



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

POTENTIAL BORROW SOURCES  
AND QUARRY SITES ASSESSMENT –  
POTENTIAL BDH RAILWAY  
(MATAGAMI TO RUPERT RIVER  
BRIDGE)

April 12, 2023

Prepared for:

Cree Development Corporation and  
Vision Eeyou Istchee

Prepared by:

Stantec Consulting Ltd.

158100425

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<b>Revision</b>	<b>Description</b>	<b>Author</b>		<b>Quality Check</b>		<b>Independent Review</b>	
00	Final Report	F. Vinet	2023-02-14	O. Piraux	2023-02-15	A. El-Dana	2023-02-17



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The conclusions in the Report titled LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I - POTENTIAL POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – POTENTIAL BDH RAILWAY (MATAGAMI TO RUPERT RIVER BRIDGE) are Stantec’s professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient’s own risk.

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Prepared by: \_\_\_\_\_  
Signature  
  
Frédéric Vinet, géo., M.Sc.  
\_\_\_\_\_  
Printed Name

Verified by: \_\_\_\_\_  
Signature  
  
Olivier Piraux, M.Sc.  
\_\_\_\_\_  
Printed Name

Approved by: \_\_\_\_\_  
Signature  
  
Afif El-Dana, ing. DESS, PMP  
\_\_\_\_\_  
Printed Name



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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 Grand Alliance. The program aims at improving and building major transportation infrastructures on the territory, including the implementation of a railway alongside the Billy-Diamond Highway to Whapmagoostui, where the construction of a deepwater port will be considered. The current study is divided into three phases, Phase I being carried out by Vision Eeyou Istchee Consortium, focusing on the feasibility design of the following infrastructures:

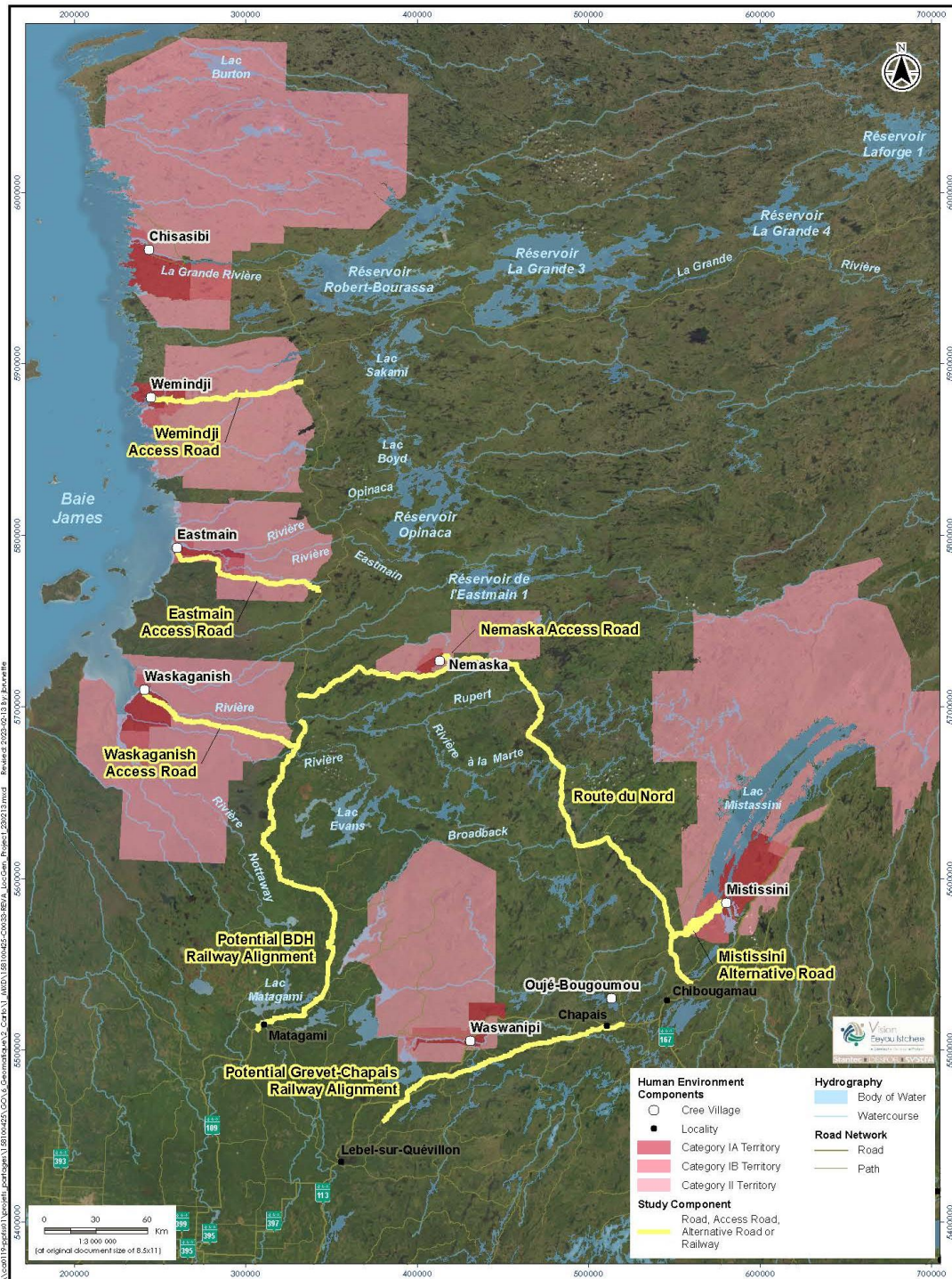
- Upgrade of the existing access roads between the Billy-Diamond Highway and the Cree communities of Waskaganish, Eastmain and Wemindji;
- Upgrade of the existing access road between the Route du Nord and the community of Nemaska;
- New railway along the Billy Diamond Highway (BDH) between the town of Matagami and KP 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 kilometre point (hereafter, KP) 257;
- Upgrade and paving 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**





# LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – POTENTIAL BDH RAILWAY (MATAGAMI TO RUPERT RIVER BRIDGE)

## 1.2 Scope of Work

One of the objectives of the Vision Eeyou Istchee feasibility study of Phase I was to evaluate the availability of borrow materials (i.e. granular borrow sources and bedrock quarries) able to supply structural fill for the construction and/or upgrade of the different infrastructures.

Subsequently, the Cree Development Corporation (CDC) mandated Stantec to conduct a geotechnical investigation which includes the exploration of potential borrows sources and quarry sites previously identified within the feasibility study. This report presents both the results of the desktop potential borrow sources and the quarry sites assessment, and the results of the geotechnical investigations of the targeted sites along the potential Billy Diamond Highway (BDH) railway.

The main tasks performed regarding the identification and exploration of potential borrow sources and quarry sites consisted of the:

- Selection and acquisition of aerial photos covering the study area;
- Compilation and review of data related to the geology and the surficial deposits;
- Photo interpretation and delineation of sectors showing potential for material extraction (granular materials and bedrock);
- Development of a field investigation program including the identification of test pits and boreholes targets;
- Obtainment of the necessary environmental permits and authorizations to carry out the geotechnical investigation;
- Execution of the geotechnical field program which includes the:
  - Coordination with subcontractors and tallymen;
  - Survey of targeted sites, forest clearing and traffic control, and;
  - Realization of test pits and boreholes.
- Conduction of laboratory testing on selected granular materials and bedrock samples;
- Preparation of a summary report presenting the main characteristics of the potential borrow sources and quarry sites, including an estimate of the potentially extractable volumes.



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### **1.3 Material Requirements**

Preliminary estimates of borrow material required for the construction of the potential BDH railway are presented in Table 1. Note that these estimates consist of compacted volumes and exclude quantities generated from the excavation of road cuts.

**Table 1 Summary of the Material Requirements for the Construction of the Potential BDH Railway**

<b>Component</b>	<b>Type of material</b>	<b>Volume (compacted) (m<sup>3</sup>)</b>
Ballast (crushed stone)	20 to 50 mm (3/4" to 2")	425 100
Sub-ballast	Granular materials	651 670
Bottom layer of embankment	MG 112	1 983 000

The information regarding the type of materials required for the construction of the railway is presented in sections 2.3 and 2.4 of Volume 1 of AREMA (2010).

A variety of materials may be used to produce railroad ballast. The most common materials include granite, trap rock, quartzite and carbonate rocks (e.g., limestone and dolomite). The recommended limit for degradation values (ASTM C131 – Los Angeles) ranges between 25% and 35% depending on the bedrock type.

Materials used for construction of railway sub-ballast are aggregates typically used for the construction of highway bases and subbases. The sub-ballast should consist of well graded granular materials to prevent the materials penetration into the subgrade and the penetration of track ballast particles into the sub-ballast materials (AREMA, vol.1, 2010).



