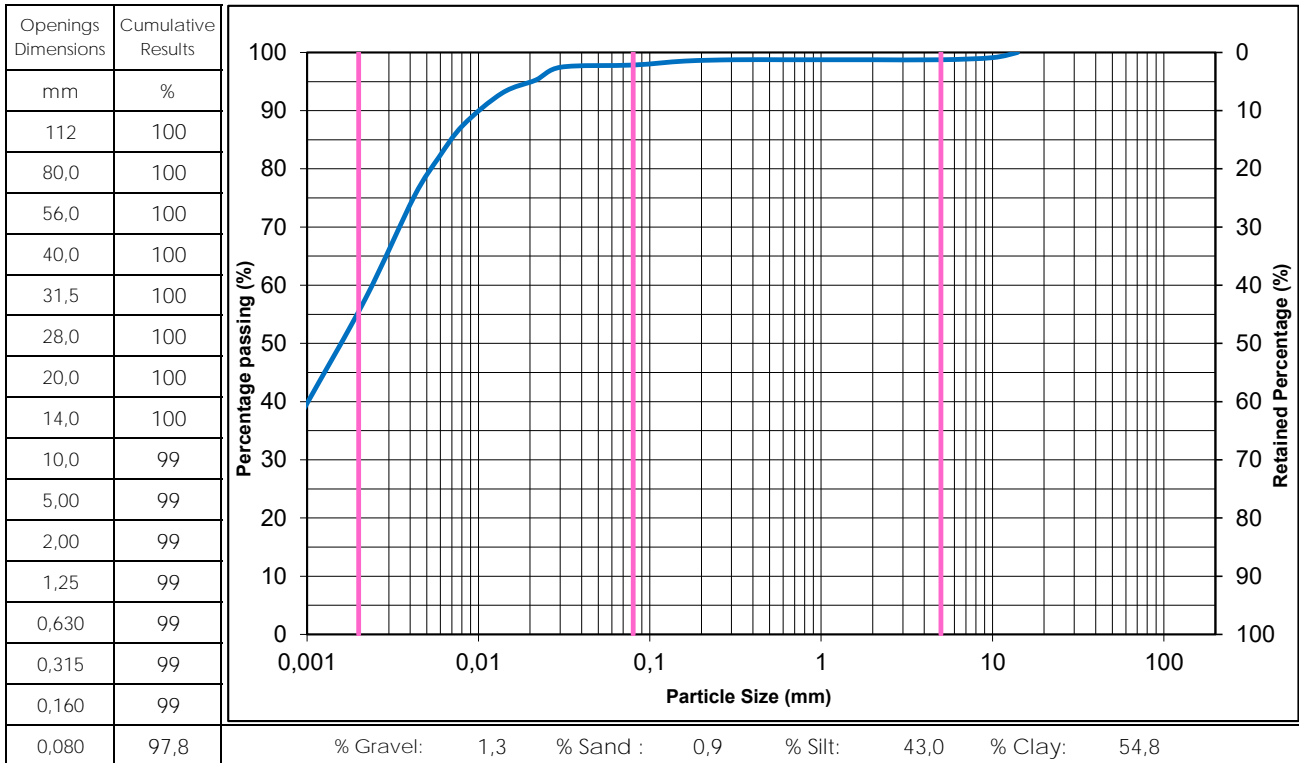
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 03, 2022

Project No : 158100425.500.710.6
Sample No : BH22-24 SS-07
Depth : 3,66 - 4,27m

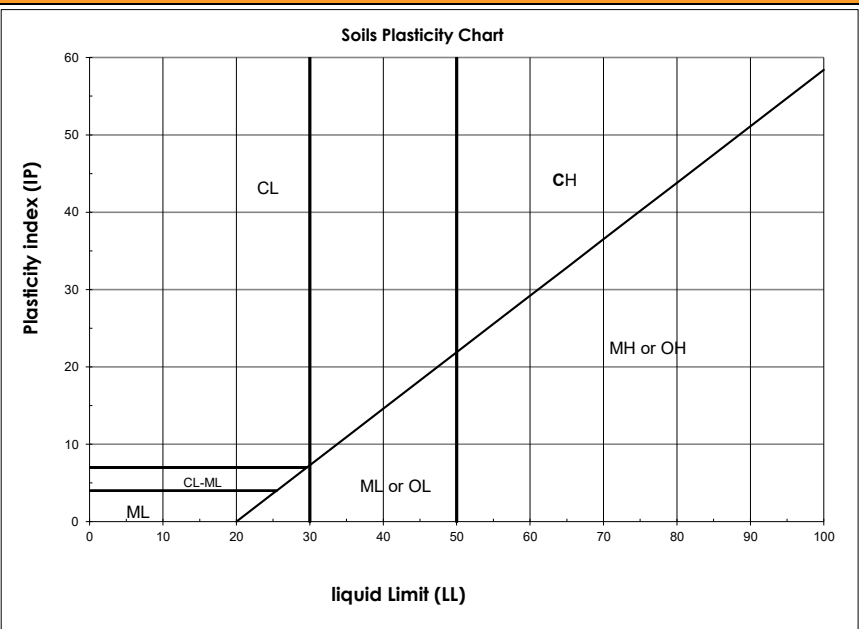
Material Description : Clay and Silt, traces of
Gravel, traces of Sand

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	33,9



Remarks : _____

Prepared by : Benoit Cyr, Geo. 

Date : December 14, 2022

Client : Cree Developpement Corporation (CDC)

Sampled by : Hugo Desrochers

Project : LGA - Grevet-Chapais Railway

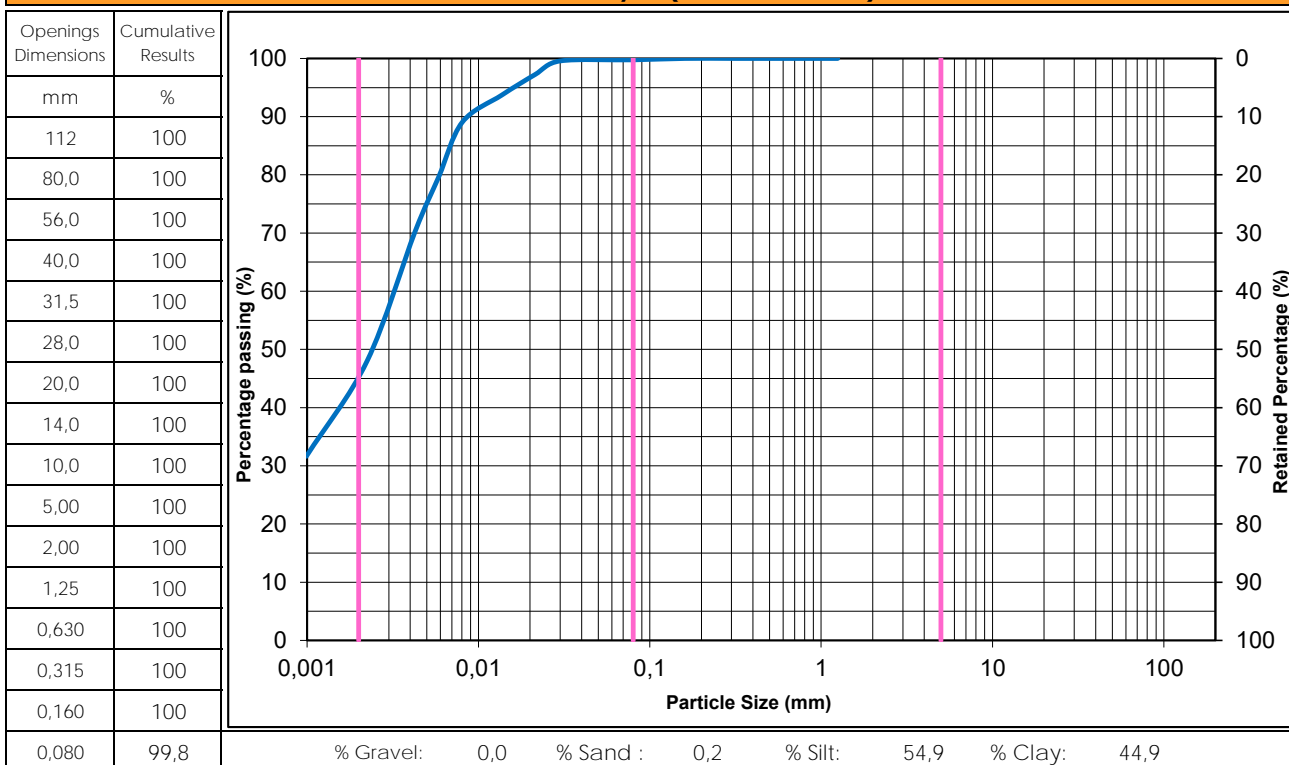
Sampling Date : September 03, 2022

Project No : 158100425.500.710.6

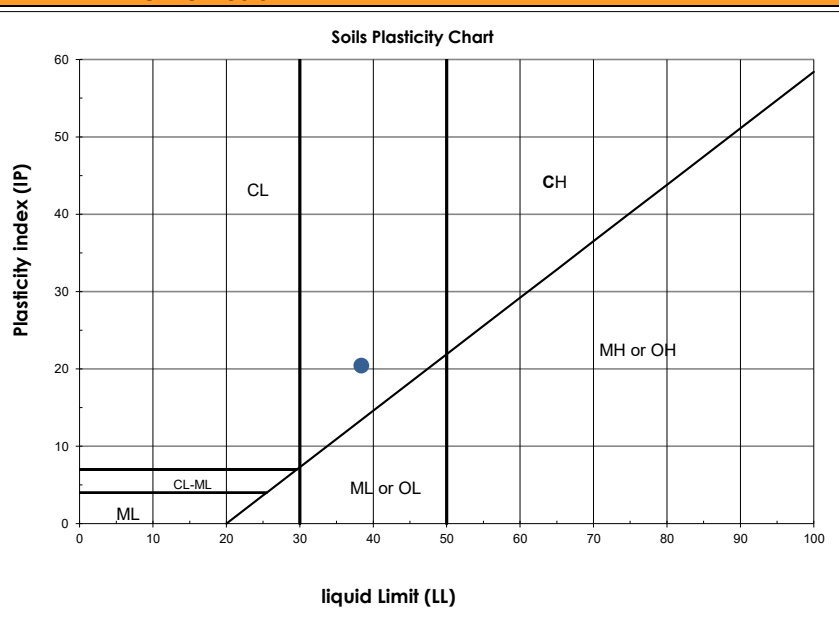
Sample No : BH22-24 SS-12

Material Description : Silt and Clay, traces of Sand,
medium plasticity (CL)

Depth : 6,71 - 7,32m

Grain Size Analysis (BNQ 2501-025)**Other tests**

Test / Standard	Results
Water Content (NQ 2501-170) (%)	50,4
Liquid Limit (BNQ 2501-092)	38
Plastic Limit (BNQ 2501-092)	18
Plasticity Index (BNQ 2501-092)	20



Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : December 14, 2022

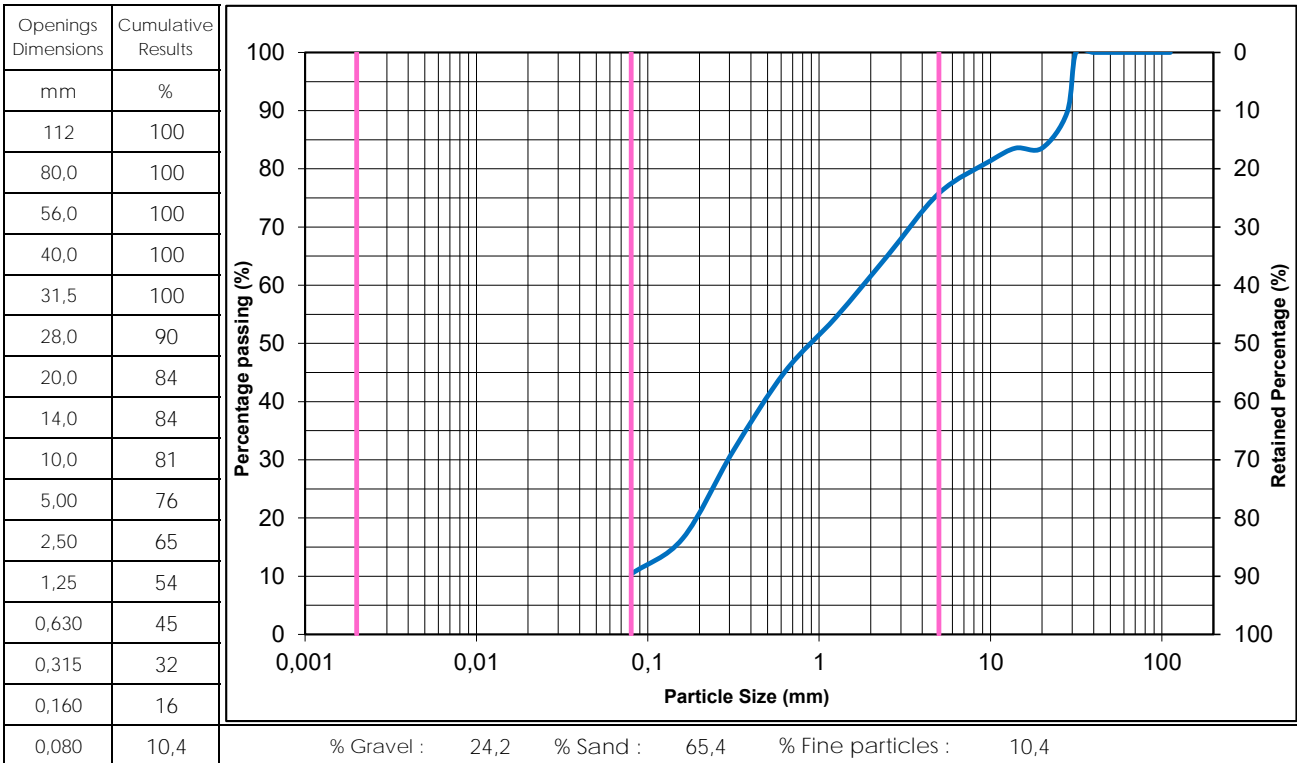
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 03, 2022

Project No : 158100425.500.710.6
Sample No : BH22-24 SS-15
Depth : 8,53 - 9,14m

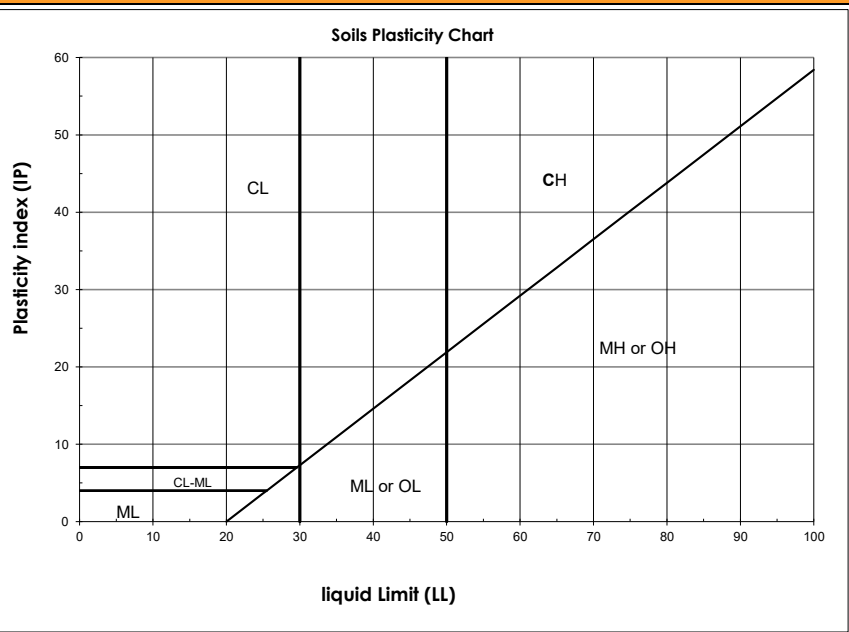
Material Description : Gravely Sand, some fine particles

Grain Size Analysis (BNQ 2501-025)




Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	13,3



Remarks :

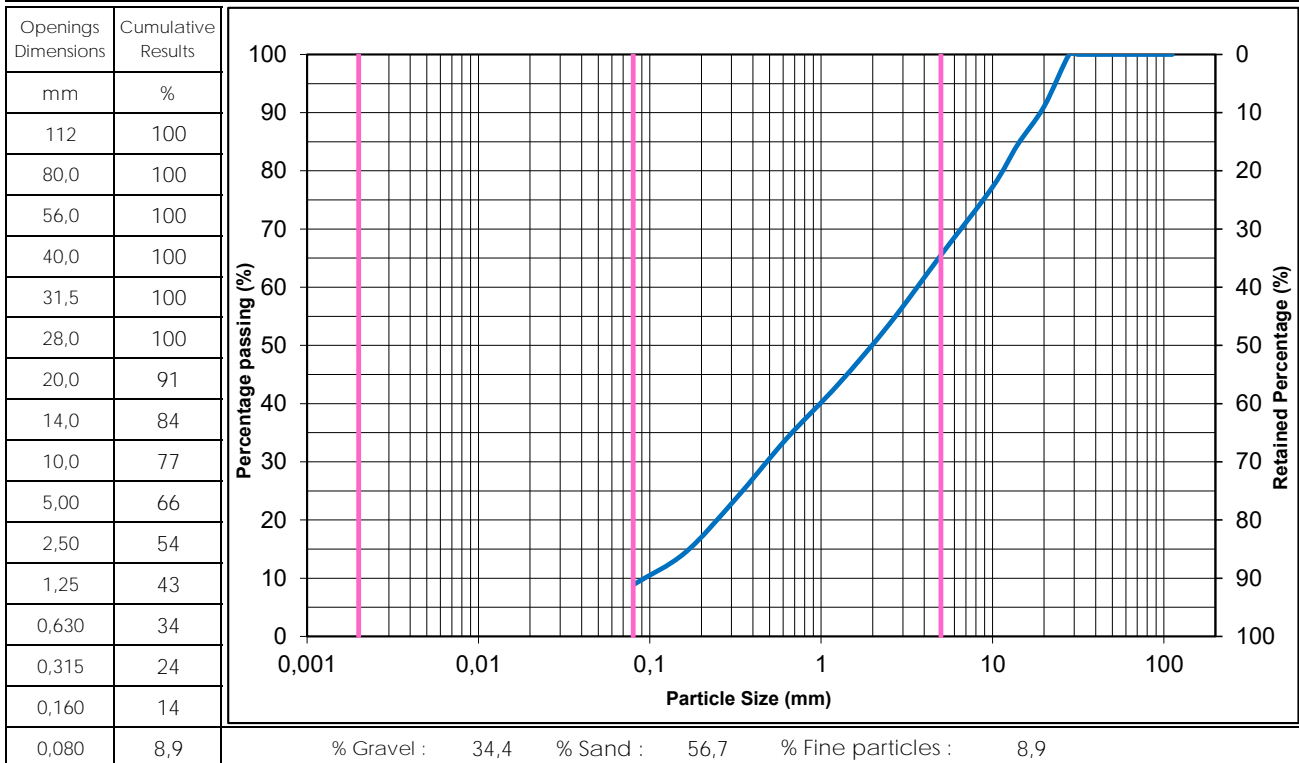
Prepared by : Benoit Cyr, Geo.  Date : December 14, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

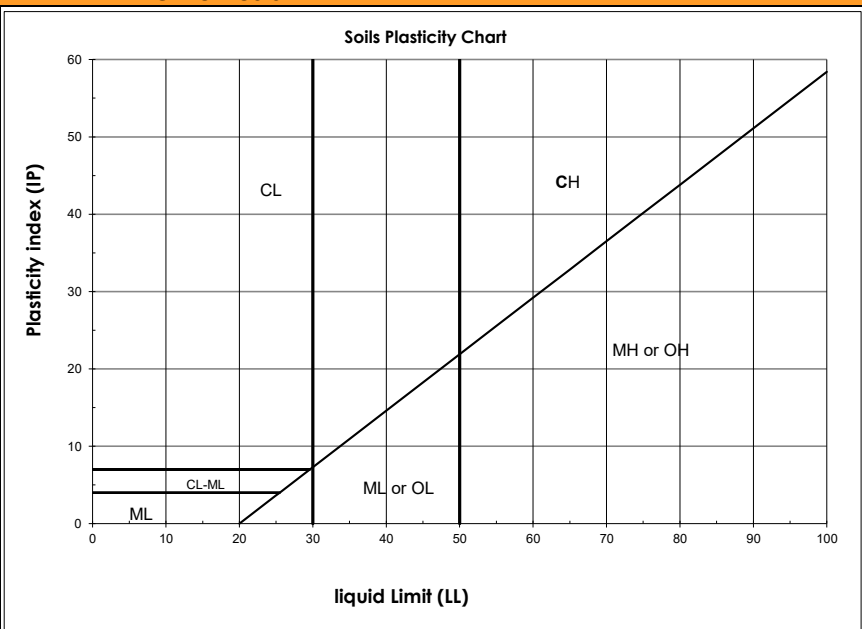
 Sampled by : Hugo Desrochers
 Sampling Date : September 04, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-25 SS-04
 Depth : 1,83 - 2,44m

Material Description : Gravely Sand, traces of fine particles

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	7,9



Remarks : _____

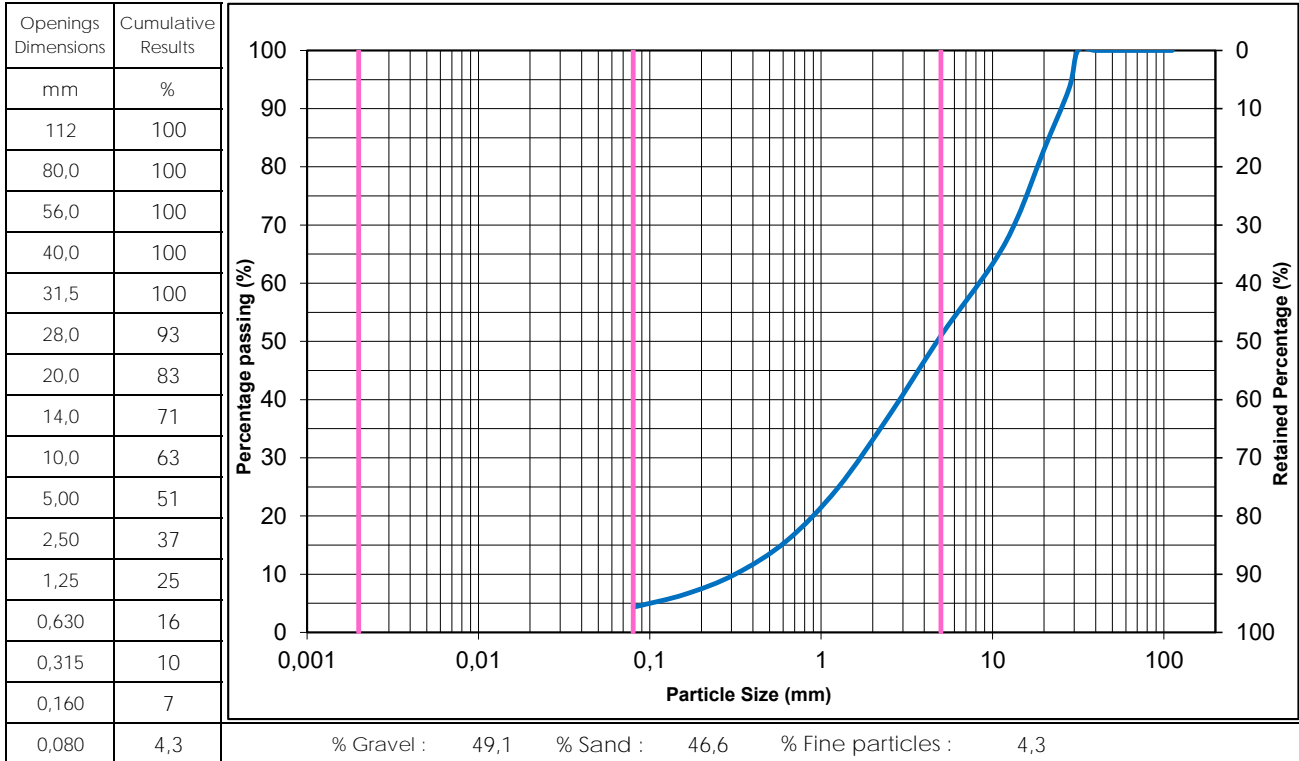
Prepared by :

Benoit Cyr, Geo.

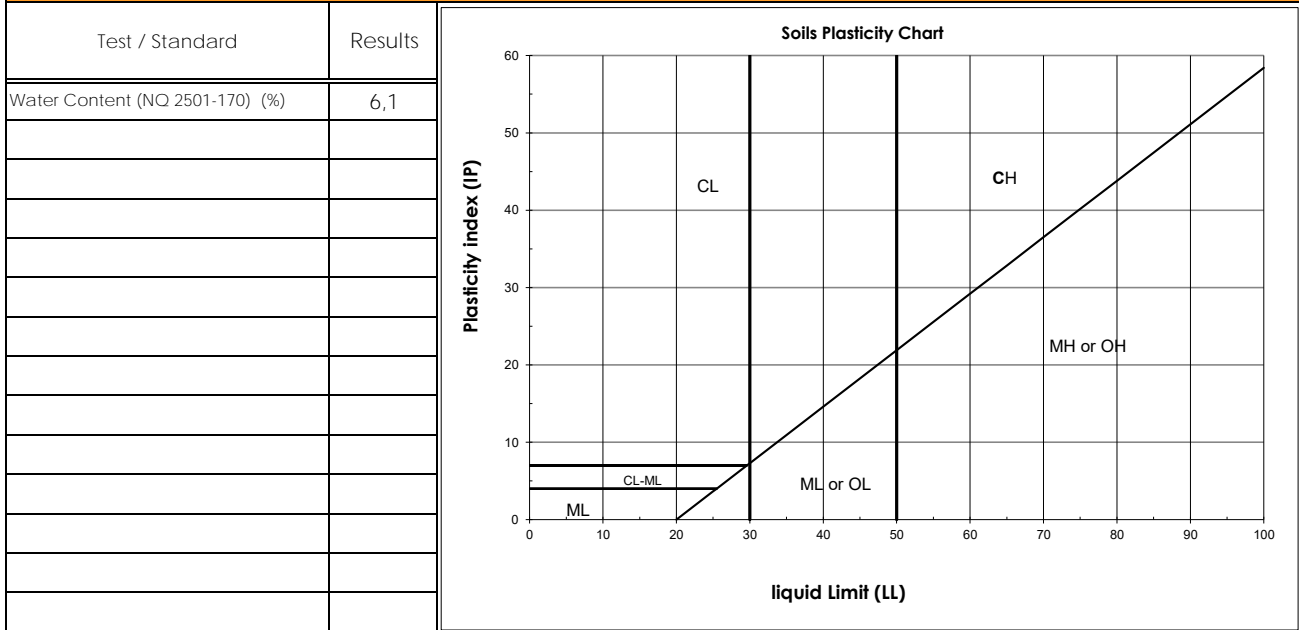
Date : December 14, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 04, 2022
Project No : 158100425.500.710.6	Material Description : Gravel and Sand, traces of fine particles
Sample No : BH22-25 SS-06	
Depth : 3,05 - 3,66m	

Grain Size Analysis (BNQ 2501-025)



Other tests



Remarks :

Prepared by :

Benoit Cyr, Geo.

Date : December 14, 2022

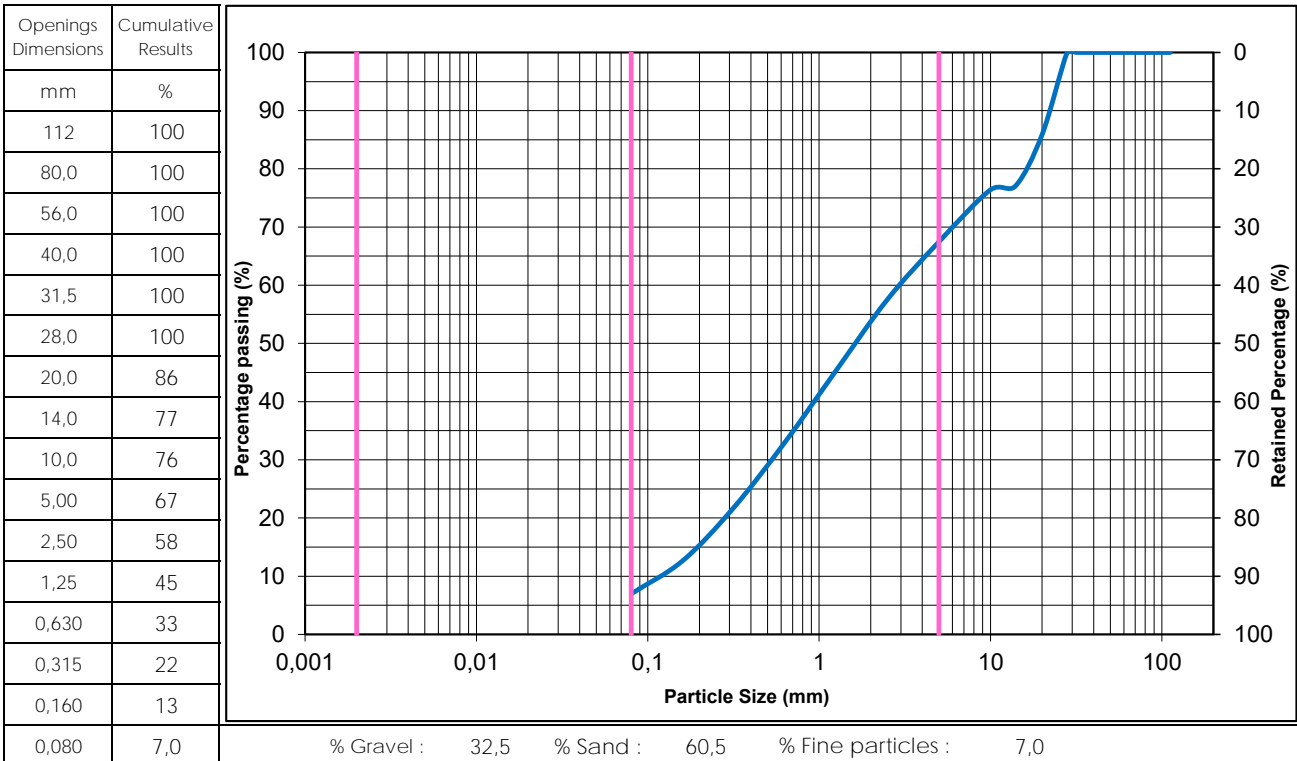
Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 04, 2022

Project No : 158100425.500.710.6
Sample No : BH22-26 SS-03
Depth : 1,83 - 2,44m

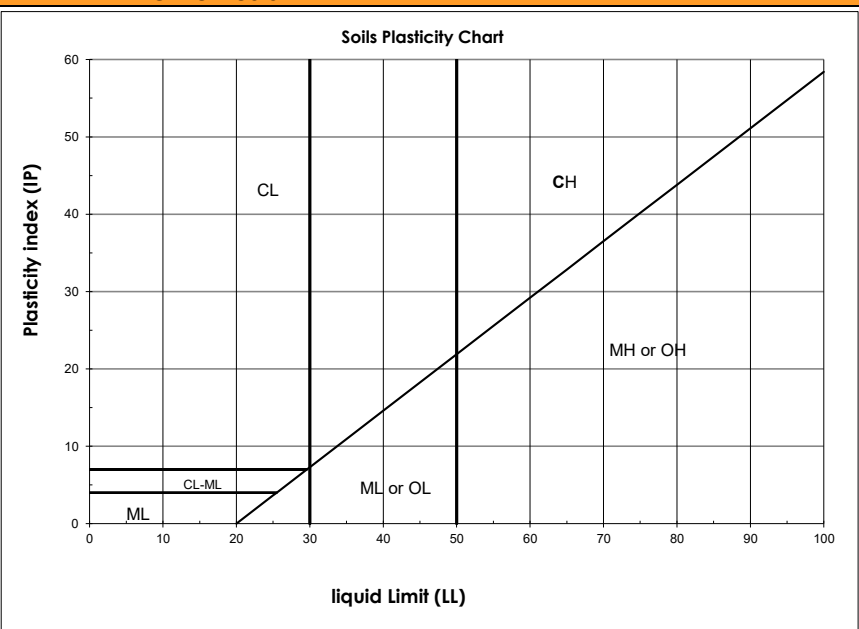
Material Description : Gravely Sand, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	12,5



Remarks : _____

Prepared by : Benoit Cyr, Geo. 

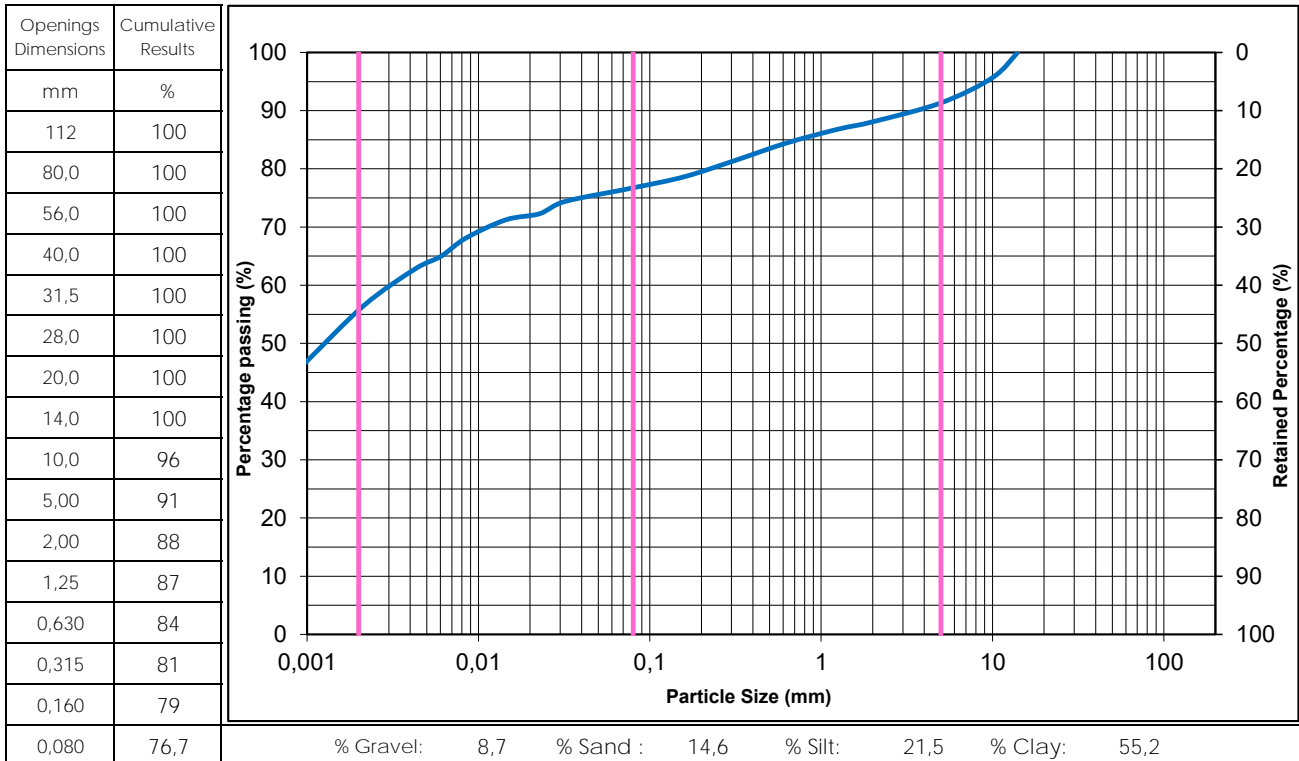
Date : December 14, 2022

Client : Cree Developpement Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

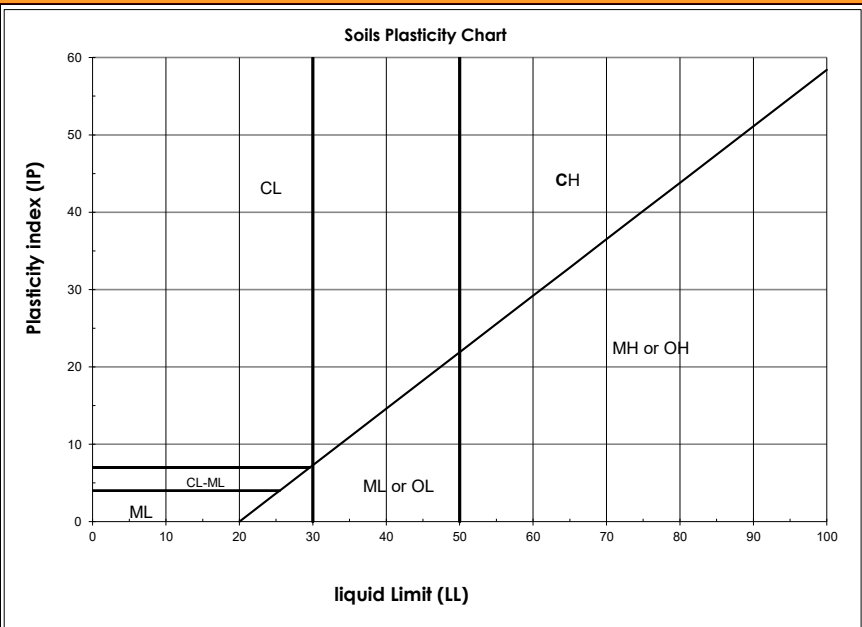
 Sampled by : Hugo Desrochers
 Sampling Date : September 04, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-26 SS-06
 Depth : 3,66 - 4,27m

 Material Description : Silty Clay, some Sand, traces
 of Gravel

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	30,4



Remarks : _____

Prepared by :

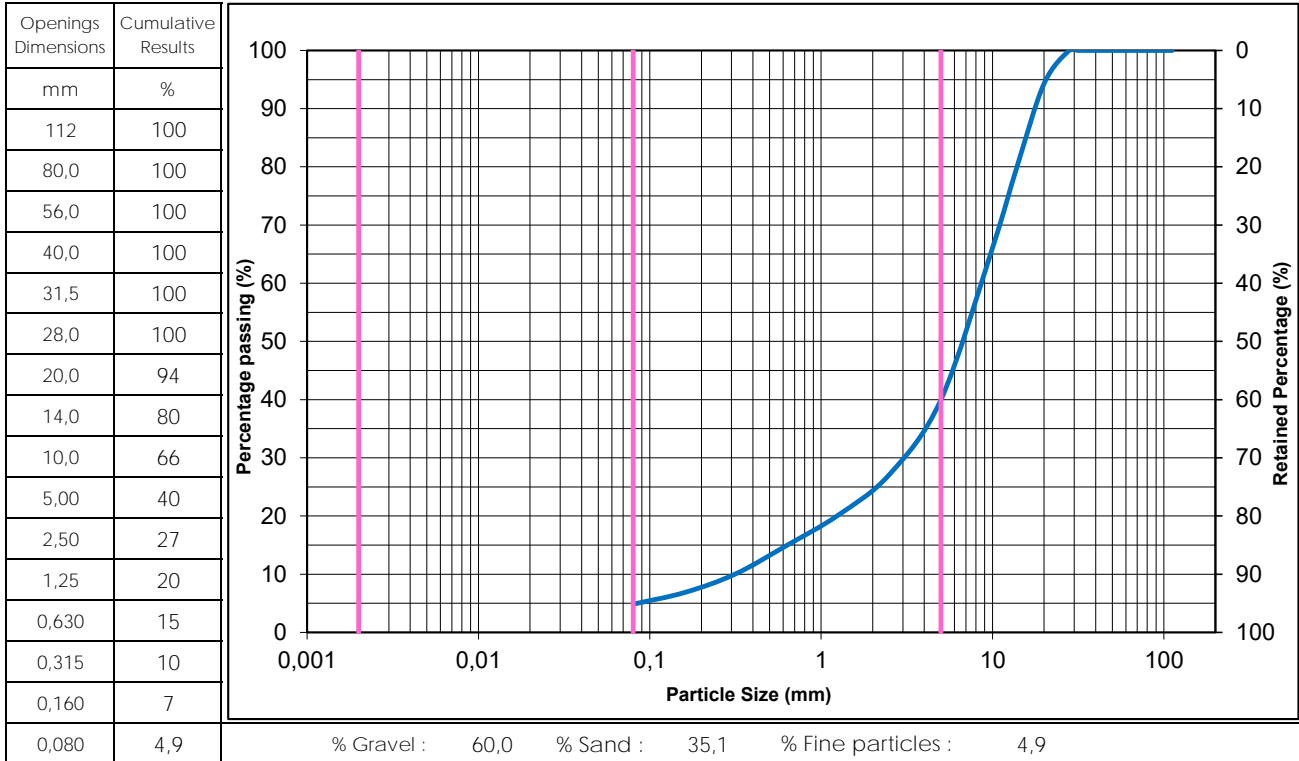
Benoit Cyr, Geo.