## **2.0 Study Area and Background Review**

The study area extends from the Matagami area (KP 0 of the BDH to the Rupert River Bridge (KP 257 of the BDH). The potential BDH railway alignment closely follows the trajectory of the Billy Diamond Highway and deviates from it at a maximum distance of 4 km in some localized sectors. The study area has a maximum width of 10 km and consists of an offset of 5 km on each side of the Billy Diamond Highway. Once all problematic areas (environmental and access constraints) are removed, the final study surface is considerably reduced. Potential sites that would require the construction of new access roads crossing major watercourses, waterbodies, and/or wetlands were also avoided when possible. Generally, the 5 km offset was reached when existing access roads were present and the sites easily reachable, otherwise the accessibility constraint was considered too high for the site to be a possible option.

Regional bedrock geology mapping (SIGÉOM, 2023) shows that the study area is underlain by Archean bedrock belonging to the Superior Province and covering three (3) subprovinces: The Abitibi Subprovince in the Matagami sector (KP 0 to 51 of the Billy Diamond Highway), the Opatica Subprovince in the central portion (KP 51 to 217 of the Billy Diamond Highway), and the Nemiscau Subprovince in the Rupert River sector (KP 217 to 257 of the Billy Diamond Highway). Generally, the bedrock encountered along the potential BHD railway alignment is dominated from south to north by intrusive mafic rocks (gabbro, gabbro-norite, and diorite), volcanic mafic and intermediate rocks (basalt, andesite, and volcanoclastic rocks), tonalite, granodiorite, and granite (tonalitic and granodioritic gneiss), and by metasedimentary rocks (paragneiss, schist, iron formation and marble).

During the Late Wisconsinan Glaciation (24 000 to 8 000 years before present (BP)), the James Bay region was covered by the Laurentide Ice Sheet. During this glaciation, large amounts of materials were transported and subsequently deposited as till (morainal deposits) across the region. Following the ice melt, the marine transgression of the Tyrrell Sea peaked around 7,900 BP (Hardy, 1977). Glaciomarine silt and clay accumulated in the low-lying areas and coarser deposits accumulated along the former Tyrrell Sea shorelines. Locally, marine clay covers the glaciolacustrine sediments of the Lake Ojibway, which are usually 10 to 15 m thick (Hardy, 1982). Peat bogs and fens have accumulated over the glacial and non-glacial deposits, especially over poorly drained glaciomarine and morainal (till) deposits.

Based on regional surficial geology mapping (SIGÉOM, 2023), the surficial deposits along the Billy Diamond Highway consist mainly of deep-water glaciolacustrine sediments. These fine-grained sediments are frequently covered by organic accumulation, especially from Matagami (KP 0) to the Broadback River (KP 232) (SIGÉOM, 2023). The landforms that rise above the plain are composed of undifferentiated till deposits, frontal moraine deposits and bedrock outcrops. North of the Broadback River (KP 232) until reaching the Rupert River (KP 257), deep-water fine-grained glaciomarine sediments cover the glaciolacustrine sediments. These materials are also favorable to peat accumulations on flat and lowlands. Till deposits of variable thickness are found along slopes and fluted landforms while materials on hilltops generally consist of exposed bedrock. Frontal moraine deposits are also common between the Broadback and Rupert rivers.



## **3.0 Methodology**

### **3.1 Photo Interpretation and Identification of Potential Borrow Sources and Quarry Sites**

Photo interpretation allows the geomorphologists to assess the study area in three dimensions in order to identify landforms that are likely to contain granular materials. Spatial delineation of potential borrow sources is based on the geomorphologist knowledge of Quaternary deposits and on their ability to identify landforms that could potentially provide suitable granular borrow materials. Within the study area, landforms expected to be favorable for borrow material extraction mainly include juxtaglacial and littoral deposits of the postglacial Tyrrell Sea since glaciofluvial landforms such as esker or outwash deposits are essentially absent west of the Sakami Moraine.

In addition to granular deposits, potential quarry sites were selected by identifying favorable bedrock hills – generally about ten (10) meters above the surrounding terrains – and by delineating areas that could provide significant volumes.

The photo interpretation exercise was completed using a mirror stereoscope for the visualization of black and white 1:40 000 to 1:60 000 scale aerial photos. The aerial photos used for the assessment were acquired from Natural Resources Canada - National Air Photo Library (NAPL) and are listed in Table 2.

The potential borrow sources and quarry sites were selected based on their distance from the Billy-Diamon Highway or other existing access in order to limit the costs associated with the construction and/or maintenance of access roads. Special attention was given to avoid apparent environmental constraints such as the proximity of the potential sites to watercourses, waterbodies and wetlands.

The potential borrow sources and quarry sites were identified and drawn directly onto the aerial photographs. These were subsequently scanned and georeferenced, and the delineated landforms were digitized using ArcMap© software. The sites are identified by the prefixes GD (Granular Deposit) or Q (Quarry) followed by the kilometre point of their location (i.e.: GD-25 or Q-22) along the BDH.



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**Table 2 Aerial Photos Used for the Identification of Potential Borrow Sources and Quarry Sites**

<b>Year</b>	<b>Roll number</b>	<b>No. of aerial photo</b>	<b>Scale</b>
1950	A12469	19 to 39	1: 40 000
1950	A12472	120 to 143; 183 to 187; 203 to 214; 232 to 234; 271 to 274; 320 to 323; 342 to 362; 411 to 428; 430	1: 40 000
1955	A14838	23 and 24	1: 60 000
1955	A14973	17 to 21; 121 to 124	1: 60 000
1955	A15064	16 to 18	1: 60 000
1987	A27108	67 to 73; 96 to 101	1: 50 000
1987	A27114	28 to 38; 87 to 97	1: 50 000
1987	A27147	92 to 103	1: 50 000
1987	A27150	37 to 42; 154 to 158; 171 to 184	1: 50 000
1989	A27531	155 to 160	1: 50 000

## **3.2 ENVIRONMENTAL PERMITTING**

Before proceeding with the geotechnical investigations, Vision Eeyou Istchee obtained the necessary authorizations and permits for the execution of the work:

- Land use (obtained from the ministère des Ressources naturelles et des Forêts du Québec);
- Tree cutting (obtained from the ministère des Forêts, de la Faune et des Parcs du Québec); and
- Declaration of compliance (submitted to the ministère de l'Environnement, de la Lutte contre les changements climatiques du Québec).

All field activities (land occupancy, land clearing, exploration trenches and drilling) were carried out in compliance with the current laws and regulations.

## **3.3 Geotechnical Field Investigation**

The desktop potential borrow sources and quarry sites analysis allowed the identification of a total of eleven (11) potentially favorable sites, including five (5) potential borrow sources and six (6) potential quarry sites. In order to evaluate the quantity (volume) and the quality of the materials, a geotechnical field investigation was conducted.



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Fieldwork for the potential borrow source assessment was carried out between March 30 and April 6, and July 15 and 16, 2022. The program consisted in excavating test pits at five (5) potential borrow source locations identified along the Billy Diamond Highway (GD-25, GD-104.9, GD 113, GD-220.3, GD-256.4). The number of test pits excavated at each potential borrow source ranged from four (4) to twelve (12), for a total of 38 tests pits.

The test pits were completed using Komatsu excavators PC78 and PC290LC. The subsurface stratigraphy encountered within each of the test pits was recorded by Stantec field personnel. Overburden soil samples were described and recovered for every soil layer. The depth of the test pits ranged between 0.3 and 5.0 m. Soil samples collected during the investigation were brought back to Stantec laboratory for detailed classification and testing.

The potential quarry sites fieldwork assessment was carried out between March 24 and April 5, 2022, and on July 21 and July 22, 2022. It consisted of drilling two (2) boreholes at each potential quarry sites (Q-22, Q-36.9, Q-85.5, Q-138.1, Q-168, Q-246.5) for a total of twelve (12) boreholes. Generally, the boreholes were drilled to a depth of around 10 m in average using a track-mounted CME-55 drill rig.

The subsurface stratigraphy encountered in the boreholes was recorded by field personnel. When encountered, overburden samples were recovered at regular intervals using a B or N size split-spoon sampler. Rock coring was carried out in all boreholes using a HQ-size core barrel (with an inner diameter of 63.5 mm) to confirm the type and characteristics of the bedrock. Bedrock samples collected during the investigation were brought back to Stantec laboratory for detailed classification and testing.

### **3.4 Laboratory Testing**

All surficial material and rock samples were subjected to detailed visual examination and additional classification by a geologist. For the potential borrow sources, representative samples were selected for a grain size analysis (sieving). A total of forty-six (34) samples were analyzed. Laboratory testing conducted on rock cores consisted of a total of thirty-one (31) Micro-Deval tests (LC 21-070), and thirty (30) Los Angeles tests (LC 21-400).