Date : December 14, 2022

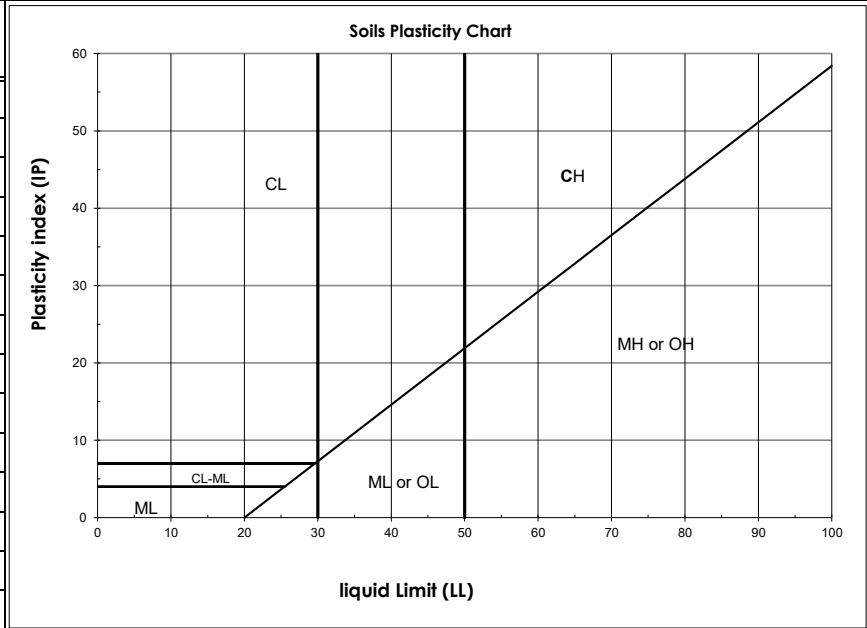
Client : Cree Developpment Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 04, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-27 SS-01	Material Description : Gravel and Sand, traces of fine particles
Depth : 0,00 - 0,61m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	2,2

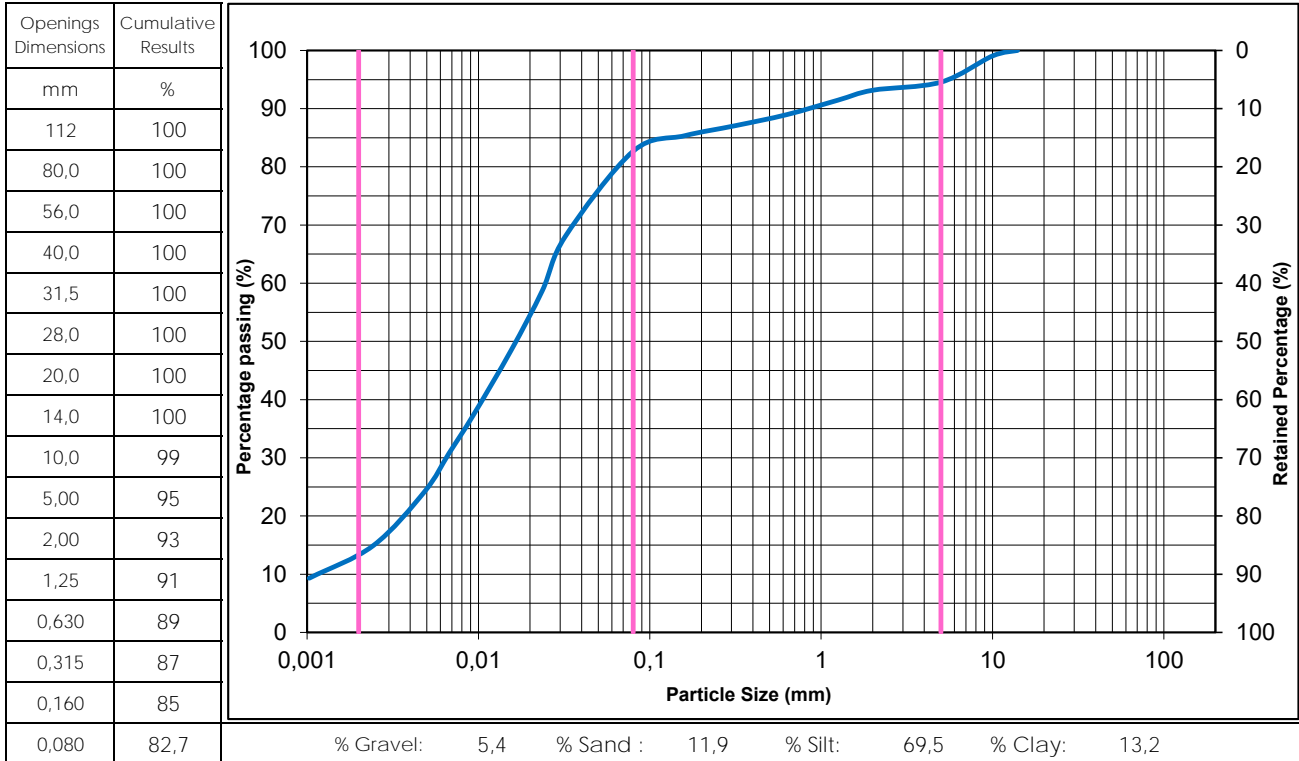


Remarks : _____

Prepared by : Benoit Cyr, Geo. **Date :** December 14, 2022

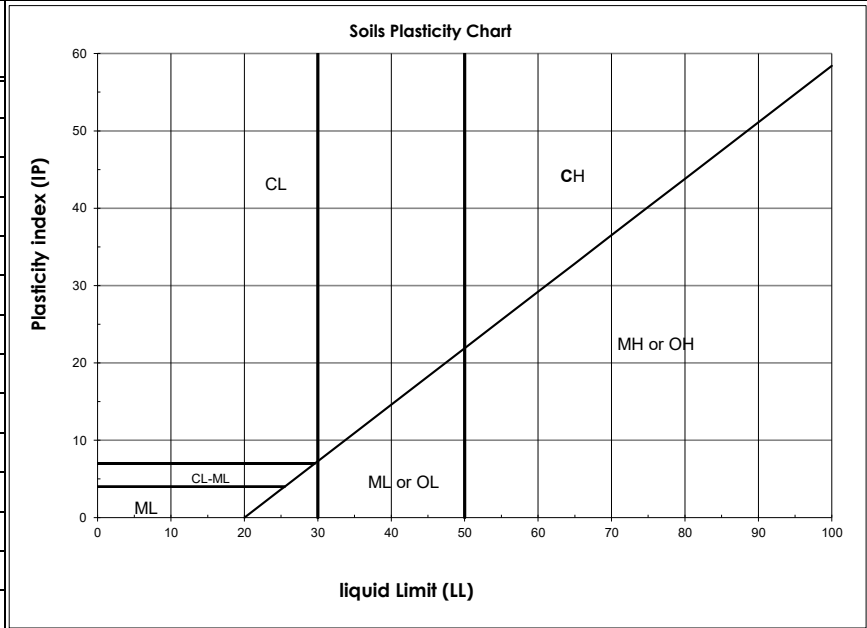
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 05, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-27 SS-04	Material Description : Silt, some Clay, some Sand, traces of Gravel
Depth : 1,83 - 2,44m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	66,3



Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC* **Date :** December 14, 2022

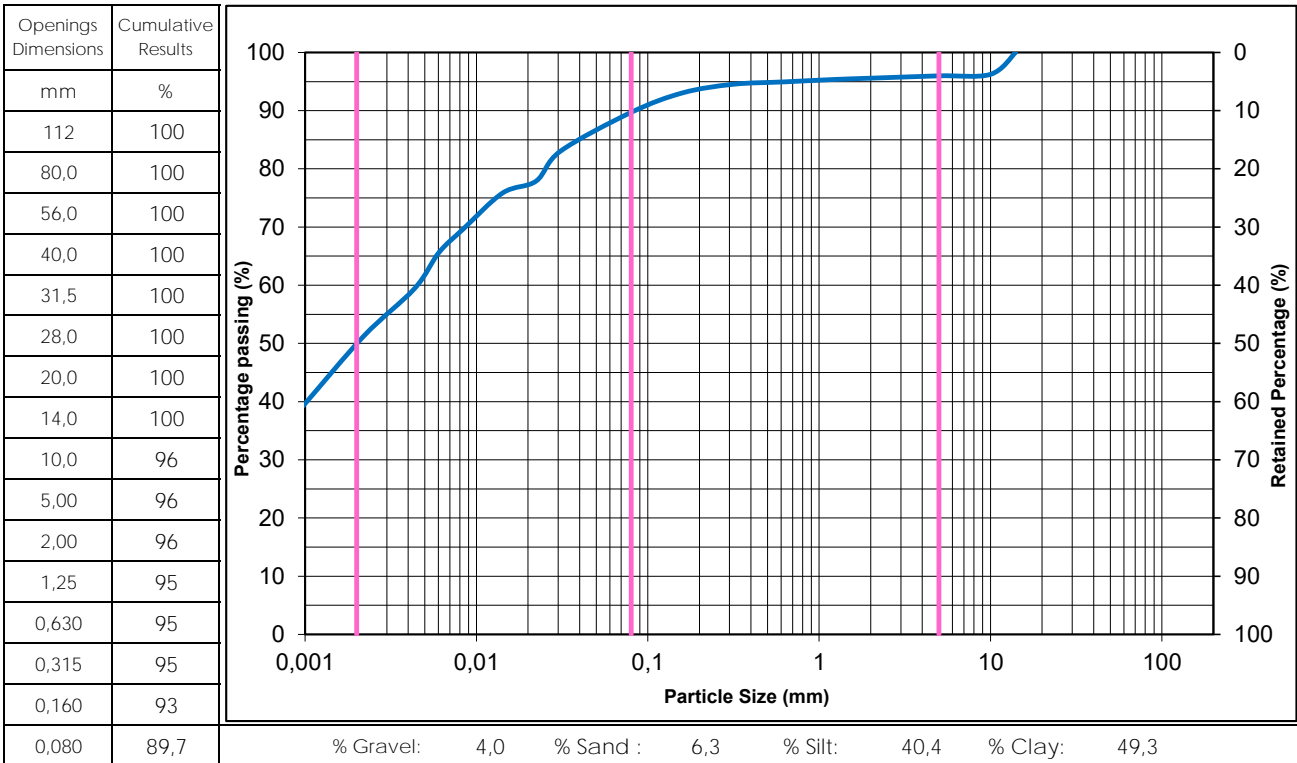
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 05, 2022

Project No : 158100425.500.710.6
Sample No : BH22-27 SS-09
Depth : 4,88 - 5,49m

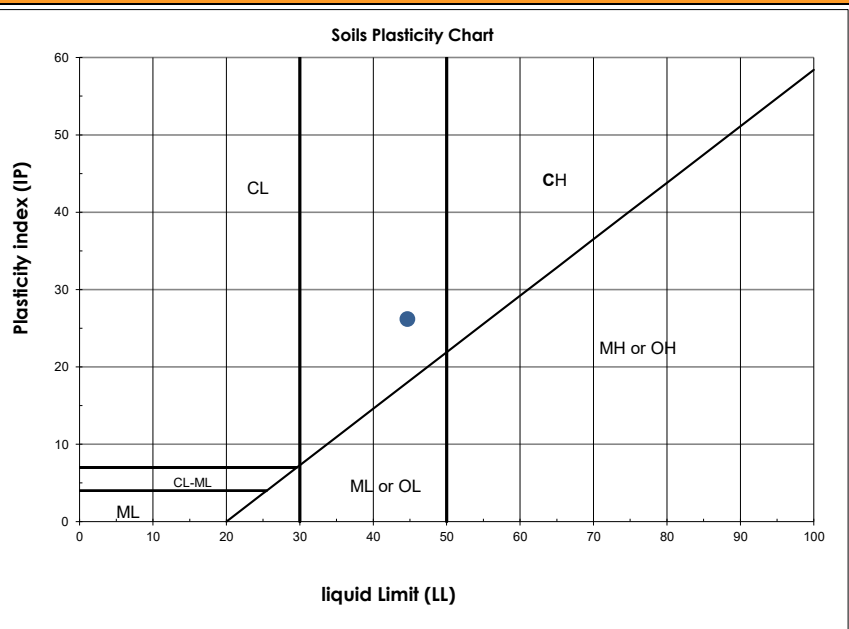
Material Description : Clay and Silt, traces of Sand, traces of Gravel, medium plasticity (CL)

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	51,2
Liquid Limit (BNQ 2501-092)	45
Plastic Limit (BNQ 2501-092)	19
Plasticity Index (BNQ 2501-092)	26



Remarks :

Prepared by :

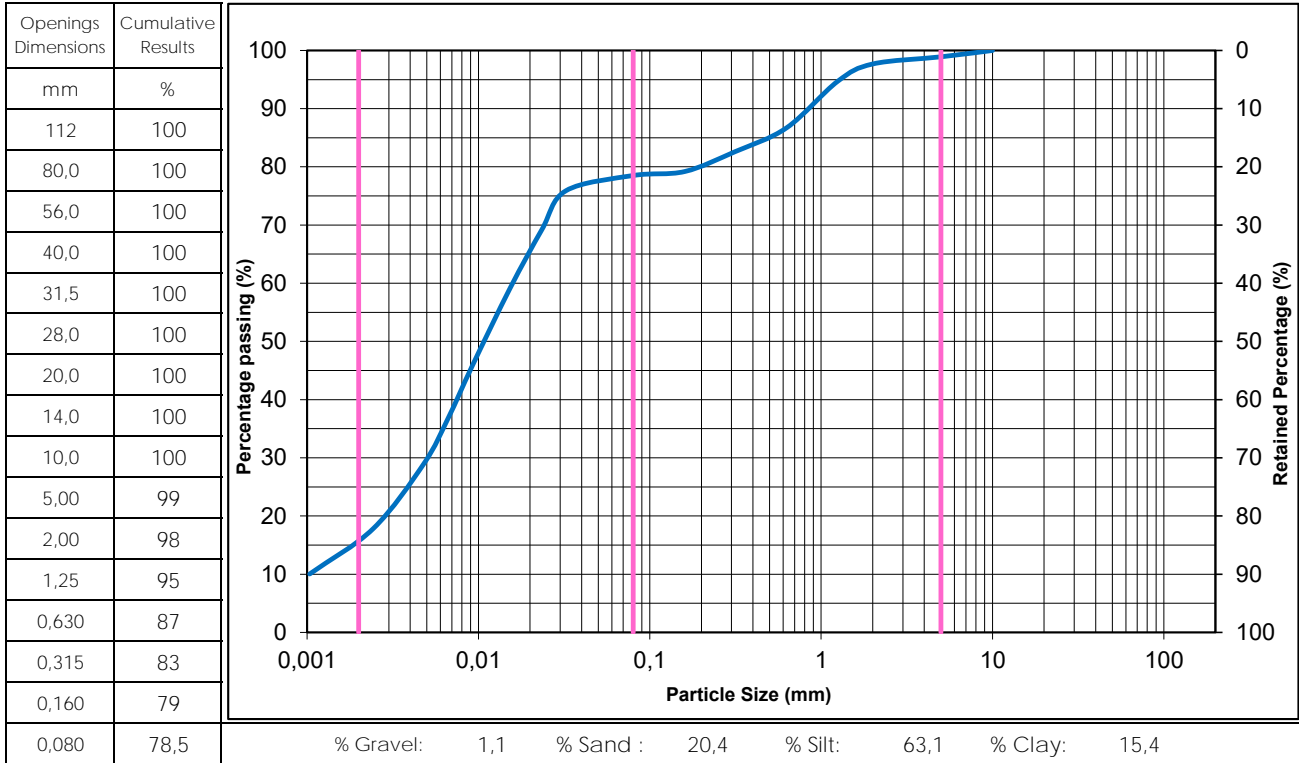
Benoit Cyr, Geo.



Date : December 14, 2022

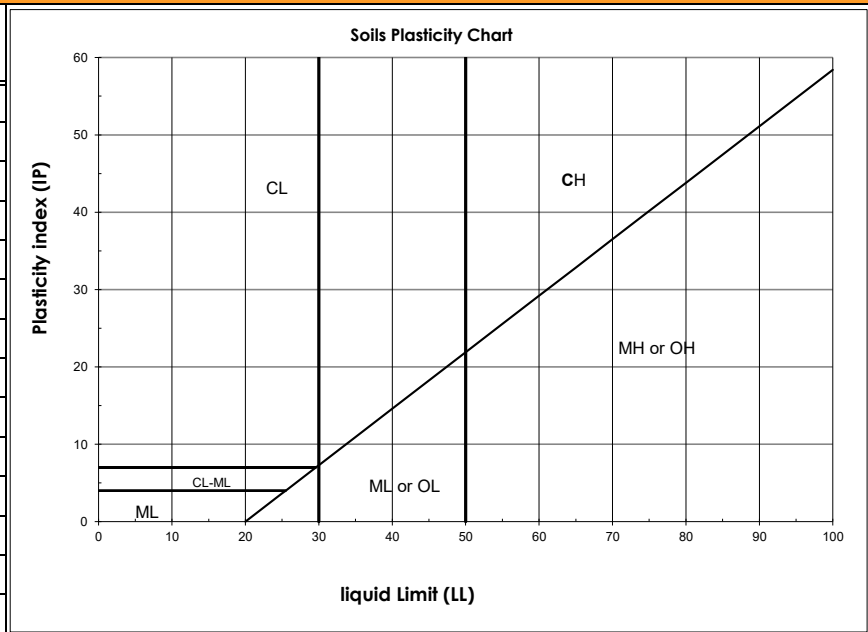
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 05, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-27 SS-16	Material Description : Sandy Silt, some Clay, traces of Gravel
Depth : 9,91 - 10,52m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	29,7

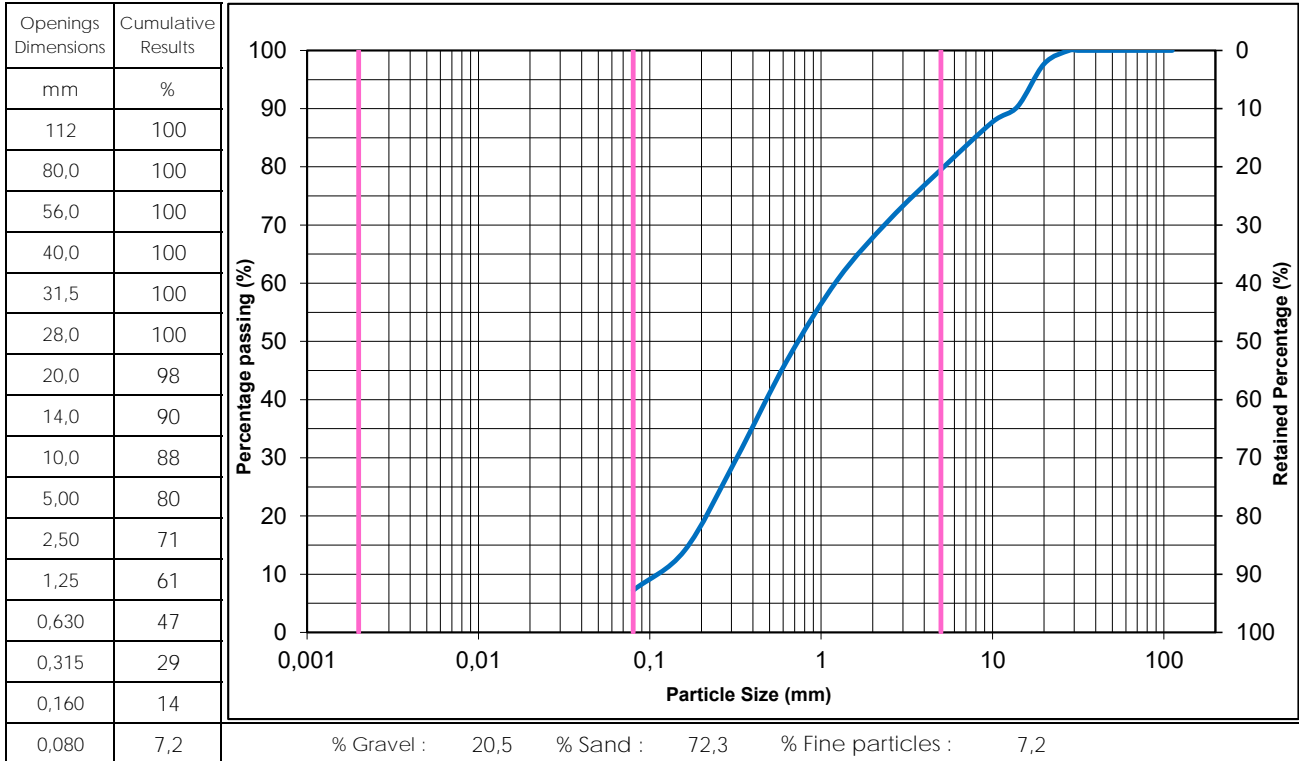


Remarks : _____

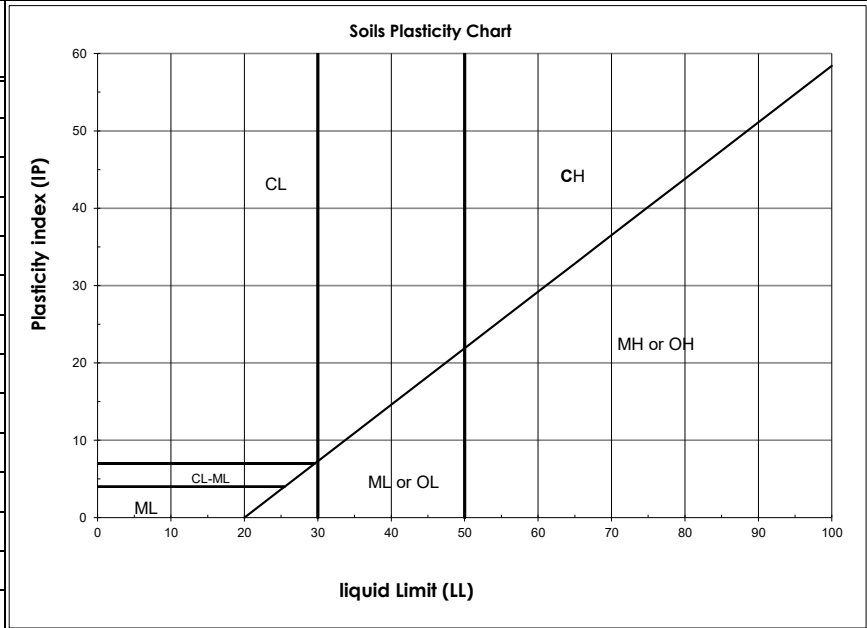
Prepared by : Benoit Cyr, Geo. *Bj*

Date : December 14, 2022

Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 03, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-28 SS-01B	Material Description : Gravely Sand, traces of fine particles
Depth : 0,08 - 0,61m	

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	5,8


Remarks : _____

Prepared by :	Benoit Cyr, Geo.	Date : November 01, 2022
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Client : Cree Developpement Corporation (CDC)

Sampled by : Hugo Desrochers

Project : LGA - Grevet-Chapais Railway

Sampling Date : September 03, 2022

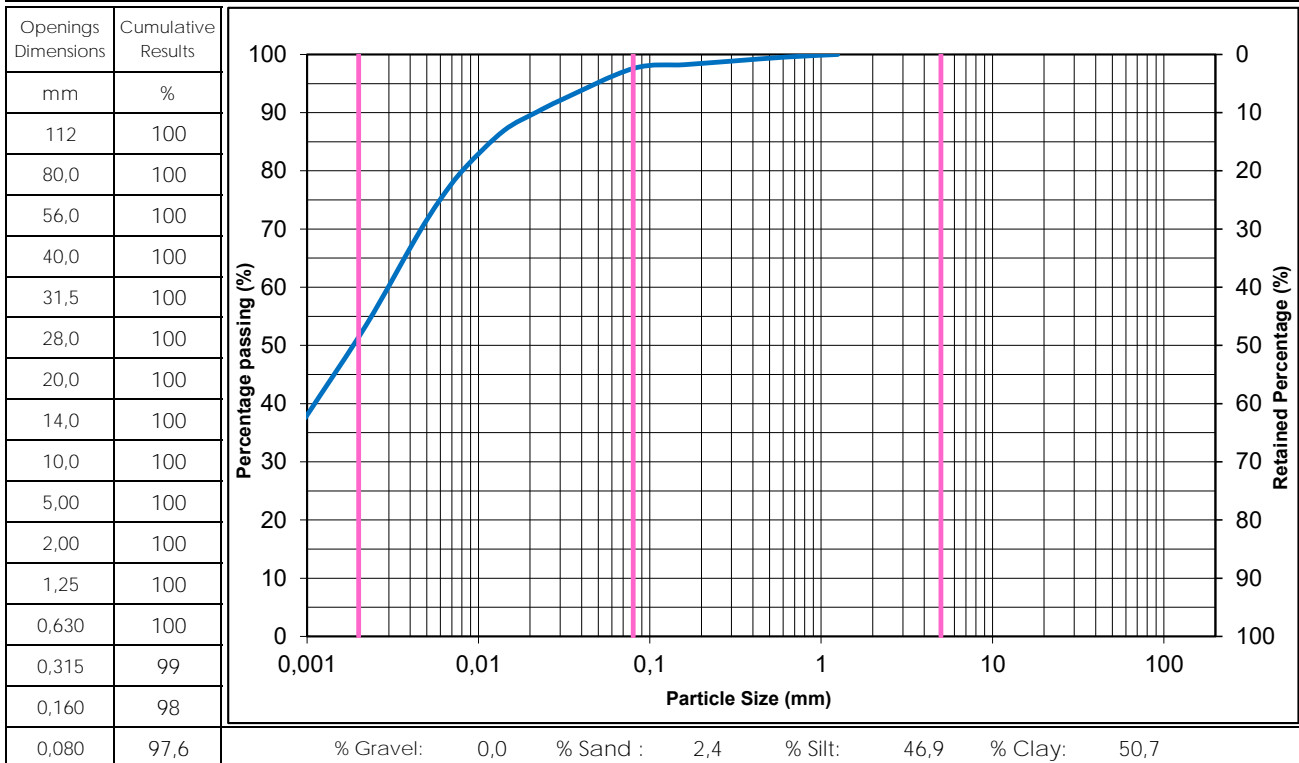
Project No : 158100425.500.710.6

Sample No : BH22-28 SS-05B

Material Description : Clay and Silt, traces of Sand

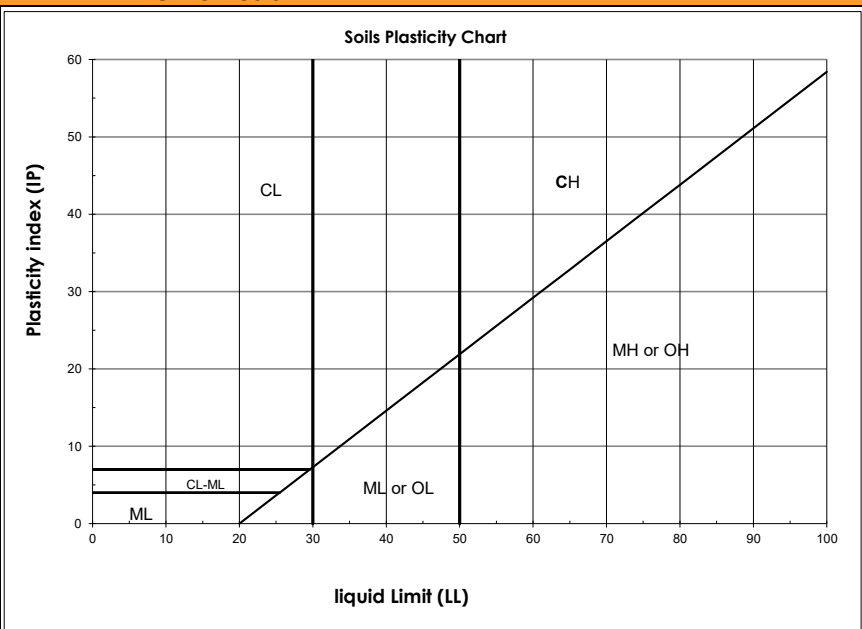
Depth : 2,59 - 3,05m

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	39,3



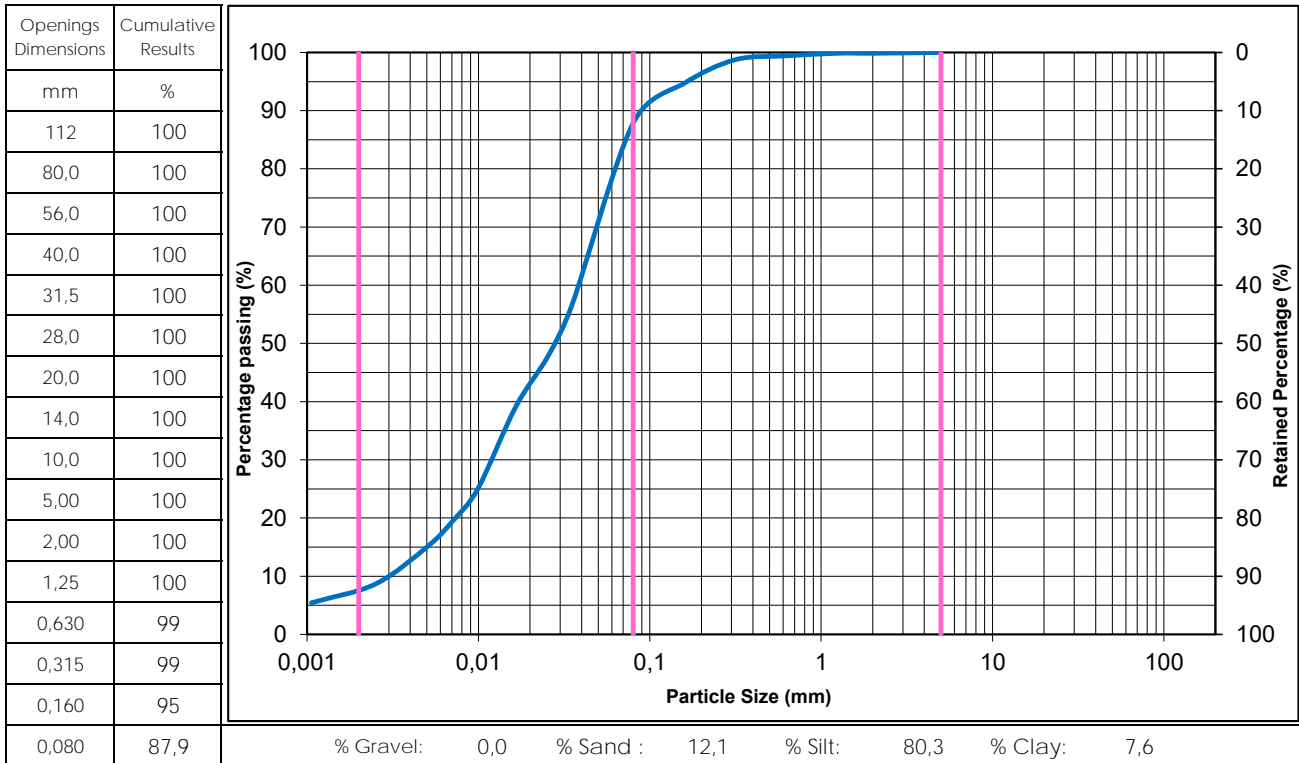
Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC*

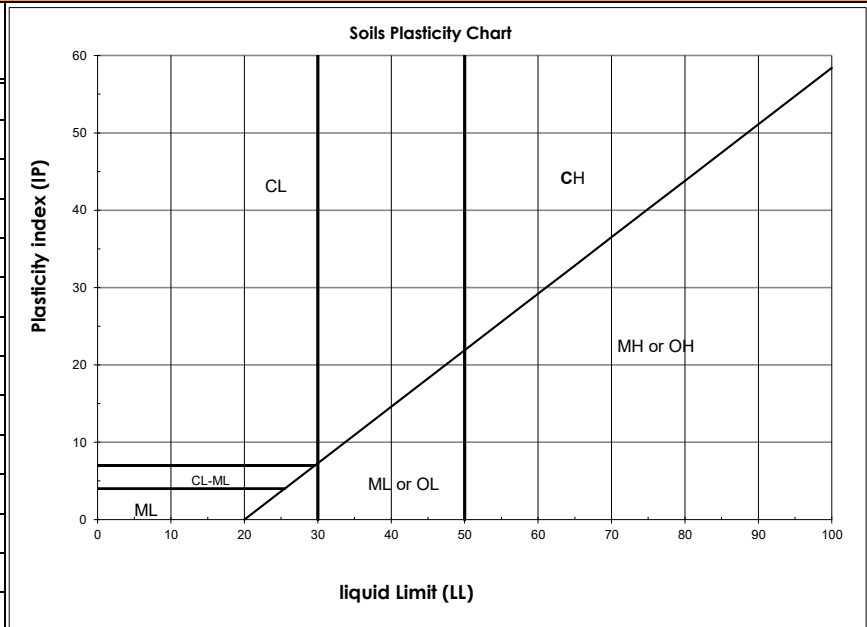
Date : November 01, 2022

Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais RailwaySampled by : Hugo Desrochers
Sampling Date : September 03, 2022Project No : 158100425.500.710.6
Sample No : BH22-28 SS-11B
Depth : 6,24 - 6,71m

Material Description : Silt, some Sand, traces of Clay

Grain Size Analysis (BNQ 2501-025)**Other tests**

Test / Standard	Results
Water Content (NQ 2501-170) (%)	21,6



Remarks :

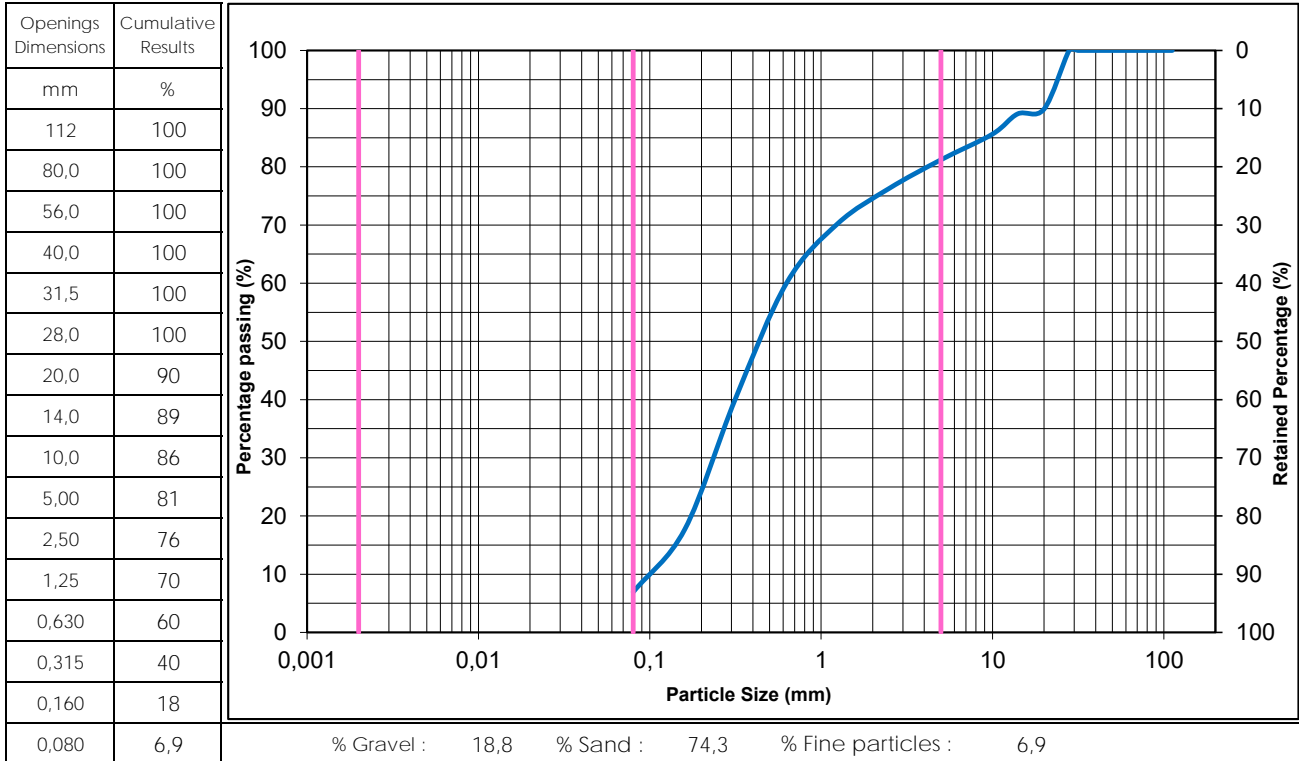
Prepared by :

Benoit Cyr, Geo.

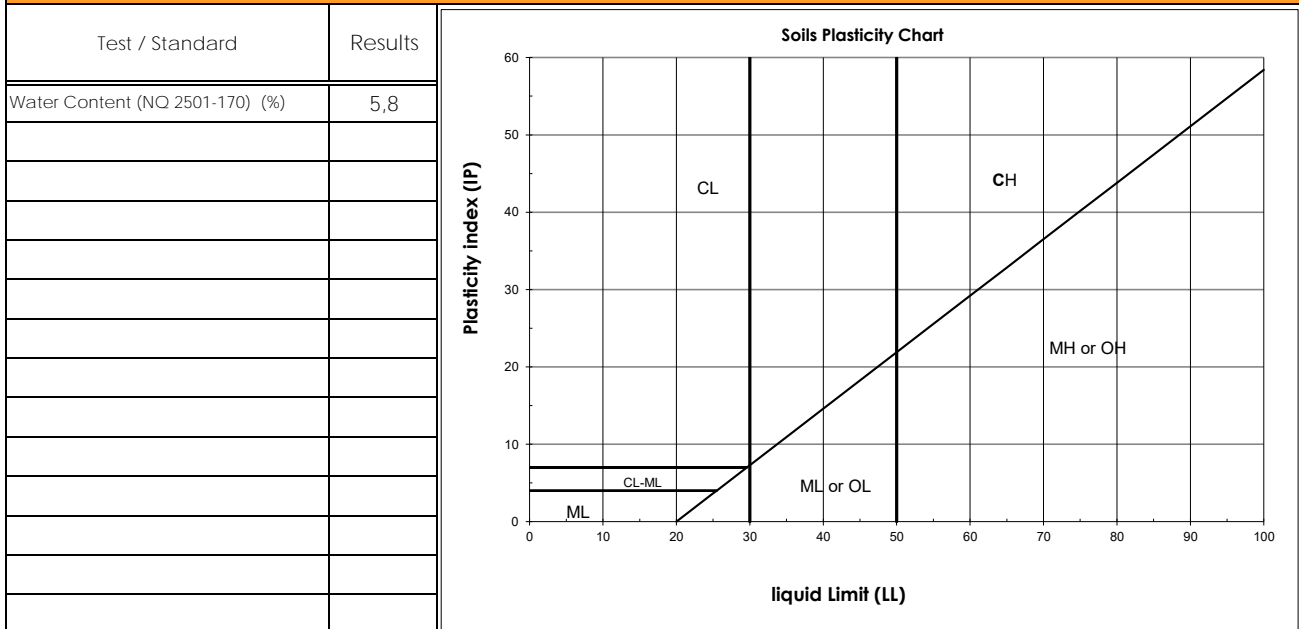
Date : November 01, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 03, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-29 SS-02	Material Description : Sand, some Gravel, traces of fine particles
Depth : 0,61 - 1,22m	

Grain Size Analysis (BNQ 2501-025)



Other tests

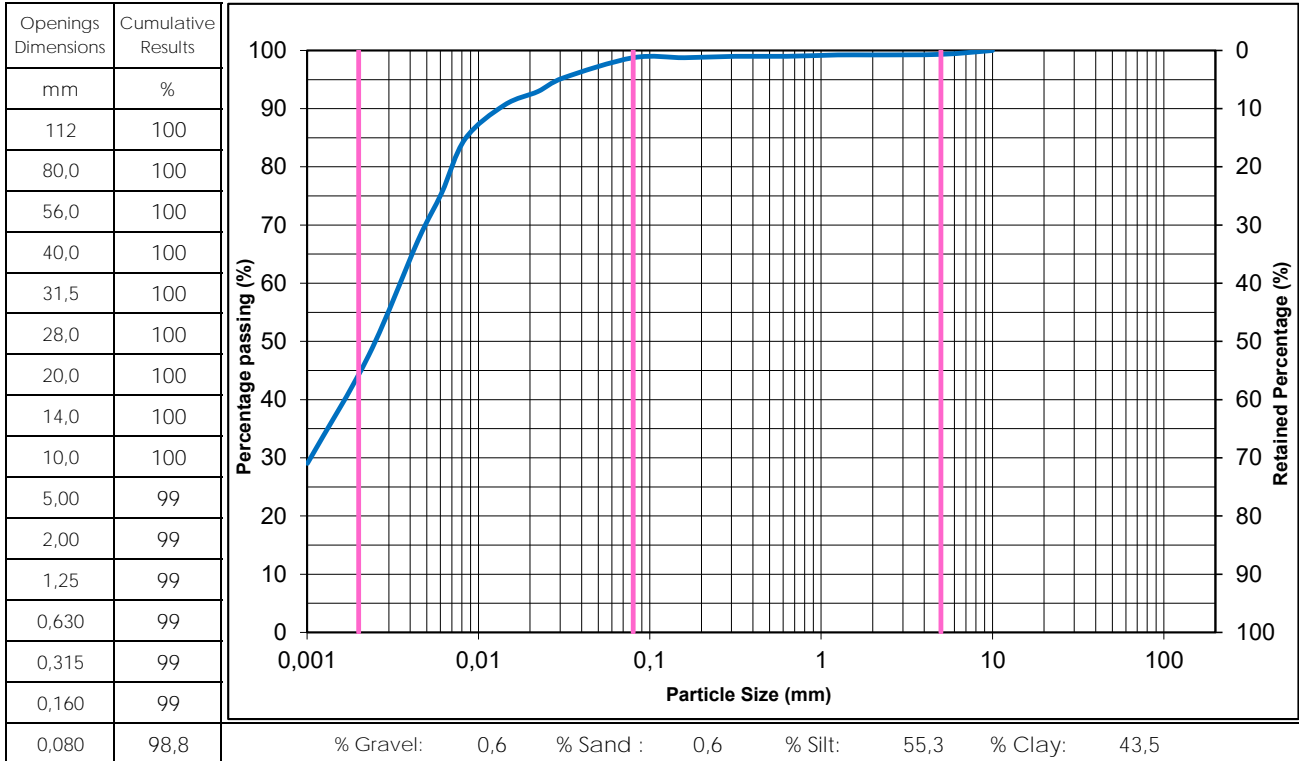


Remarks : _____

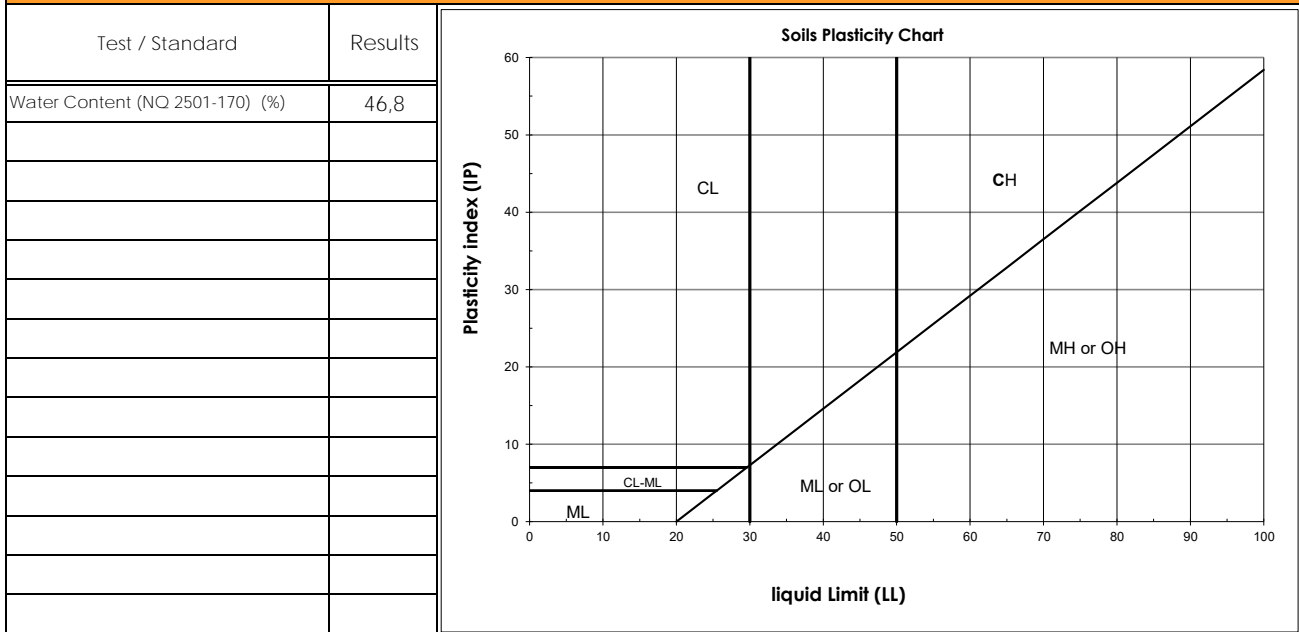
Prepared by : Benoit Cyr, Geo. *BC* _____ **Date :** November 01, 2022

Client : Cree Development Corporation (CDC) Project : LGA - Grevet-Chapais Railway Project No : 158100425.500.710.6 Sample No : BH22-29 SS-06A Depth : 3,05 - 3,58m	Sampled by : Hugo Desrochers Sampling Date : September 03, 2022 Material Description : Silt and Clay, traces of Sand, traces of Gravel
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Grain Size Analysis (BNQ 2501-025)