Laboratory testing results are presented in Appendix D.

### **3.5 Calculation of Potential Suitable Material Volume**

The volume estimates were calculated by multiplying the potential borrow sources or quarry sites area by the estimated average thickness of suitable materials or exploitable bedrock. The average thickness was based on the aerial photo interpretation. For some sectors, publicly available digital elevation models derived from the LiDAR data (Données Québec, 2021) or Canadian Digital Surface Models derived from radar data (NRCan, 2000) were used to determine the exploitable thickness of granular material or bedrock. However, a conservative approach was used while estimating the potential volumes to avoid overestimating the material availability.



### **3.6 Site Potential Classification**

The site potential classification consists of a qualitative assessment of the site based on the accessibility, material quality (grain-size distribution, Los Angeles and Micro-Deval results), potential available volume, and the effort required to develop the site.

The classification used is as follows:

**High** – Clean, well-graded sand with variable proportions of gravel, or bedrock suitable to use as high-quality aggregates with a minimum processing. Presence of significant volumes and easy to access with minimum effort required for site development.

**Good** – Good quality material generally consisting of well-graded sand with variable proportions of gravel and limited quantities of silt, or good quality bedrock which could provide good quality aggregates with a minimal processing effort. Presence of significant volumes and relatively easy to access with limited effort required for site development.

**Fair** – Fair quality material consisting generally of poorly graded sand and variable proportions of gravel with or without substantial silt content or fair quality bedrock. Available material volumes are less significant and/or are relatively difficult to access (absence of existing access road or requiring significant rehabilitation works). Materials may require treatment to meet the standards (granulometric specification).

**Poor (not suitable)** – Poor quality material generally consisting of silty, poorly graded, fine-grained sand with minor gravel, poor-quality bedrock or presence of major extraction constraints (shallow water table, thick overburden, etc.).



## **4.0 Results**

Using aerial photo interpretation, five (5) potential borrow sources and six (6) potential quarry sites were identified as being more likely to contain suitable construction material along the Billy Diamond Highway and the potential BDH railway alignment. Typically, the potential borrow sources consist of juxtaglacial and littoral landforms, which are a common source of sand and gravel material within the James Bay region. The potential quarry sites usually consist of small bedrock hills which have the potential to provide an approximated mining depth of at least 10 m. A specific attention was given to avoid sites where environmental constraints (proximity of watercourses, waterbodies, or wetlands) are present. The main characteristics of the potential borrow sources and quarry sites identified are shown in Table 3 while the specific description of each site is presented below.





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**Table 3 Potential Borrow Sources and Quarry Sites Identified Along the Billy Diamond Highway  
Between Matagami and the Rupert River Bridge**

Site ID	Cell	Status	Centroid Coordinates (NAD 83 CSRS MTM 9)		No. SMS <sup>1</sup> (lease expiration date) <sup>1</sup>	Claim <sup>1</sup> (date of expiration)	Material Type	Area (ha)	Community
			Easting (m)	Northing (m)					
GD-25	A	Existing	244 370	5 518 600	32F14-14 (2023-03-31)	-	Sand	16.4	Waswanipi
	B	New	245 085	5 518 480	-	-	Sand	1.6	Waswanipi
	C	New	245 805	5 518 070	-	-	Sand	9.8	Waswanipi
GD-104.9	-	Existing	266 450	5 585 270	32K06-7 (2023-03-31)	Yes (2026-02-06)	Sand	32.3	Waswanipi
GD-113	-	New	258 985	5 589 260	32K06-69/68 (expired)	Yes (2026-02-06)	Till	-	Waswanipi
GD-220.3	A	Existing	228 830	5 662 205	32N04-3 (expired)	Yes (2024-08-18)	Sand, some silt	16.9	Nemaska
	B	New	228 860	5 661 655	-	Yes (2024-08-18)	Sand, some silt	7.3	Nemaska
	C	New	228 000	5 661 710	-	Yes (2024-08-18)	Sand to silty sand	42.0	Nemaska
GD-256.4	-	Existing	242 890	5 692 365	32N06-3 (expired)	Partially (2025-03-10)	Till	49.5	Waskaganish & Nemaska
Q-22	-	New	241 040	5 519 535	-	Yes (2023-08-31)-	Bedrock (Schisty basalt)	5.9	Waswanipi
Q-36.9	-	New	250 285	5 526 755	-	Partially (2024-01-04)	Bedrock (Diorite/Gabbro)	10.6	Waswanipi
Q-85.5	-	Existing	262 860	5 565 020	32K03-34 (2028-11-15)-	Yes (2025-05-01)	Bedrock (Granite/Diorite)	15.3	Waswanipi
Q-138.1	-	New	234 590	5 595 320	-	Yes (2025-03-01)	Bedrock (Gneiss)	18.5	Nemaska
Q-168	-	Existing	222 220	5 618 260	32K12-1 (Expired)	-	Bedrock (Meta-Basalt)	6.2	Nemaska
Q-246.5	-	New	242 480	5 686 075	-	-	Bedrock (Migmatite)	-	Nemaska

<sup>1</sup> Source: Gestim Plus, 2023



## **4.1 Potential Borrow Sources (Granular Material)**

The following sections (4.1.1 to 4.1.5) present the potential borrow sources identified along the Billy Diamond Highway between Matagami (KP 0) and the Rupert River Bridge (KP 257). Figure B1 (Appendix B) shows the distribution of the potential borrow source locations along the Billy Diamond Highway. Figures B2 to B6 (Appendix B) present an overview of each site, including the location of the test pits and the anticipated access road layout. The detailed test pit reports are provided in Appendix C while the grain size analysis results are presented in Appendix D. Pictures of each test pit and/or excavated material are presented in Appendix E.

### **4.1.1 Potential Borrow Source GD-25**

**Landform type:** Undulating juxtaglacial deposit

**Material:** Sand

**Estimated average material thickness:** Cell A: > 5 m  
Cell B: 3 m  
Cell C: 5 m

**Estimated volume:** Cell A: > 400 000 m<sup>3</sup>  
Cell B: 30 000 m<sup>3</sup>  
Cell C: 150 000 m<sup>3</sup>

**Site description:**

The potential borrow source GD-25 is located on the east side of KP 25 of the Billy Diamond Highway. The site consists of a juxtaglacial deposit where an existing borrow pit was previously exploited. The open faces show material thicknesses of approximately 10 to 15 m height (cell A).

The landform identified as being potentially favorable for borrow source development includes three cells (GD-25-A, GD-25-B, GD-25-C). The approximative areas of the cells A, B, and C are respectively 16,4 ha, 1,6 ha and 9,8 ha for a total area of 27,8 ha. Cells A and B are mostly forested, while cell B is in a cleared area. A peatland is located approximately 100 m north of cell C, and the Gabrielle Lake is located about 250 m west of the cell A.

**Site access:**

The site is easily accessible from the Billy Diamond Highway and through an access road that serves the existing borrow source and logging operations. Since the three cells are adjacent to the existing borrow pit (cell A) or to the existing access road (cells B and C), the access development would be limited to short roads for the extraction of material in cells B and C.



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**Field investigation program and laboratory testing:**

The field program was carried out on March 30, 2022 and consisted of the excavation of nine (9) test pits designated as GD-25-TP22-01 to GD-25-TP22-09 (Figure 2; Appendix B). The depth of the test pits ranged between 3.75 and 4.00 m. Their stratigraphy is presented in Table 4.

A total of seven (7) samples were selected for grain-size analysis. Their proportion of gravel, sand and fine particles (silt and clay combined) are summarized in Table 5.

**Subsurface conditions:**

Cell A: Two (2) test pits were conducted within cell A (GD-25-TP22-01 and GD-25-TP22-03). The encountered stratigraphy consisted of topsoil (0.10 to 0.25 m thick) overlying layers of sand with variable proportions of gravel and traces of silt with the presence of cobbles up to a depth of 3.75 m. However, the test pit GD-25-TP22-01 showed a layer of finer materials which consisted of sand with some silt and clay between a depth of 1.00 and 2.00 m. No water inflow was observed.

Cell B: Test pit GD-25-TP22-05 was excavated within cell B. Its stratigraphy consisted of 0.15 m of topsoil overlying 3.75 m of sand with traces of gravel and silt. No water inflow was observed.

Cell C: The cell C regroups test pits GD-25-TP22-07 and GD-25-TP22-08. The encountered stratigraphy consisted of a topsoil of 0.15 m overlying sand deposits with variable proportions of gravel and traces of silt. No water inflow was observed within the two (2) test pits.

Following the geotechnical field investigation, the delineation of site GD-25 was revised to exclude sectors where unsuitable materials were expected to be present. This includes the sectors of TP22-02, TP22-04, TP22-06 and TP22-09 where silty clay to clayey silt layer or silt and sand were encountered at shallow depth.