Other tests

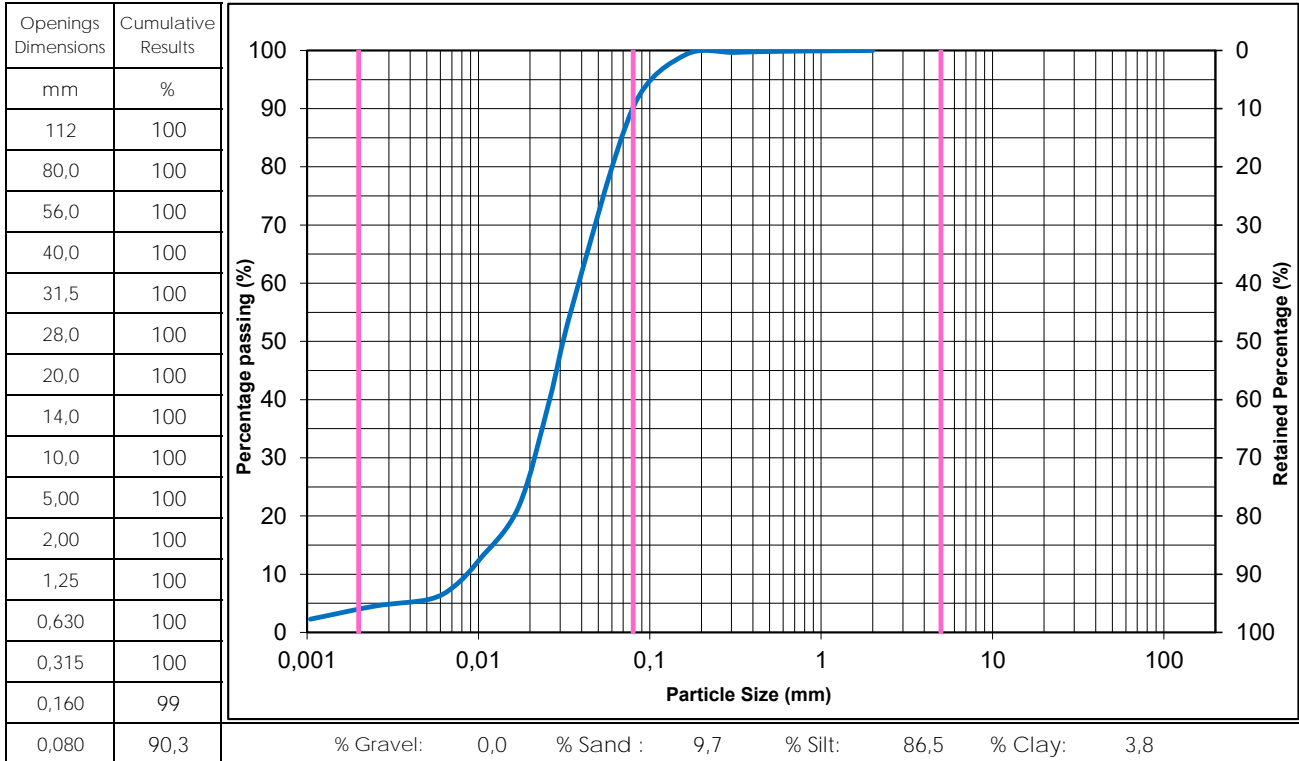


Remarks : _____

Prepared by : Benoit Cyr, Geo.  _____ **Date :** November 01, 2022

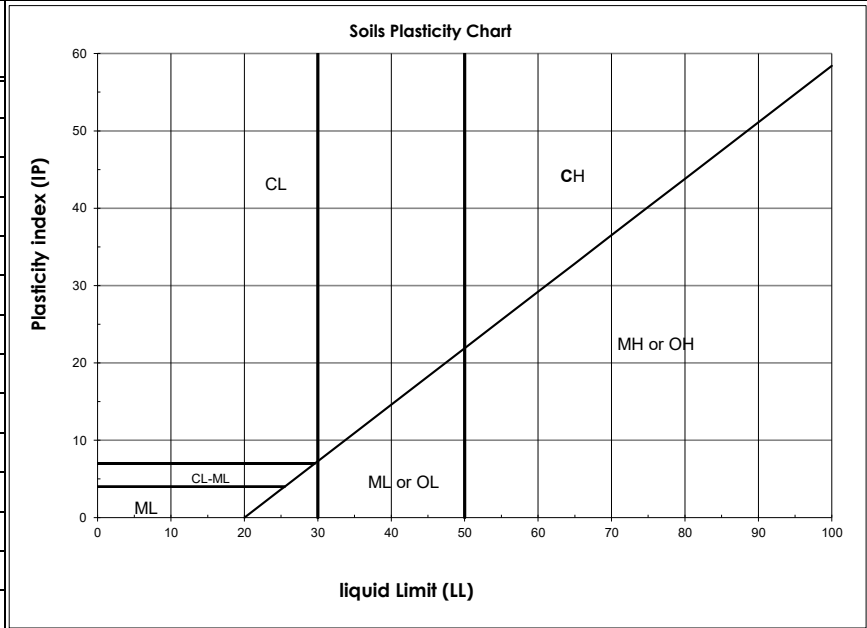
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 03, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-29 SS-07	Material Description : Silt, traces of Sand, traces of Clay
Depth : 3,66 - 4,27m	

Grain Size Analysis (BNQ 2501-025)




Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	15,6



Remarks : _____

Prepared by : Benoit Cyr, Geo.  Date : November 01, 2022

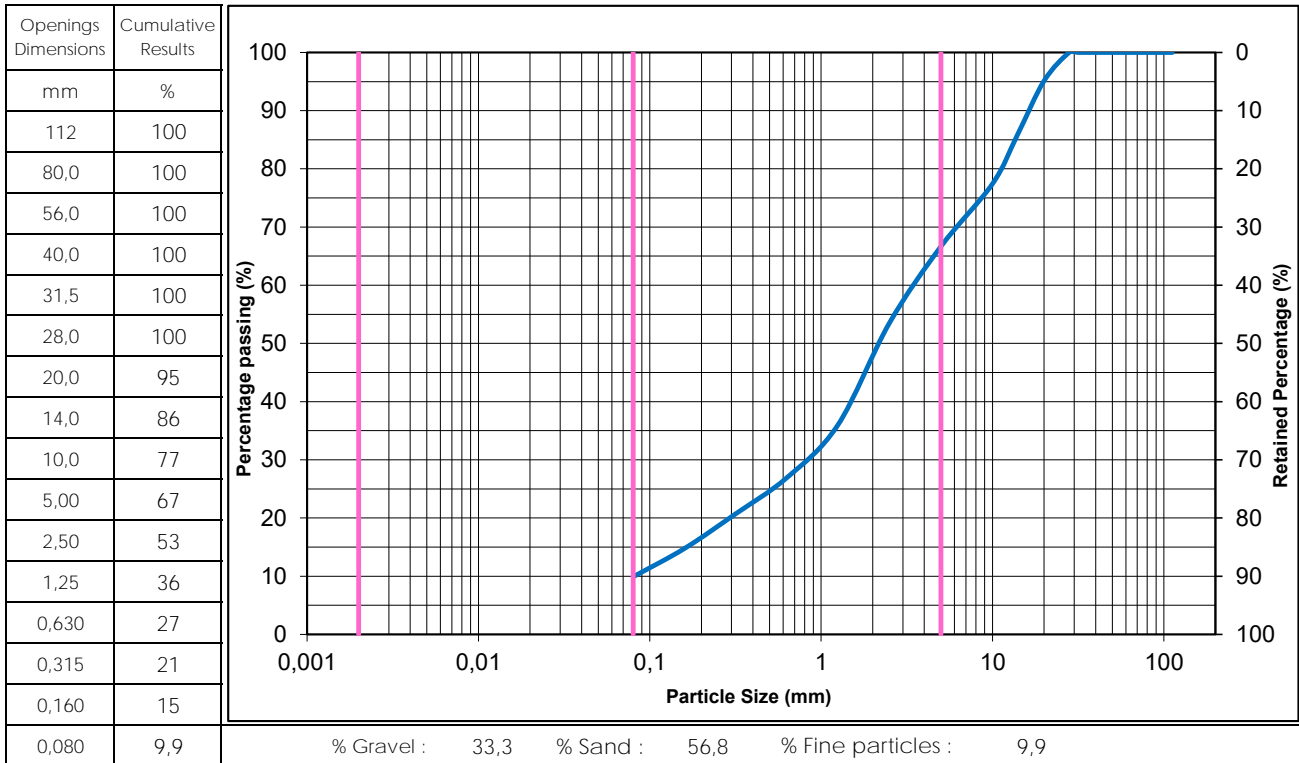
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 03, 2022

Project No : 158100425.500.710.6
Sample No : BH22-29 SS-11
Depth : 6,10 - 6,71m

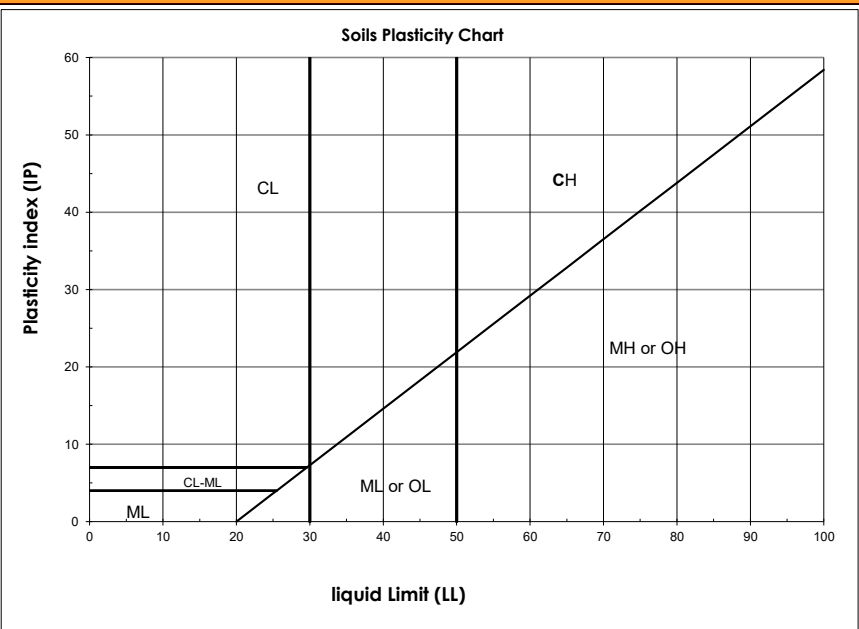
Material Description : Gravely Sand, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	15,4



Remarks :

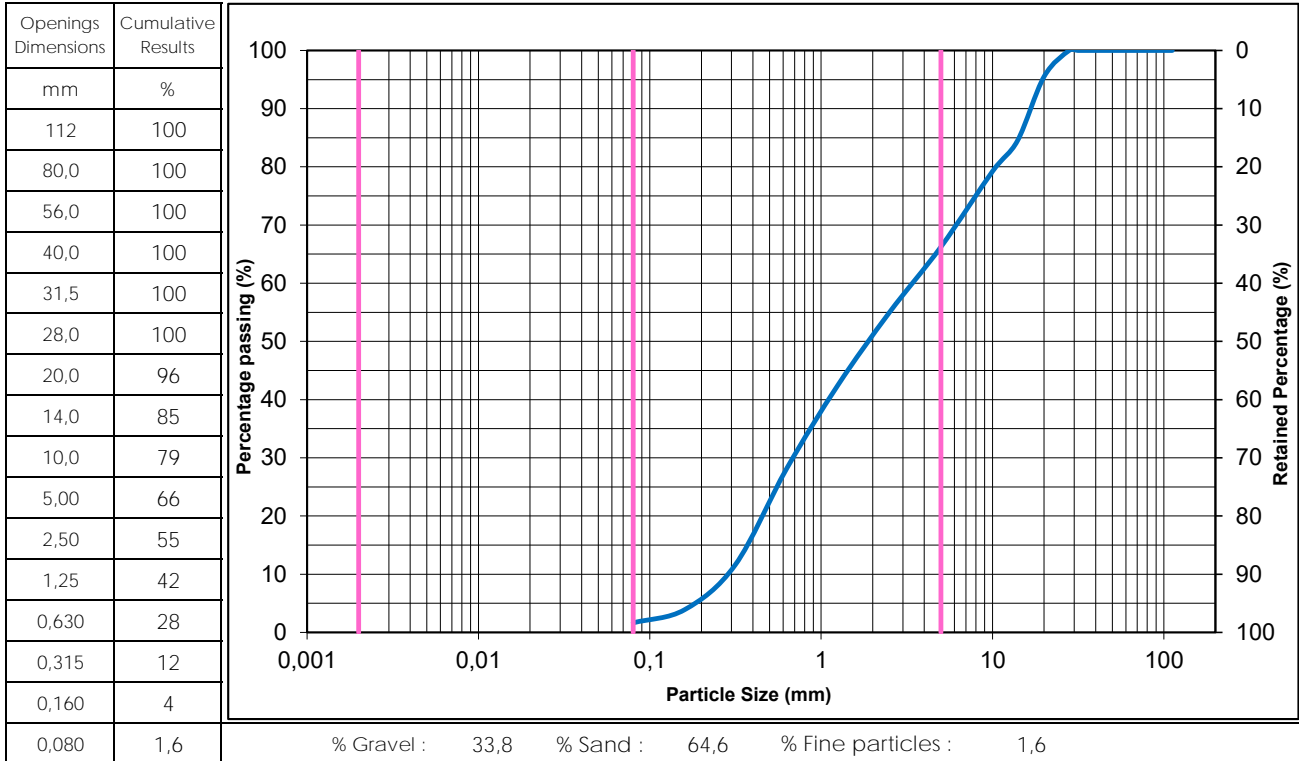
Prepared by :

Benoit Cyr, Geo. *BJ*

Date : November 01, 2022

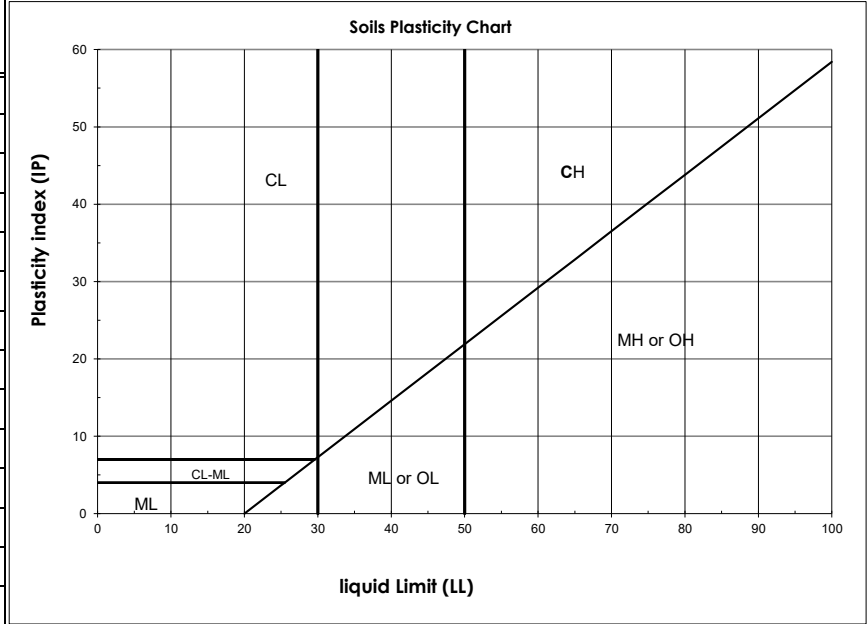
Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 02, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-30 SS-04	Material Description : Gravely Sand, traces of fine particles
Depth : 1,83 - 2,44m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	11,5

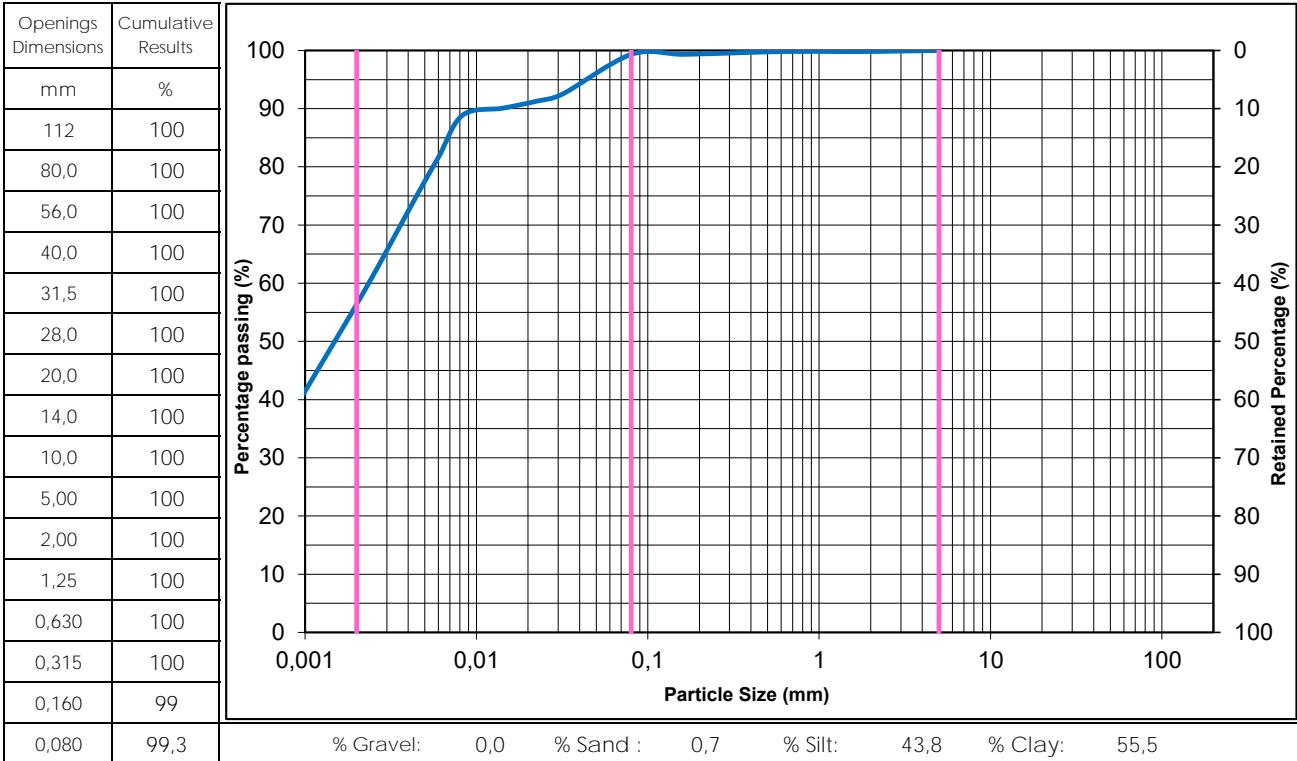


Remarks : _____

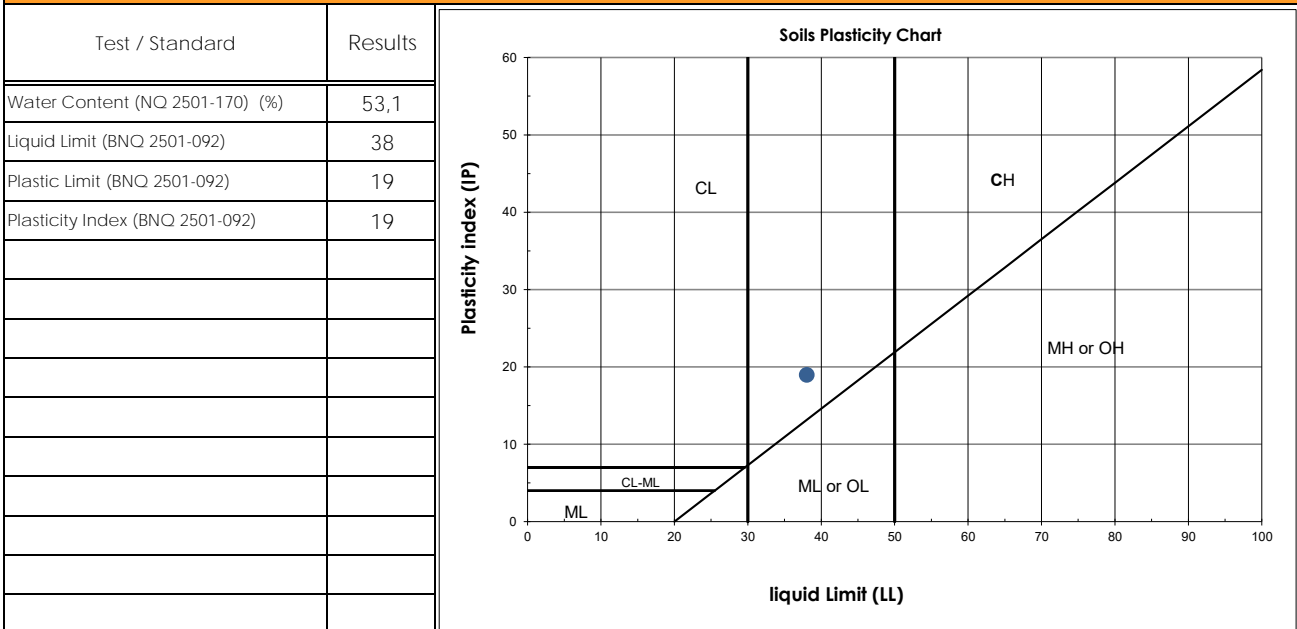
Prepared by : Benoit Cyr, Geo. _____ **Date :** November 01, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 02, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-30 SS-14	Material Description : Clay and Silt, traces of Sand, average plasticity (CL)
Depth : 9,14 - 9,75m	

Grain Size Analysis (BNQ 2501-025)



Other tests

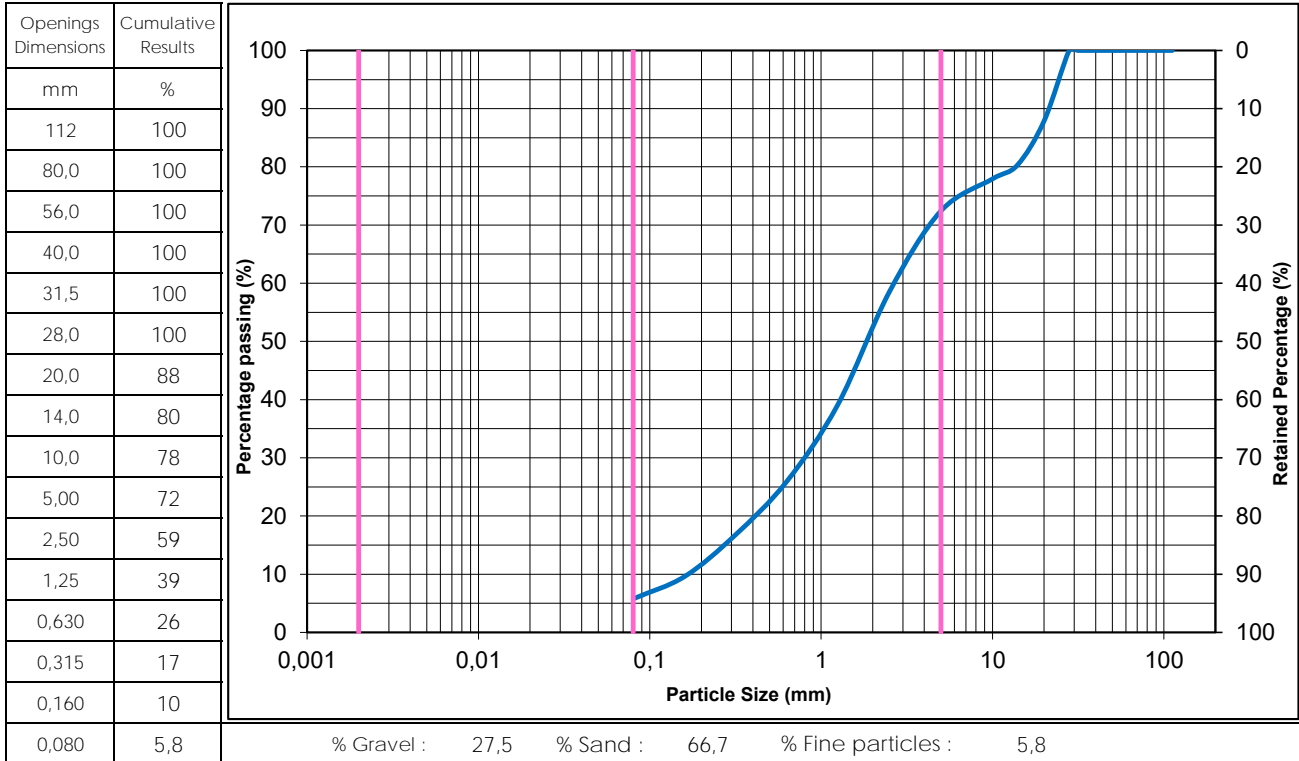


Remarks : _____

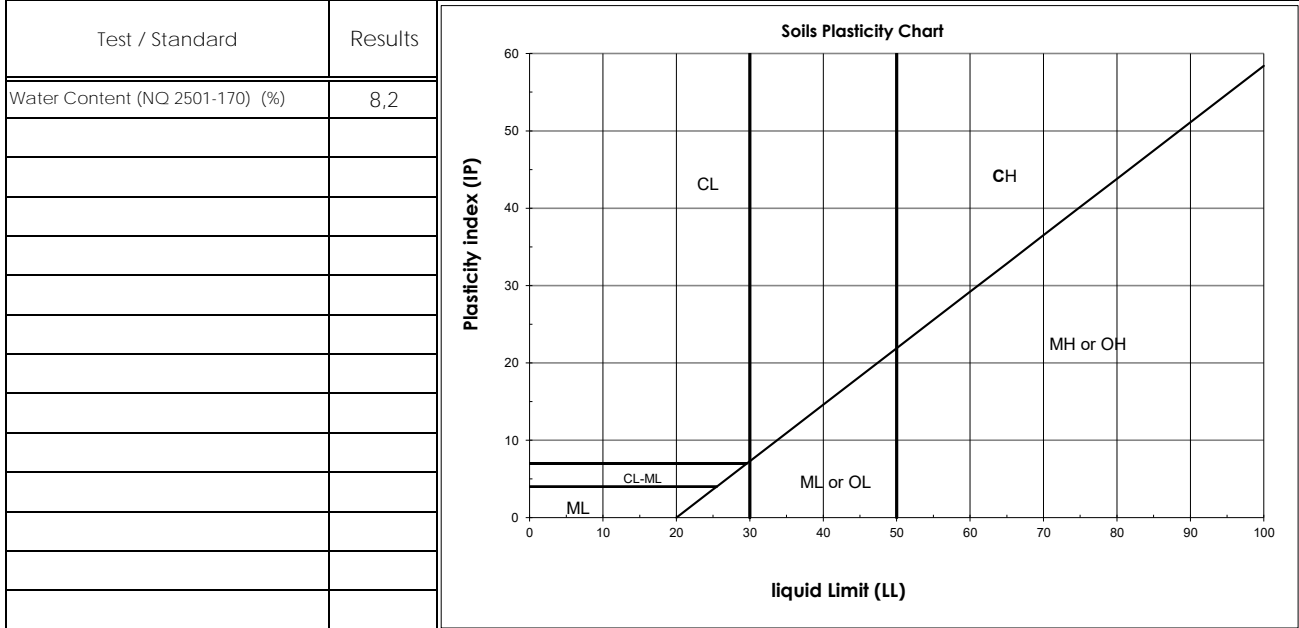
Prepared by : Benoit Cyr, Geo. *Bj* Date : November 01, 2022

Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 02, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-30 SS-19	Material Description : Gravely Sand, traces of fine particles
Depth : 13,41 - 14,02m	

Grain Size Analysis (BNQ 2501-025)



Other tests



Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC* Date : November 01, 2022

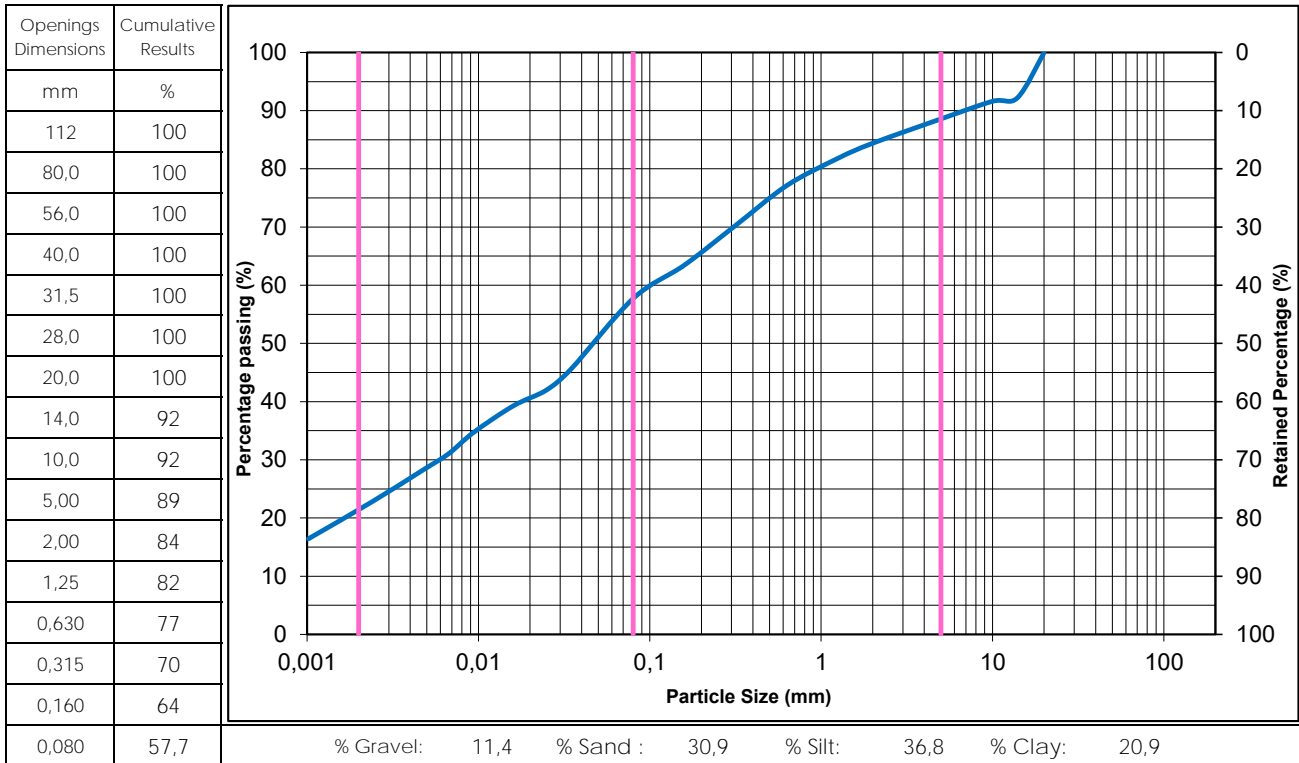
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 02, 2022

Project No : 158100425.500.710.6
Sample No : BH22-31 SS-04B
Depth : 1,93 - 2,44m

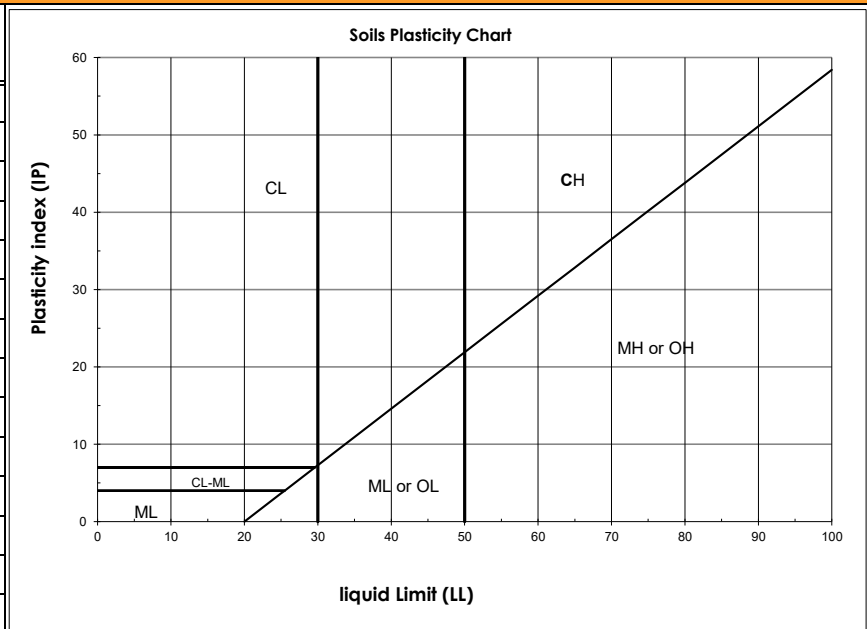
Material Description : Clayey, Sandy Silt, some Gravel

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	27,1



Remarks :

Prepared by :

Benoit Cyr, Geo.

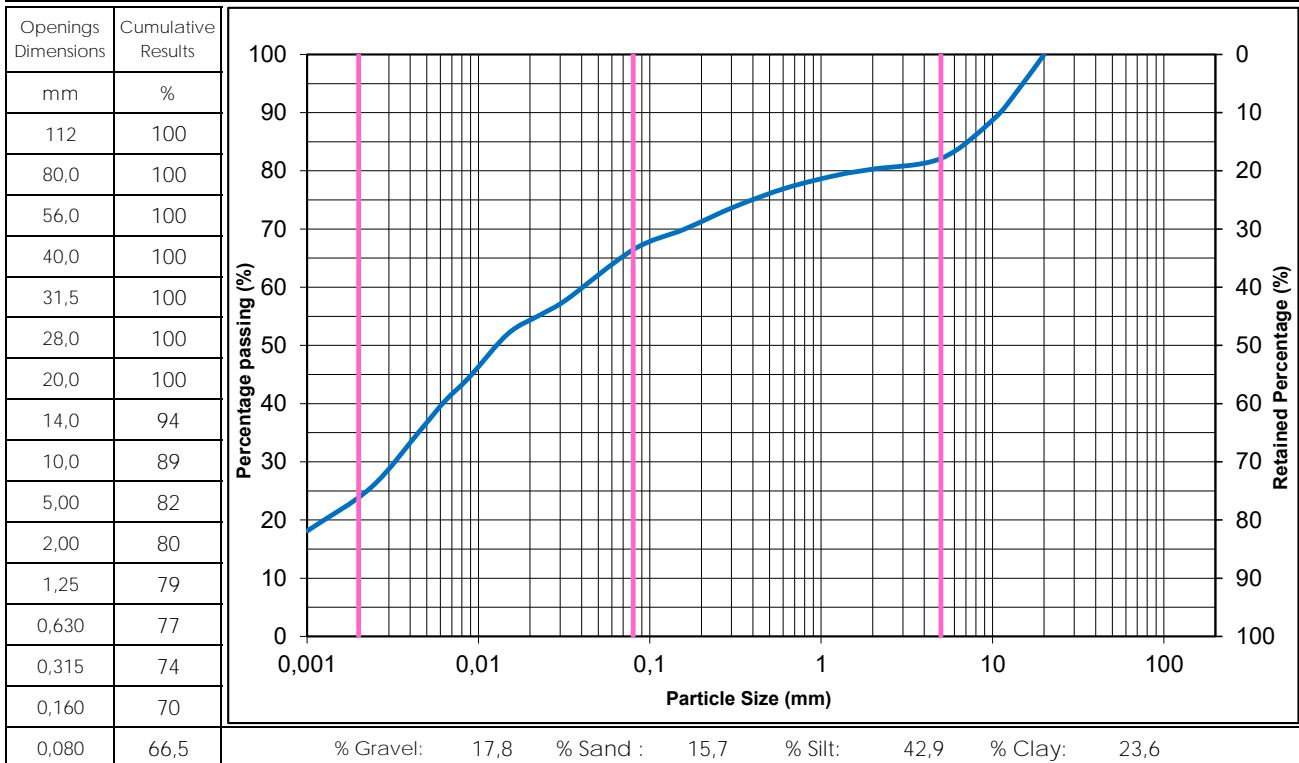
Date : November 01, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

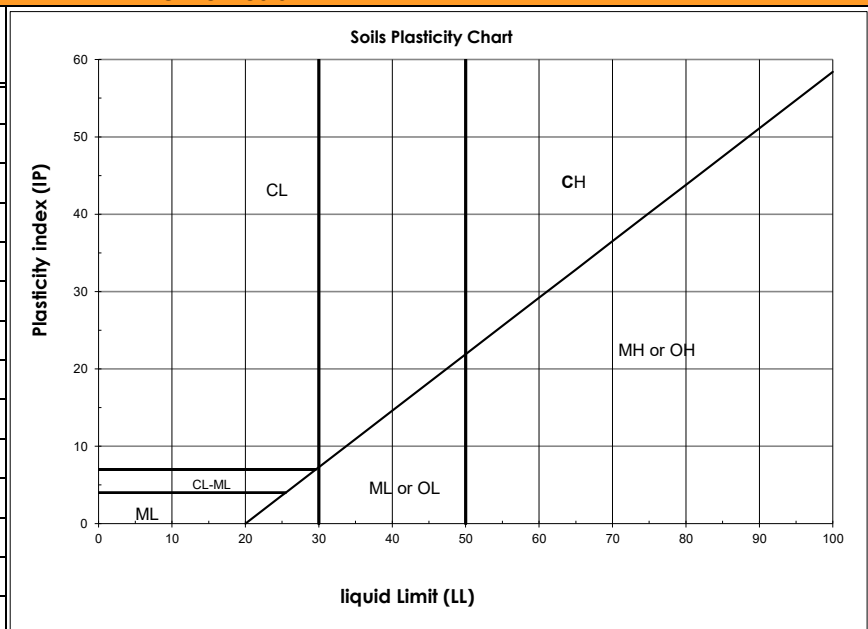
 Sampled by : Hugo Desrochers
 Sampling Date : September 02, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-31 SS-06
 Depth : 3,05 - 3,66m

 Material Description : Clayey Silt, some Gravel,
 some Sand

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	31,0



Remarks : _____

Prepared by :

 Benoit Cyr, Geo. *BC*

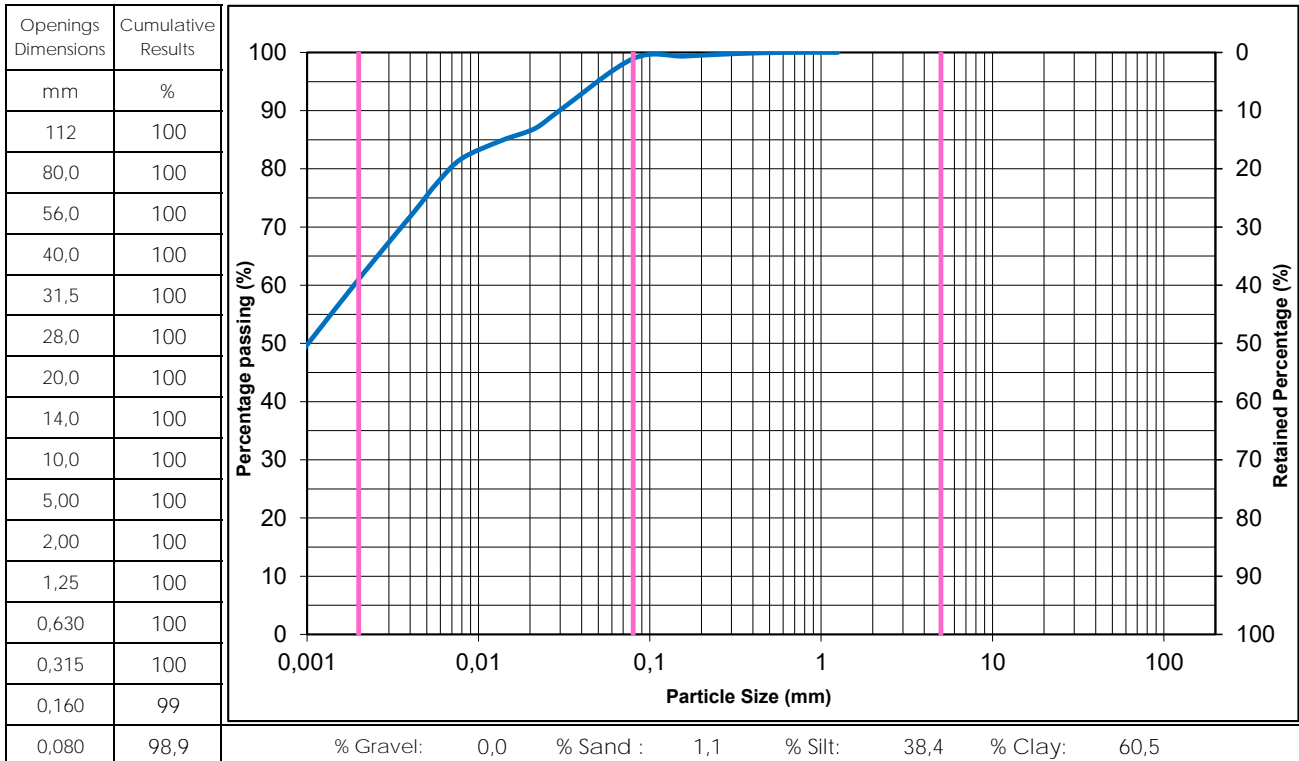
Date : November 01, 2022

Client : Cree Developpement Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

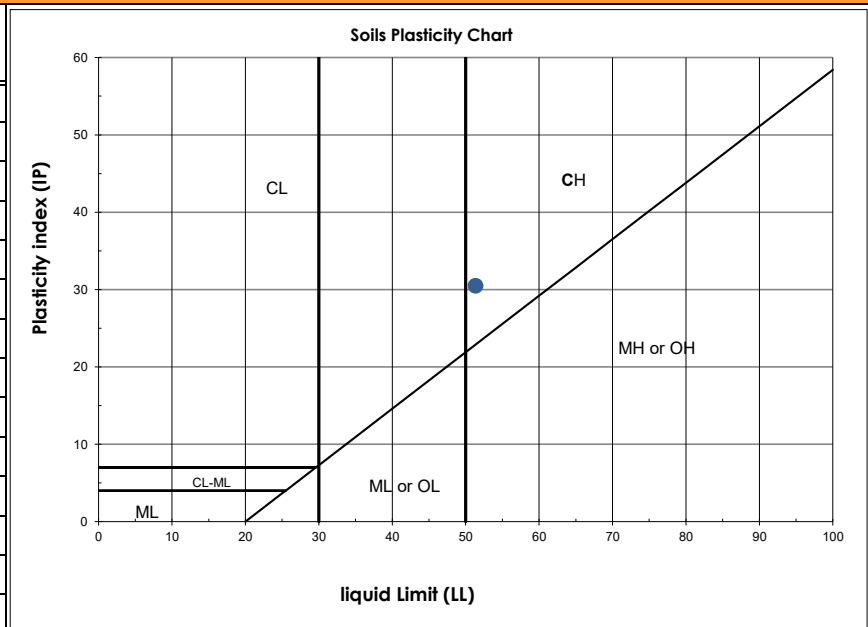
 Sampled by : Hugo Desrochers
 Sampling Date : September 02, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-31 SS-10
 Depth : 5,49 - 6,10m

 Material Description : Clay and Silt, traces of Sand,
 high plasticity (CH)

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	46,6
Liquid Limit (BNQ 2501-092)	51
Plastic Limit (BNQ 2501-092)	21
Plasticity Index (BNQ 2501-092)	30


Remarks :
Prepared by :

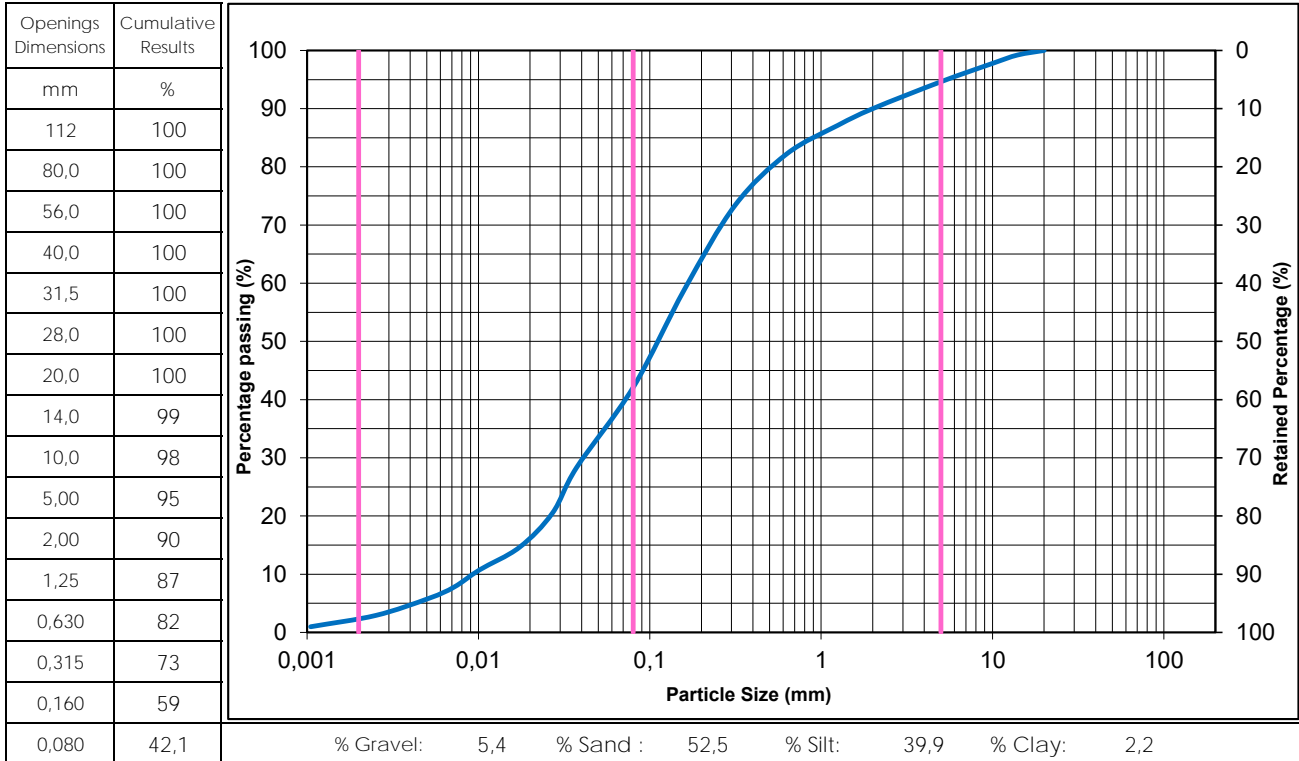
 Benoit Cyr, Geo. 
Date : November 01, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

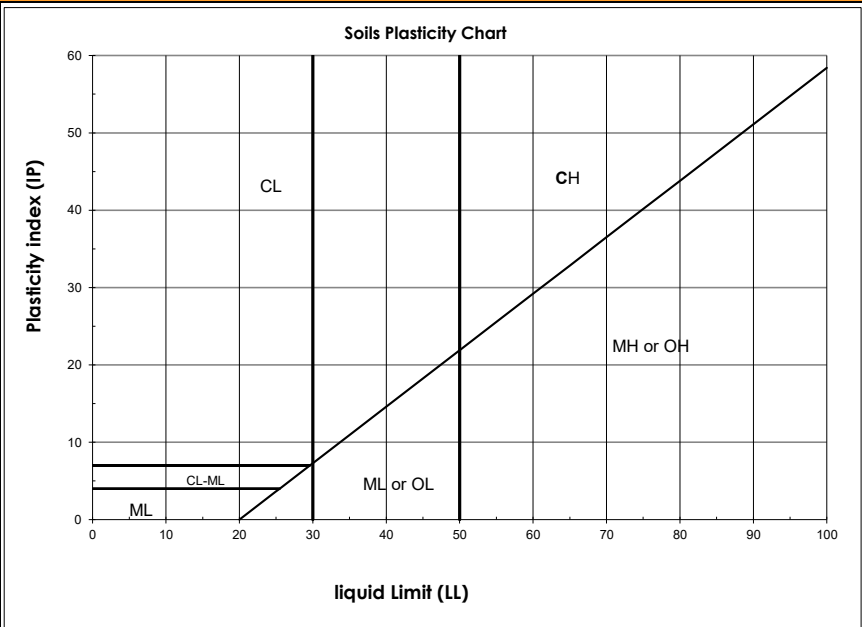
Sampled by : Hugo Desrochers
 Sampling Date : September 02, 2022

Project No : 158100425.500.710.6
 Sample No : BH22-31 SS-14
 Depth : 9,14 - 9,75m

Material Description : Silty Sand, traces of Gravel,
 traces of Clay

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	12,5


Remarks :
Prepared by :

Benoit Cyr, Geo.


Date : November 01, 2022

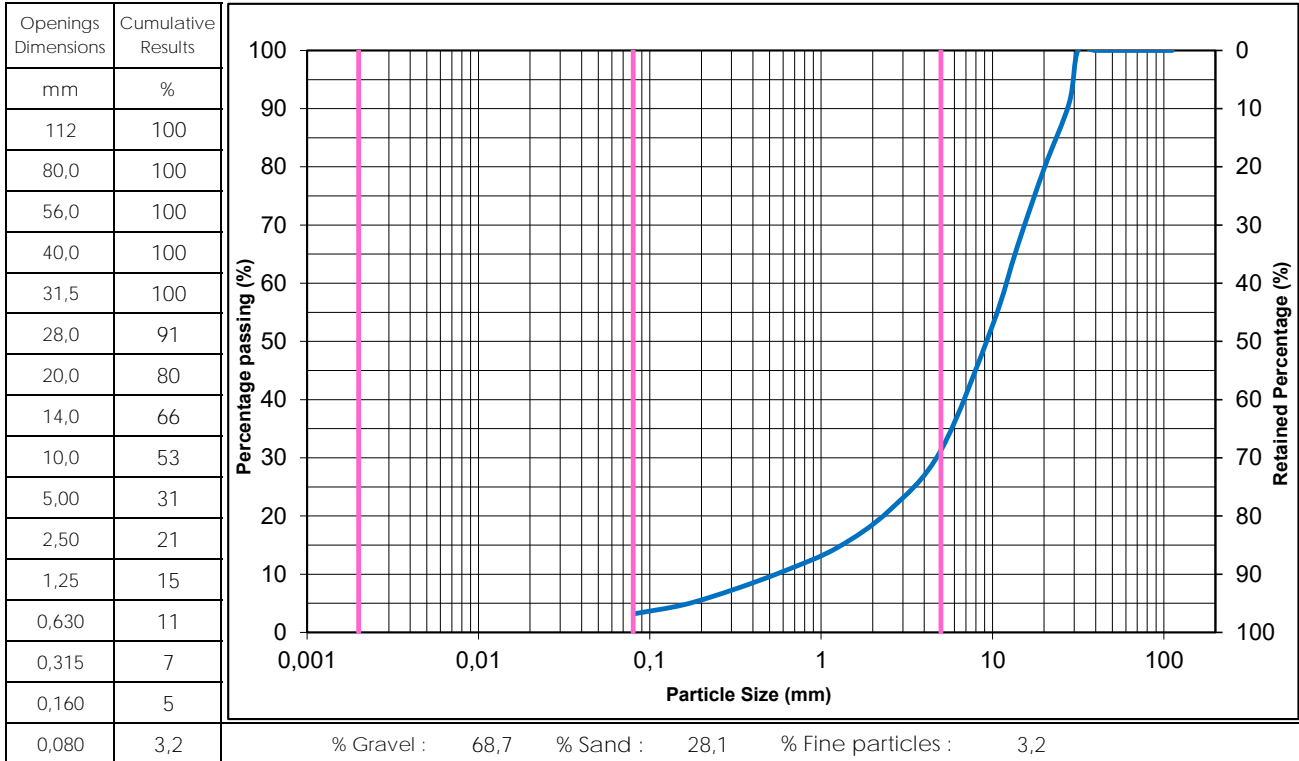
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 02, 2022

Project No : 158100425.500.710.6
Sample No : BH22-32 SS-01
Depth : 0,00 - 0,61m

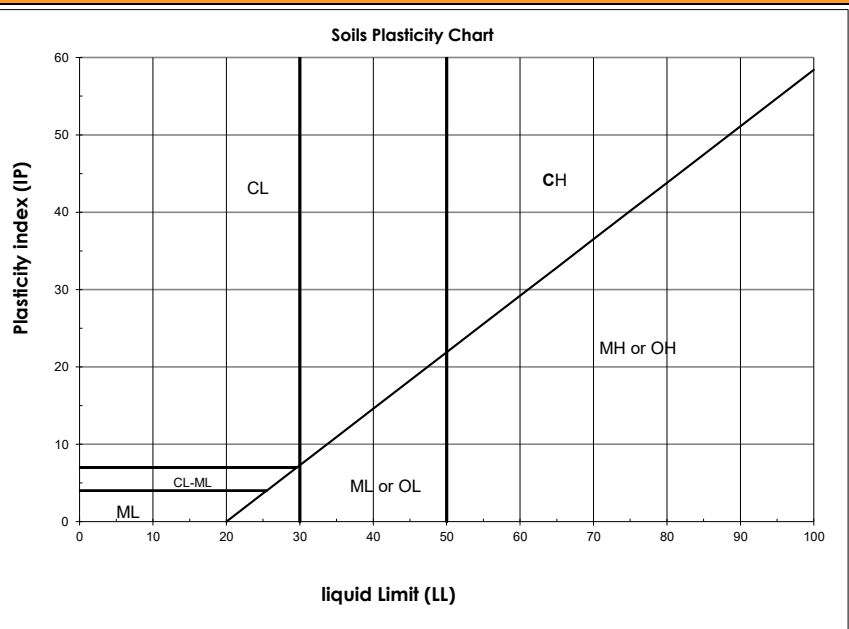
Material Description : Sandy Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	1,5



Remarks : _____

Prepared by : Benoit Cyr, Geo.

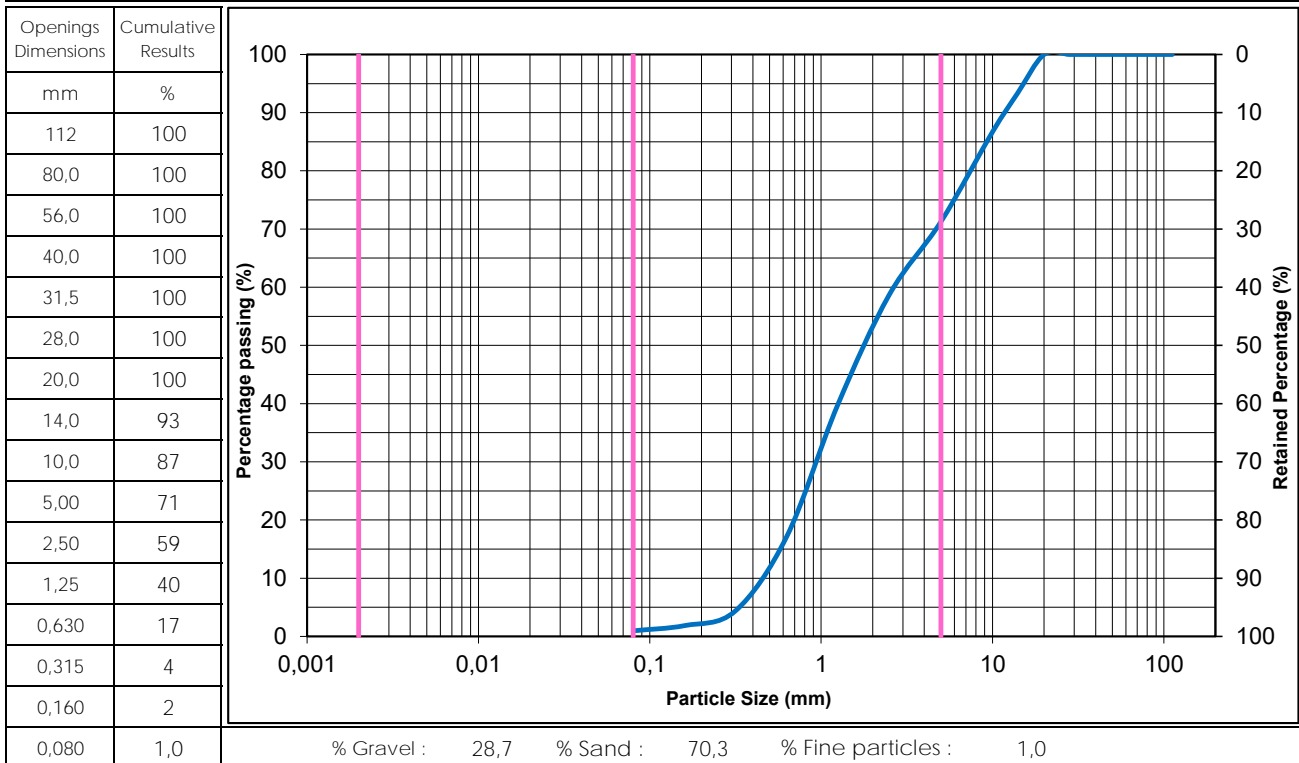
Date : November 01, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

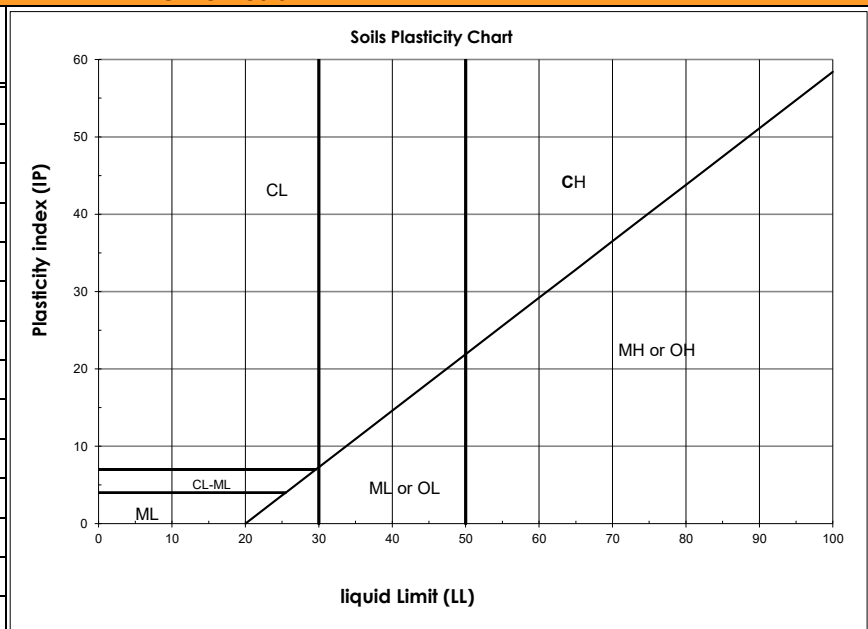
 Sampled by : Hugo Desrochers
 Sampling Date : September 02, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-32 SS-03
 Depth : 1,22 - 1,83m

Material Description : Gravely Sand, traces of fine particles

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	10,3



Remarks :

Prepared by :

 Benoit Cyr, Geo. *Bj*

Date : November 01, 2022

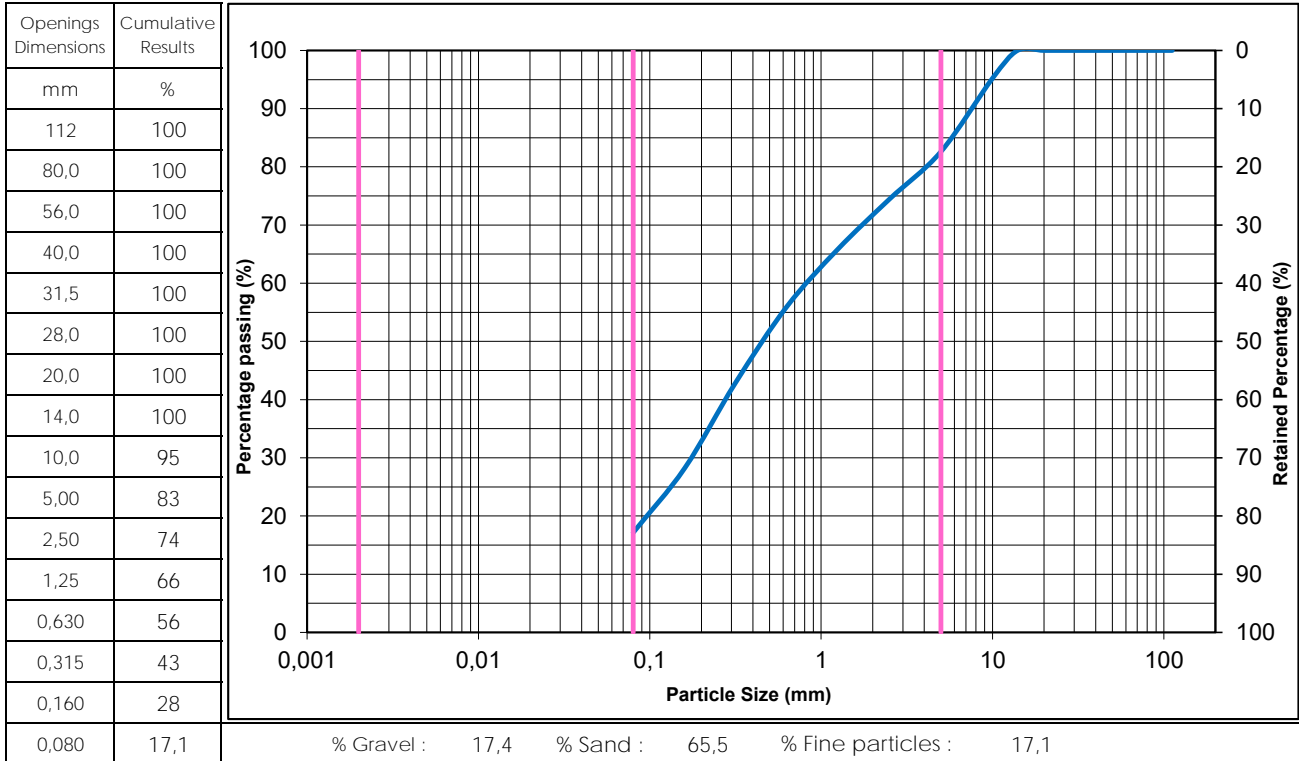
Client : Cree Development Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

Sampled by : Hugo Desrochers
Sampling Date : September 02, 2022

Project No : 158100425.500.710.6
Sample No : BH22-32 SS-09
Depth : 4,88 - 5,49m

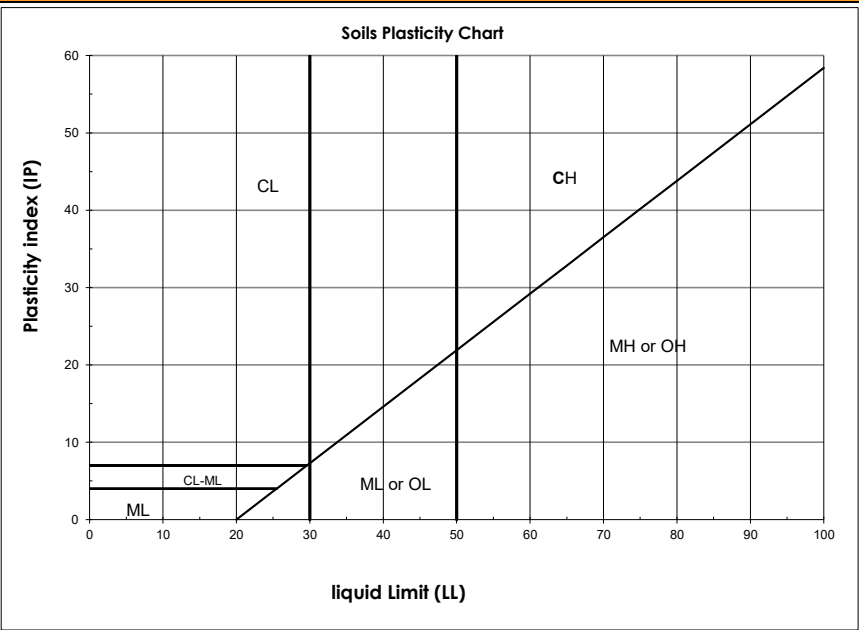
Material Description : Sand, some Gravel, some fine particles

Grain Size Analysis (BNQ 2501-025)




Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	12,8



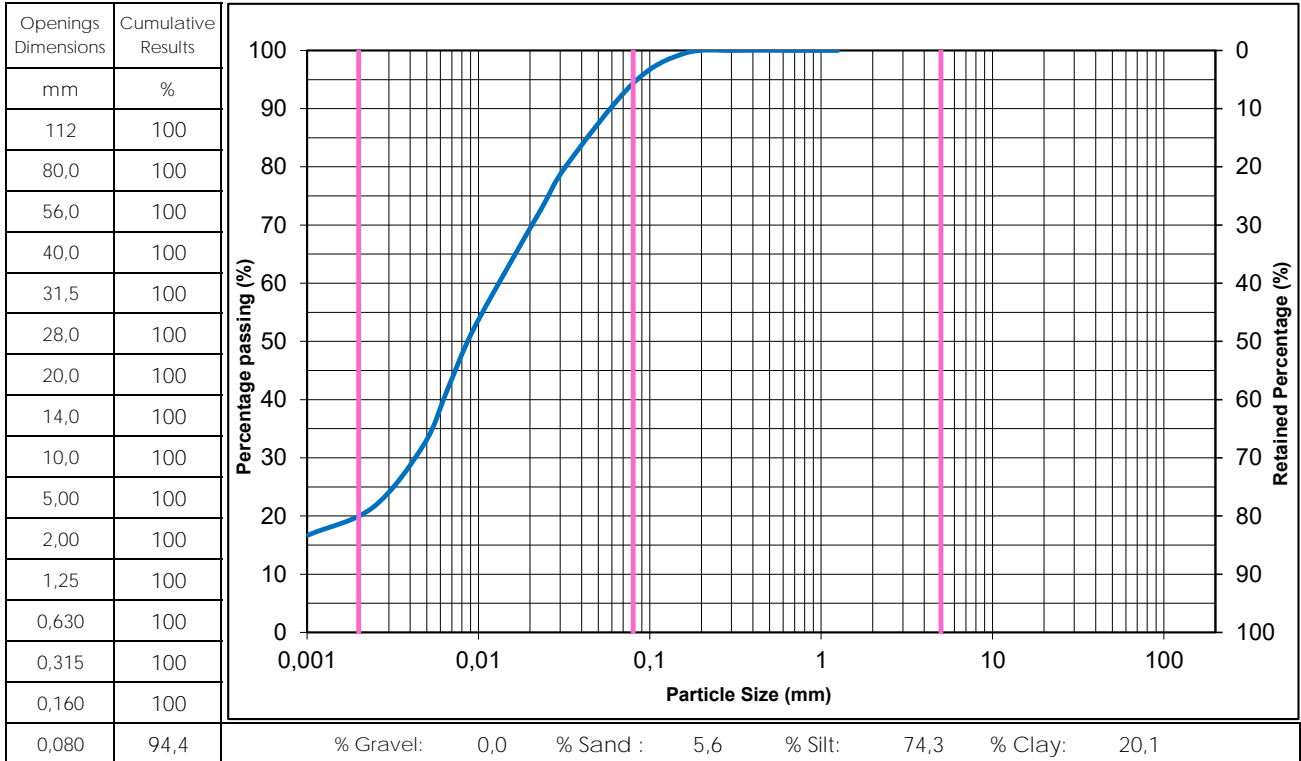
Remarks :

Prepared by : Benoit Cyr, Geo. 

Date : November 01, 2022

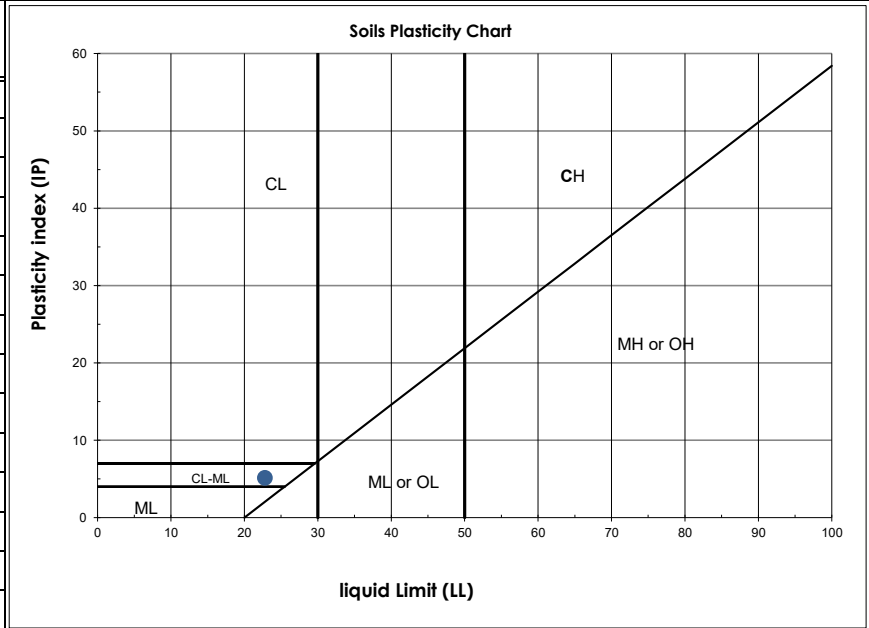
Client : Cree Developpement Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : September 02, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-32 SS-15	Material Description : Clayey Silt, traces of Sand, low plasticity (CL-ML)
Depth : 9,14 - 9,75m	

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	31,3
Liquid Limit (BNQ 2501-092)	23
Plastic Limit (BNQ 2501-092)	18
Plasticity Index (BNQ 2501-092)	5



Remarks :

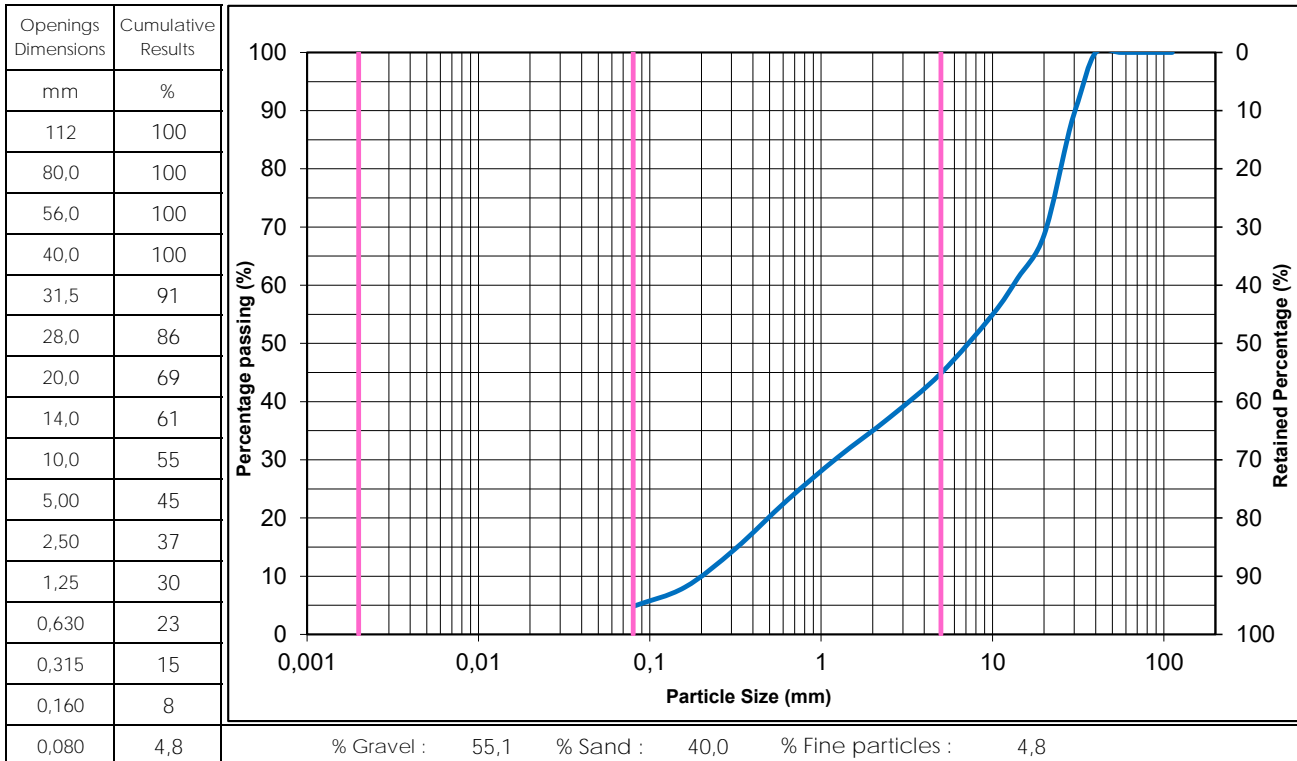
Prepared by : Benoit Cyr, Geo. *Bj* Date : December 16, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

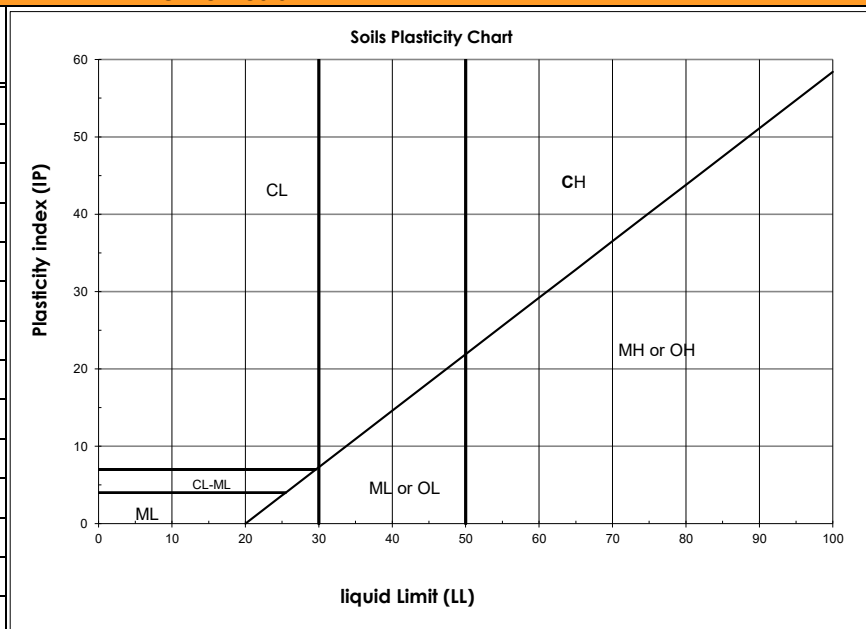
 Sampled by : Hugo Desrochers
 Sampling Date : August 28, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-33 SS-01
 Depth : 0,00 - 0,61m

 Material Description : Gravel and Sand, traces of
 fine particles

Grain Size Analysis (BNQ 2501-025)

Other tests

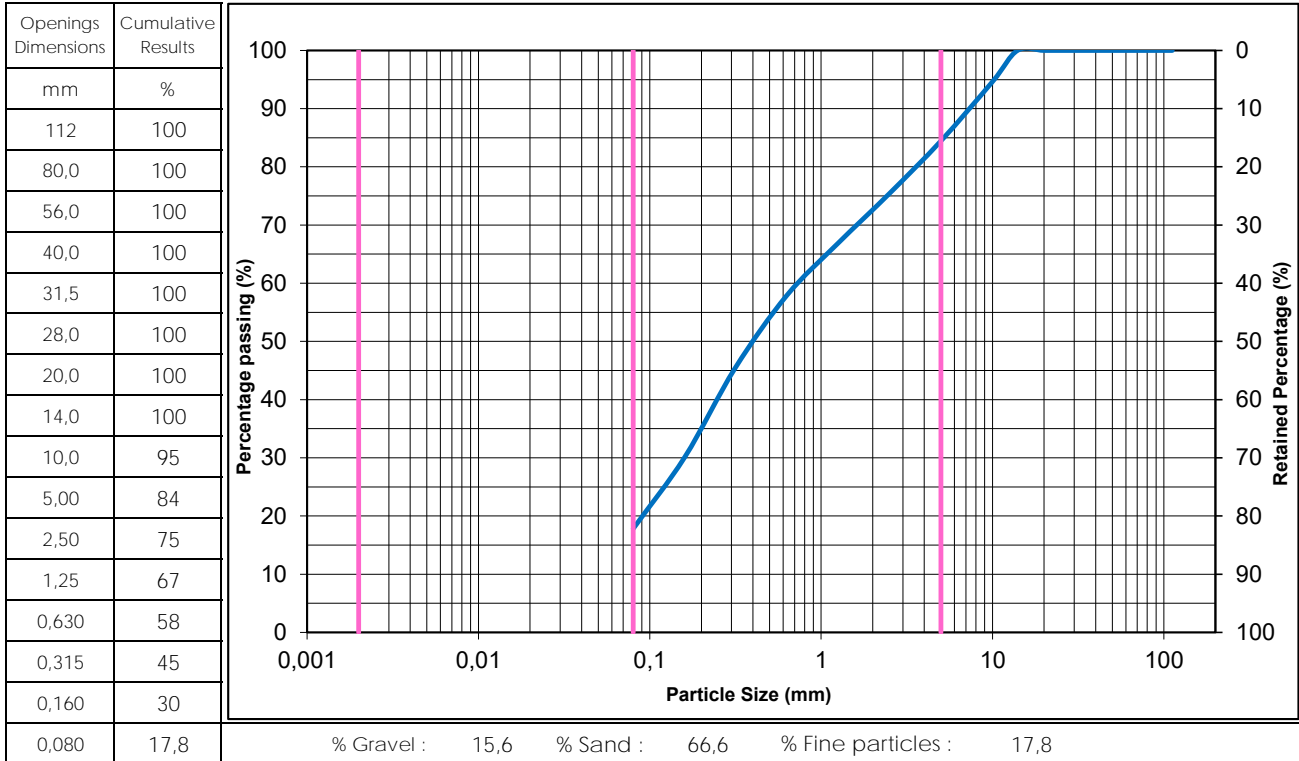
Test / Standard	Results
Water Content (NQ 2501-170) (%)	8,0


Remarks : _____

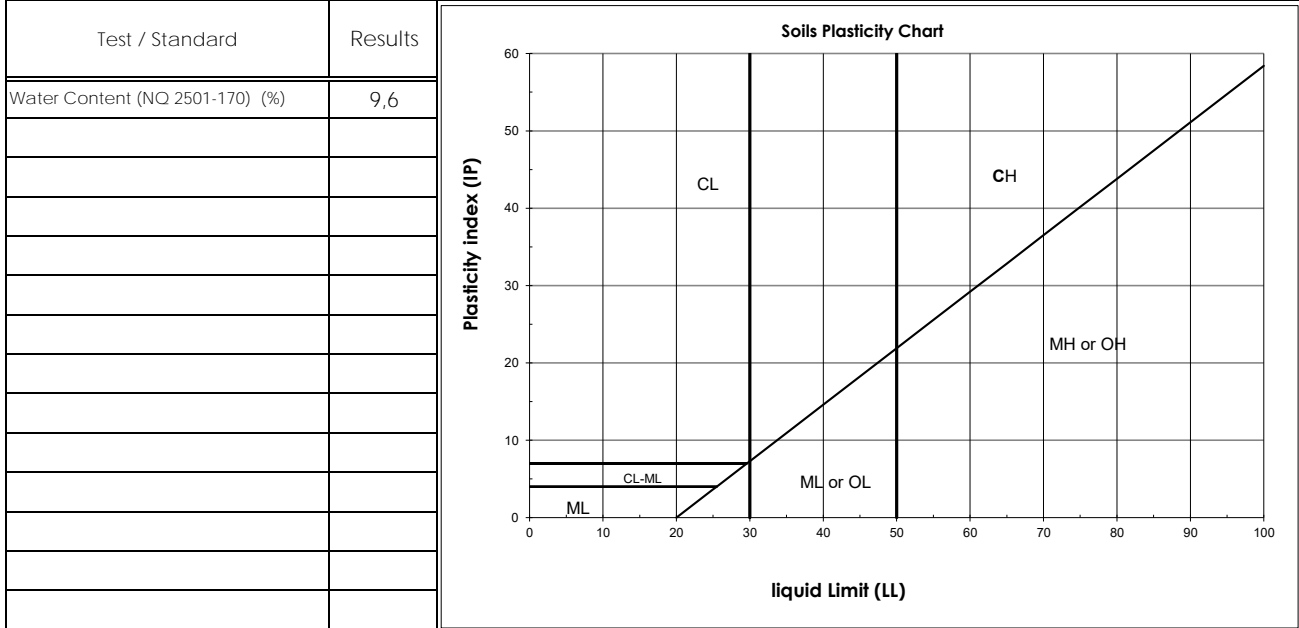
Prepared by : Benoit Cyr, Geo. *BH*
Date : December 16, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 28, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-33 SS-05	Material Description : Sand, some fine particles, some Gravel
Depth : 2,44 - 3,05m	

Grain Size Analysis (BNQ 2501-025)



Other tests

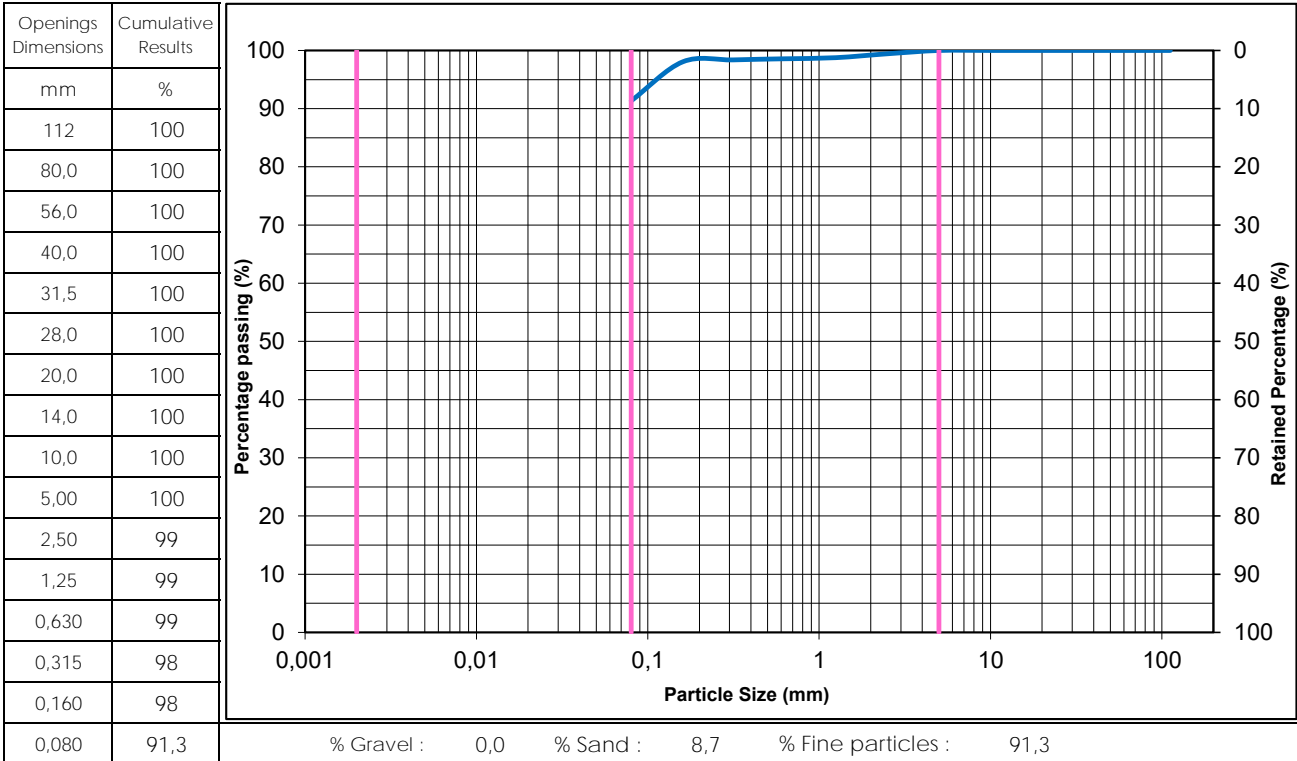


Remarks : _____

Prepared by : Benoit Cyr, Geo. Date : December 16, 2022

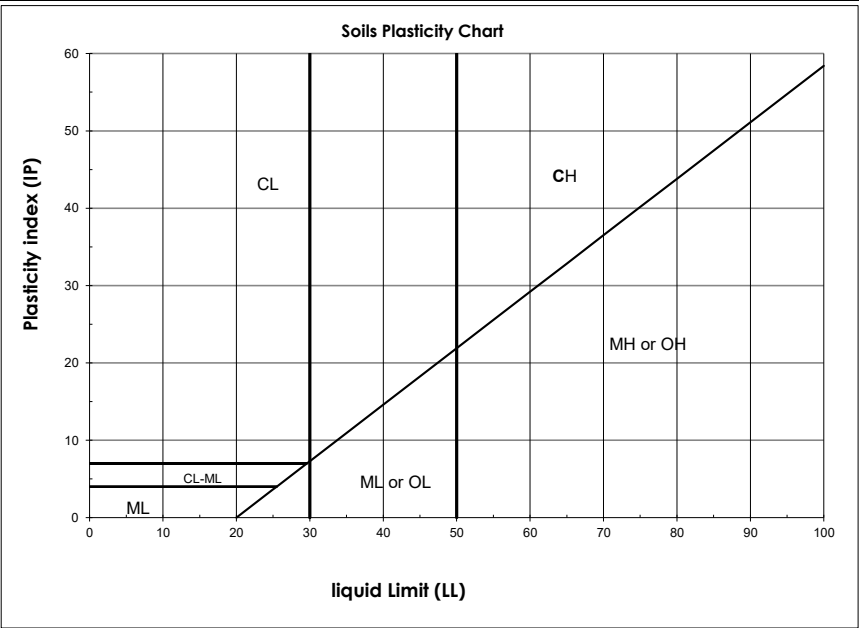
Client :	Cree Developpement Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	August 28, 2022
Project No :	158100425.500.710.6	Material Description :	Fine particles, traces of Sand
Sample No :	BH22-33 SS-11		
Depth :	6,86 - 7,47m		