**Groundwater conditions:**

Water infiltration was observed at a depth of 0.25 m in GD-25-TP22-04. Otherwise, the water table wasn't reached within the other tests pits.

**Site potential classification:**

Cell A: High – Existing pit, easy to access and materials present a low proportion of fines.

Cell B: Good – Easy to access, materials present a low proportion of silt, but the exploitable volume is expected to be limited.

Cell C: Good - Easy to access, materials present a low proportion of silt but there is a possibility for higher fine proportions in the northeast section of the cell.



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**Table 4 Summary of Observed Stratigraphy for the Potential Borrow Source GD-25**

Test pit	Stratigraphy (depth-m)						Water inflow depth (m)
	Topsoil	Fill	Sand, variable proportion of gravel, traces of silt	Sand, some silt to silt and sand	Cohesive deposit	Till	
GD-25-TP22-01	0.00 – 0.15	-	0.15 – 1.00 2.00 – 3.75	1.00 – 2.00	-	-	-
GD-25-TP22-02	0.00 – 0.15 1.30 – 1.50 (buried)	0.15 – 1.30	-	-	1.50 – 4.00	-	-
GD-25-TP22-03	0.00 – 0.15	-	0.15 – 3.75	-	-	-	-
GD-25-TP22-04	0.00 – 0.25	-	-	2.00 – 2.50	0.25 – 2.00	2.50 – 4.00	0.25
GD-25-TP22-05	0.00 – 0.15	-	0.15 – 3.90	-	-	-	-
GD-25-TP22-06	0.00 – 0.15	-	0.15 – 0.50 1.60 – 2.60	2.60 – 3.80	0.50 – 1.60	-	-
GD-25-TP22-07	0.00 – 0.15	-	0.15 – 4.00	-	-	-	-
GD-25-TP22-08	0.00 – 0.15	-	0.15 – 3.75	-	-	-	-
GD-25-TP22-09	0.00 – 0.10	-	3.50 – 4.00	0.10 – 0.30 2.60 – 3.50	0.30 – 2.60		-

**Table 5 Grain Size Analysis Results for the Potential Borrow Source GD-25**

Test pit	Sample	Depth (m)	Gravel (%)	Sand (%)	Silt and clay (%)	Soil Classification (USCS)
GD-25-TP22-01	MA-02	1.00 - 2.00	2.7	83.2	14.1	SM
GD-25-TP22-03	MA-03	2.00 - 3.00	0.5	92.0	7.5	SP-SM
GD-25-TP22-05	MA-02	1.00 - 2.00	4.9	93.2	1.9	SP
GD-25-TP22-05	MA-04	3.00 - 3.90	2.1	96.0	1.9	SP
GD-25-TP22-07	MA-03	2.00 - 3.00	0.0	93.9	6.1	SP-SM
GD-25-TP22-08	MA-02	1.00 - 2.00	15.5	75.3	9.2	SP-SM
GD-25-TP22-09	MA-03	1.30 - 2.60	4.0	37.3	58.7	ML



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**4.1.2 Potential Borrow Source GD-104.9**

**Landform type:** Northwest-southeast oriented juxtaglacial deposit

**Material:** Sand to silty sand

**Estimated average material thickness:** 3 m

**Estimated volume:** ~ 400,000 m<sup>3</sup>

**Site description:**

The potential borrow source GD-104.9 is located 5.4 km northeast of KP 104.9 of the Billy Diamond Highway. An existing forest road connects the Billy Diamond Highway to the site while another forest road extends parallel to the site. The site GD-104.9 consists of a northwest-southeast oriented ridge that shows previous sign of sand extraction. The ridge is 2.2 km long by 100 m to 225 m wide, for a total area of approximately 32.2 ha. The site is mostly forested except for the small areas where material extraction previously occurred.

The exploitation of the site does not seem to be limited by the presence of environmental constraints such as the proximity of watercourses or wetlands.

**Site access:**

The site is easily accessible from an existing access road located east of KP 104.9 of the Billy Diamond Highway.



**Figure 2 Existing Borrow Source GD-104.9**



## **LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – POTENTIAL BDH RAILWAY (MATAGAMI TO RUPERT RIVER BRIDGE)**

### **Field investigation program and laboratory testing:**

The field program was carried out on April 1 and 2, 2022 and consisted of seven (7) test pits designated as GD-104.9-TP22-01 to GD-104.9-TP22-07. The depth of the test pits ranged between 0.3 m – in the abandoned northwest sector (rock refusal) – and 5 m within the main site. Their stratigraphy is presented in Table 6.

A total of five (5) samples were retained for grain size analysis. Results are summarized in Table 7.

### **Subsurface conditions:**

The stratigraphy encountered in the northwest sector of the deposit (tests pits GD-104.9-TP22-01 and GD-104.9-TP22-02) consisted of a topsoil layer (approximately 0.15 m) overlying layers of sand with variable proportions of gravel and traces of silt. The central sector of the deposit (GD-104.9-TP-22-03 and 04) showed finer materials ranging from silty sand to sand with some silt, with variable proportions of gravel. At the southeast extremity of the site, the materials were previously partially exploited, but the results obtained from GD-104.9-TP-05 showed the presence of cohesive material consisting of silty clay with some sand and traces of gravel between 0.80 and 1.80 m deep. Since this type of material is not suitable as granular borrow materials, the delineated area excludes the sector of test pit GD-104.9-TP-05.

Test pits GD104.9-TP22-06 and GD104.9-TP22-07 were excavated in the northwest sector of the site. Bedrock was encountered at shallow depth (respectively 0.90 and 0.30 m), and therefore, the sector was excluded from the potential borrow source.

### **Groundwater conditions:**

No water inflow was observed in any of the test pits.

### **Site potential:**

**Fair** - Existing pit, easy to access but the materials present high proportions of fines (silt and clay), especially in the southeast portion of the site. Some processing would be required to satisfy MG 112 granulometric specification.



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**Table 6 Summary of Observed Stratigraphy for the Potential Borrow Source GD-104.9**

Test pit	Stratigraphy (depth-m)					Bedrock	Water inflow depth (m)
	Topsoil	Sand, variable proportions of gravel, <u>traces of silt</u>	Sand, variable proportion of gravel, <u>some silt to sand and silt</u>	Cohesive deposit	Till		
GD-104.9-TP22-01	0.00 – 0.15	0.15 – 5.00					-
GD-104.9-TP22-02	0.00 – 0.15	0.15 – 5.00					-
GD-104.9-TP22-03	0.00 – 0.30		0.30 – 3.10				-
GD-104.9-TP22-04	0.00 – 0.25	0.25 – 1.00 2.00 – 4.00	1.00 – 2.00				-
GD-104.9-TP22-05	0.00 – 0.30	0.30 – 0.80		0.80 – 1.80	1.80 – 2.40	≥ 2.40	-
GD-104.9-TP22-06	0.00 – 0.30		0.30 – 0.90			≥ 0.90	-
GD-104.9-TP22-07	0.00 – 0.20		0.20 – 0.30			≥ 0.30	-

**Table 7 Grain Size Analysis Results for the Potential Borrow Source GD-104.9**

Test pit	Sample	Depth (m)	Gravel (%)	Sand (%)	Silt and clay (%)	Soil Classification (USCS)
GD-104.9-TP22-01	MA-03	0.90 - 2.10	1.6	95.5	2.9	SP
GD-104.9-TP22-02	MA-04	3.50 - 4.00	1.5	95.7	2.8	SP
GD-104.9-TP22-03	MA-01	0.30 - 1.00	4.0	67.1	28.9	SM
GD-104.9-TP22-03	MA-03	1.50 - 2.30	13.2	70.3	16.5	SM
GD-104.9-TP22-04	MA-02	1.00 - 2.00	6.0	58.9	35.1	SM



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### **4.1.3 Potential Borrow Source GD-113**

**Landform type:** Till ridge

**Material:** Till partially covered by silty sand to silty clay

**Estimated average material thickness:** N/A

**Estimated volume:** N/A

**Site description:**

The potential borrow source GD-113 is directly adjacent to the Billy Dimond Highway (east side), north of KP 113. The landform consists of a northwest-southeast oriented till ridge and is mostly forested. The ridge stands approximately 6 to 8 m high above the surrounding terrain which is mainly covered by fine-grained deposits and wetlands.

**Field investigation program and laboratory testing:**

The field program was carried out on March 31 and April 1, 2022 and consisted of the excavation of four (4) test pits designated as GD-113-TP22-01 to GD-113-TP22-04. The depth of the test pits ranged between 1.7 m and 3.9 m. Their stratigraphy is presented in Table 8.

Field classification showed that the material was not favorable to support the construction work. No samples were analyzed for this site.

**Site access:**

The site is directly adjacent the Billy Diamond Highway (KP 113).