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	23,9

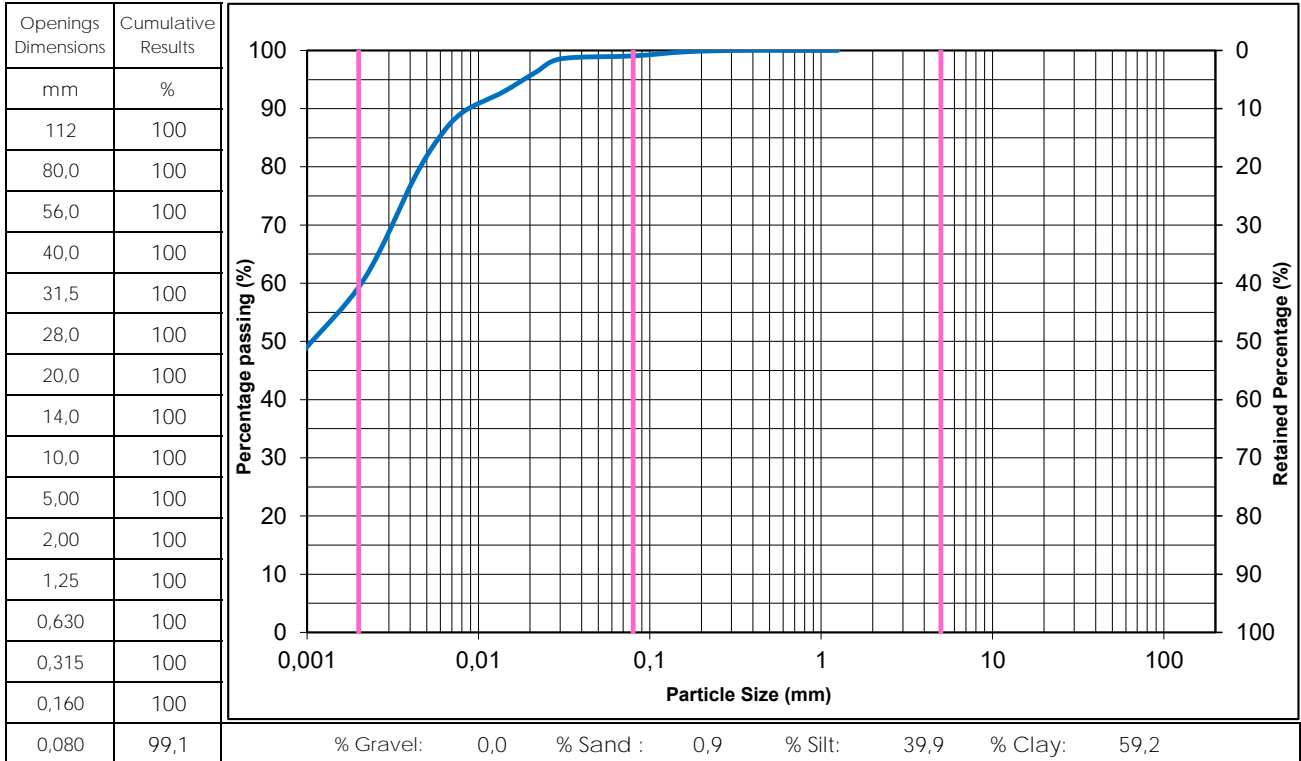


Remarks :

Prepared by : Benoit Cyr, Geo. Date : December 16, 2022

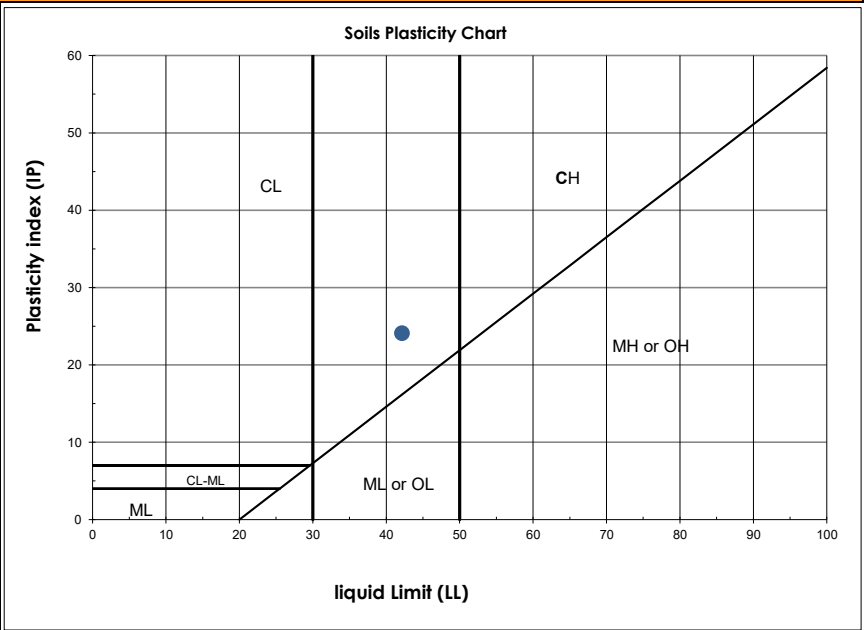
Client :	Cree Development Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	August 28, 2022
Project No :	158100425.500.710.6		
Sample No :	BH22-33 SS-15	Material Description :	Clay and Silt, traces of Sand, medium plasticity (CL)
Depth :	12,19 - 12,80m		

Grain Size Analysis (BNQ 2501-025)



Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	59,4
Liquid Limit (BNQ 2501-092)	42
Plastic Limit (BNQ 2501-092)	18
Plasticity Index (BNQ 2501-092)	24

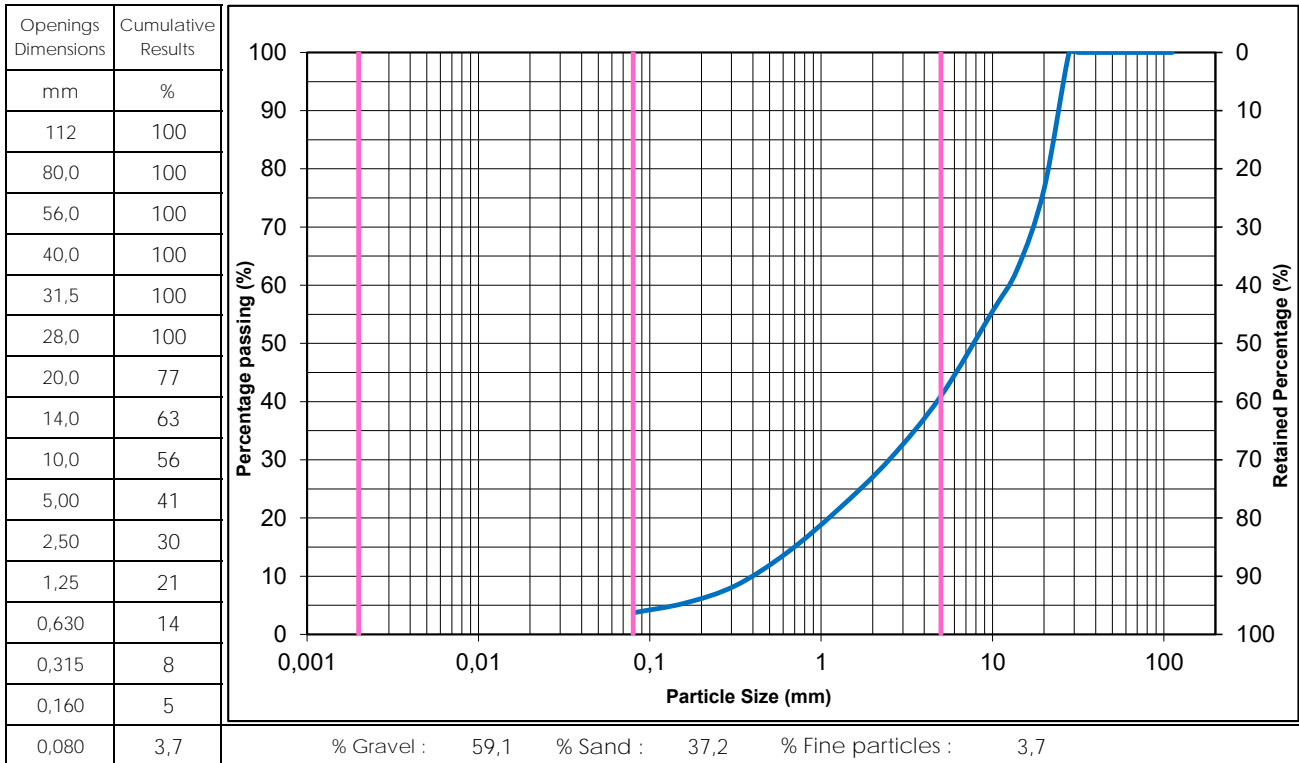


Remarks :

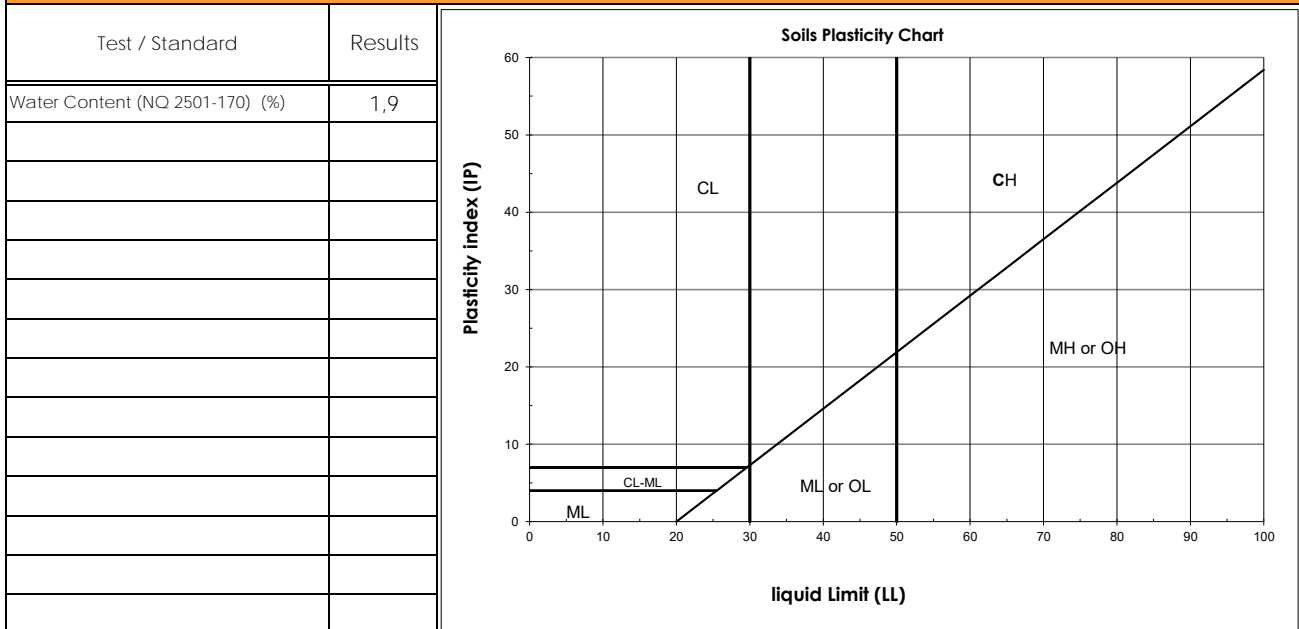
Prepared by : Benoit Cyr, Geo. *BC* Date : December 16, 2022

Client :	Cree Development Corporation (CDC)	Sampled by :	Hugo Desrochers
Project :	LGA - Grevet-Chapais Railway	Sampling Date :	August 28, 2022
Project No :	158100425.500.710.6	Material Description :	Gravel and Sand, traces of fine particles
Sample No :	BH22-34 SS-02		
Depth :	0,61 - 1,22m		

Grain Size Analysis (BNQ 2501-025)



Other tests



Remarks :

Prepared by :

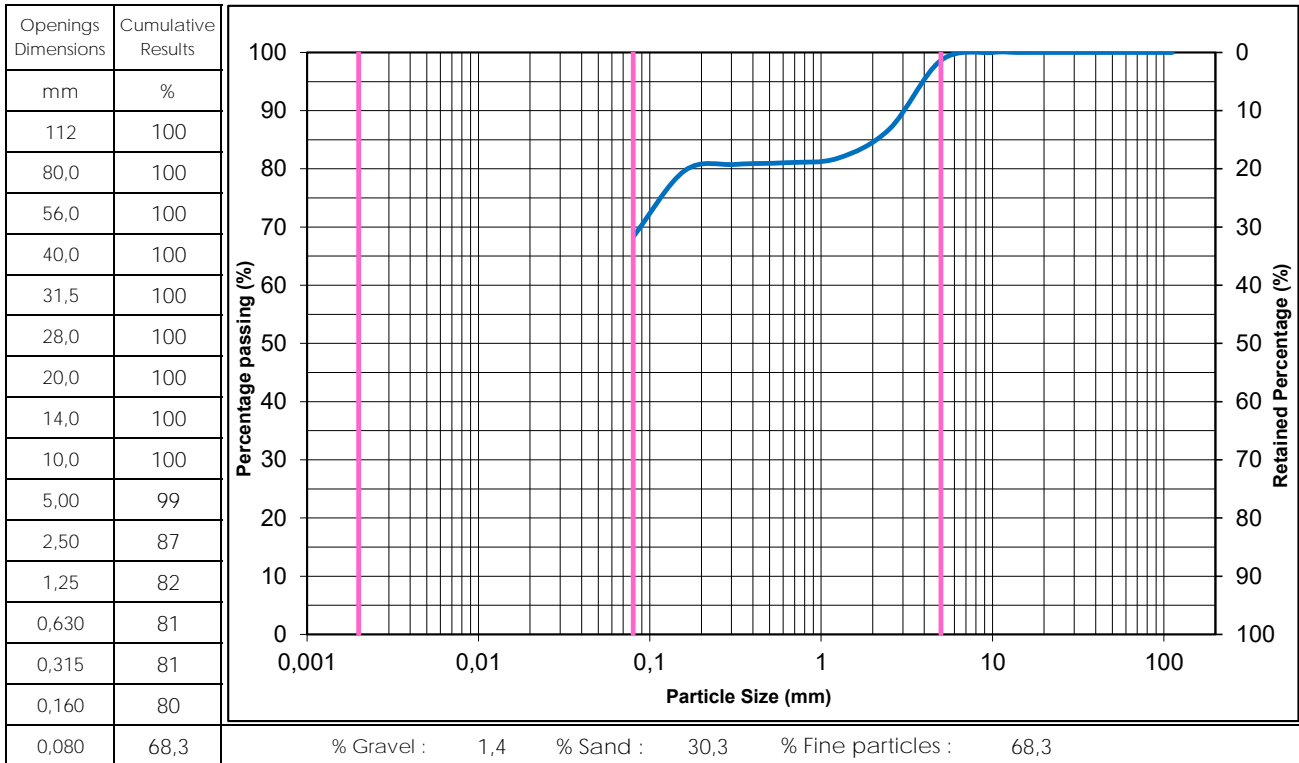
Benoit Cyr, Geo.



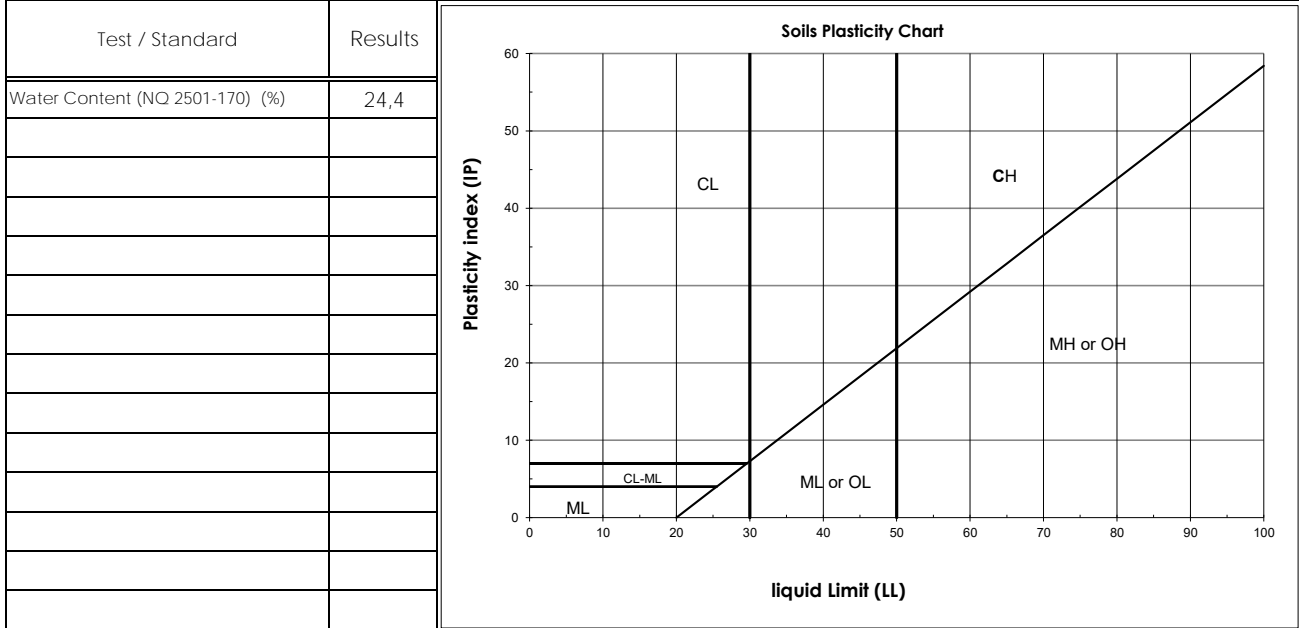
Date : December 16, 2022

Client : Cree Development Corporation (CDC)	Sampled by : Hugo Desrochers
Project : LGA - Grevet-Chapais Railway	Sampling Date : August 28, 2022
Project No : 158100425.500.710.6	
Sample No : BH22-34 SS-05	Material Description : Sandy fine particles, traces of Gravel
Depth : 2,44 - 3,05m	

Grain Size Analysis (BNQ 2501-025)



Other tests



Remarks : _____

Prepared by : Benoit Cyr, Geo. _____ Date : December 16, 2022

Client : Cree Developpement Corporation (CDC)
Project : LGA - Grevet-Chapais Railway

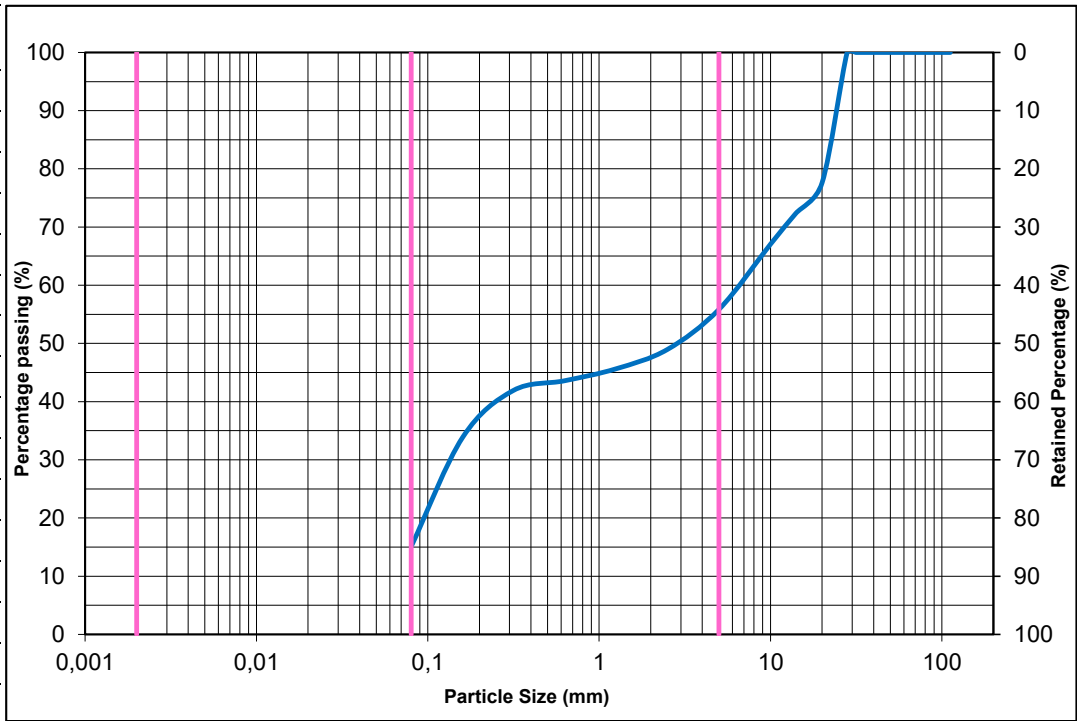
Sampled by : Hugo Desrochers
Sampling Date : August 28, 2022

Project No : 158100425.500.710.6
Sample No : BH22-34 SS-13
Depth : 9,14 - 9,75m

Material Description : Gravel and Sand, some fine particles

Grain Size Analysis (BNQ 2501-025)

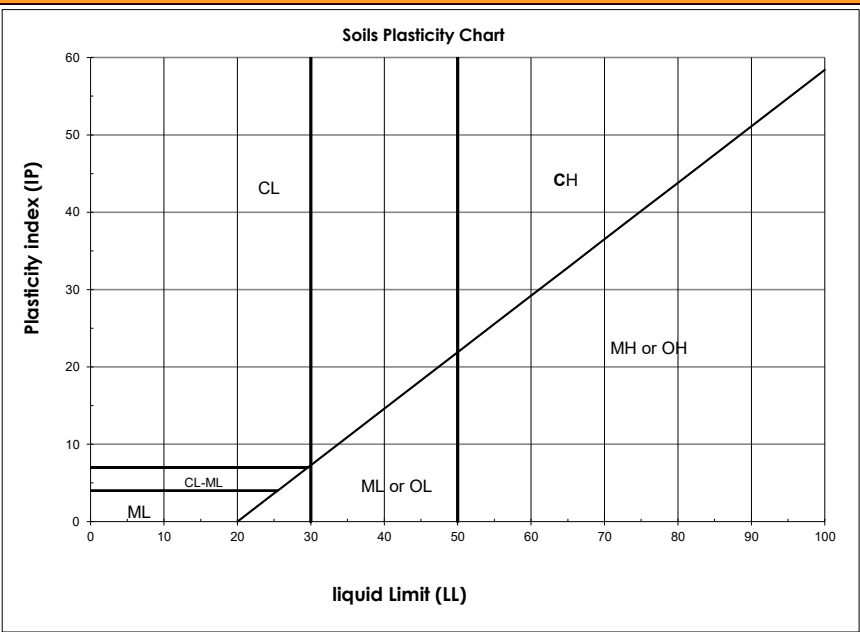
Openings Dimensions	Cumulative Results
mm	%
112	100
80,0	100
56,0	100
40,0	100
31,5	100
28,0	100
20,0	78
14,0	72
10,0	67
5,00	56
2,50	49
1,25	46
0,630	44
0,315	42
0,160	34
0,080	15,1



% Gravel : 44,2 % Sand : 40,7 % Fine particles : 15,1

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	11,1



Remarks : _____

Prepared by : Benoit Cyr, Geo. *BC*

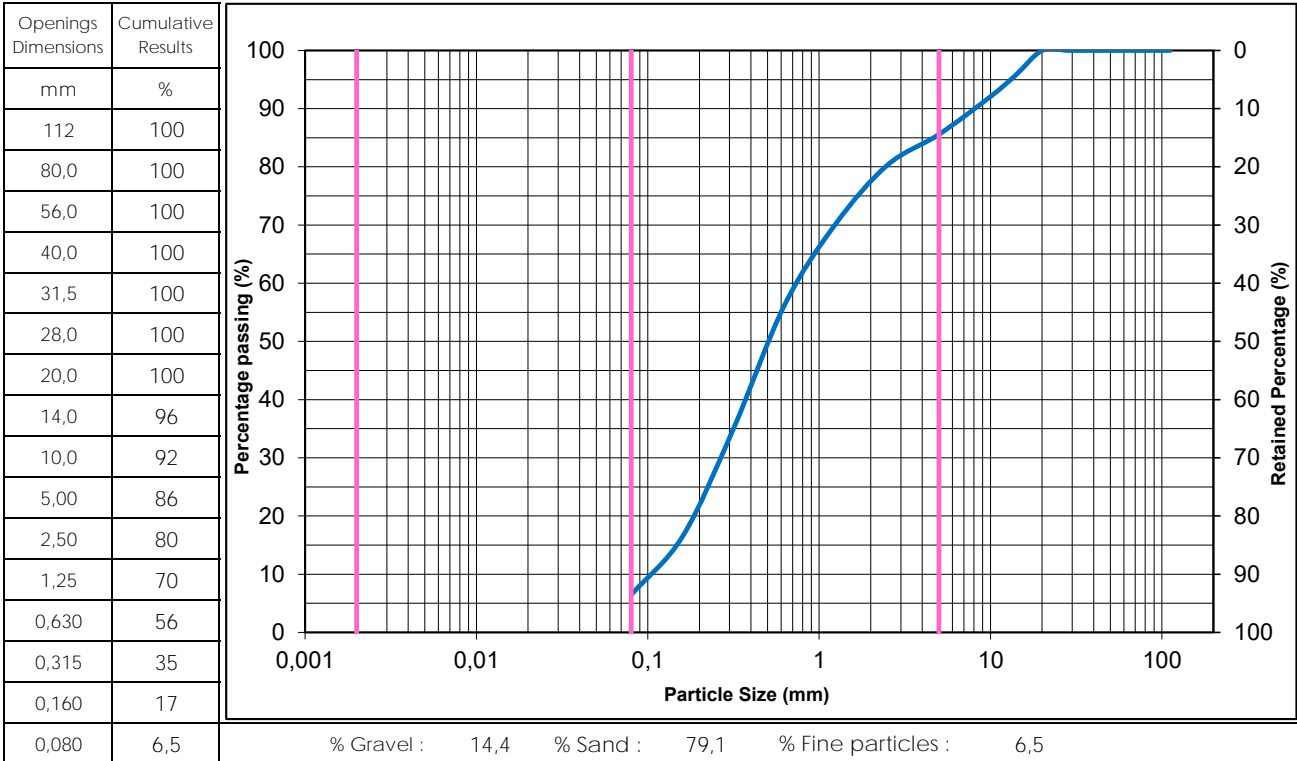
Date : December 16, 2022

Client : Cree Development Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

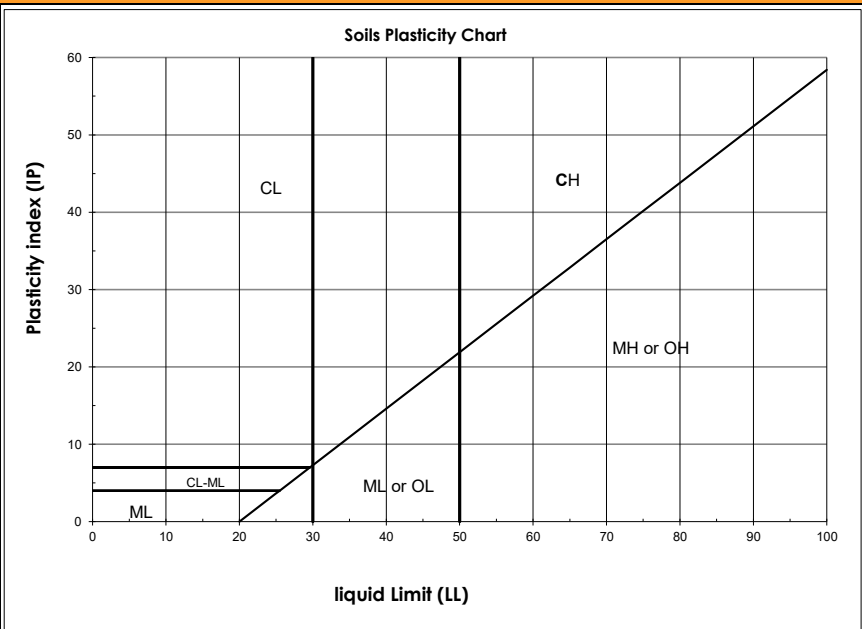
 Sampled by : Hugo Desrochers
 Sampling Date : August 31, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-35 SS-01B
 Depth : 0,10 - 0,61m


Material Description : Sand, some Gravel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	12,4



Remarks : _____

 Prepared by : Benoit Cyr, Geo. 

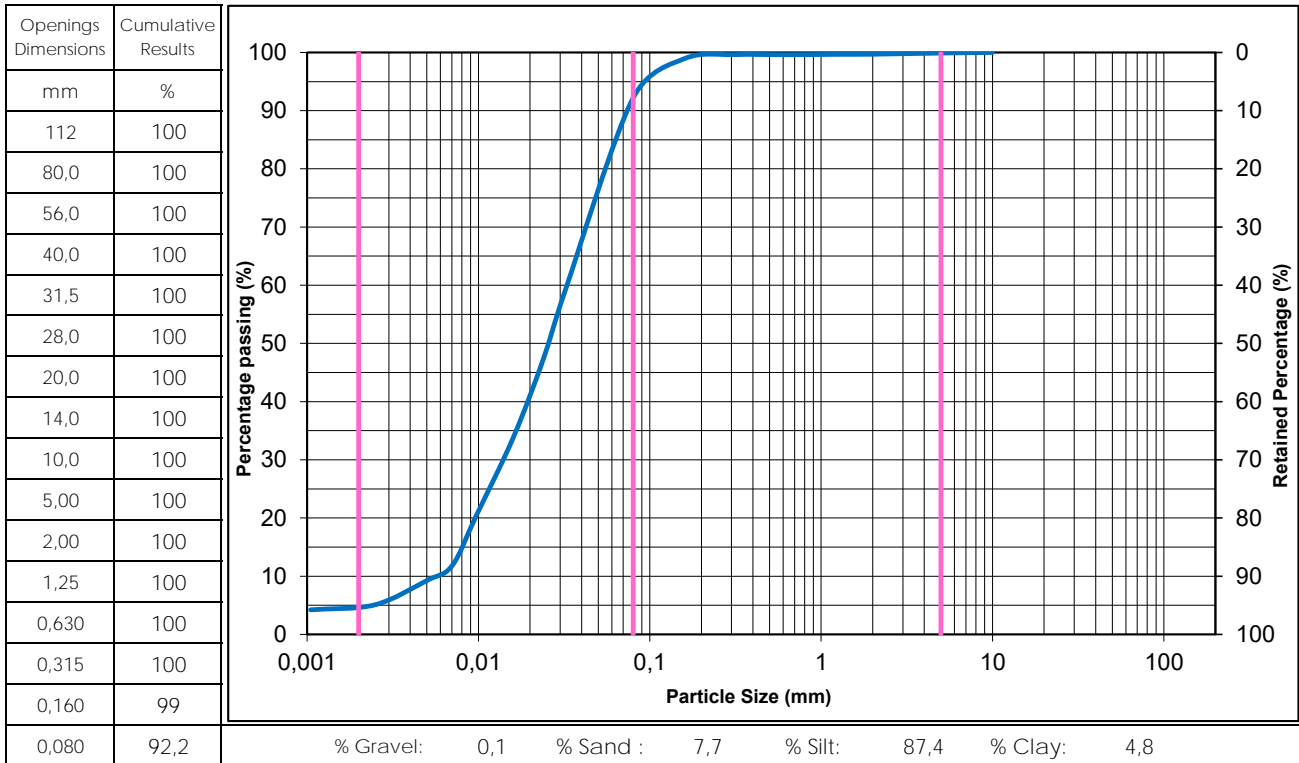
Date : December 16, 2022

Client : Cree Developpement Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

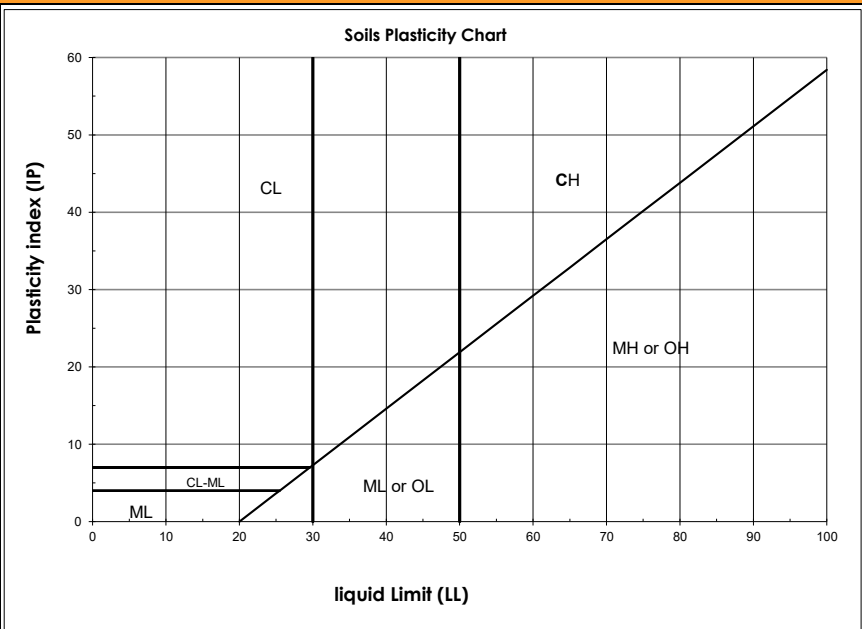
 Sampled by : Hugo Desrochers
 Sampling Date : August 31, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-35 SS-05
 Depth : 2,44 - 3,05m

Material Description : Silt, traces of Sand, traces of Clay, traces of Gravel

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	22,4



Remarks :

Prepared by :

Benoit Cyr, Geo.



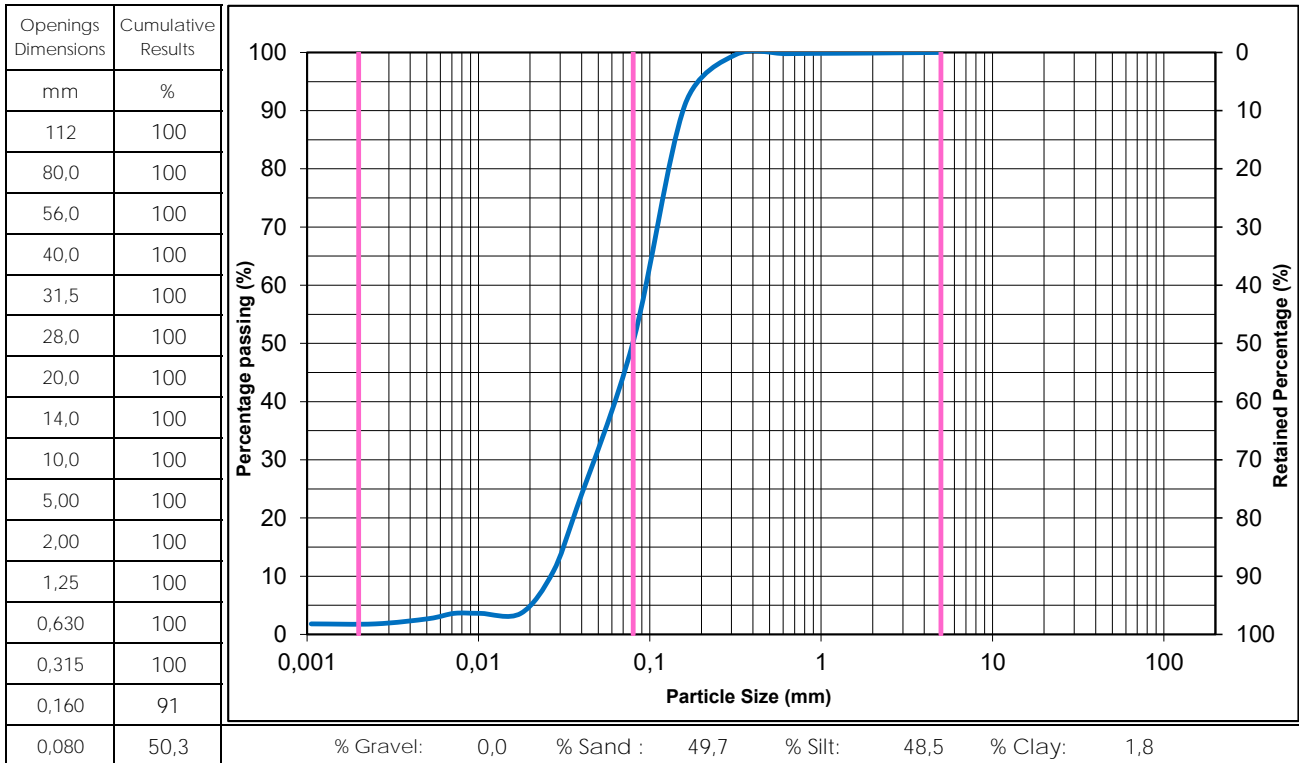
Date : December 16, 2022

Client : Cree Developpement Corporation (CDC)
 Project : LGA - Grevet-Chapais Railway

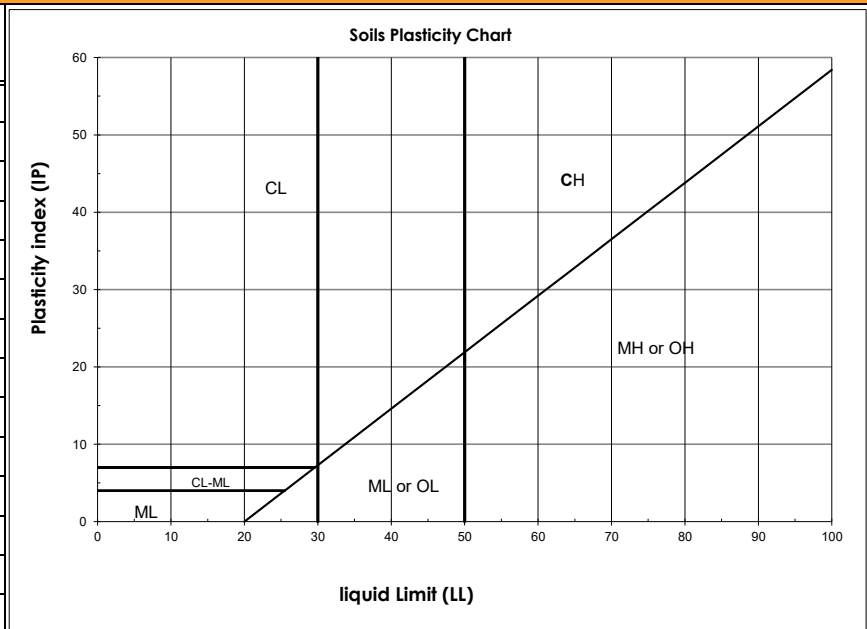
 Sampled by : Hugo Desrochers
 Sampling Date : August 31, 2022

 Project No : 158100425.500.710.6
 Sample No : BH22-35 SS-08
 Depth : 4,57 - 5,18m

Material Description : Sand and Silt, traces of Clay

Grain Size Analysis (BNQ 2501-025)

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	15,4



Remarks :

Prepared by :

 Benoit Cyr, Geo. *BJ*

Date : December 16, 2022



2273 Michelin Street
Laval QC, H7L 5B8

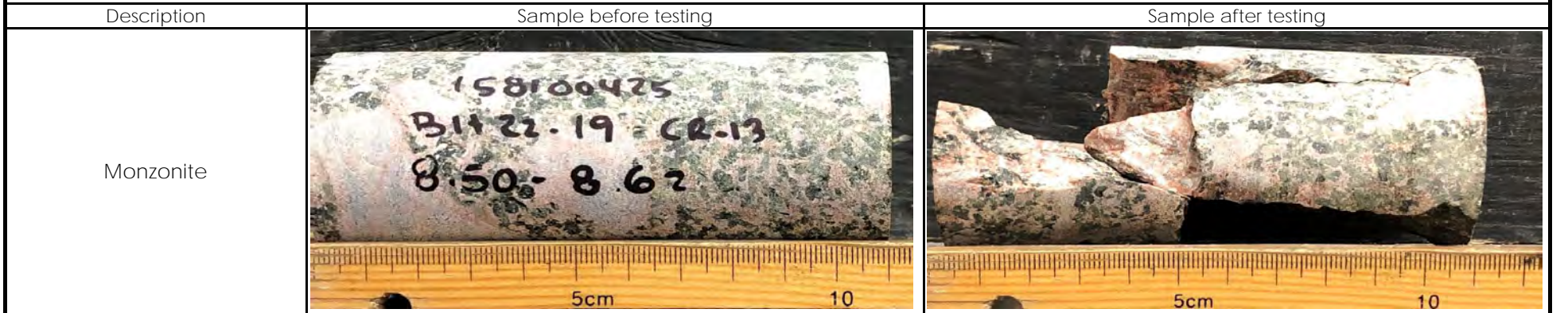
Compressive Strength of Intact Rock Core Specimens, ASTM D 7012, Method C

Client : Cree Developpment Corporation (CDC) Project : La Grande Alliance - Feasibility Study - Phase I
Project No : 158100425.500.710.6 Preliminary Geotechnical Investigations - Grevet Chapais Railway

Borehole No : BH22-19 Depth : 8,50 - 8,62m Sampled by : Hugo Desrochers
Sample No : DC-13 Date of sampling : August 31, 2022

Apparatus : Loading Device no : LAV-011 Caliper no : LAV-104
Scale Protractor no : LAV-029 Scale no : LAV-012

Average Length (mm)	Average Diameter (mm)	L/D Ratio	Weight (Kg)	Volumic Weight (kg/m³)	Humidity Conditions	Targeted Loading Rate (lbs/sec)	Time to Failure	load at failure (lbs)	Compressive Strength (MPa)
112,0	47,0	2,4	0,548	2820	Dry	331	2min 30sec	56830	145,7



Remarks :

Tested by : Marc Clairoux Date : January 11, 2023 Approved by : Benoit Cyr, Geo. *BJ*



2273 Michelin Street
Laval QC, H7L 5B8

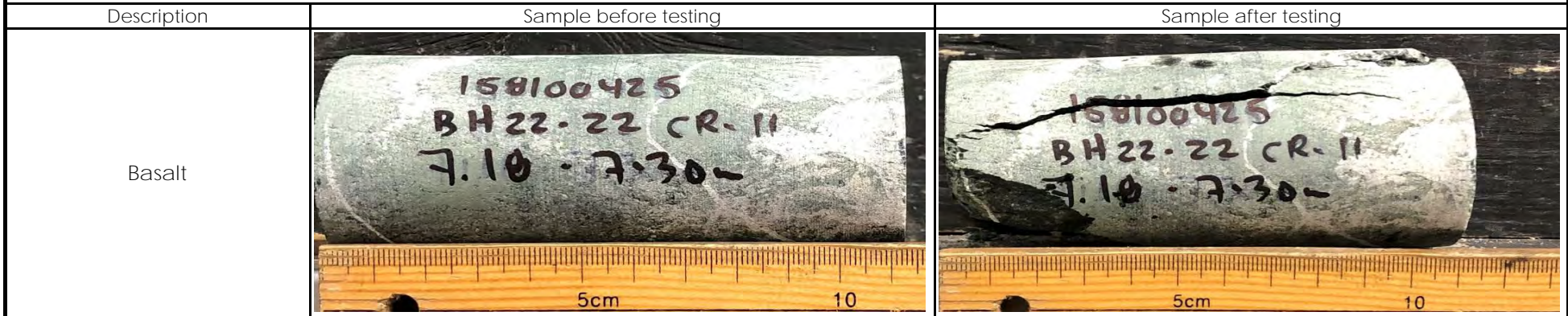
Compressive Strength of Intact Rock Core Specimens, ASTM D 7012, Method C

Client : Cree Developpment Corporation (CDC) Project : La Grande Alliance - Feasibility Study - Phase I
Project No : 158100425.500.710.6 Preliminary Geotechnical Investigations - Grevet Chapais Railway

Borehole No : BH22-22 Depth : 7,18 - 7,30m Sampled by : Hugo Desrochers
Sample No : DC-11 Date of sampling : September 02, 2022

Apparatus : Loading Device no : LAV-011 Caliper no : LAV-104
Scale Protractor no : LAV-029 Scale no : LAV-012

Average Length (mm)	Average Diameter (mm)	L/D Ratio	Weight (Kg)	Volumic Weight (kg/m³)	Humidity Conditions	Targeted Loading Rate (lbs/sec)	Time to Failure	load at failure (lbs)	Compressive Strength (MPa)
114,0	47,0	2,4	0,565	2857	Dry	331	1min 15sec	32230	82,6



Remarks :

Tested by : Marc Clairoux Date : January 11, 2023 Approved by : Benoit Cyr, Geo. *BC*



2273 Michelin Street
Laval QC, H7L 5B8

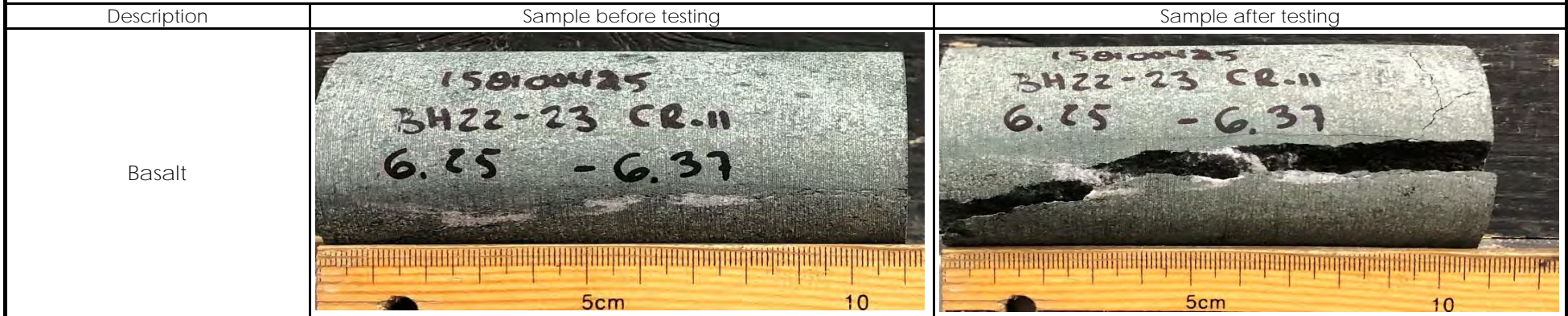
Compressive Strength of Intact Rock Core Specimens, ASTM D 7012, Method C

Client : Cree Developpment Corporation (CDC) Project : La Grande Alliance - Feasibility Study - Phase I
Project No : 158100425.500.710.6 Preliminary Geotechnical Investigations - Grevet Chapais Railway

Borehole No : BH22-23 Depth : 6,25 - 6,37m Sampled by : Hugo Desrochers
Sample No : DC-10 Date of sampling : September 03, 2022

Apparatus : Loading Device no : LAV-011 Caliper no : LAV-104
Scale Protractor no : LAV-029 Scale no : LAV-012

Average Length (mm)	Average Diameter (mm)	L/D Ratio	Weight (Kg)	Volumic Weight (kg/m³)	Humidity Conditions	Targeted Loading Rate (lbs/sec)	Time to Failure	load at failure (lbs)	Compressive Strength (MPa)
113,0	47,0	2,4	0,585	2984	Dry	331	1min 00sec	22090	56,6



Remarks :

Tested by : Marc Clairoux Date : January 11, 2023 Approved by : Benoit Cyr, Geo.