**Subsurface conditions:**

A topsoil layer between 0.20 and 0.25 m thick was encountered at the surface. In the test pits GD-113-TP22-01 and GD-113-TP22-04, the topsoil overlies till deposit usually composed of sand and gravel with traces of silt and presence of cobbles and boulders. For the test pits GD-113-TP22-02 and GD-113-TP22-03, the topsoil sits on layers of fine grain cohesive deposits composed of silty sand and clay to clay and silt of respectively 1.65 m and 3.1 m thick before reaching the till deposit. Refusals on boulders were met in the test pits GD-113-TP22-01 and GD-113-TP22-03 at depths of 3.10 and 3.80 m respectively, while the bedrock surface was reached in the test pit GD-113-TP22-04 at a depth of 1.70 m.

**Groundwater conditions:**

No water inflow was observed in any of the test pits.

**Site potential:**

Low (not suitable) – The till deposit is partially covered by a layer of cohesive material.





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**Table 8 Summary of Observed Stratigraphy for the Potential Borrow Source GD-113**

Test pit	Stratigraphy (depth-m)				Water inflow depth (m)
	Topsoil	Cohesive deposit	Till	Bedrock	
GD-113-TP22-01	0.00 – 0.20		0.20 – 3.10		-
GD-113-TP22-02	0.00 – 0.25	0.25 – 1.90	1.90 – 3.90		-
GD-113-TP22-03	0.00 – 0.20	0.20 – 3.30	3.30 – 3.80		-
GD-113-TP22-04	0.00 – 0.20		0.20 – 1.70	≥ 1.70	-

**4.1.4 Potential Borrow Source GD-220.3**

**Landform type:** Undulating littoral deposit and littoral ridge

**Material:** Sand with variable proportion of silt and gravel

**Estimated average material thickness:** Cell A: 2.5 m  
 Cell B: 2 m  
 Cell C: 3 m

**Estimated volume:** Cell A: 60 000 m<sup>3</sup>  
 Cell B: 0 (20 000 with an environmental exemption)  
 Cell C : 300 000 m<sup>3</sup>

**Site description:**

The potential borrow source GD-220.3 is located at approximately 2.4 km west of KP 220 of the Billy Diamond Highway. The landform identified as being potentially favorable to borrow source development includes three (3) cells (A, B and C). The cells A and C consist of slightly undulating deposit of respective areas of 16.9 and 42.0 ha. The cell B is located at approximately 250 m south of the cells A and C and consists mainly of a narrow ridge of approximately 1 km long and 40 to 75 m wide for a total area of 7.3 ha.

The cell A has already been partially exploited (Figure 3). However, a significant volume of material remains available. The cell B and C were both explored in the past but were not previously exploited. The site was impacted by a forest fire before 2013 (Google Earth, 2022), but tree clearing would still be required. All cells are surrounded by wetlands which could represent a constraint to site exploitation.



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**Site access:**

The site is accessible from the KP 220.3 of the Billy Diamond Highway and through the existing ~2.9 km long access road leading to the borrow source (cell A). Considering the culverts have been removed, the vegetation has grown, road rehabilitation would be required.



**Figure 3 Former Borrow Pit at Site GD-220.3**

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## Field investigation program and laboratory testing:

The field program was carried out on July 15 and 16, 2022 and consisted of the excavation of 12 test pits designated as GD-220.3-TP22-01 to GD-220.3-TP22-12. The depth of the test pits ranged from approximately 2.5 m to 3.7 m deep. Their stratigraphy is presented in Table 9.

A total of 14 samples were selected for grain size analysis. Results are summarized in Table 10.

## Subsurface conditions:

Cell A: Three (3) test pits were excavated within the cell A (GD-220.3-TP22-01 to GD-220.3-TP22-03). The stratigraphy encountered within the test pits GD-220.3-TP22-01 and GD-220.3-TP22-03 consisted of sand with variable proportions of gravel and traces of silt from the surface to depths between 2.74 and 3.66 m. The test pit GD-220.3-TP22-02 showed an alternance of fine layers of sand with variable proportions of gravel and some silt below 0.74 m deep.

Cell B: Three (3) test pits were excavated within the cell B (GD-220.3-TP22-04 to GD-220.3-TP22-06). The stratigraphy consisted of an alternance of layers of sand with variable proportions of gravel and traces of silt with layers of sand containing variable proportions of gravel with some silt. Water inflows were observed in each test pit at depths of 3.66 m (GD-220.3-TP22-04), 0.91 m (GD-220.3-TP22-05) and 3,2 m (GD-220.3-TP22-06).

Cell C: Six (6) test pits were excavated within the cell C (GD-220.3-TP22-07 to GD-220.3-TP22-12). The encountered stratigraphy showed 0.08 to 0.15 m thick of topsoil overlying sand with variable proportions of gravel and traces of silt to a depth of 0.33 to 3.66 m. The test pits GD-220.3-TP22-07, GD-220.3-TP22-11 and GD-220.3-TP22-12 showed more in-depth variations between layers of sand with traces of gravel and silt, and a finer sandy unit reaching up to 20 % of fines (silt and clay combined).

## Groundwater conditions:

Water inflows were only observed in cell B at depths of 3.66 m (GD-220.3-TP22-04), 0.91 m (GD-220.3-TP22-05) and 3,2 m (GD-220.3-TP22-06).

## Site potential:

Cell A: Good – Former sand pit, presence of an existing access road requiring rehabilitation works, and the materials usually present low proportions of fines (silt and clay). Some processing could be required to satisfy MG 112 granulometric specification in some sectors.

Cell B: Low – The encountered materials contain layers with high proportions of fines and the exploitable area is largely limited by the presence of environmental constraints (wetlands and a small watercourse). The existing access road should also be extended to reach the cell.

Cell C: Good – Although the existing access road would have to be extended and rehabilitated, the cell presents a significant volume of sand with low proportions of silt, except for the east extremity of the cell (GD-220.3-TP-11 and GD-220.3-TP-12) where materials are finer.



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**Table 9 Summary of Observed Stratigraphy for the Potential Borrow Source GD-220.3**

Test pit	Stratigraphy (depth-m)			Water inflow depth (m)
	Topsoil	Sand, variable proportion of gravel, <u>traces of silt</u>	Sand, variable proportion of gravel, <u>some silt to sand and silt</u>	
GD-220.3-TP22-01	-	0.00 – 2.74		-
GD-220.3-TP22-02	-	0.00 – 0.74 1.52 – 2.13	0.74 - 1.52 2.13 – 3.66	-
GD-220.3-TP22-03	-	0.00 – 3.66		-
GD-220.3-TP22-04	0.00 – 0.15	0.15 – 0.99 1.22 – 3.35	0.99 – 1.22 3.35 – 3.66	3.66
GD-220.3-TP22-05	0.00 – 0.20	0.20 – 0.46	0.46 – 2.44	0.91
GD-220.3-TP22-06	0.00 – 0.20	0.20 – 0.56 1.78 – 3.66	0.56 – 1.78	3.20
GD-220.3-TP22-07	-	0.00 – 0.61 0.81 – 1.52 2.74 – 3.66	0.61 – 0.81 1.52 – 2.74	-
GD-220.3-TP22-08	0.00 – 0.10	0.10 – 3.66		-
GD-220.3-TP22-09	0.00 – 0.15	0.15 – 3.66		-
GD-220.3-TP22-10	0.00 – 0.10	0.10 – 3.35		-
GD-220.3-TP22-11	0.00 – 0.08	0.08 – 0.33	0.33 – 3.66	-
GD-220.3-TP22-12	0.00 – 0.13	0.13 – 0.61	0.61 – 3.66	-



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**Table 10 Grain Size Analysis Results for the Potential Borrow Source GD-220.3**

Test pit	Sample	Depth (m)	Gravel (%)	Sand (%)	Silt and clay (%)	Soil Classification (USCS)
GD-220.3-TP22-01	MA-02	0.30 - 1.20	0.4	98.9	0.7	SP
GD-220.3-TP22-02	MA-03	0.80 - 1.50	38.9	49.7	11.4	SW-SM
GD-220.3-TP22-02	MA-06	3.00 - 3.70	2.3	80.3	17.4	SM
GD-220.3-TP22-03	MA-04	1.60 - 2.40	1.6	89.1	9.3	SP-SM
GD-220.3-TP22-04	MA-04	1.20 - 2.10	18.6	74.1	7.3	SP-SM
GD-220.3-TP22-06	MA-03	0.70 – 1.50	24.8	56.8	18.4	SM
GD-220.3-TP22-07	MA-05	0.60 – 0.70	8.1	73.9	18.0	SM
GD-220.3-TP22-07	MA-12	1.50 – 1.80	2.8	77.0	20.2	SM
GD-220.3-TP22-08	MA-04	1.50 – 2.40	33.9	64.6	1.5	SP
GD-220.3-TP22-09	MA-06	2.70 – 3.70	4.1	88.7	7.2	SP-SM
GD-220.3-TP22-10	MA-03	0.40 – 1.10	10.6	68.5	20.9	SM
GD-220.3-TP22-11	MA-02	0.30 – 1.20	2.7	77.1	20.2	SM
GD-220.3-TP22-11	MA-04	1.80 – 2.70	3.1	71.8	25.1	SM
GD-220.3-TP22-12	MA-05	1.20 – 1.80	7.8	65.9	26.3	SM

#### 4.1.5 Potential Borrow Source GD-256.4

**Landform type:** Undulating till deposit

**Material:** Till (sand with variable proportions of gravel and fines, presence of cobbles and boulders)

**Estimated average material thickness:** 4 m

**Estimated volume:** > 500 000 m<sup>3</sup>

**Site description:**

The site GD-256.4 is located at approximately 2.2 km north of KP 256 of the Billy Diamond Highway, near the Rupert River. The site consists of undulating terrain covered by a continuous till deposit. An existing pit was previously exploited within the same deposit but has been revegetated since (Figure 4). The delineated potential borrow source is approximately 1 km long and about 340 to 500 m wide for a total area of 49.5 ha.