2273 Michelin Street
Laval QC, H7L 5B8

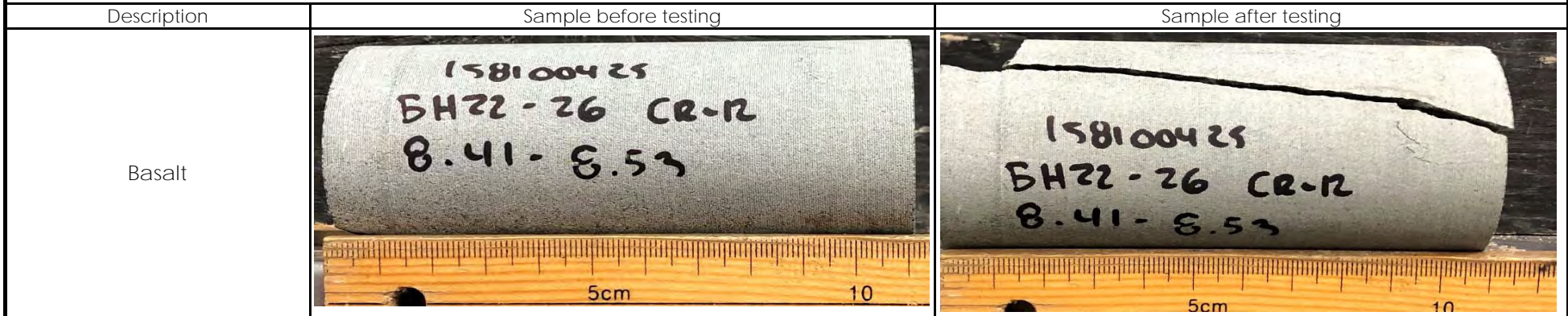
Compressive Strength of Intact Rock Core Specimens, ASTM D 7012, Method C

Client : Cree Developpment Corporation (CDC) Project : La Grande Alliance - Feasibility Study - Phase I
Project No : 158100425.500.710.6 Preliminary Geotechnical Investigations - Grevet Chapais Railway

Borehole No : BH22-26 Depth : 8,41 - 8,53m Sampled by : Hugo Desrochers
Sample No : DC-12 Date of sampling : September 04, 2022

Apparatus : Loading Device no : LAV-011 Caliper no : LAV-104
Scale Protractor no : LAV-029 Scale no : LAV-012

Average Length (mm)	Average Diameter (mm)	L/D Ratio	Weight (Kg)	Volumic Weight (kg/m³)	Humidity Conditions	Targeted Loading Rate (lbs/sec)	Time to Failure	load at failure (lbs)	Compressive Strength (MPa)
112,0	47,0	2,4	0,560	2882	Dry	331	0min 55sec	24620	63,1



Remarks :

Tested by : Marc Clairoux Date : January 11, 2023 Approved by : Benoit Cyr, Geo. *BC*



Stantec Consulting Ltd.
2781 Lancaster Rd, Suite 100 A&B, Ottawa ON K1B 1A7

December 22, 2022
File: 158100425.500.710.6-Grevet Chapais

Reference: ASTM D2216 & ASTM D 7263, Method B

The following table summarizes two Moisture contents & Unit Weights results.

Source	Depth (m)	Moisture Content (%)	Unit Weight (γ) KN/m ³
BH22-13 ST07	3.66-4.27	65.5	15.8
BH22-14 ST12	7.62-8.23	99.3	14.8

Sincerely,

Stantec Consulting Ltd.

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com



December 01, 2022
File: 158100425.500.710.6-Grevet Chapais

Reference: ASTM D2216 & ASTM D 7263, Method B

The following table summarizes 10 Moisture contents & Unit Weights results.

Source	Depth (m)	Moisture Content (%)	Unit Weight (γ) KN/m ³
BH22-05 ST23	9.14-9.75	78.2	15.2
BH22-06 ST24	6.10-6.71	72.9	14.8
BH22-09 ST12	2.44-3.05	41.4	17.7
BH22-10 ST12	4.75-5.18	36.7	*18.4
BH22-17 ST07	3.81-4.42	49.5	16.5
BH22-21 ST15	4.27-4.88	80.8	14.9
BH22-28 ST10	5.49-6.10	62.9	15.6
BH22-30 ST15	9.75-10.36	28.1	18.6
BH22-32 ST16	9.91-10.52	36.6	16.4
BH22-33 ST16	12.95-13.56	30.9	19.0

*Computed using consolidation specimen due to lack of adequate sample

Sincerely,

Stantec Consulting Ltd.

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

**Résistance au cisaillement : Méthode
du pénétromètre à cône
NQ 2501-110**

Client : Cree Development Corporation Projet : La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation Endroit : Grevet-Chapais Railway	Dossier : 158100425.500.710.6 Réf. client : Rapport n° : 1 Rév. Page 1 de 7
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ÉCHANTILLONNAGE			
N° d'échantillon : BH22-05	Description de l'échantillon :		
N° d'éch. client :			
Endroit échantillonné :			
N° forage : BH22-05	N° d'éch. : ST-23	Prélevé le :	August 28, 2022
Profondeur : 9.14-9.75 m		Par :	Stantec
		Reçu le :	October 27, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)					
CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input type="checkbox"/> 100g / 30° <input checked="" type="checkbox"/> 400g / 30°					
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N}$ $\bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u1} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2}$ $C_{u2} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ Résistance (Cu) : 27 kPa	
1	12.0 <input checked="" type="checkbox"/>	Contenant n°	20		
2	12.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	16.09		
3	12.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	39.91		
4	12.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	29.64		
5	12.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	75.8		

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu _r)					
CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°					
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau		$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N}$ $\bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u_r} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2}$ $C_{u_r} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ Résistance (Cu_r) : 1.0 kPa
1	13.0	13.0	Contenant n°	20	
2	13.0	13.0	Masse du contenant (g)	16.09	
3	13.0	13.0	Masse du contenant + sol humide (g)	39.91	
<i>Facultatif</i>			Masse du contenant + sol sec (g)	29.64	
<i>Facultatif</i>			Teneur en eau (%)	75.8	
Pénétration moyenne (mm)	13.0 <input checked="" type="checkbox"/>	13.0 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r .		Conforme

REMARQUES
Description: Extremely sensitive silty clay, grey, friable, very wet

Sensibilité (Cu/Cu _r)	
27	Sensibilité au remaniement
	< 2 Insensible
	2 - 4 Sensibilité moyenne
	4 - 8 Sensible
	8 - 16 Très sensible
	> 16 Extrêmement sensible

Préparé par : Denis Rodriguez	Date :
	5-Dec-22

Approuvé par : Daniel Boateng	Date :
	6-Dec-22

Résistance au cisaillement : Méthode du pénétromètre à cône NQ 2501-110

Client : Cree Development Corporation(CDC)
 Projet : **La Grande Alliance - Feasibility Study - Phase I
 Preliminary Geotechnical Investigation**
 Endroit : **Grevet-Chapais Railway**

Dossier : **158100425.500.710.6**
 Réf. client :
 Rapport n° : **1** Rév.
 Page **1** de **2**

ÉCHANTILLONNAGE

N° d'échantillon : BH22-13 Description de l'échantillon :
 N° d'éch. client :
 Endroit :
 échantillonné :
 N° forage : BH22-13 N° d'éch. : ST-07 Prélevé le : August 11, 2022
 Profondeur : 3.66-4.27 m Par : Stantec
 Reçu le : November 23, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input type="checkbox"/> 100g / 30° <input checked="" type="checkbox"/> 400g / 30°					
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N}$ $\bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u1} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2}$ $C_{u2} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ <p style="text-align: center;">Résistance (Cu) : 20 kPa</p>	
1	14.0 <input checked="" type="checkbox"/>	Contenant n°	4		
2	14.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	15.46		
3	14.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	50.68		
4	14.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	36.75		
5	14.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	65.4		

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu_r)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°					
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau		$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N}$ $\bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u_r} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2}$ $C_{u_r} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ <p style="text-align: center;">Résistance (Cu_r) : 3.6 kPa</p>
1	7.0	7.0	Contenant n°	4	
2	7.0	7.0	Masse du contenant (g)	15.46	
3	7.0	7.0	Masse du contenant + sol humide (g)	50.68	
Facultatif			Masse du contenant + sol sec (g)	36.75	
Facultatif			Teneur en eau (%)	65.4	
Pénétration moyenne (mm)	7.0 <input checked="" type="checkbox"/>	7.0 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r .		Conforme

REMARQUES

Description: Sensitive silty clay, grey, wet

Sensibilité (Cu/Cu_r)

		Sensibilité au remaniement	
		6	< 2
	2 - 4	Sensibilité moyenne	
	4 - 8	Sensible	
	8 - 16	Très sensible	
	> 16	Extrêmement sensible	

Préparé par : Denis Rodriguez

Date :

5-Dec-22

Approuvé par : Daniel Boateng

Date :

22-Dec-22

Résistance au cisaillement : Méthode du pénétromètre à cône NQ 2501-110

Client : Cree Development Corporation
 Projet : **La Grande Alliance - Feasibility Study - Phase I
 Preliminary Geotechnical Investigation**
 Endroit : **Grevet-Chapais Railway**

Dossier : 158100425.500.710.6
 Réf. client :
 Rapport n° : 2 Rév.
 Page 2 de 2

ÉCHANTILLONNAGE

N° d'échantillon : BH22-14 Description de l'échantillon :
 N° d'éch. client :
 Endroit :
 échantillonné :
 N° forage : BH22-14 N° d'éch. : ST-12 Prélevé le : August 12, 2022
 Profondeur : 7.62-8.23 m Par : Stantec
 Reçu le : November 23, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input type="checkbox"/> 100g / 30° <input checked="" type="checkbox"/> 400g / 30°					
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N}$ $\bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u1} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2}$ $C_{u2} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ <p>Résistance (Cu) : 11 kPa</p>	
1	19.0 <input checked="" type="checkbox"/>	Contenant n°	19		
2	19.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	15.92		
3	19.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	50.22		
4	19.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	33.83		
5	19.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	91.5		

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu_r)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°					
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau		$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N}$ $\bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u_r} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2}$ $C_{u_r} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ <p>Résistance (Cu_r) : 1.2 kPa</p>
1	12.0	12.0	Contenant n°	19	
2	12.0	12.0	Masse du contenant (g)	15.92	
3	12.0	12.0	Masse du contenant + sol humide (g)	50.22	
Facultatif			Masse du contenant + sol sec (g)	33.83	
Facultatif			Teneur en eau (%)	91.5	
Pénétration moyenne (mm)	12.0 <input checked="" type="checkbox"/>	12.0 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r .		Conforme

REMARQUES

Description: Very sensitive silty clay, grey, wet

Sensibilité (Cu/Cu_r)

		Sensibilité au remaniement	
		9	< 2
	2 - 4	Sensibilité moyenne	
	4 - 8	Sensible	
	8 - 16	Très sensible	
	> 16	Extrêmement sensible	

Préparé par : Denis Rodriguez

Date :

5-Dec-22

Approuvé par : Daniel Boateng

Date :

22-Dec-22

Résistance au cisaillement : Méthode du pénétromètre à cône NQ 2501-110

Client : Cree Development Corporation Projet : La Grande Alliance - Feasibility Study - Phase I Preliminary Geotechnical Investigation Endroit : Grevet-Chapais Railway	Dossier : 158100425.500.710.6 Réf. client : Rapport n° : 2 Rév. Page 2 de 7
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ÉCHANTILLONNAGE			
N° d'échantillon : BH22-17	Description de l'échantillon :		
N° d'éch. client :			
Endroit échantillonné :			
N° forage : BH22-17	N° d'éch. : ST-07	Prélevé le :	August 14, 2022
Profondeur : 3.81-4.42 m		Par :	Stantec
		Reçu le :	October 27, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)					
CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input type="checkbox"/> 100g / 30° <input checked="" type="checkbox"/> 400g / 30°					
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N}$ $\bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u1} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2}$ $C_{u2} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ <p style="text-align: center;">Résistance (Cu) : 20 kPa</p>	
1	14.0 <input checked="" type="checkbox"/>	Contenant n°	39		
2	14.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	16.07		
3	14.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	55.64		
4	14.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	42.78		
5	14.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	48.1		

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu _r)					
CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°					
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau		$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N}$ $\bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u_r} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2}$ $C_{u_r} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ <p style="text-align: center;">Résistance (Cu_r) : 0.5 kPa</p>
1	19.0	19.0	Contenant n°	39	
2	18.0	18.0	Masse du contenant (g)	16.07	
3	18.0	18.0	Masse du contenant + sol humide (g)	55.64	
<i>Facultatif</i>			Masse du contenant + sol sec (g)	42.78	
<i>Facultatif</i>			Teneur en eau (%)	48.1	
Pénétration moyenne (mm)	18.3 <input checked="" type="checkbox"/>	18.3 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r .		Conforme

REMARQUES
Description: Extremely sensitive silty clay, grey, very moist

Sensibilité (Cu/Cu _r)		
40	Sensibilité au remaniement	
	< 2	Insensible
	2 - 4	Sensibilité moyenne
	4 - 8	Sensible
	8 - 16	Très sensible
	> 16	Extrêmement sensible

Préparé par : Denis Rodriguez	Date :
	5-Dec-22

Approuvé par : Daniel Boateng	Date :
	6-Dec-22

**Résistance au cisaillement : Méthode
du pénétromètre à cône
NQ 2501-110**

Client : Cree Development Corporation
Projet : La Grande Alliance - Feasibility Study - Phase I
Preliminary Geotechnical Investigation

Endroit : Grevet-Chapais Railway

Dossier : 158100425.500.710.6

Réf. client :

Rapport n° : 3 Rév. :
Page 3 de 7

ÉCHANTILLONNAGE

N° d'échantillon : BH22-21	Description de l'échantillon :
N° d'éch. client :	
Endroit échantillonné :	
N° forage : BH22-21	N° d'éch. : ST-15
Profondeur : 4.27-4.88 m	Prélevé le : September 1, 2022
	Par : Stantec
	Reçu le : October 27, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input type="checkbox"/> 100g / 30° <input checked="" type="checkbox"/> 400g / 30°					
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N}$ $\bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u100} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2}$ $C_{u400} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ <p>Résistance (Cu) : 17 kPa</p>	
1	15.0 <input checked="" type="checkbox"/>	Contenant n°	12		
2	15.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	123.92		
3	15.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	224.79		
4	15.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	179.71		
5	15.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	80.8		

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu_r)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°					
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau		$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N}$ $\bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u60} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2}$ $C_{u10} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ <p>Résistance (Cu_r) : 2.2 kPa</p>
1	9.0	9.0	Contenant n°	12	
2	9.0	9.0	Masse du contenant (g)	123.92	
3	9.0	9.0	Masse du contenant + sol humide (g)	224.79	
Facultatif			Masse du contenant + sol sec (g)	179.71	
Facultatif			Teneur en eau (%)	80.8	
Pénétration moyenne (mm)	9.0 <input checked="" type="checkbox"/>	9.0 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r .		Conforme

REMARQUES

Description: Sensitive silty clay, grey, very wet

Sensibilité (Cu/Cu_r)

		Sensibilité au remaniement	
		8	< 2
2 - 4	Sensibilité moyenne		
4 - 8	Sensible		
8 - 16	Très sensible		
> 16	Extrêmement sensible		

Préparé par : Denis Rodriguez

Date :

5-Dec-22

Approuvé par : Daniel Boateng

Date :

6-Dec-22

**Résistance au cisaillement : Méthode
du pénétromètre à cône
NQ 2501-110**

Client : Cree Development Corporation
Projet : La Grande Alliance - Feasibility Study - Phase I
Preliminary Geotechnical Investigation

Dossier : 158100425.500.710.6

Réf. client :

Endroit : Grevet-Chapais Railway

Rapport n° : 4 **Rév.**
Page 4 de 7

ÉCHANTILLONNAGE

N° d'échantillon : BH22-28	Description de l'échantillon :
N° d'éch. client :	
Endroit échantillonné :	Prélevé le : September 3, 2022
N° forage : BH22-28 N° d'éch. : ST-10	Par : Stantec
Profondeur : 5.49-6.10 m	Reçu le : October 27, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)

CÔNE utilisé		Appareil n°		Cône n°		Balance n°		
<input checked="" type="checkbox"/> 100g / 30° <input type="checkbox"/> 400g / 30°								
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N}$ $\bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u1} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2}$ $C_{u2} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ <p style="text-align: center;">Résistance (Cu) : 8 kPa</p>				
1	11.0 <input checked="" type="checkbox"/>	Contenant n°	14					
2	11.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	61.69					
3	11.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	268.00					
4	11.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	188.32					
5	11.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	62.9					

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu_r)

CÔNE utilisé		Appareil n°		Cône n°		Balance n°			
<input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°									
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau		$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N}$ $\bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u_r} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2}$ $C_{u_r} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ <p style="text-align: center;">Résistance (Cu_r) : 1.2 kPa</p>				
1	12.0	12.0	Contenant n°	14					
2	12.0	12.0	Masse du contenant (g)	61.69					
3	12.0	12.0	Masse du contenant + sol humide (g)	268.00					
<i>Facultatif</i>			Masse du contenant + sol sec (g)	188.32					
<i>Facultatif</i>			Teneur en eau (%)	62.9					
Pénétration moyenne (mm)	12.0 <input checked="" type="checkbox"/>	12.0 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r .			Conforme			

REMARQUES

Description: Sensitive silty clay, grey, wet

Sensibilité (Cu/Cu_r)

		Sensibilité au remaniement		
		7	< 2	Insensible
		2 - 4	Sensibilité moyenne	
		4 - 8	Sensible	
		8 - 16	Très sensible	
		> 16	Extrêmement sensible	

Préparé par : Denis Rodriguez

Date :

5-Dec-22

Approuvé par : Daniel Boateng

Date :

6-Dec-22

**Résistance au cisaillement : Méthode
du pénétromètre à cône
NQ 2501-110**

Client : Cree Development Corporation
Projet : La Grande Alliance - Feasibility Study - Phase I
Preliminary Geotechnical Investigation

Endroit : Grevet-Chapais Railway

Dossier : 158100425.500.710.6

Réf. client :

Rapport n° : 5 **Rév.**

Page 5 de 7

ÉCHANTILLONNAGE

N° d'échantillon : BH22-30	Description de l'échantillon :
N° d'éch. client :	
Endroit échantillonné :	Prélevé le : September 2, 2022
N° forage : BH22-30 N° d'éch. : ST-15	Par : Stantec
Profondeur : 9.75-10.36 m	Reçu le : October 27, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input type="checkbox"/> 100g / 30° <input checked="" type="checkbox"/> 400g / 30°					
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N}$ $\bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u1} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2}$ $C_{u2} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ <p style="text-align: center;">Résistance (Cu) : 48 kPa</p>	
1	9.0 <input checked="" type="checkbox"/>	Contenant n°	1		
2	9.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	16.08		
3	9.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	51.10		
4	9.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	43.89		
5	9.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	25.9		

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu_r)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°					
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau		$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N}$ $\bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u_r} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2}$ $C_{u_r} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ <p style="text-align: center;">Résistance (Cu_r) : 3.6 kPa</p>
1	7.0	7.0	Contenant n°	1	
2	7.0	7.0	Masse du contenant (g)	16.08	
3	7.0	7.0	Masse du contenant + sol humide (g)	51.10	
<i>Facultatif</i>			Masse du contenant + sol sec (g)	43.89	
<i>Facultatif</i>			Teneur en eau (%)	25.9	
Pénétration moyenne (mm)	7.0 <input checked="" type="checkbox"/>	7.0 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r .		Conforme

REMARQUES

Description: Very sensitive silt and clay, grey, very moist

Sensibilité (Cu/Cu_r)

13	Sensibilité au remaniement	
	< 2	Insensible
	2 - 4	Sensibilité moyenne
	4 - 8	Sensible
	8 - 16	Très sensible
	> 16	Extrêmement sensible

Préparé par : Denis Rodriguez

Date :

5-Dec-22

Approuvé par : Daniel Boateng

Date :

6-Dec-22

**Résistance au cisaillement : Méthode
du pénétromètre à cône
NQ 2501-110**

Client : Cree Development Corporation
Projet : La Grande Alliance - Feasibility Study - Phase I
Preliminary Geotechnical Investigation

Dossier : 158100425.500.710.6

Réf. client :

Endroit : Grevet-Chapais Railway

Rapport n° : 6 Rév.

Page 6 de 7

ÉCHANTILLONNAGE

N° d'échantillon : BH22-32	Description de l'échantillon :
N° d'éch. client :	
Endroit échantillonné :	Prélevé le : September 2, 2022
N° forage : BH22-32 N° d'éch. : ST-16	Par : Stantec
Profondeur : 9.61-10.52 m	Reçu le : October 27, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input type="checkbox"/> 100g / 30° <input checked="" type="checkbox"/> 400g / 30°					
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N}$ $\bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u1} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2}$ $C_{u2} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ <p>Résistance (Cu) : 48 kPa</p>	
1	9.0 <input checked="" type="checkbox"/>	Contenant n°	13		
2	9.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	61.85		
3	9.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	129.96		
4	9.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	111.89		
5	9.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	36.1		

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu_r)

CÔNE utilisé		Appareil n°		Cône n°	Balance n°
<input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°					
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau		$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N}$ $\bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u_r} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2}$ $C_{u_r} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ <p>Résistance (Cu_r) : 7.1 kPa</p>
1	5.0	5.0	Contenant n°	13	
2	5.0	5.0	Masse du contenant (g)	61.85	
3	5.0	5.0	Masse du contenant + sol humide (g)	129.96	
Facultatif			Masse du contenant + sol sec (g)	111.89	
Facultatif			Teneur en eau (%)	36.1	
Pénétration moyenne (mm)	5.0 <input checked="" type="checkbox"/>	5.0 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r .		Conforme

REMARQUES

Description: Sensitive silty clay, grey to dark grey, friable, moist

Sensibilité (Cu/Cu_r)

		Sensibilité au remaniement	
7	< 2	Insensible	
	2 - 4	Sensibilité moyenne	
	4 - 8	Sensible	
	8 - 16	Très sensible	
	> 16	Extrêmement sensible	

Préparé par : Denis Rodriguez

Date :

5-Dec-22

Approuvé par : Daniel Boateng

Date :

6-Dec-22

**Résistance au cisaillement : Méthode
du pénétromètre à cône
NQ 2501-110**

Client : Cree Development Corporation
Projet : La Grande Alliance - Feasibility Study - Phase I
Preliminary Geotechnical Investigation

Dossier : 158100425.500.710.6
Réf. client :

Endroit : Grevet-Chapais Railway

Rapport n° : 7 **Rév.**
Page 7 de 7

ÉCHANTILLONNAGE

N° d'échantillon : BH22-33	Description de l'échantillon :
N° d'éch. client :	
Endroit échantillonné :	Prélevé le : August 28, 2022
N° forage : BH22-33 N° d'éch. : ST-16	Par : Stantec
Profondeur : 12.95-13.56 m	Reçu le : October 27, 2022

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT INTACT (Cu)

CÔNE utilisé <input type="checkbox"/> 100g / 30° <input checked="" type="checkbox"/> 400g / 30°		Appareil n°	Cône n°	Balance n°
Essai n°	Lectures (mm)	Teneur en eau		$\bar{P}_{100}^2 = \frac{\sum P_{100}^2}{N} \quad \bar{P}_{400}^2 = \frac{\sum P_{400}^2}{N}$ $C_{u100} = \frac{g K_{30} m_{100}}{\bar{P}_{100}^2} \quad C_{u400} = \frac{g K_{30} m_{400}}{\bar{P}_{400}^2}$ $g = 9,8 \quad K_{30} = 1,0$ <p style="text-align: center;">Résistance (Cu) : 61 kPa</p>
1	8.0 <input checked="" type="checkbox"/>	Contenant n°	25	
2	8.0 <input checked="" type="checkbox"/>	Masse du contenant (g)	15.36	
3	8.0 <input checked="" type="checkbox"/>	Masse du contenant + sol humide (g)	59.72	
4	8.0 <input checked="" type="checkbox"/>	Masse du contenant + sol sec (g)	49.86	
5	8.0 <input checked="" type="checkbox"/>	Teneur en eau (%)	28.6	

RÉSISTANCE AU CISAILLEMENT À L'ÉTAT REMANIÉ (Cu_r)

CÔNE utilisé <input checked="" type="checkbox"/> 60g / 60° <input type="checkbox"/> 10g / 60°		Appareil n°	Cône n°	Balance n°	
Essai n°	Lectures série 1 (mm)	Lectures série 2 (mm)	Teneur en eau	$\bar{P}_{60}^2 = \frac{\sum P_{60}^2}{N} \quad \bar{P}_{10}^2 = \frac{\sum P_{10}^2}{N}$ $C_{u60} = \frac{g K_{60} m_{60}}{\bar{P}_{60}^2} \quad C_{u10} = \frac{g K_{60} m_{10}}{\bar{P}_{10}^2}$ $g = 9,8 \quad K_{60} = 0,3$ <p style="text-align: center;">Résistance (Cu_r) : 2.2 kPa</p>	
1	9.0	9.0	Contenant n°		25
2	9.0	9.0	Masse du contenant (g)		15.36
3	9.0	9.0	Masse du contenant + sol humide (g)		59.72
<i>Facultatif</i>			Masse du contenant + sol sec (g)		49.86
<i>Facultatif</i>			Teneur en eau (%)		28.6
Pénétration moyenne (mm)	9.0 <input checked="" type="checkbox"/>	9.0 <input type="checkbox"/>	L'écart entre les 2 pénétrations moyennes doit être ≤ 0,3 mm : La valeur la plus élevée doit être retenue pour le calcul du Cu _r . <i>Conforme</i>		

REMARQUES

Description: Extremely sensitive silty clay, grey, varved, moist

Sensibilité (Cu/Cu_r)

28	Sensibilité au remaniement	
	< 2	Insensible
	2 - 4	Sensibilité moyenne
	4 - 8	Sensible
	8 - 16	Très sensible
	> 16	Extrêmement sensible

Préparé par : Denis Rodriguez

Date :

5-Dec-22

Approuvé par : Daniel Boateng

Date :

6-Dec-22

Project

La Grande Alliance - Feasibility Study - Phase I

Project No.

158100425.500.710.6

Borehole No.

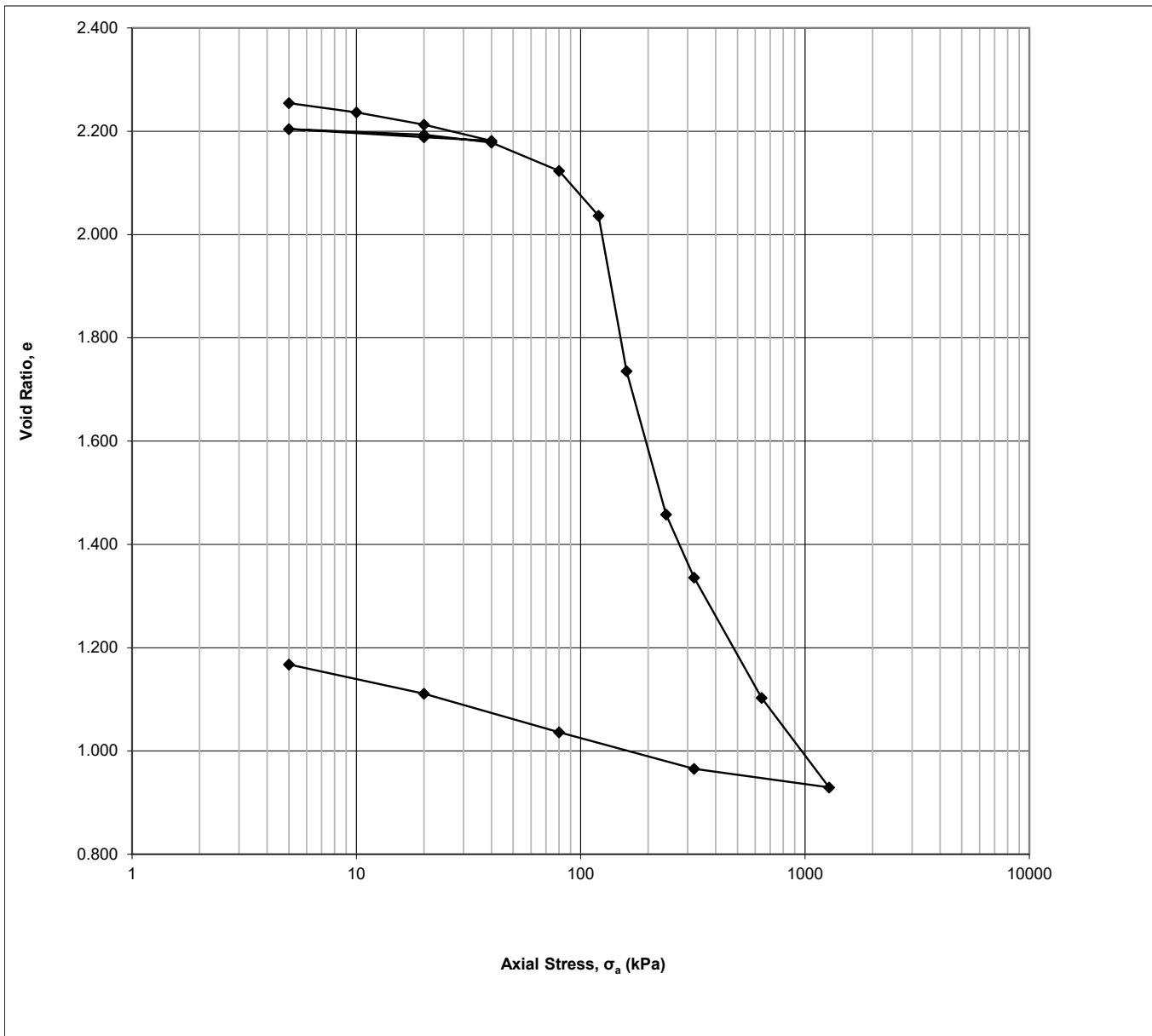
BH22-05

Sample No.

ST-23

Sample Depth

9.14-9.45 m.





One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

November 29, 2022
November 29, 2022

Date: Date:
D. Boateng R. Ghassemi

Checked by: Approved by:

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-05
Sample No.	ST-23
Depth	9.14-9.45 m.
Sample Date	August 28, 2022
Test Number	One
Technician Name	Daniel Boateng

Soil Description & Classification

<i>Silty clay, grey, friable, very wet</i>	
Specific Gravity of Solids	2.750
Average water content of trimmings %	78.19
Additional Notes (information source, occurrence and size of large isolated particles etc.)	
<i>Specific Gravity of Solids was Assumed</i>	

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm ²	1963
Volume	mm ³	39270
Mass	g	59.87
Dry Mass	g	32.72
Density	Mg/m ³	1.525
Dry Density	Mg/m ³	0.833
Water Content	%	82.98
Degree of Saturation	%	99.2
Height of Solids	mm	6.06
Initial Void Ratio		2.300

Final Specimen Conditions

Water Content	%	47.10
Final Void Ratio		1.167
Final Height	mm	13.13



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-05
Sample No.	ST-23
Depth	9.14-9.45 m.
Sample Date	August 28, 2022
Test Number	One
Technician Name	Daniel Boateng

Test Procedure

Date Started	November 17, 2022
Date Finished	November 18, 2022
Machine Number	Frame C
Cell Number	C
Ring Number	C
Trimming Procedure	Cutting ring/Trimming turntable
Moisture Condition	Inundated
Axial Stress at Inundation	5 kPa
Water Used	De-aired Tap Water
Test Method	B
Interpretation Procedure for c_v	2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

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Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ϵ_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	2.300
1	20.0	5	0.2748	19.7252	1.40	2.254
2	21.5	10	0.3790	19.6210	1.95	2.236
3	21.5	20	0.5195	19.4805	2.66	2.213
4	29.8	40	0.6975	19.3025	3.61	2.181
5	20.0	20	0.6781	19.3219	3.39	2.189
6	21.5	5	0.5847	19.4153	2.92	2.204
7	20.0	20	0.6475	19.3525	3.25	2.193
8	20.0	40	0.7310	19.2690	3.71	2.178
9	58.3	80	0.9841	19.0159	5.37	2.123
10	126.8	120	1.3974	18.6026	8.00	2.036
11	519.5	160	3.4204	16.5796	17.13	1.735
12	194.0	240	5.1026	14.8974	25.53	1.458
13	147.0	320	5.8203	14.1797	29.23	1.336
14	118.5	640	7.0413	12.9587	36.29	1.103
15	95.0	1280	8.1300	11.8700	41.54	0.929
16	28.8	320	8.0831	11.9169	40.45	0.965
17	62.8	80	7.6590	12.3410	38.31	1.036
18	100.3	20	7.2134	12.7866	36.04	1.111
19	136.3	5	7.2051	12.7949	34.33	1.167

November 29, 2022
November 29, 2022

Date: Date:
D. Boateng R. Ghassemi

Checked by: Approved by:

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Date: November 29, 2022

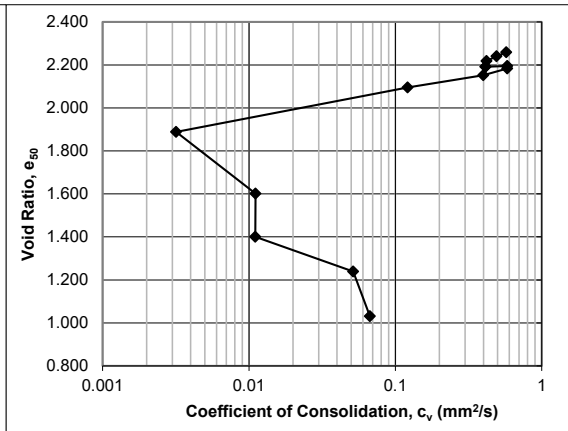
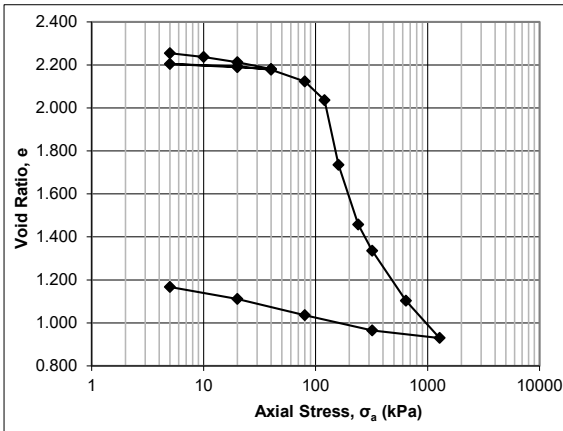
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Job Location	Grevet-Chapais Railway
Borehole	BH22-05
Sample No.	ST-23
Depth	9.14-9.45 m.
Sample Date	August 28, 2022
Test Number	One
Technician Name	Daniel Boateng

Calculations

Load Increment	Axial Stress σ_a , average kPa	Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
		Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\epsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm ² /s	Time t_{90} sec	Coeff. Consol. c_v mm ² /s
Seating	0								
1	3	0.2532	19.7468	1.27	2.259			144	5.74E-01
2	8	0.3630	19.6370	1.82	2.241			166	4.92E-01
3	15	0.4966	19.5034	2.48	2.219			192	4.20E-01
4	30	0.6603	19.3397	3.30	2.192			192	4.13E-01
5	30	0.6871	19.3129	3.44	2.187				
6	13	0.6102	19.3898	3.05	2.200				
7	13	0.6363	19.3637	3.18	2.195			137	5.81E-01
8	30	0.7129	19.2871	3.56	2.183			135	5.82E-01
9	60	0.8995	19.1005	4.50	2.152			194	3.99E-01
10	100	1.2460	18.7540	6.23	2.095			614	1.21E-01
11	140	2.4969	17.5031	12.48	1.888			20416	3.18E-03
12	200	4.2339	15.7661	21.17	1.602			4756	1.11E-02
13	280	5.4560	14.5440	27.28	1.400			4052	1.11E-02
14	480	6.4346	13.5654	32.17	1.239			758	5.15E-02
15	960	7.6940	12.3060	38.47	1.031			479	6.70E-02
16	800	8.1698	11.8302	40.85	0.952				
17	200	7.8629	12.1371	39.31	1.003				
18	50	7.4340	12.5660	37.17	1.074				
19	13	7.2066	12.7934	36.03	1.111				



November 29, 2022
November 29, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

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November 29, 2022

Filename:
Date:



Project No.: 158100425.500.710.6

Project Name: La Grande Alliance - Feasibility Study
Phase I - Preliminary Geotechnical Investigation

Photo Log

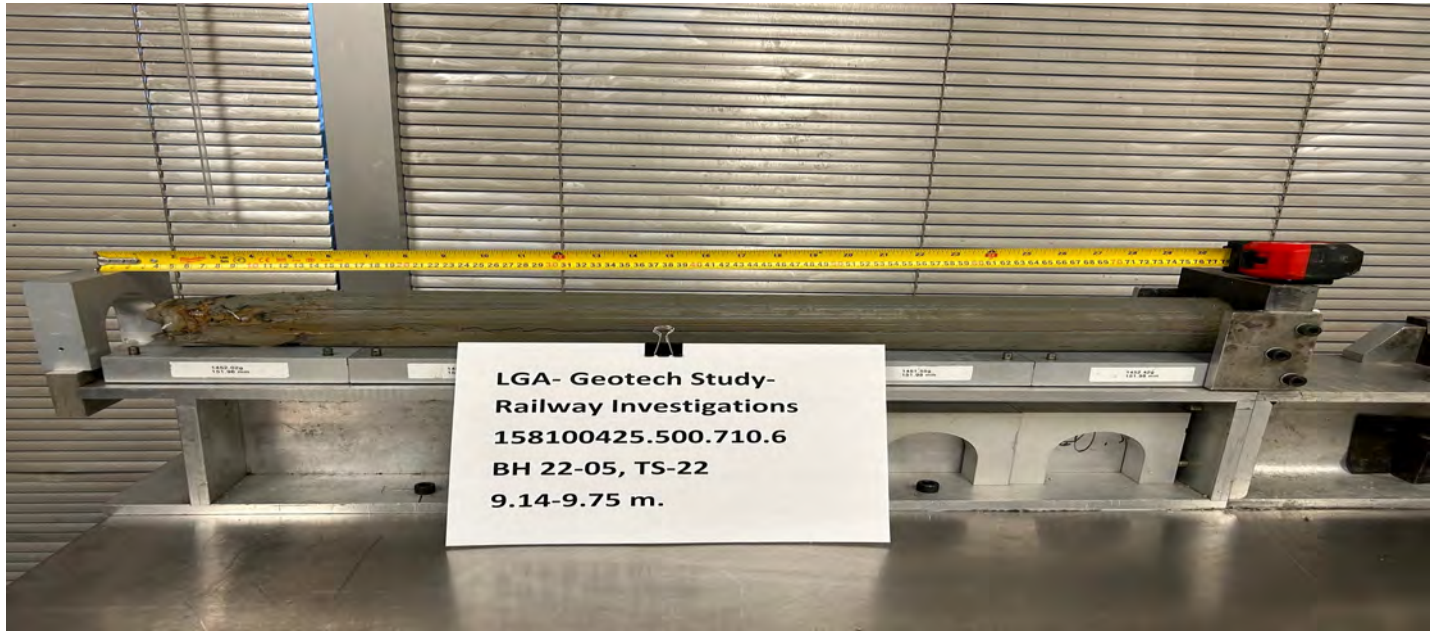


Photo No.:

1

Borehole: BH22-05 ST-23

Depth: 9.14-9.75 m

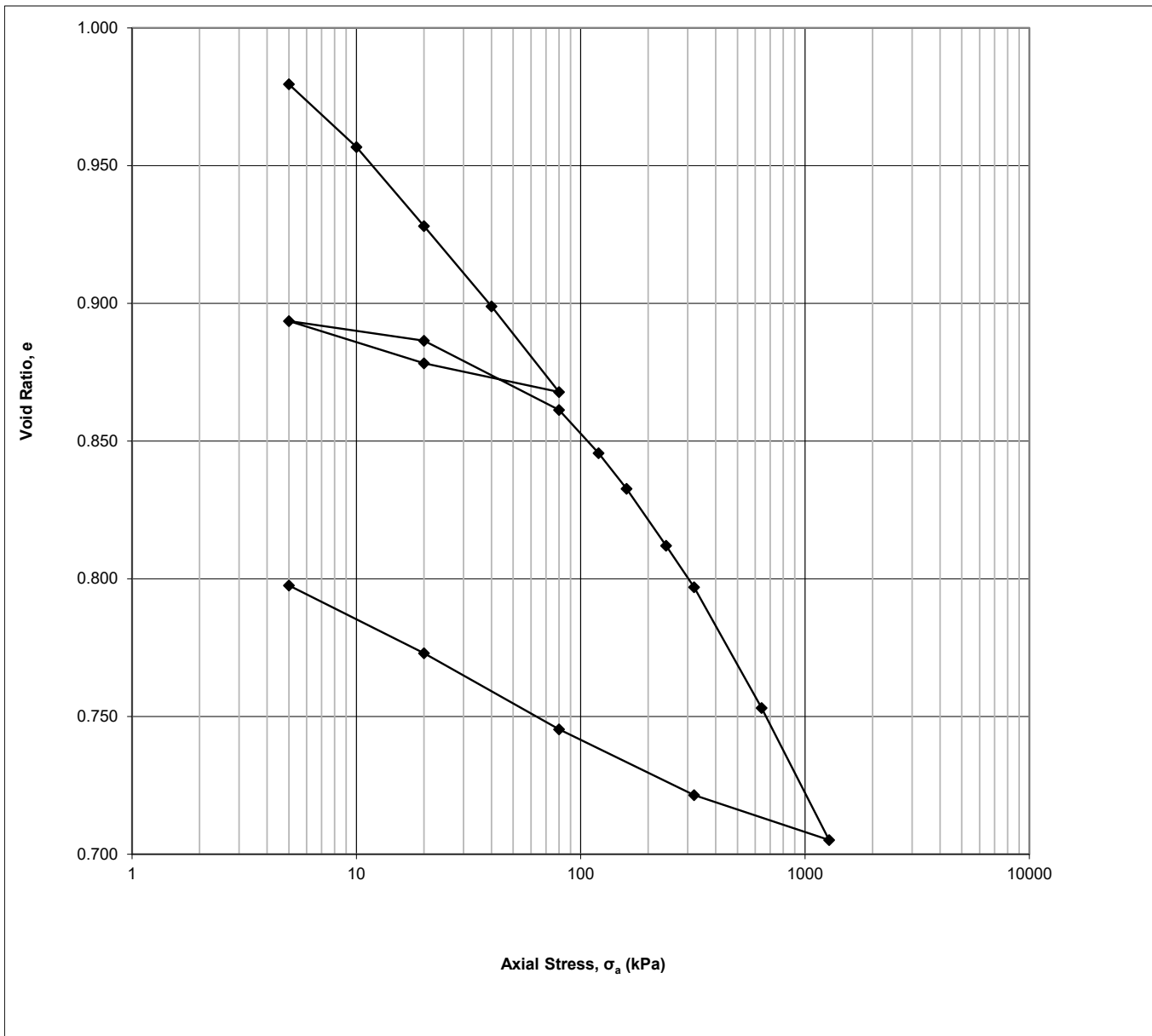


Photo No.:

2

Borehole: BH22-05 ST-23

Depth: 9.14-9.75 m

Project**La Grande Alliance - Feasibility Study - Phase I****Project No.****158100425.500.710.6****Borehole No.****BH22-10****Sample No.****ST-12****Sample Depth****4.75-5.18 m.**



One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

November 29, 2022
November 29, 2022

Date: Date:
D. Boateng R. Ghassemi

Checked by: Approved by:

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-10
Sample No.	ST-12
Depth	4.75-5.18 m.
Sample Date	August 25, 2022
Test Number	Two
Technician Name	Daniel Boateng

Soil Description & Classification

<i>Silty clay with root mat and gravel, dark grey, moist</i>	
Specific Gravity of Solids	2.750
Average water content of trimmings %	36.82
Additional Notes (information source, occurrence and size of large isolated particles etc.)	
1. Specific Gravity of Solids was Assumed, 2. Sample appears disturbed, 3. Very poor recovery	

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm ²	1963
Volume	mm ³	39270
Mass	g	73.49
Dry Mass	g	53.97
Density	Mg/m ³	1.871
Dry Density	Mg/m ³	1.374
Water Content	%	36.17
Degree of Saturation	%	99.4
Height of Solids	mm	10.00
Initial Void Ratio		1.001

Final Specimen Conditions

Water Content	%	30.02
Final Void Ratio		0.798
Final Height	mm	17.97



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-10
Sample No.	ST-12
Depth	4.75-5.18 m.
Sample Date	August 25, 2022
Test Number	Two
Technician Name	Daniel Boateng

Test Procedure

Date Started	November 17, 2022
Date Finished	November 18, 2022
Machine Number	Frame D
Cell Number	D
Ring Number	D
Trimming Procedure	Cutting ring/Trimming turntable
Moisture Condition	Inundated
Axial Stress at Inundation	5 kPa
Water Used	De-aired Tap Water
Test Method	B
Interpretation Procedure for c_v	2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

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Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ϵ_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	1.001
1	53.0	5	0.1737	19.8263	1.07	0.980
2	83.0	10	0.2585	19.7415	2.21	0.957
3	99.8	20	0.7495	19.2505	3.64	0.928
4	81.5	40	0.9758	19.0242	5.10	0.899
5	63.3	80	1.3067	18.6933	6.65	0.868
6	30.0	20	1.2291	18.7709	6.13	0.878
7	53.5	5	1.0657	18.9343	5.37	0.894
8	30.0	20	1.1359	18.8641	5.72	0.886
9	50.0	80	1.3702	18.6298	6.98	0.861
10	51.8	120	1.5327	18.4673	7.76	0.846
11	45.3	160	1.6719	18.3281	8.41	0.833
12	46.8	240	1.8586	18.1414	9.44	0.812
13	43.5	320	2.0258	17.9742	10.20	0.797
14	48.5	640	2.4270	17.5730	12.39	0.753
15	47.0	1280	2.9070	17.0930	14.78	0.705
16	25.0	320	2.7891	17.2109	13.97	0.722
17	43.5	80	2.5565	17.4435	12.77	0.745
18	80.8	20	2.2807	17.7193	11.39	0.773
19	108.0	5	2.2661	17.7339	10.16	0.798

November 29, 2022
November 29, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

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Filename:
Date:

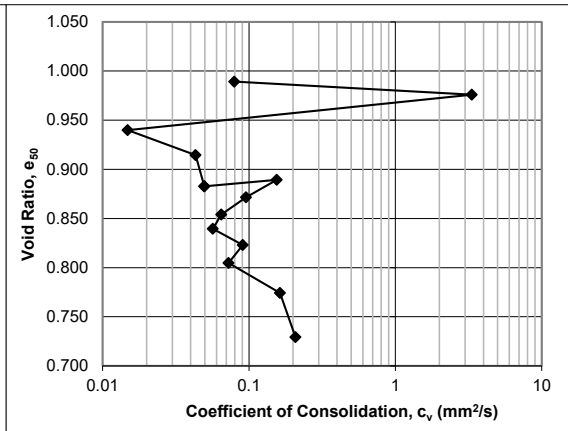
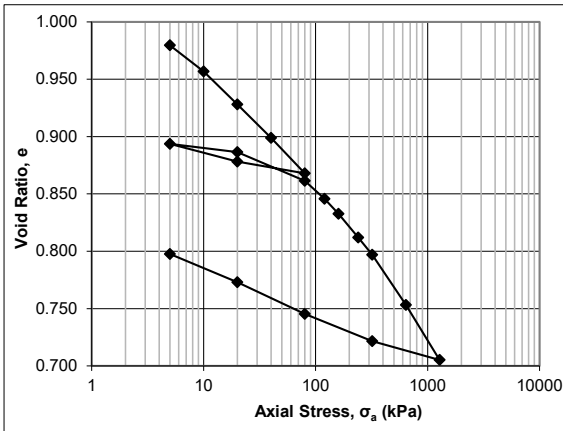
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Job Location	Grevet-Chapais Railway
Borehole	BH22-10
Sample No.	ST-12
Depth	4.75-5.18 m.
Sample Date	August 25, 2022
Test Number	Two
Technician Name	Daniel Boateng

Calculations

Load Increment	Axial Stress σ_a , average kPa	Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
		Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\epsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm ² /s	Time t_{90} sec	Coeff. Consol. c_v mm ² /s
Seating	0								
1	3	0.1167	19.8833	0.58	0.989			1056	7.93E-02
2	8	0.2511	19.7489	1.26	0.976			25	3.34E+00
3	15	0.6117	19.3883	3.06	0.940			5362	1.49E-02
4	30	0.8643	19.1357	4.32	0.914			1797	4.32E-02
5	60	1.1814	18.8186	5.91	0.883			1516	4.95E-02
6	50	1.2630	18.7370	6.32	0.875				
7	13	1.1364	18.8636	5.68	0.887				
8	13	1.1151	18.8849	5.58	0.889			488	1.55E-01
9	50	1.2933	18.7067	6.47	0.872			777	9.55E-02
10	100	1.4689	18.5311	7.34	0.854			1126	6.47E-02
11	140	1.6143	18.3857	8.07	0.839			1264	5.67E-02
12	200	1.7784	18.2216	8.89	0.823			776	9.07E-02
13	280	1.9617	18.0383	9.81	0.805			951	7.25E-02
14	480	2.2653	17.7347	11.33	0.774			410	1.63E-01
15	960	2.7165	17.2835	13.58	0.729			305	2.08E-01
16	800	2.8390	17.1610	14.19	0.717				
17	200	2.6553	17.3447	13.28	0.735				
18	50	2.4125	17.5875	12.06	0.760				
19	13	2.2703	17.7297	11.35	0.774				



November 29, 2022
November 29, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

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November 29, 2022

Filename:
Date:



Project No.: 158100425.500.710.6

Project Name: La Grande Alliance - Feasibility Study
Phase I - Preliminary Geotechnical Investigation

Photo Log

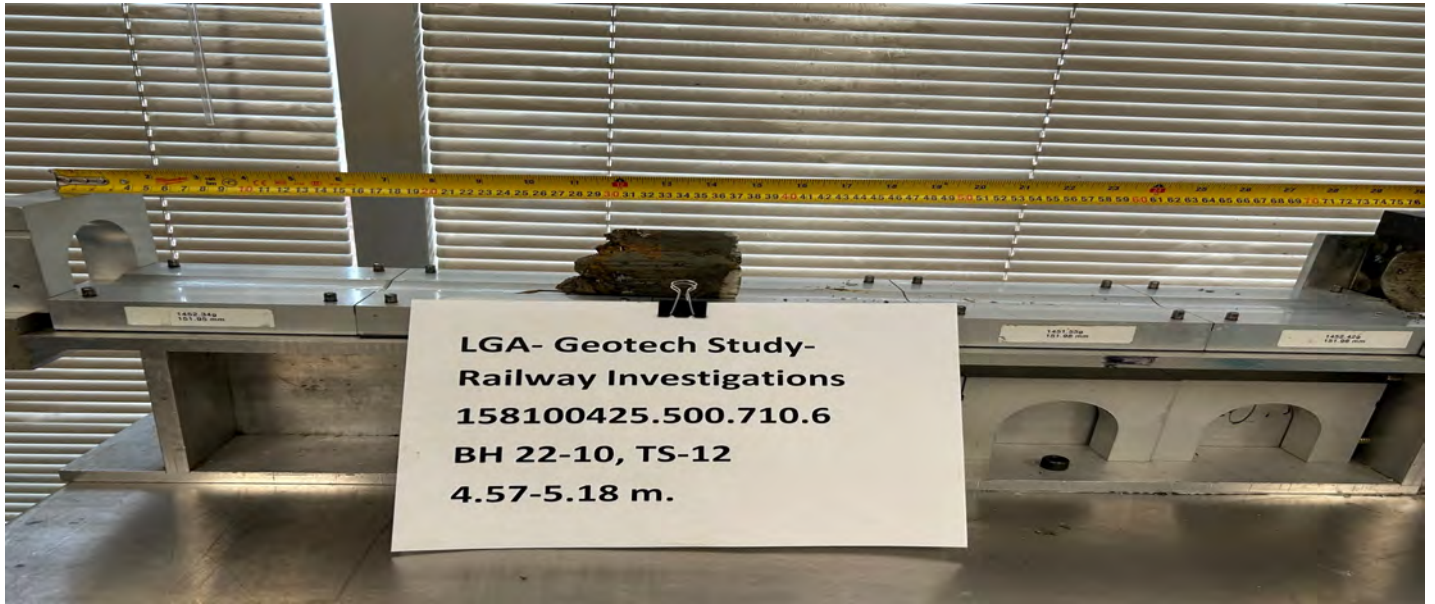


Photo No.:

1

Borehole: BH22-10 ST-12

Depth: 4.57-5.18 m



Photo No.:

2

Borehole: BH22-10 ST-12

Depth: 4.57-5.18 m

Project

La Grande Alliance - Feasibility Study - Phase I

Project No.

158100425.500.710.6

Borehole No.

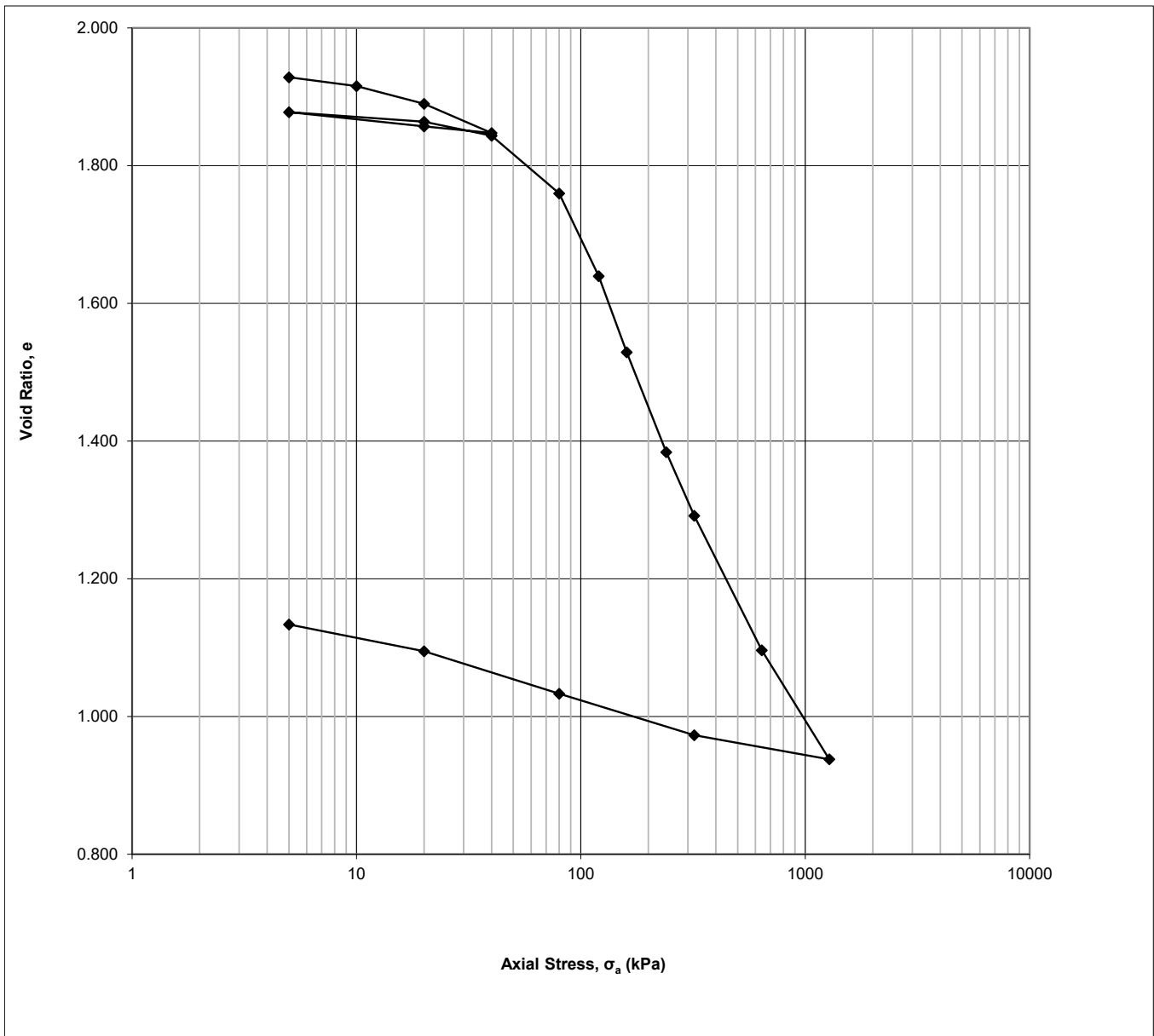
BH22-13

Sample No.

ST-07

Sample Depth

3.66-4.27 m.





One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

December 15, 2022
December 15, 2022

Date: Date:
D. Boateng R. Ghassemi

Checked by: Approved by:

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-13
Sample No.	ST-07
Depth	3.66-4.27 m.
Sample Date	August 11, 2022
Test Number	Seven
Technician Name	Daniel Boateng

Soil Description & Classification

<i>Silty clay, grey, wet</i>	
Specific Gravity of Solids	2.750
Average water content of trimmings %	65.52
Additional Notes (information source, occurrence and size of large isolated particles etc.)	
<i>Specific Gravity of Solids was Assumed</i>	

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm ²	1963
Volume	mm ³	39270
Mass	g	61.98
Dry Mass	g	36.74
Density	Mg/m ³	1.578
Dry Density	Mg/m ³	0.936
Water Content	%	68.70
Degree of Saturation	%	97.4
Height of Solids	mm	6.80
Initial Void Ratio		1.939

Final Specimen Conditions

Water Content	%	42.71
Final Void Ratio		1.134
Final Height	mm	14.52



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-13
Sample No.	ST-07
Depth	3.66-4.27 m.
Sample Date	August 11, 2022
Test Number	Seven
Technician Name	Daniel Boateng

Test Procedure

Date Started	December 5, 2022
Date Finished	December 6, 2022
Machine Number	Frame D
Cell Number	D
Ring Number	D
Trimming Procedure	Cutting ring/Trimming turntable
Moisture Condition	Inundated
Axial Stress at Inundation	5 kPa
Water Used	De-aired Tap Water
Test Method	B
Interpretation Procedure for c_v	2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

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Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ϵ_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	1.939
1	23.3	5	0.0650	19.9350	0.37	1.928
2	28.3	10	0.1444	19.8556	0.82	1.915
3	35.0	20	0.3030	19.6970	1.68	1.890
4	48.0	40	0.5734	19.4266	3.13	1.847
5	21.5	20	0.5601	19.4399	2.80	1.857
6	31.5	5	0.4214	19.5786	2.10	1.878
7	23.3	20	0.5069	19.4931	2.57	1.864
8	30.0	40	0.6284	19.3716	3.27	1.843
9	98.5	80	1.0562	18.9438	6.11	1.760
10	167.5	120	1.9508	18.0492	10.20	1.639
11	166.3	160	2.7753	17.2247	13.96	1.529
12	141.3	240	3.7589	16.2411	18.89	1.384
13	138.3	320	4.3889	15.6111	22.03	1.292
14	113.0	640	5.5531	14.4469	28.69	1.096
15	94.5	1280	6.6330	13.3670	34.07	0.938
16	28.5	320	6.5666	13.4334	32.87	0.973
17	54.0	80	6.1650	13.8350	30.83	1.033
18	105.0	20	5.7538	14.2462	28.73	1.095
19	105.3	5	5.7378	14.2622	27.41	1.134

December 15, 2022
December 15, 2022

Date:
Date:
D. Boateng
R. Ghassemi

Checked by:
Approved by:

Filename: V:\01216\active\other_pc_projects\158100425-500.710.6\Grevet-Chapais-Lab reques
Date: December 15, 2022



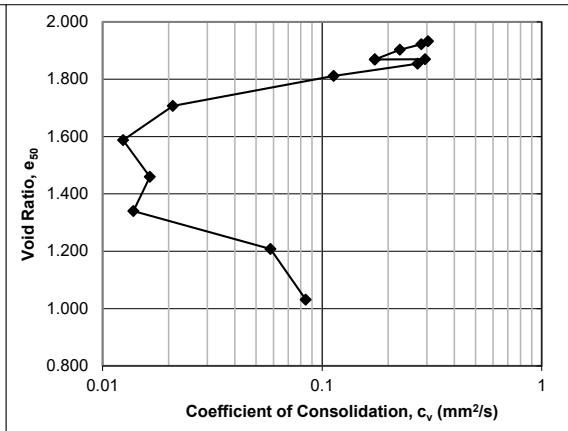
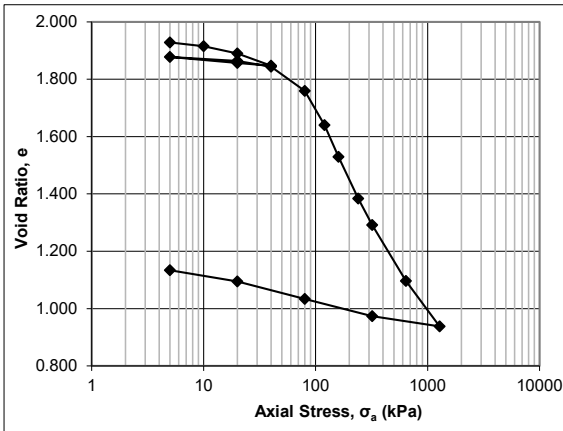
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Job Location	Grevet-Chapais Railway
Borehole	BH22-13
Sample No.	ST-07
Depth	3.66-4.27 m.
Sample Date	August 11, 2022
Test Number	Seven
Technician Name	Daniel Boateng

Calculations

Load Increment	Axial Stress σ_a , average kPa	Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
		Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\epsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm ² /s	Time t_{90} sec	Coeff. Consol. c_v mm ² /s
Seating	0								
1	3	0.0466	19.9534	0.23	1.933			278	3.03E-01
2	8	0.1191	19.8809	0.60	1.922			296	2.83E-01
3	15	0.2505	19.7495	1.25	1.903			366	2.26E-01
4	30	0.4773	19.5227	2.39	1.869			464	1.74E-01
5	30	0.5858	19.4142	2.93	1.853				
6	13	0.4804	19.5196	2.40	1.869				
7	13	0.4737	19.5263	2.37	1.870			275	2.94E-01
8	30	0.5813	19.4187	2.91	1.854			294	2.72E-01
9	60	0.8676	19.1324	4.34	1.812			688	1.13E-01
10	100	1.5792	18.4208	7.90	1.707			3438	2.09E-02
11	140	2.3909	17.6091	11.95	1.588			5302	1.24E-02
12	200	3.2648	16.7352	16.32	1.460			3614	1.64E-02
13	280	4.0763	15.9237	20.38	1.340			3887	1.38E-02
14	480	4.9801	15.0199	24.90	1.207			822	5.82E-02
15	960	6.1784	13.8216	30.89	1.031			481	8.42E-02
16	800	6.6650	13.3350	33.32	0.960				
17	200	6.3576	13.6424	31.79	1.005				
18	50	5.9535	14.0465	29.77	1.064				
19	13	5.7409	14.2591	28.70	1.096				



December 15, 2022
December 15, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

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December 15, 2022

Filename:
Date:



Project No.: 158100425.500.710.6

Project Name: La Grande Alliance - Feasibility Study
Phase I - Preliminary Geotechnical Investigation

Photo Log



Photo No.:

1

Borehole: BH22-13 ST-07

Depth: 3.66-4.27 m

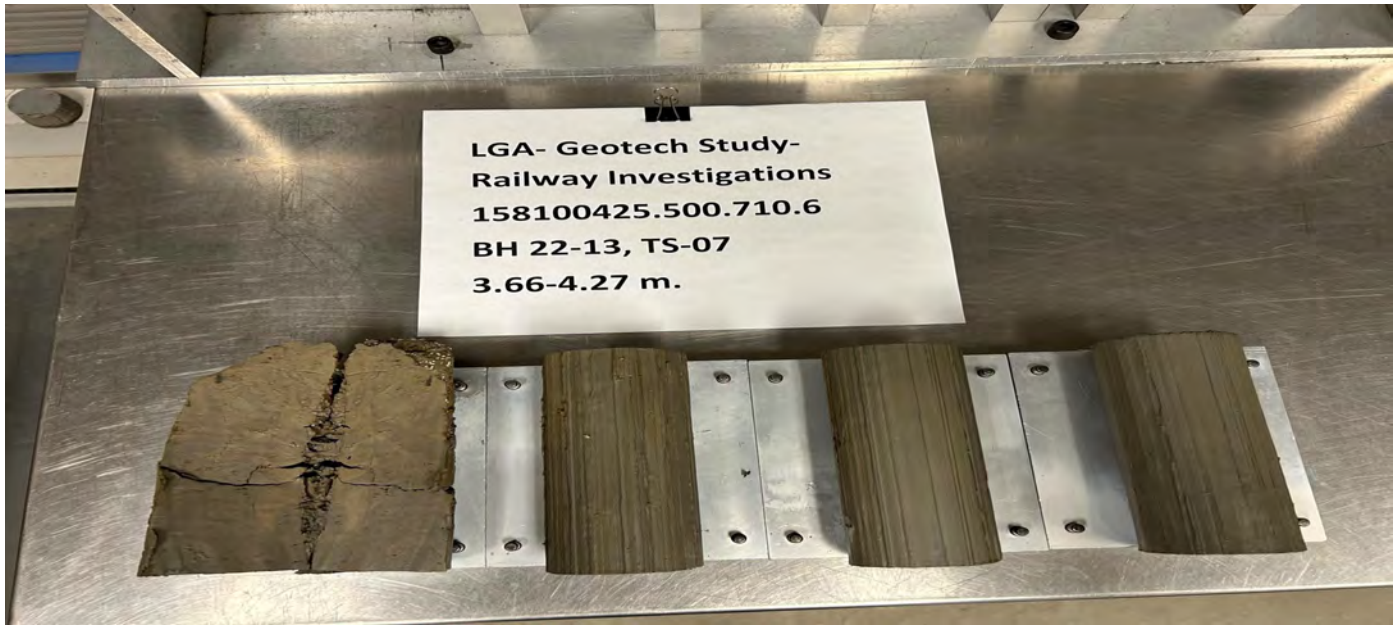


Photo No.:

2

Borehole: BH22-13 ST-07

Depth: 3.66-4.27 m

Project

La Grande Alliance - Feasibility Study - Phase I

Project No.

158100425.500.710.6

Borehole No.

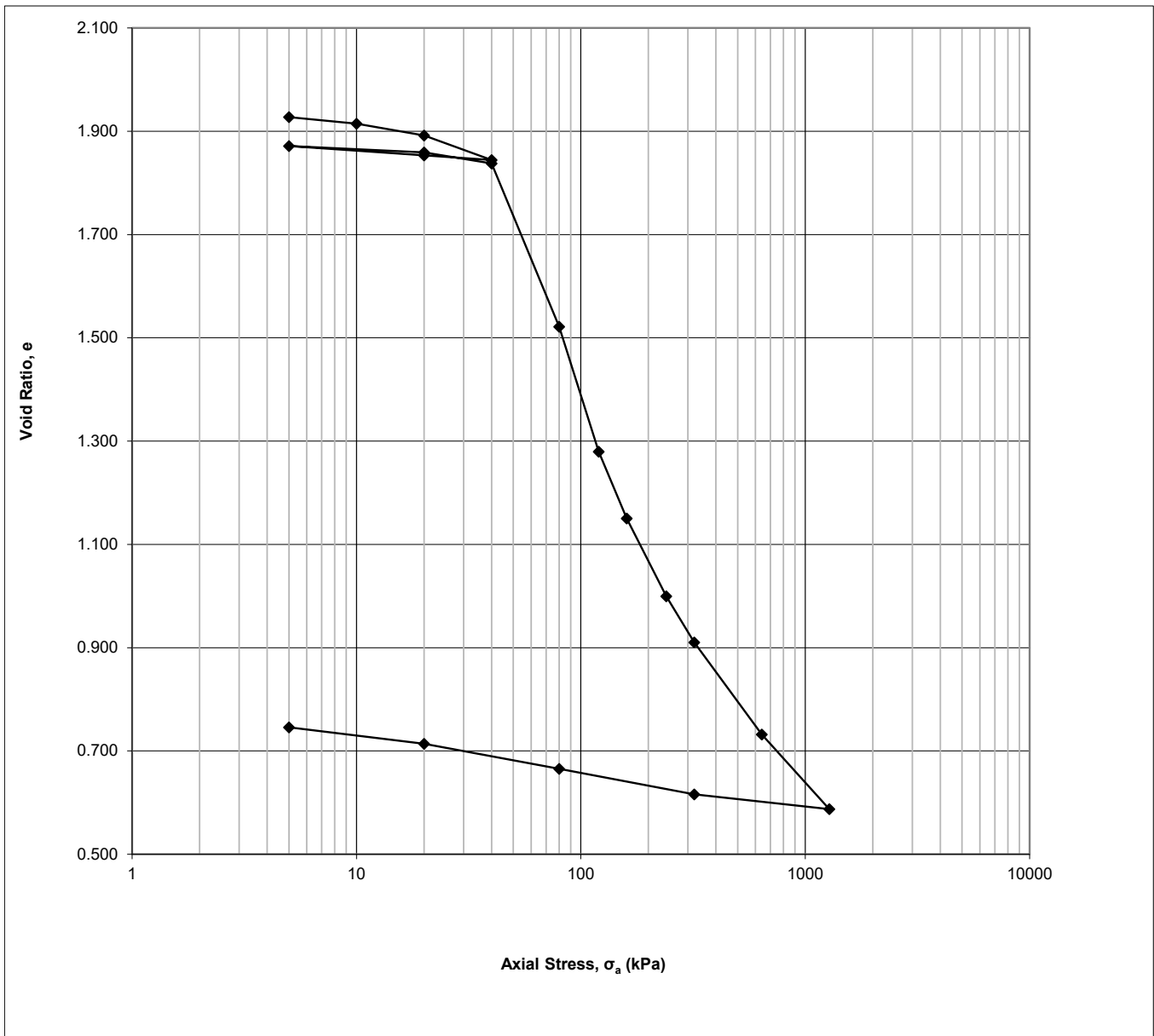
BH22-14

Sample No.

ST-12

Sample Depth

7.62-8.23 m.





One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

December 15, 2022
December 15, 2022

Date: Date:
D. Boateng R. Ghassemi

Checked by: Approved by:

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-14
Sample No.	ST-12
Depth	7.62-8.23 m.
Sample Date	August 12, 2022
Test Number	Eight
Technician Name	Daniel Boateng

Soil Description & Classification

<i>Silty clay, grey, wet</i>	
Specific Gravity of Solids	2.750
Average water content of trimmings %	65.52
Additional Notes (information source, occurrence and size of large isolated particles etc.)	
<i>Specific Gravity of Solids was Assumed</i>	

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm ²	1963
Volume	mm ³	39270
Mass	g	61.98
Dry Mass	g	36.74
Density	Mg/m ³	1.578
Dry Density	Mg/m ³	0.936
Water Content	%	68.70
Degree of Saturation	%	97.4
Height of Solids	mm	6.80
Initial Void Ratio		1.939

Final Specimen Conditions

Water Content	%	42.71
Final Void Ratio		0.746
Final Height	mm	11.88



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-14
Sample No.	ST-12
Depth	7.62-8.23 m.
Sample Date	August 12, 2022
Test Number	Eight
Technician Name	Daniel Boateng

Test Procedure

Date Started	December 5, 2022
Date Finished	December 7, 2022
Machine Number	Frame E
Cell Number	E
Ring Number	E
Trimming Procedure	Cutting ring/Trimming turntable
Moisture Condition	Inundated
Axial Stress at Inundation	5 kPa
Water Used	De-aired Tap Water
Test Method	B
Interpretation Procedure for c_v	2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

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Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ϵ_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	1.939
1	21.5	5	0.0753	19.9247	0.41	1.927
2	23.3	10	0.1551	19.8449	0.84	1.915
3	26.5	20	0.2934	19.7066	1.61	1.892
4	51.5	40	0.5623	19.4377	3.24	1.844
5	20.0	20	0.5861	19.4139	2.93	1.853
6	23.3	5	0.4616	19.5384	2.31	1.871
7	20.0	20	0.5397	19.4603	2.73	1.859
8	36.5	40	0.6579	19.3421	3.46	1.838
9	374.0	80	1.8947	18.1053	14.22	1.521
10	198.5	120	4.3330	15.6670	22.45	1.280
11	165.3	160	5.3227	14.6773	26.85	1.150
12	147.0	240	6.1871	13.8129	31.97	1.000
13	142.3	320	6.8985	13.1015	35.02	0.910
14	110.3	640	7.9868	12.0132	41.08	0.732
15	93.3	1280	9.0224	10.9776	46.00	0.587
16	27.0	320	9.0028	10.9972	45.03	0.616
17	49.3	80	8.6631	11.3369	43.35	0.665
18	83.3	20	8.3432	11.6568	41.69	0.714
19	95.5	5	8.1081	11.8919	40.61	0.746

December 15, 2022
December 15, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

Filename: V:\01216\active\other_pc_projects\158100425.500.710.6\Grevet-Chapais-Lab reques
Date: December 15, 2022

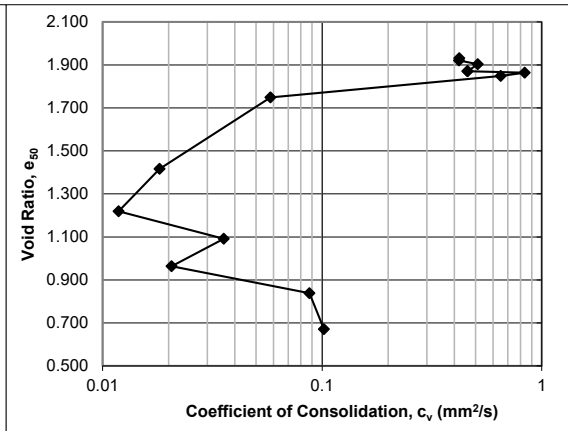
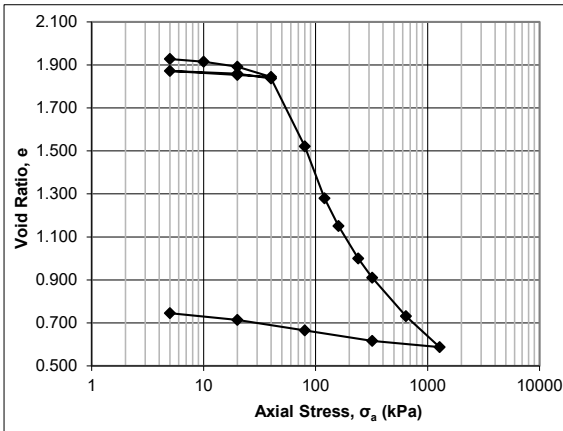
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Job Location	Grevet-Chapais Railway
Borehole	BH22-14
Sample No.	ST-12
Depth	7.62-8.23 m.
Sample Date	August 12, 2022
Test Number	Eight
Technician Name	Daniel Boateng

Calculations

Load Increment	Axial Stress σ_a , average kPa	Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
		Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\epsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm ² /s	Time t_{90} sec	Coeff. Consol. c_v mm ² /s
Seating	0								
1	3	0.0526	19.9474	0.26	1.932			200	4.22E-01
2	8	0.1289	19.8711	0.64	1.920			199	4.21E-01
3	15	0.2470	19.7530	1.23	1.903			162	5.11E-01
4	30	0.4633	19.5367	2.32	1.871			176	4.59E-01
5	30	0.6040	19.3960	3.02	1.851				
6	13	0.5067	19.4933	2.53	1.865				
7	13	0.5126	19.4874	2.56	1.864			96	8.38E-01
8	30	0.6171	19.3829	3.09	1.849			122	6.51E-01
9	60	1.3008	18.6992	6.50	1.748			1273	5.82E-02
10	100	3.5545	16.4455	17.77	1.417			3149	1.82E-02
11	140	4.8971	15.1029	24.49	1.220			4088	1.18E-02
12	200	5.7673	14.2327	28.84	1.092			1203	3.57E-02
13	280	6.6419	13.3581	33.21	0.963			1834	2.06E-02
14	480	7.4941	12.5059	37.47	0.838			379	8.76E-02
15	960	8.6325	11.3675	43.16	0.671			268	1.02E-01
16	800	9.0604	10.9396	45.30	0.608				
17	200	8.8103	11.1897	44.05	0.645				
18	50	8.5001	11.4999	42.50	0.690				
19	13	8.2234	11.7766	41.12	0.731				



December 15, 2022
December 15, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

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December 15, 2022

Filename:
Date:



Project No.: 158100425.500.710.6

Project Name: La Grande Alliance - Feasibility Study
Phase I - Preliminary Geotechnical Investigation

Photo Log



Photo No.:

1

Borehole: BH22-14 ST-12

Depth: 7.62-8.23 m



Photo No.:

2

Borehole: BH22-14 ST-12

Depth: 7.62-8.23 m

Project

La Grande Alliance - Feasibility Study - Phase I

Project No.

158100425.500.710.6

Borehole No.

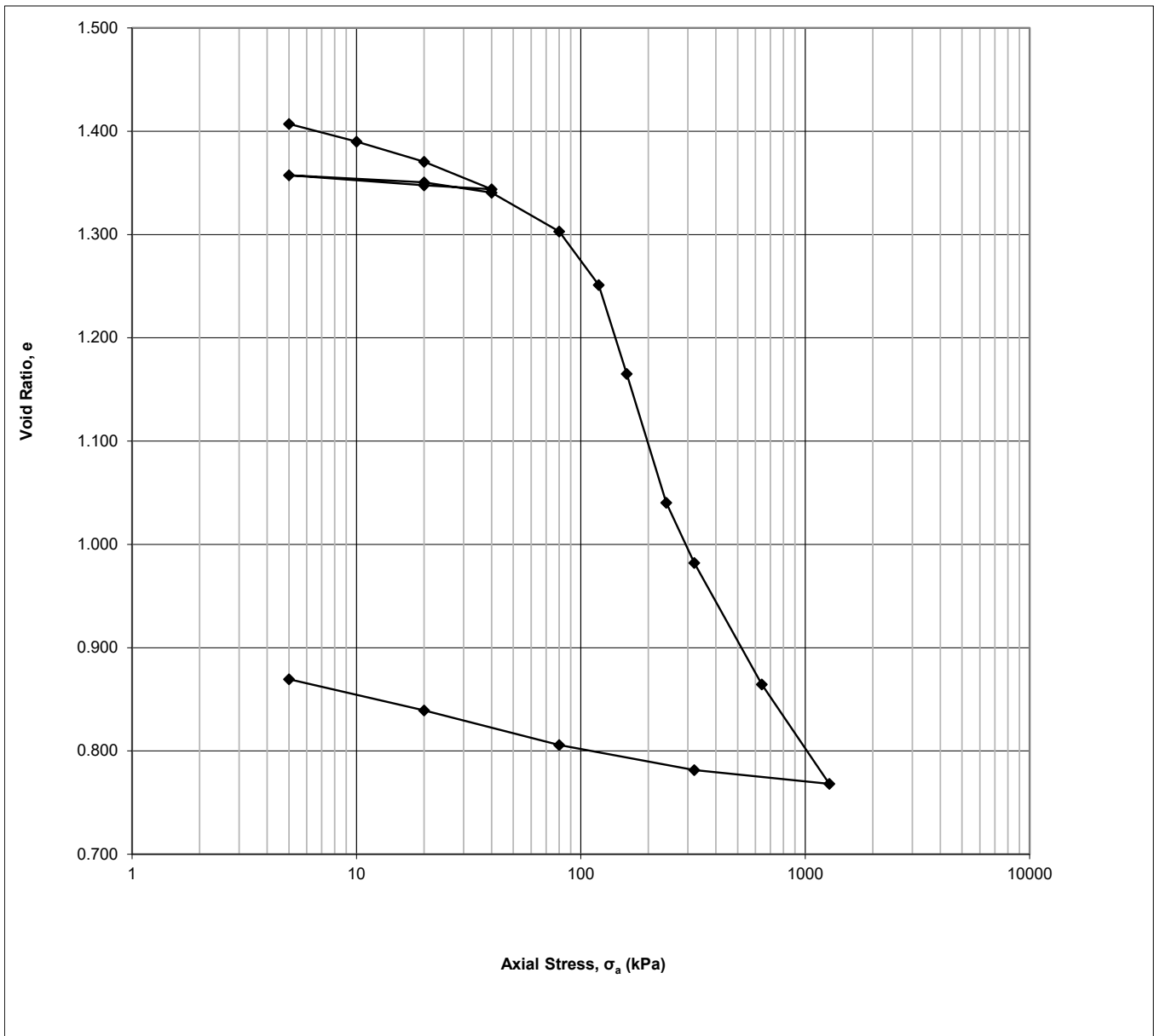
BH22-17

Sample No.

ST-07

Sample Depth

3.81-4.42 m.