Some wetlands are located in the vicinity of the site (to the east and west), but they are not expected to represent a significant limitation to the extraction of borrow material in the area.



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**Site access:**

The site is accessible from the KP 256.4 of the Billy Diamond Highway and through an existing ~2.3 km long access road leading to the weir KP 110.3 (Eastmain-1-A/ Sarcelle/ Rupert development). Then, the site could be reached by upgrading the former access road within the previous borrow pit.



**Figure 4 Previously Exploited Area Adjacent to Potential Borrow Source GD-256.4**



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**Field investigation program and laboratory testing:**

The field program was carried out on April 6, 2022 and consisted of the excavation of six (6) test pits designated as GD-256.3-TP22-01 to GD-256.3-TP22-06. The depth of the test pits ranged from 4 m to 5 m. Their stratigraphy is presented in Table 11.

A total of eight (8) representative samples were selected for grain size analysis. Results are summarized in Table 12.

**Subsurface conditions:**

The observed stratigraphy consists mainly of a topsoil layer of 0.30 m thick overlying till deposit which is usually composed of sand with gravel and traces of silt to silty and gravelly sand with the presence of cobbles and boulders. The proportion of cobble and boulder was visually estimated and generally ranged between 0 and 20 % (exception for the first meter of materials where up to 40%-50% of cobble was observed).

**Groundwater conditions:**

The water table was not reached, and no water inflow was observed within the test pits.

**Site potential:**

Good (backfill use only) – The site is adjacent to a former till pit and accessible by a former access road which would need some rehabilitation work. The site contains a significant volume to be used as backfill. However, the materials are not suitable to produce MG 112 since the proportion of fines are too high.

**Table 11 Summary of Observed Stratigraphy for the Potential Borrow Source GD-256.4**

Test pit	Stratigraphy (depth-m)		Water inflow depth (m)
	Topsoil	Till	
GD-256.4-TP22-01	0.00 – 0.30	0.30 – 5.00	-
GD-256.4-TP22-02	0.00 – 0.30	0.30 – 5.00	-
GD-256.4-TP22-03	0.00 – 0.30	0.30 – 5.00	-
GD-256.4-TP22-04	0.00 – 0.30	0.30 – 5.00	-
GD-256.4-TP22-05	0.00 – 0.30	0.30 – 5.00	-
GD-256.4-TP22-06	0.00 – 0.30	0.30 – 4.00	-



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**Table 12 Grain Size Analysis Results for the Potential Borrow Source GD-256.4**

Test pit	Sample	Depth (m)	Gravel (%)	Sand (%)	Silt and clay (%)	Soil Classification (USCS)
GD-256.4-TP22-01	MA-02	0.90 - 2.50	25.30	50.30	24.40	SM
GD-256.4-TP22-02	MA-04	2.50 - 5.00	4.40	75.80	19.80	SM
GD-256.4-TP22-03	MA-01	0.30 - 0.60	61.20	36.50	2.30	GW-GM
GD-256.4-TP22-03	MA-03	2.00 - 3.50	14.10	52.10	33.80	SM
GD-256.4-TP22-04	MA-04	2.30 - 5.00	1.80	78.30	19.90	SM
GD-256.4-TP22-05	MA-03	1,50 – 4,0	0.00	80.40	19.60	SM
GD-256.4-TP22-06	MA-02	0,8 – 1,2	12.20	47.30	40.50	SM
GD-256.4-TP22-06	MA-04	2.0 – 4.0	34.8	52.4	12.8	SM

## 4.2 Potential Quarry Sites

The following sections (4.2.1 to 4.2.6) present the potential quarry sites identified along the Billy Diamond Highway between Matagami (KP 0) and the Rupert River Bridge (KP 257). The Figure B1 (Appendix B) shows an overview of the potential borrow sources locations along the Billy Diamond Highway, while larger scale map figures for each site (Figures B7 to B12; Appendix B) present the borehole locations and their surrounding terrain. The borehole reports are provided in Appendix C, and the Los Angeles and Micro-Deval laboratory results are shown in Appendix D. Appendix E provides a photographic album of each rock core.

### 4.2.1 Potential Quarry Site Q-22

**Landform type:** Rounded rocky hill

**Material:** Bedrock (schisty basalt)

**Estimated average material thickness:** 10 m

**Estimated volume:** > 225 000 m<sup>3</sup> (260 000 m<sup>3</sup> including a swell ratio of 1.15 once compacted)

**Site description:**

The potential quarry site Q-22 is located at approximately 230 m north of km 21.2 of the Billy Diamond Highway. The landform rises approximately 50 m above the surrounding terrains, but the retained area is limited to the higher part of the hill which stands approximately 10-12 m high at the summit. The site presents an irregular shape of approximately 300 m long by 200 m wide and occupies a total area of approximately 5.9 ha. The sector is forested, and the site has never been exploited. An existing borrow pit is located about 500 m west and some exploration trails appear to have been cleared from the pit toward the potential quarry site.





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No hydrographic features or wetlands that could affect the potential exploitable volume were observed in the vicinity of the site.

**Site access:**

No existing access is available to reach the site. However, some trails passing south of the quarry site could be upgraded on approximately 585 m long to provide access to the site.

**Field investigation program and laboratory testing:**

Two (2) boreholes (Q-22-BH22-01 and Q-22-BH22-02) were drilled on March 29 and March 30, 2022, and reached depths of 12.06 and 9.42 m, respectively. Their stratigraphy is summarized in Table 13. Following the description of the bedrock cores by a geologist, representative rock samples were selected to conduct two (2) Micro-Deval tests (LC 21-070), and two (2) Los Angeles tests (LC 21-400) for each borehole. The results are presented in Table 14.

**Subsurface conditions:**

The borehole Q-22-BH22-01 showed an overburden thickness of 7.57 m overlying grey schist basalt up to a depth of 12.08 m. Although the overburden thickness for this borehole was significant, it does not represent the expected superficial material thickness within the site boundaries. Due to accessibility constraints, the borehole was drilled in a sector of bedrock depression filled by till deposit which was excluded from the potential quarry site area. However, the bedrock conditions are representative of the local geology since comparable characteristics were found in borehole Q-22-BH22-02.

The borehole Q-22-BH22-02 was drilled at approximately 135 m southeast of Q-22-BH22-01. In that sector, the encountered stratigraphy consists of 2.21 m of overburden overlying grey schist basalt.

The Micro Deval values for the boreholes drilled within this site ranged from 4 % to 7 %, while the Los Angeles results ranged from 11 % to 14 %, indicating suitable rock quality for the ballast and sub ballast materials. The laboratory test results are provided in Table 14.

**Site potential:**

Good – The encountered bedrock appears to be suitable to produce crushed stone. However, the site would require clearing and construction of an access road.