One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

November 29, 2022
November 29, 2022

Date: Date:
D. Boateng R. Ghassemi

Checked by: Approved by:

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-17
Sample No.	ST-07
Depth	3.81-4.42 m.
Sample Date	August 14, 2022
Test Number	Three
Technician Name	Daniel Boateng

Soil Description & Classification

<i>Silty clay, grey, very moist</i>	
Specific Gravity of Solids	2.750
Average water content of trimmings %	49.48
Additional Notes (information source, occurrence and size of large isolated particles etc.)	
<i>Specific Gravity of Solids was Assumed</i>	

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm ²	1963
Volume	mm ³	39270
Mass	g	67.62
Dry Mass	g	44.55
Density	Mg/m ³	1.722
Dry Density	Mg/m ³	1.134
Water Content	%	51.78
Degree of Saturation	%	100.0
Height of Solids	mm	8.25
Initial Void Ratio		1.424

Final Specimen Conditions

Water Content	%	33.06
Final Void Ratio		0.870
Final Height	mm	15.42



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-17
Sample No.	ST-07
Depth	3.81-4.42 m.
Sample Date	August 14, 2022
Test Number	Three
Technician Name	Daniel Boateng

Test Procedure

Date Started	November 17, 2022
Date Finished	November 18, 2022
Machine Number	Frame E
Cell Number	E
Ring Number	E
Trimming Procedure	Cutting ring/Trimming turntable
Moisture Condition	Inundated
Axial Stress at Inundation	5 kPa
Water Used	De-aired Tap Water
Test Method	B
Interpretation Procedure for c_v	2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

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Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ϵ_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	1.424
1	26.5	5	0.1323	19.8677	0.70	1.407
2	29.8	10	0.2662	19.7338	1.41	1.390
3	31.5	20	0.4182	19.5818	2.21	1.370
4	38.3	40	0.6246	19.3754	3.30	1.344
5	20.0	20	0.6308	19.3692	3.15	1.348
6	23.3	5	0.5506	19.4494	2.75	1.357
7	20.0	20	0.6029	19.3971	3.03	1.351
8	26.5	40	0.6753	19.3247	3.45	1.340
9	58.3	80	0.9126	19.0874	5.00	1.303
10	130.3	120	1.2263	18.7737	7.13	1.251
11	234.8	160	2.0783	17.9217	10.69	1.165
12	148.0	240	3.0678	16.9322	15.83	1.040
13	112.8	320	3.5711	16.4289	18.23	0.982
14	94.5	640	4.4648	15.5352	23.08	0.865
15	77.5	1280	5.2540	14.7460	27.06	0.768
16	20.0	320	5.2997	14.7003	26.50	0.782
17	32.0	80	5.0962	14.9038	25.50	0.806
18	64.3	20	4.8307	15.1693	24.13	0.839
19	93.0	5	4.5717	15.4283	22.88	0.870

November 29, 2022
November 29, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

Filename: V:\01216\active\other_pc_projects\158100425-500.710.6\Grevet-Chapais\Consolidati
Date: November 29, 2022

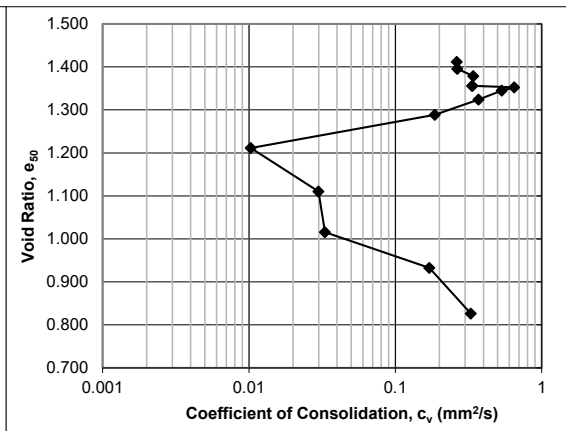
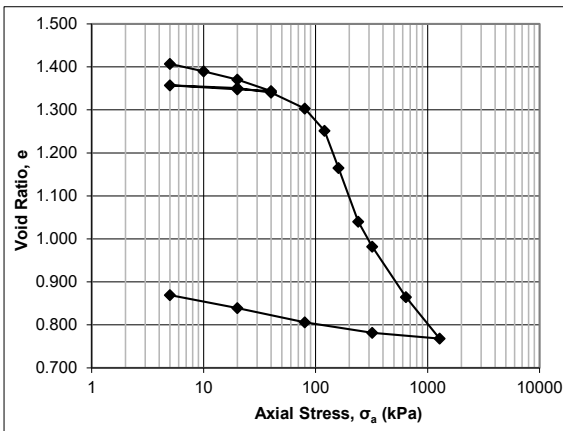
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Job Location	Grevet-Chapais Railway
Borehole	BH22-17
Sample No.	ST-07
Depth	3.81-4.42 m.
Sample Date	August 14, 2022
Test Number	Three
Technician Name	Daniel Boateng

Calculations

Load Increment	Axial Stress σ_a , average kPa	Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
		Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\epsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm ² /s	Time t_{90} sec	Coeff. Consol. c_v mm ² /s
Seating	0								
1	3	0.1016	19.8984	0.51	1.412			319	2.63E-01
2	8	0.2339	19.7661	1.17	1.396			312	2.66E-01
3	15	0.3727	19.6273	1.86	1.379			239	3.41E-01
4	30	0.5624	19.4376	2.81	1.356			239	3.35E-01
5	30	0.6382	19.3618	3.19	1.347				
6	13	0.5791	19.4209	2.90	1.354				
7	13	0.5879	19.4121	2.94	1.353			123	6.51E-01
8	30	0.6541	19.3459	3.27	1.345			148	5.35E-01
9	60	0.8239	19.1761	4.12	1.324			211	3.70E-01
10	100	1.1196	18.8804	5.60	1.288			406	1.86E-01
11	140	1.7538	18.2462	8.77	1.212			6848	1.03E-02
12	200	2.5888	17.4112	12.94	1.110			2150	2.99E-02
13	280	3.3682	16.6318	16.84	1.016			1774	3.31E-02
14	480	4.0532	15.9468	20.27	0.933			315	1.71E-01
15	960	4.9316	15.0684	24.66	0.826			147	3.28E-01
16	800	5.3180	14.6820	26.59	0.780				
17	200	5.1796	14.8204	25.90	0.796				
18	50	4.9599	15.0401	24.80	0.823				
19	13	4.6993	15.3007	23.50	0.855				



November 29, 2022
November 29, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

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November 29, 2022

Filename:
Date:



Project No.: 158100425.500.710.6

Project Name: La Grande Alliance - Feasibility Study
Phase I - Preliminary Geotechnical Investigation

Photo Log

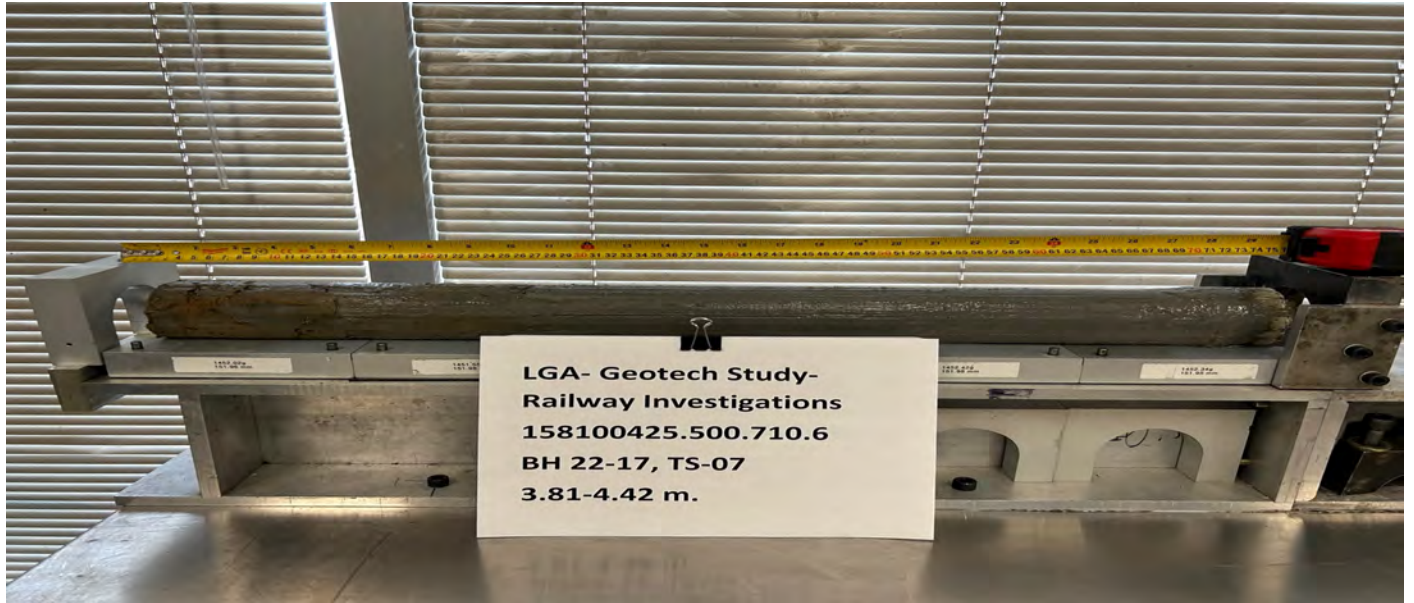


Photo No.:

1

Borehole: BH22-17 ST-07

Depth: 3.81-4.42 m



Photo No.:

2

Borehole: BH22-17 ST-07

Depth: 3.81-4.42 m

Project

La Grande Alliance - Feasibility Study - Phase I

Project No.

158100425.500.710.6

Borehole No.

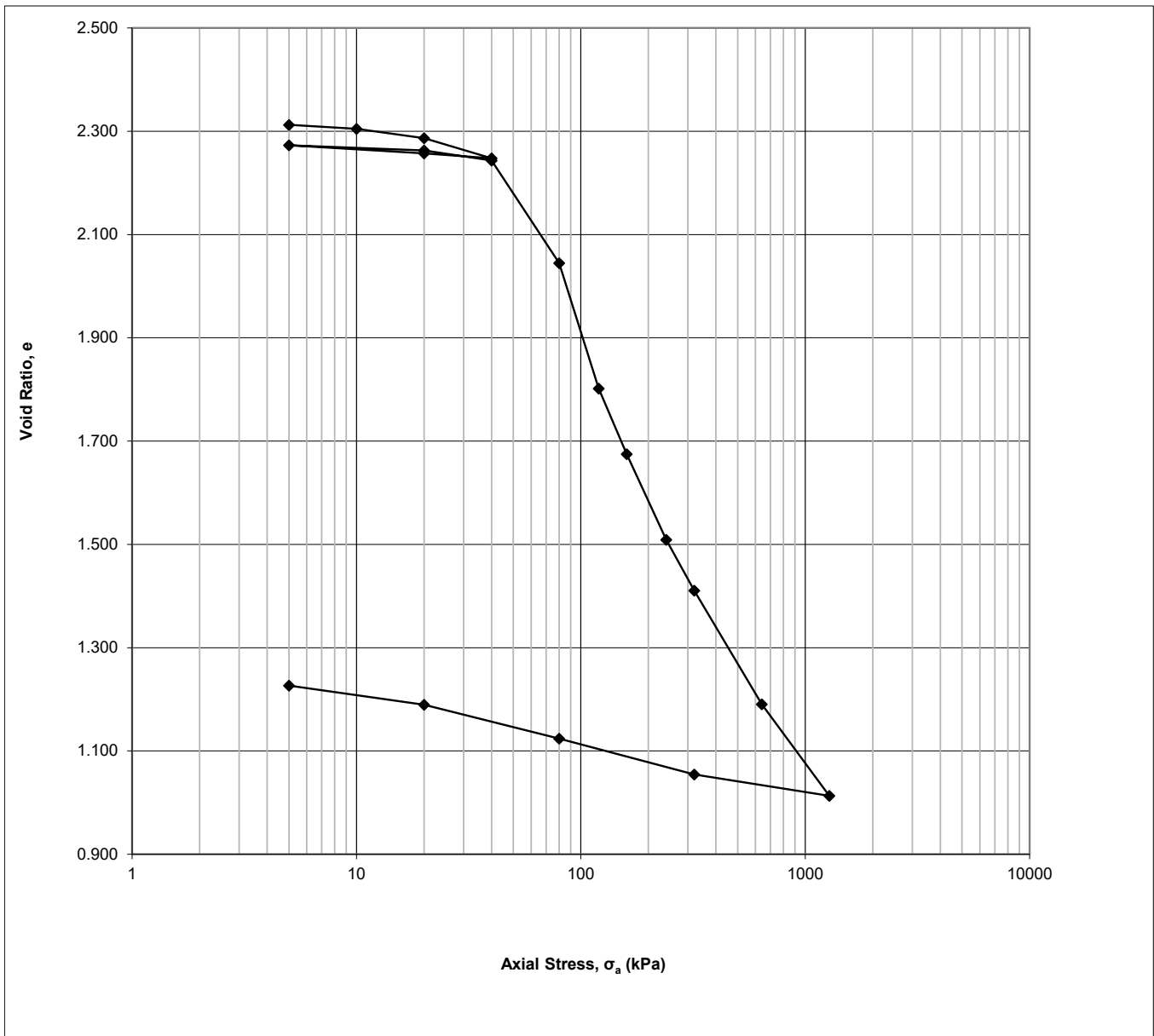
BH22-21

Sample No.

ST-15

Sample Depth

4.27-4.88 m.





Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

November 29, 2022
November 29, 2022

Date: Date:
D. Boateng R. Ghassemi

Checked by: Approved by:

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-21
Sample No.	ST-15
Depth	4.27-4.88 m.
Sample Date	September 1, 2022
Test Number	Four
Technician Name	Daniel Boateng

Soil Description & Classification

<i>Silty clay, grey, very wet</i>	
Specific Gravity of Solids	2.750
Average water content of trimmings %	80.81
Additional Notes (information source, occurrence and size of large isolated particles etc.)	
<i>Specific Gravity of Solids was Assumed</i>	

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm ²	1963
Volume	mm ³	39270
Mass	g	60.13
Dry Mass	g	32.54
Density	Mg/m ³	1.531
Dry Density	Mg/m ³	0.829
Water Content	%	84.79
Degree of Saturation	%	100.0
Height of Solids	mm	6.03
Initial Void Ratio		2.332

Final Specimen Conditions

Water Content	%	46.50
Final Void Ratio		1.226
Final Height	mm	13.42



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-21
Sample No.	ST-15
Depth	4.27-4.88 m.
Sample Date	September 1, 2022
Test Number	Four
Technician Name	Daniel Boateng

Test Procedure

Date Started	November 17, 2022
Date Finished	November 18, 2022
Machine Number	Frame F
Cell Number	F
Ring Number	F
Trimming Procedure	Cutting ring/Trimming turntable
Moisture Condition	Inundated
Axial Stress at Inundation	5 kPa
Water Used	De-aired Tap Water
Test Method	B
Interpretation Procedure for c_v	2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ϵ_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	2.332
1	20.0	5	0.0393	19.9607	0.19	2.312
2	20.0	10	0.0784	19.9216	0.42	2.305
3	23.3	20	0.1795	19.8205	0.97	2.287
4	34.8	40	0.3731	19.6269	2.14	2.248
5	20.0	20	0.3694	19.6306	1.86	2.257
6	21.5	5	0.2781	19.7219	1.38	2.273
7	20.0	20	0.3341	19.6659	1.69	2.263
8	21.8	40	0.4407	19.5593	2.27	2.243
9	160.3	80	1.2582	18.7418	8.27	2.044
10	139.0	120	3.0968	16.9032	15.58	1.802
11	100.5	160	3.8958	16.1042	19.41	1.675
12	97.3	240	4.7960	15.2040	24.40	1.509
13	77.3	320	5.4590	14.5410	27.37	1.410
14	69.0	640	6.6711	13.3289	33.99	1.191
15	55.5	1280	7.7449	12.2551	39.34	1.013
16	23.5	320	7.6112	12.3888	38.10	1.054
17	40.3	80	7.2028	12.7972	36.00	1.124
18	64.0	20	6.8007	13.1993	34.03	1.189
19	65.8	5	6.7646	13.2354	32.91	1.226

November 29, 2022
November 29, 2022

Date:
Date:
D. Boateng
R. Ghassemi

Checked by:
Approved by:

Filename: V:\01216\active\other_pc_projects\158100425-500.710.6\Grevet-Chapais\Consolidati
Date: November 29, 2022



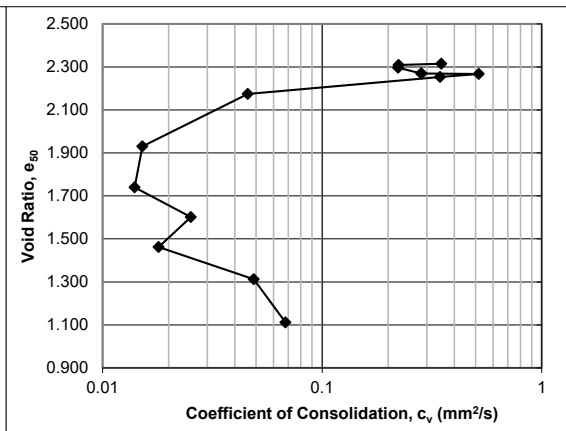
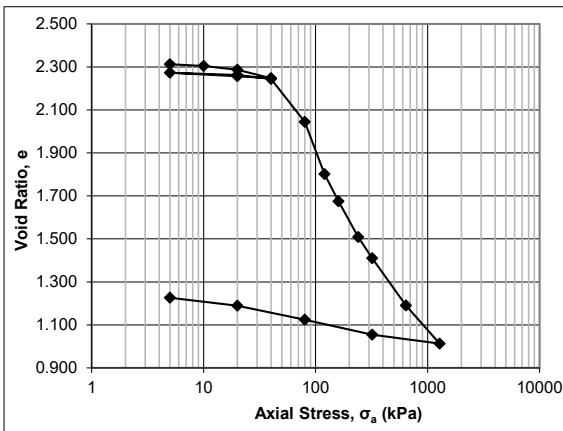
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Job Location	Grevet-Chapais Railway
Borehole	BH22-21
Sample No.	ST-15
Depth	4.27-4.88 m.
Sample Date	September 1, 2022
Test Number	Four
Technician Name	Daniel Boateng

Calculations

Load Increment	Axial Stress σ_a , average kPa	Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
		Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\epsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm ² /s	Time t_{90} sec	Coeff. Consol. c_v mm ² /s
Seating	0								
1	3	0.0235	19.9765	0.12	2.315			242	3.50E-01
2	8	0.0616	19.9384	0.31	2.309			378	2.23E-01
3	15	0.1391	19.8609	0.70	2.296			377	2.22E-01
4	30	0.2940	19.7060	1.47	2.270			290	2.83E-01
5	30	0.3930	19.6070	1.96	2.254				
6	13	0.3175	19.6825	1.59	2.266				
7	13	0.3103	19.6897	1.55	2.267			159	5.18E-01
8	30	0.3976	19.6024	1.99	2.253			237	3.44E-01
9	60	0.8692	19.1308	4.35	2.175			1690	4.59E-02
10	100	2.3382	17.6618	11.69	1.931			4359	1.52E-02
11	140	3.4862	16.5138	17.43	1.740			4131	1.40E-02
12	200	4.3213	15.6787	21.61	1.602			2063	2.53E-02
13	280	5.1633	14.8367	25.82	1.462			2589	1.80E-02
14	480	6.0683	13.9317	30.34	1.312			843	4.88E-02
15	960	7.2747	12.7253	36.37	1.112			504	6.81E-02
16	800	7.7166	12.2834	38.58	1.038				
17	200	7.4030	12.5970	37.02	1.090				
18	50	6.9997	13.0003	35.00	1.157				
19	13	6.7864	13.2136	33.93	1.193				



November 29, 2022
November 29, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

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November 29, 2022

Filename:
Date:



Project No.: 158100425.500.710.6

Project Name: La Grande Alliance - Feasibility Study
Phase I - Preliminary Geotechnical Investigation

Photo Log



Photo No.:

1

Borehole: BH22-21 ST-15

Depth: 4.27-4.88 m



Photo No.:

2

Borehole: BH22-21 ST-15

Depth: 4.27-4.88 m

Project

La Grande Alliance - Feasibility Study - Phase I

Project No.

158100425.500.710.6

Borehole No.

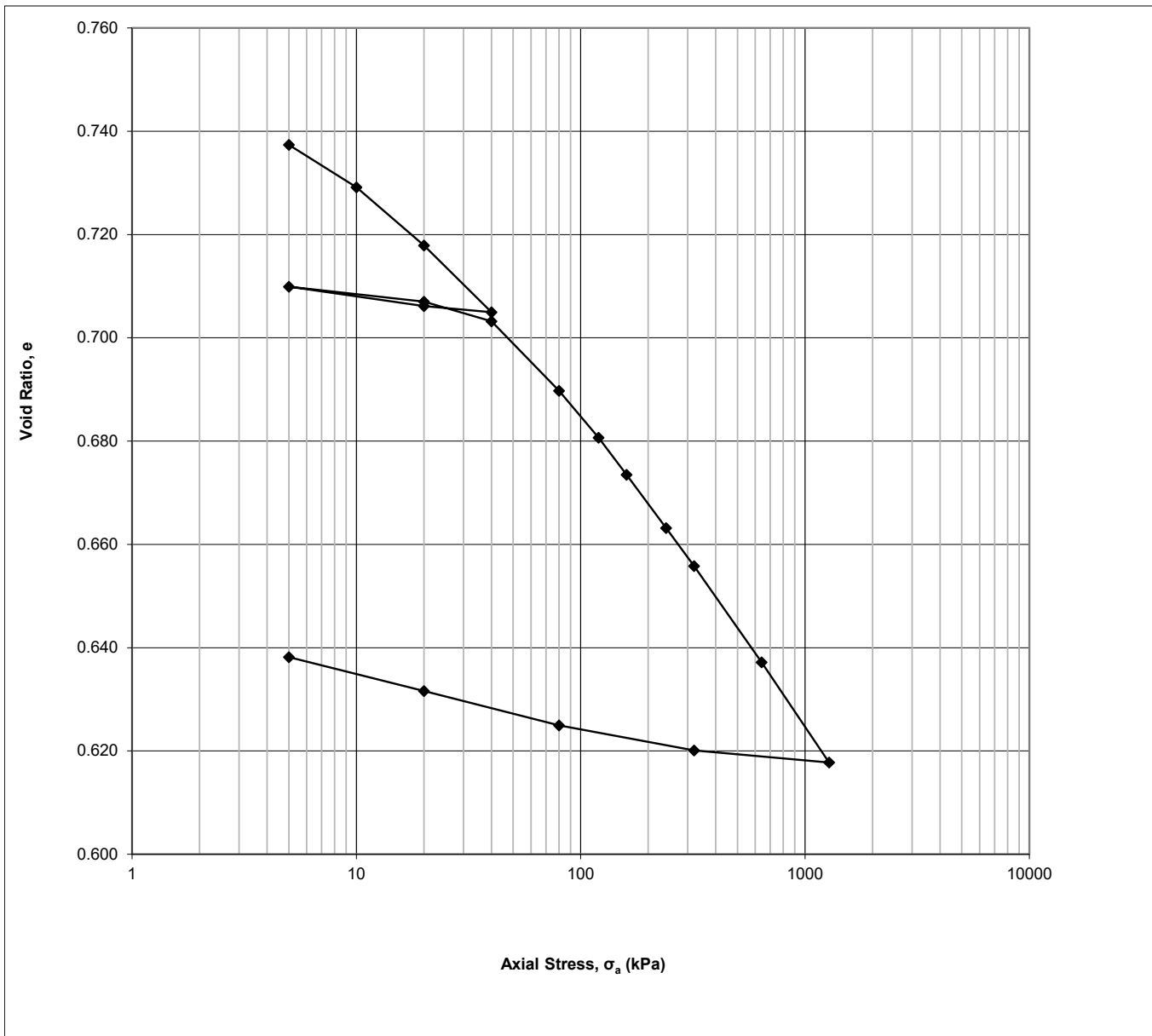
BH22-30

Sample No.

ST-15

Sample Depth

9.75-10.36 m.





One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

November 29, 2022
November 29, 2022

Date: Date:
D. Boateng R. Ghassemi

Checked by: Approved by:

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-30
Sample No.	ST-15
Depth	9.75-10.36 m.
Sample Date	September 2, 2022
Test Number	Five
Technician Name	Daniel Boateng

Soil Description & Classification

<i>Silt and clay, some gravel, grey, very moist</i>	
Specific Gravity of Solids	2.750
Average water content of trimmings %	28.11
Additional Notes (information source, occurrence and size of large isolated particles etc.)	
<i>Specific Gravity of Solids was Assumed</i>	

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm ²	1963
Volume	mm ³	39270
Mass	g	78.52
Dry Mass	g	61.74
Density	Mg/m ³	1.999
Dry Density	Mg/m ³	1.572
Water Content	%	27.18
Degree of Saturation	%	99.8
Height of Solids	mm	11.43
Initial Void Ratio		0.749

Final Specimen Conditions

Water Content	%	22.79
Final Void Ratio		0.638
Final Height	mm	18.73



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-30
Sample No.	ST-15
Depth	9.75-10.36 m.
Sample Date	September 2, 2022
Test Number	Five
Technician Name	Daniel Boateng

Test Procedure

Date Started	November 21, 2022
Date Finished	November 22, 2022
Machine Number	Frame C
Cell Number	C
Ring Number	C
Trimming Procedure	Cutting ring/Trimming turntable
Moisture Condition	Inundated
Axial Stress at Inundation	5 kPa
Water Used	De-aired Tap Water
Test Method	B
Interpretation Procedure for c_v	2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ϵ_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	0.749
1	21.5	5	0.1253	19.8747	0.67	0.737
2	23.3	10	0.2115	19.7885	1.14	0.729
3	29.8	20	0.3344	19.6656	1.79	0.718
4	28.3	40	0.4817	19.5183	2.53	0.705
5	20.0	20	0.4911	19.5089	2.46	0.706
6	20.0	5	0.4501	19.5499	2.25	0.710
7	20.0	20	0.4807	19.5193	2.41	0.707
8	20.0	40	0.5206	19.4794	2.63	0.703
9	33.3	80	0.6589	19.3411	3.40	0.690
10	28.3	120	0.7693	19.2307	3.92	0.681
11	33.3	160	0.8488	19.1512	4.33	0.673
12	33.3	240	0.9632	19.0368	4.92	0.663
13	31.5	320	1.0549	18.9451	5.34	0.656
14	35.0	640	1.2665	18.7335	6.40	0.637
15	33.3	1280	1.4859	18.5141	7.51	0.618
16	20.0	320	1.4753	18.5247	7.38	0.620
17	20.0	80	1.4200	18.5800	7.10	0.625
18	21.5	20	1.3452	18.6548	6.72	0.632
19	23.3	5	1.2721	18.7279	6.34	0.638

November 29, 2022
November 29, 2022

Date:
Date:
D. Boateng
R. Ghassemi

Checked by:
Approved by:

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Date: November 29, 2022



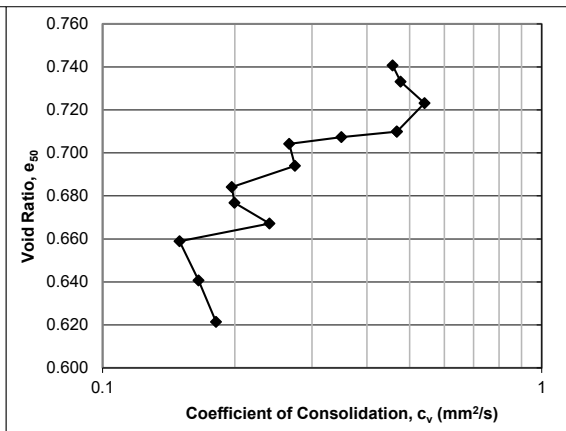
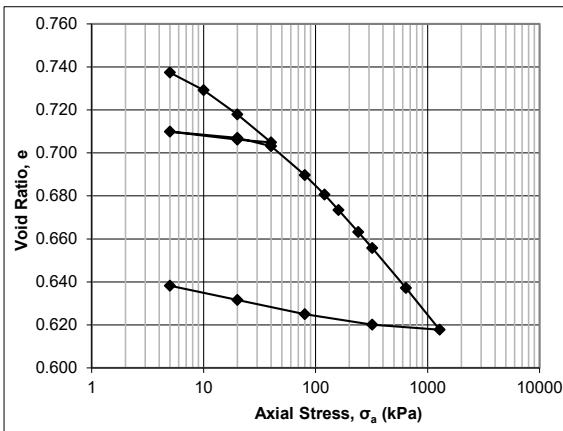
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Job Location	Grevet-Chapais Railway
Borehole	BH22-30
Sample No.	ST-15
Depth	9.75-10.36 m.
Sample Date	September 2, 2022
Test Number	Five
Technician Name	Daniel Boateng

Calculations

Load Increment	Axial Stress σ_a , average kPa	Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
		Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\epsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm ² /s	Time t_{90} sec	Coeff. Consol. c_v mm ² /s
Seating	0								
1	3	0.0968	19.9032	0.48	0.741			184	4.58E-01
2	8	0.1837	19.8163	0.92	0.733			174	4.78E-01
3	15	0.2975	19.7025	1.49	0.723			152	5.41E-01
4	30	0.4484	19.5516	2.24	0.710			173	4.68E-01
5	30	0.4934	19.5066	2.47	0.706				
6	13	0.4586	19.5414	2.29	0.709				
7	13	0.4779	19.5221	2.39	0.707			231	3.50E-01
8	30	0.5132	19.4868	2.57	0.704			303	2.66E-01
9	60	0.6310	19.3690	3.16	0.694			290	2.74E-01
10	100	0.7434	19.2566	3.72	0.684			399	1.97E-01
11	140	0.8267	19.1733	4.13	0.677			390	2.00E-01
12	200	0.9381	19.0619	4.69	0.667			321	2.40E-01
13	280	1.0324	18.9676	5.16	0.659			509	1.50E-01
14	480	1.2408	18.7592	6.20	0.641			451	1.65E-01
15	960	1.4610	18.5390	7.31	0.621			402	1.81E-01
16	800	1.4773	18.5227	7.39	0.620				
17	200	1.4269	18.5731	7.13	0.624				
18	50	1.3626	18.6374	6.81	0.630				
19	13	1.2962	18.7038	6.48	0.636				



November 29, 2022
November 29, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

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November 29, 2022

Filename:
Date:



Project No.: 158100425.500.710.6

Project Name: La Grande Alliance - Feasibility Study
Phase I - Preliminary Geotechnical Investigation

Photo Log

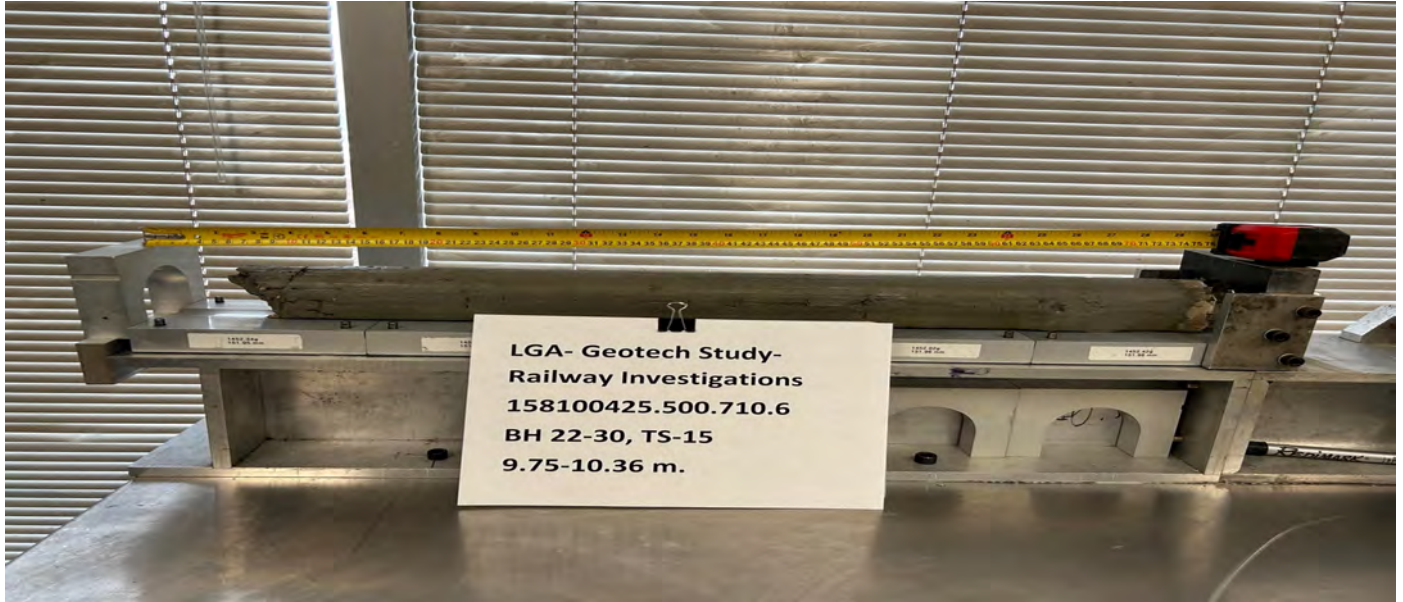


Photo No.:

1

Borehole: BH22-30 ST-15

Depth: 9.75=10.36 m

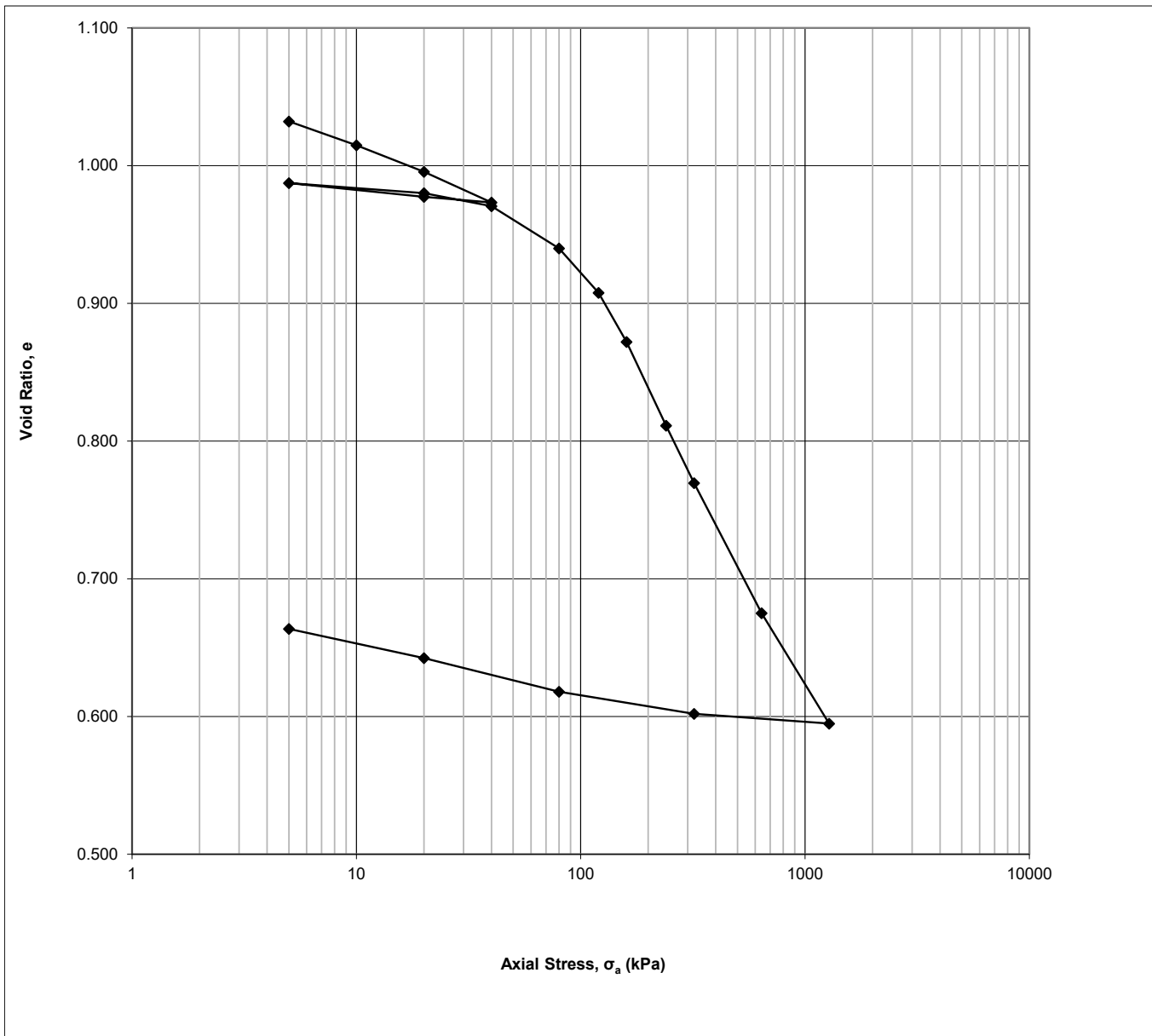


Photo No.:

2

Borehole: BH22-30 ST-15

Depth: 9.75=10.36 m

Project**La Grande Alliance - Feasibility Study - Phase I****Project No.****158100425.500.710.6****Borehole No.****BH22-32****Sample No.****ST-16****Sample Depth****9.91-10.52 m.**



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

November 29, 2022
November 29, 2022

Date: Date:
D. Boateng R. Chassegni

Checked by: Approved by:

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-32
Sample No.	ST-16
Depth	9.91-10.52 m.
Sample Date	August 26, 2022
Test Number	Four
Technician Name	Daniel Boateng

Soil Description & Classification

<i>Silty clay, grey to dark grey, friable, moist</i>	
Specific Gravity of Solids	2.750
Average water content of trimmings %	36.63
Additional Notes (information source, occurrence and size of large isolated particles etc.)	
<i>Specific Gravity of Solids was Assumed</i>	

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm ²	1963
Volume	mm ³	39270
Mass	g	72.22
Dry Mass	g	52.82
Density	Mg/m ³	1.839
Dry Density	Mg/m ³	1.345
Water Content	%	36.73
Degree of Saturation	%	96.7
Height of Solids	mm	9.78
Initial Void Ratio		1.045

Final Specimen Conditions

Water Content	%	25.73
Final Void Ratio		0.664
Degree of Saturation	%	106.6
Final Height	mm	16.27
Estimated Preconsolidation Stress	kPa	306



Stantec Consulting Ltd.

One-Dimensional Consolidation Test using Incremental Loading ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Project Location	Grevet-Chapais Railway
Borehole	BH22-32
Sample No.	ST-16
Depth	9.91-10.52 m.
Sample Date	August 26, 2022
Test Number	Four
Technician Name	Daniel Boateng

Test Procedure

Date Started	November 21, 2022
Date Finished	November 22, 2022
Machine Number	Frame D
Cell Number	D
Ring Number	D
Trimming Procedure	Cutting ring/Trimming turntable
Moisture Condition	Inundated
Axial Stress at Inundation	5 kPa
Water Used	De-aired Tap Water
Test Method	B
Interpretation Procedure for c_v	2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

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Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ϵ_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	1.045
1	20.0	5	0.1165	19.8835	0.60	1.032
2	26.5	10	0.2736	19.7264	1.45	1.015
3	24.8	20	0.4624	19.5376	2.40	0.996
4	31.5	40	0.6703	19.3297	3.49	0.973
5	20.0	20	0.6579	19.3421	3.29	0.977
6	21.5	5	0.5610	19.4390	2.80	0.987
7	20.0	20	0.6268	19.3732	3.15	0.980
8	21.5	40	0.7133	19.2867	3.62	0.971
9	44.8	80	0.9651	19.0349	5.12	0.940
10	73.3	120	1.2365	18.7635	6.69	0.908
11	100.0	160	1.5805	18.4195	8.44	0.872
12	95.3	240	2.0878	17.9122	11.41	0.811
13	87.0	320	2.5842	17.4158	13.45	0.770
14	77.0	640	3.4488	16.5512	18.07	0.675
15	70.3	1280	4.2328	15.7672	21.99	0.595
16	20.0	320	4.3297	15.6703	21.65	0.602
17	26.8	80	4.1704	15.8296	20.86	0.618
18	50.3	20	3.9373	16.0627	19.67	0.642
19	67.3	5	3.7297	16.2703	18.63	0.664

November 29, 2022
November 29, 2022

Date: D. Boateng
Date: R. Ghassemi

Checked by:
Approved by:

Filename: V:\01216\active\other_pc_projects\158100425-500.710.6\Grevet-Chapais\Consolidati
Date: November 29, 2022



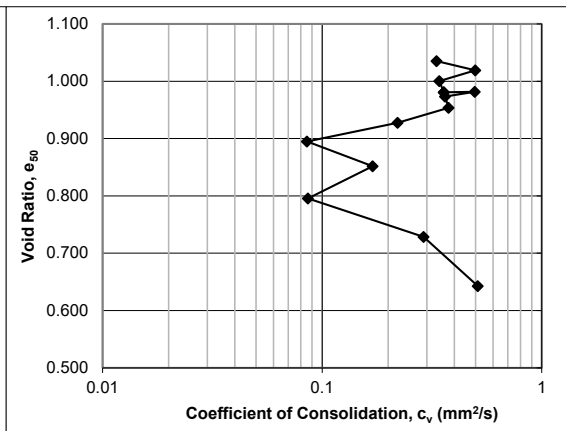
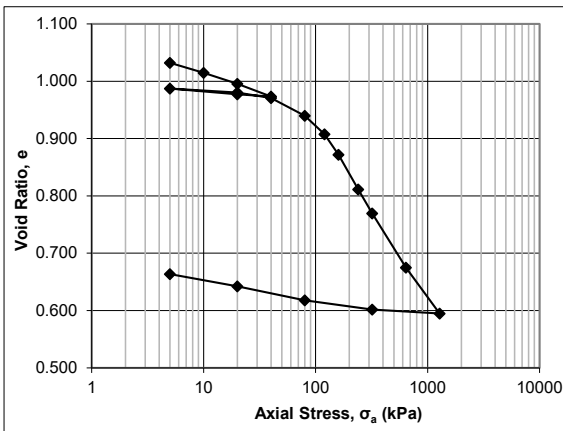
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	La Grande Alliance - Feasibility Study - Phase I - Preliminary Geotechnical Investigation
Job Location	Grevet-Chapais Railway
Borehole	BH22-32
Sample No.	ST-16
Depth	9.91-10.52 m.
Sample Date	August 26, 2022
Test Number	Four
Technician Name	Daniel Boateng

Calculations

Load Increment	Axial Stress σ_a , average kPa	Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
		Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\epsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm ² /s	Time t_{90} sec	Coeff. Consol. c_v mm ² /s
Seating	0								
1	3	0.0916	19.9084	0.46	1.035			253	3.33E-01
2	8	0.2493	19.7507	1.25	1.019			166	4.99E-01
3	15	0.4319	19.5681	2.16	1.000			238	3.42E-01
4	30	0.6234	19.3766	3.12	0.981			222	3.58E-01
5	30	0.6654	19.3346	3.33	0.977				
6	13	0.5901	19.4099	2.95	0.984				
7	13	0.6143	19.3857	3.07	0.982			161	4.96E-01
8	30	0.6950	19.3050	3.48	0.973			217	3.64E-01
9	60	0.8878	19.1122	4.44	0.954			206	3.76E-01
10	100	1.1453	18.8547	5.73	0.927			341	2.21E-01
11	140	1.4630	18.5370	7.31	0.895			853	8.54E-02
12	200	1.8866	18.1134	9.43	0.852			410	1.70E-01
13	280	2.4341	17.5659	12.17	0.796			760	8.61E-02
14	480	3.0925	16.9075	15.46	0.728			209	2.90E-01
15	960	3.9311	16.0689	19.66	0.643			107	5.12E-01
16	800	4.3397	15.6603	21.70	0.601				
17	200	4.2289	15.7711	21.14	0.612				
18	50	4.0459	15.9541	20.23	0.631				
19	13	3.8292	16.1708	19.15	0.653				



November 29, 2022
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Date: D. Boateng
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Approved by:

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November 29, 2022

Filename:
Date:



Project No.: 158100425.500.710.6

Project Name: La Grande Alliance - Feasibility Study
Phase I - Preliminary Geotechnical Investigation

Photo Log

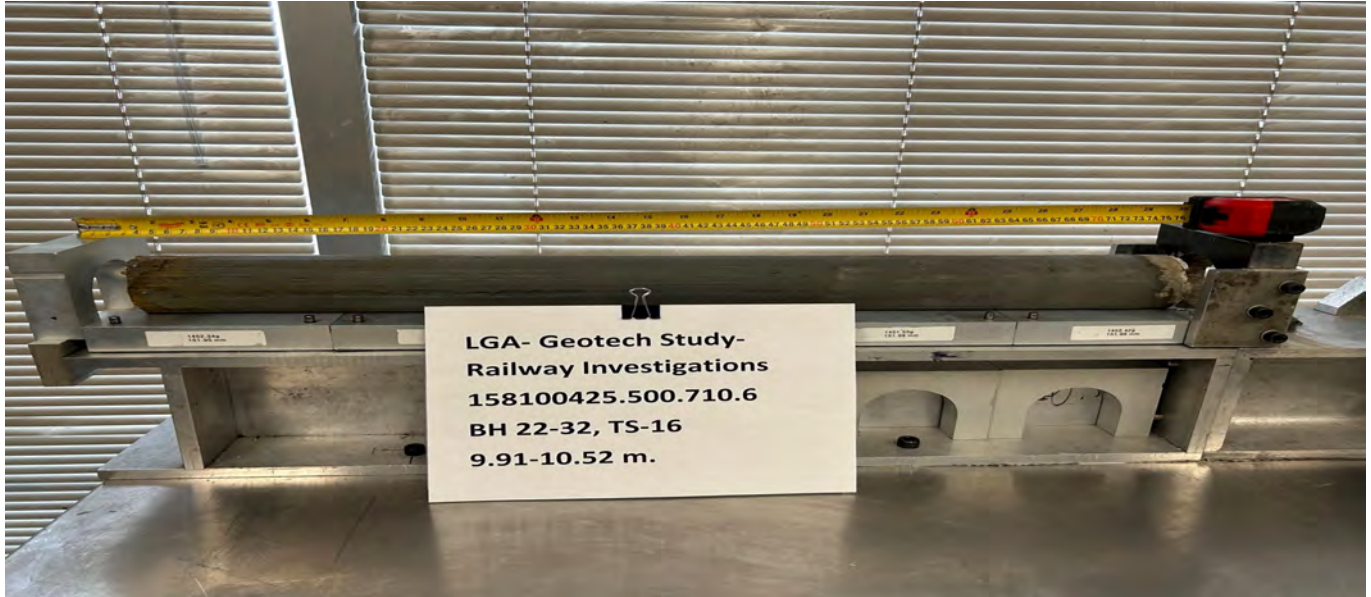


Photo No.:

1

Borehole: BH22-32 ST-16

Depth: 9.91-10.52 m



Photo No.:

2

Borehole: BH22-32 ST-16

Depth: 9.91-10.52 m