**Table 13 Summary of the Encountered Stratigraphy for Potential Quarry Site Q-22**

Borehole ID	Total depth (m)	Stratigraphy (depth-m)		
		Topsoil	Surficial deposits	Schisty Basalt
Q-22-BH22-01	12.06	0.61	0.61 – 7.57	7.57 – 12.06
Q-22-BH22-02	9.42	0.61	0.61 – 2.21	2.21 – 9.42



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**Table 14 Laboratory Results for Potential Quarry Site Q-22**

Borehole ID	Sample	Depth (m)	Geotechnical laboratory test results	
			Micro-Deval (%) (LC 21-070)	Los Angeles (%) (LC 21-400)
Q-22-BH22-01	DC-07 and DC -08	7,57 – 9.68	7	14
Q-22-BH22-01	DC-08 and DC-09	9,68 – 12.06	7	11
Q-22-BH22-02	DC-05 and DC-06	2.21– 4.93	4	13
Q-22-BH22-02	DC-07 to DC-09	6.11 – 9.73	4	13

#### **4.2.2 Potential Quarry Site Q-36.9**

**Landform type:** Rocky hill

**Material:** Bedrock (quartz diorite)

**Estimated average material thickness:** 10 m

**Estimated volume:** 500 000 m<sup>3</sup> (575 000 m<sup>3</sup> including a swell ratio of 1.15 once compacted)

**Site description:**

The potential quarry site Q-36.9 is located at approximately 30 m west of KP 36.2 of the Billy Diamond Highway. The site has never been exploited and the sector is densely forested. It consists of a relatively round shaped bedrock hill covered by an overburden layer of about 2 m thick. The site is approximately 340 m long and 330 m wide for a total area of 10.6 ha. The bedrock-controlled landform is approximately 12 to 20 m above the surrounding terrains, which are mainly covered by sandy silt to gravelly sand to the north, west and south and marine fine sediments overlaid by a peat veneer in the valley to the east.

An existing quarry site is located 0.5 km south of Q-36.9 (KP 35.5). The bedrock were notably exploited in 2017 for rehabilitation works to be conducted along the Billy Diamond Highway and the residual volume is considered to be very low. Consequently, the site was not considered as a potential quarry site for railway construction.

**Site access:**

The site can be reached using an existing north-south oriented trail (650 m long) starting perpendicularly to the Matagami Lake camping access road.



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**Field investigation program and laboratory testing:**

Two (2) boreholes (Q-36.9-BH22-01 and Q-36.9-BH22-02) were drilled on site on March 24 and 29, 2022. The boreholes reached depths of 9.63 and 11.10 m, while the bedrock was intersected at depths of 1.70 and 2.16 m, respectively. Their stratigraphy is presented in Table 15.

For each borehole, three (3) Micro-Deval and three (3) Los Angeles tests were conducted. Laboratory results are presented in Table 16.

**Subsurface conditions:**

Located in the northwest sector of the site, the borehole Q-36.9-BH22-01 showed an overburden layer of approximately 1.70 m thick. The underlying bedrock consisted of massive quartz diorite bedrock with some oblique joint and light alteration down to a depth of 8.13 m. Below this depth, the borehole intersected a pink and white mafic dyke until 9.63 m deep. Approximately 170 m southeast of the borehole Q-36.9-BH22-01, the borehole Q-36.9-BH22-02 showed a 2.16 m thick overburden layer. The intersected bedrock mainly consisted of quartz diorite from 2.16 m to 11.10 m, except for the presence of a layer of gabbro between 8.10 and 9.60 m deep.

Laboratory tests results for selected samples from the two boreholes showed Micro-Deval values ranging from 5 to 9 %, while Los Angeles values ranged from 13 to 20 %. These values suggest that the bedrock should be suitable to produce various types of crushed stones (Table 16).

**Site potential:**

Good – The encountered bedrock appears to be suitable to produce crushed stone. However, the site would require clearing and construction of an access road.

**Table 15 Summary of the Encountered Stratigraphy for Potential Quarry Site Q-36.9**

Borehole ID	Total depth (m)	Stratigraphy (depth-m)				
		Topsoil	Surficial deposits	Quartz diorite bedrock	Mafic dyke	Gabbro
Q-36.9-BH22-01	9.63	-	0.00 – 1.70	1.70 – 8.13	8.13 – 9.63	
Q-36.9-BH22-02	11.10	-	0.00 – 2.16	2.16 – 8.10 9.60 – 11.10		8.10 – 9.60



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**Table 16 Laboratory Results for Potential Quarry Site Q-36.9**

Borehole ID	Sample	Depth (m)	Geotechnical laboratory test results	
			Micro-Deval (%) (LC 21-070)	Los Angeles (%) (LC 21-400)
Q-36.9-BH22-01	DC-05 and DC-06	2.13 – 4.42	6	17
Q-36.9-BH22-01	DC-06 and DC-07	4.42 – 6.63	6	17
Q-36.9-BH22-01	DC-09	8.13 – 9.62	5	13
Q-36.9-BH22-02	DC-06	3.61 – 5.11	9	18
Q-36.9-BH22-02	DC-07 and DC-08	5.79 – 8.10	9	19
Q-36.9-BH22-02	DC-11	9.60 – 11.10	9	20

**4.2.3 Potential Quarry Site Q-85.5**

**Landform type:** Elongated rocky hill

**Material:** Bedrock (granite/granitoid and quartz diorite)

**Estimated average material thickness:** 15 m

**Estimated volume:** > 1 000 000 m<sup>3</sup> (> 1 150 000 m<sup>3</sup> including a swell ratio of 1.15 once compacted)

**Site description:**

The potential quarry site Q-85.5 is located approximately 800 m east of the KP 86 of the Billy Diamond Highway. The site consists of an existing quarry where different bedrock faces were mined. The general landform consists of an elongated east-west oriented bedrock hill. The western open bedrock face is approximately 10-15 m high while the eastern faces reach up to 20 m high. The potential quarry site is approximately 500 m long by 300 m wide for a total area of 15.3 ha. Most of the site surface remains densely forested.

Some water courses flowing eastward are present southeast of the site, but they don't constitute constraints to the potentially exploitable volume.



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**Site access:**

The site is easily accessible from the Billy Diamond Highway using the existing hauling road to the quarry site Q-85.5.

**Field investigation program and laboratory testing:**

Two (2) boreholes (Q-85.5-BH22-01 and Q-85.5-BH22-02) were drilled on site on March 27 and 28, 2022. The boreholes reached depths of 8.03 m (Q-85.5-BH22-01) and 9.53 m (Q-85.5-BH22-02), respectively, while the bedrock was intersected at depths of 0.79 m and 0.43 m, respectively. Their stratigraphy is presented in Table 17.

For each borehole, three (3) Micro-Deval and two (2) or three (3) Los Angeles tests were conducted. Laboratory results are presented in Table 18.

**Subsurface conditions:**

Encountered subsurface conditions showed the presence of a 0.43 to 0.61 m thick topsoil layer. The borehole Q-85.5-BH22-01 intersected a thin sandy deposit before reaching the bedrock surface at a depth of 0,79 m, while the topsoil sits directly on the bedrock surface in borehole Q-85.5-BH22-02. In both boreholes, the bedrock consisted of an alternance of coarse to fine grained pink granite/granitoid and white to grey massive quartz diorite until the bottom of the holes at 8.03 (Q-85.5-BH22-01) and 9.53 m (Q-85.5-BH22-02) below ground surface.

Laboratory testing on selected core samples obtained from the two (2) boreholes showed Micro-Deval ranging from 6 to 10 % and Los Angeles values ranging from 24 to 31 %. These values suggest that the bedrock should be suitable to produce various types of aggregates (Table 18).

**Site potential:**

High – The encountered bedrock appears to be suitable to produce crushed stone. The overburden is thin, and the site is accessible by the existing access road.

**Table 17 Summary of the Encountered Stratigraphy for Potential Quarry Site Q-85.5**

Borehole ID	Total depth (m)	Stratigraphy (depth-m)			
		Topsoil	Surficial deposits	Granite/ granitoid bedrock	Quartz diorite
Q-85.5-BH22-01	8.03	0.00 – 0.61	0.61 – 0.79	0.79 – 3.91 6.83 – 8.03	3.91 – 6.83
Q-85.5-BH22-02	9.53	0.00 – 0.43	-	0.91 – 3.35	0.43 – 0.91 3.35 – 9.53



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**Table 18 Laboratory Results for Potential Quarry Site Q-85.5**

Borehole ID	Sample	Depth (m)	Geotechnical laboratory test results	
			Micro-Deval (%) (LC 21-070)	Los Angeles (%) (LC 21-400)
Q-85.5-BH22-01	DC-04	2.03 – 3.83	7	31
Q-85.5-BH22-01	DC-05 and DC-06	3.91 – 6.52	8	29
Q-85.5-BH22-01	DC-07	6.83 – 8.03	6	-
Q-85.5-BH22-02	DC-02 and DC-03	0.91 – 3.25	6	29
Q-85.5-BH22-02	DC-04	3.53 – 5.03	9	24
Q-85.5-BH22-02	DC-06 and DC-07	7.18 – 9.53	10	28

#### **4.2.4 Potential Quarry Site Q-138.1**

**Landform type:** Elongated rocky hill

**Material:** Bedrock (gneiss)

**Estimated average material thickness:** 12-15 m

**Estimated volume:** > 1 000 000 m<sup>3</sup> (> 1 150 000 m<sup>3</sup> including a swell ratio of 1.15 once compacted)

**Site description:**

The potential quarry site Q-138.1 is located approximately 1.8 km southwest of the KP 138.5 of the Billy Diamond Highway. The site consists of an elongated northeast/ southwest orientated bedrock hill. Its dimensions are approximately 750 m long and 260 m wide for a total area of 18.5 ha. The site rises 50 m above the surrounding terrain. However, the delineated landform is limited to the central portion of the hill to minimize the overburden thickness and the proximity with the surrounding wetlands. The site was not exploited and is partially forested.

**Site access:**

The site is located at 1.8 km from the Billy Diamond Highway and the potential BDH railway alignment. The exploitation of the site would require the construction of a new access road. However, an existing 2.7 km long logging trail provides access to the site from the Billy Diamond Highway. This trail allowed our team to access the site with the drilling rig. Nevertheless, the trail would require significant upgrades to allow the exploitation of a quarry at this location.



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**Field investigation program and laboratory testing:**

Two (2) boreholes were drilled on site (Q-138.1-BH22-01, Q-138.1-BH22-02) between April 3 and April 5, 2022. The boreholes were drilled to depths of 9.20 m (Q-138.1-BH22-01) and 9.30 m (Q-138.1-BH22-02), while the bedrock surface was reached at depths of 1.32 m and 0.76 m, respectively. The stratigraphy encountered at each borehole is summarized in Table 19.

For each borehole, three (3) Micro-Deval and three (3) Los Angeles tests were conducted. Laboratory results are presented in Table 20.

**Subsurface conditions:**

The subsurface conditions encountered at boreholes Q-138.1-BH22-01 and Q-138.1-BH22-02 consisted of an overburden layer (organic and/or granular) of 0.76 m to 1.32 m, overlying massive pink gneiss bedrock to depths of 9.19 m and 9.30 m, respectively.

Laboratory tests results for the selected samples from each borehole show that Micro-Deval values range from 6 to 9 %, while Los Angeles values range from 27 to 34 %. These values suggest that the bedrock is suitable to produce various types of aggregates (Table 20).

**Site potential:**

Good – The encountered bedrock appears to be suitable to provide crushed stone for the construction of a new railway. However, the site is located at approximately 1.8 km from the Billy Diamond Highway; consequently, the existing logging trail requires to be converted to a hauling road.

**Table 19 Summary of the Encountered Stratigraphy for Potential Quarry Site Q-138.1**

Borehole ID	Total depth (m)	Stratigraphy (depth-m)		
		Organic matter	Surficial deposits	Gneiss
Q-138.1-BH22-01	9.20	0.00 – 1.32	-	1.32 – 9.19
Q-138.1-BH22-02	9.30	-	0.00 – 0.76	0.76 – 9.30

**Table 20 Laboratory Results for Potential Quarry Site Q-138.1**

Borehole ID	Sample	Depth (m)	Geotechnical laboratory test results	
			Micro-Deval (%) (LC 21-070)	Los Angeles (%) (LC 21-400)
Q-138.1-BH22-01	DC-01 and DC-02	1.32 – 3.53	9	34
Q-138.1-BH22-01	DC-03 and DC-04	3.53 – 6.52	6	27
Q-138.1-BH22-01	DC-06	8.03 – 9.20	8	24
Q-138.1-BH22-02	DC-03 and DC-04	0.94 – 3.33	9	33
Q-138.1-BH22-02	DC-05 and DC-06	3.33 – 6.05	7	32
Q-138.1-BH22-02	DC-07 and DC-08	6.30 – 9.30	7	30



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#### **4.2.5 Potential Quarry Site Q-168.1**

**Landform type:** Elongated rocky hill

**Material:** Bedrock (meta-basalt)

**Estimated average material thickness:** 10 m

**Estimated volume:** 200 000 m<sup>3</sup> (230 000 m<sup>3</sup> including a swell ratio of 1.15 once compacted)

**Site description:**

The quarry site Q-168.1 is located southwest of the KP 167 of the Billy Diamond Highway. An existing quarry site was previously exploited at this location at approximately 320 m of the Billy Diamond Highway. The open face showed a bedrock thickness of about 10 m high while the existing quarry occupies an area of approximately 2.5 ha (Figure 5). Although some bedrock was extracted at this location for the 2017-2021 Billy Diamond Highway rehabilitation works, a significant bedrock volume is still available for material production.

The new delineated potential quarry site is located southeast portion of this northwest-southeast rock ridge. The site is approximately 300 m long by 180 m wide with a northwest extension of 200 m long by approximately 40 m wide along the previous quarry. The total area of these two (2) sectors is approximately 5.6 ha. The site would require some vegetation clearing, but its surface is generally only sparsely wooded. The site lies about 20 m above the surrounding terrains, but the average extraction thickness is expected to be comparable to the current open bedrock face, which is approximately 10 m.

No apparent environmental constraints were observed in the vicinity of the site.

**Site access:**

The site is accessible from the Billy Diamond Highway (KP 167) using the existing 320 m long access road leading to the existing quarry. The condition of the hauling road should be validated before mobilizing to the site since some road improvement could be necessary.





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**Figure 5 Existing Quarry Site Q-168.1**

**Field investigation program and laboratory testing:**

Two (2) boreholes were drilled on site (Q-168.1-BH22-01 and Q-168.1-BH22-02) on April 1 and 2, 2022. The borehole Q-168.1-BH22-01 and Q-168.1-BH22-02 reached depths of 9.40 m and 9.32 m, whereas the bedrock was met at 0.99 and 0.94 m, respectively. Their stratigraphy is summarized in Table 21.

For each borehole, three (3) Micro-Deval and three (3) Los Angeles tests were conducted. Laboratory results are presented in Table 22.

**Subsurface conditions:**

The subsurface conditions encountered at boreholes Q-168.1-BH22-01 and Q-168.1-BH22-02 consist of an overburden layer (organic matter or surficial deposit) of 0.99 m to 0.94 m overlying grey fine-grained meta-basalt bedrock down to 9.40 m and 9.32 m deep, respectively.



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The Micro Deval results ranged from 5 % to 13 %, while the Los Angeles results ranged from 11 % to 21 %, indicating suitable rock quality for the ballast and sub ballast materials. The laboratory test results are presented in Table 22.

**Site potential:**

High – The encountered bedrock appears to be suitable to produce crushed stones, the overburden is thin, and the site is accessible by the existing access road.

**Table 21 Summary of the Encountered Stratigraphy for Potential Quarry Site Q-168.1**

Borehole ID	Total depth (m)	Stratigraphy (depth-m)		
		Organic matter	Surficial deposit	Meta-basalt
Q-168.1-BH22-01	9.40	0.00 – 0.58	0.58 – 0.99	0.99 – 9.40
Q-168.1-BH22-02	9.32	-	0.00 – 0.94	0.94 – 9.32

**Table 22 Laboratory Results for Potential Quarry Site Q-168.1**

Borehole ID	Sample	Depth (m)	Geotechnical laboratory test results	
			Micro-Deval (%) (LC 21-070)	Los Angeles (%) (LC 21-400)
Q-168.1-BH22-01	DC-03 and DC-04	0.99 – 3.40	12	17
Q-168.1-BH22-01	DC-05 and DC-06	3.40 – 6.40	12	18
Q-168.1-BH22-01	DC-07 and DC-08	6.40 – 9.40	13	21
Q-168.1-BH22-02	DC-04 and DC-05	1.83 – 4.01	9	11
Q-168.1-BH22-02	DC-06 and DC-07	4.83 – 7.16	5	13
Q-168.1-BH22-02	DC-07 and DC-08	7.16 – 9.32	5	12



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#### **4.2.6 Potential Quarry Site Q-246.5**

**Landform type:** Rounded hill

**Material:** Till deposit overlying bedrock (migmatite)

**Estimated average material thickness:** N/A

**Estimated volume:** N/A

**Site description:**

The potential quarry site is located approximately 1.1 km northwest of KP 246.5 of the Billy Diamond Highway. The landform consists of a rounded hill and presents a sparsely forested cover. The site stands approximately 10 to 15 m above the surrounding terrains except for a sector at the northwest of the site where the topography drops by approximately 30 m. The site is about 570 m long and 360 m wide with a total area of 16.1 ha and has never been exploited before. The surrounding terrains are mainly covered by till deposits and wetlands.

**Site access:**

N/A – Site access is not recommended since the site presents a low potential for bedrock extraction.

**Field investigation program and laboratory testing:**

Two (2) boreholes were drilled on site (Q-246.5-BH22-01 and Q-246.5-BH22-02) on July 21 and 22, 2022. The boreholes Q-246.5-BH22-01 and Q-246.5-BH22-02 were respectively drilled to depths of 13.36 m and 9.60 m and where the bedrock was intersected 2.92 m and 5.79 m deep. A total of three (3) Micro-Deval and three (3) Los Angeles tests were conducted for this site.

**Subsurface conditions:**

The subsurface conditions encountered within the boreholes Q-246.5-BH22-01 and Q-246.5-BH22-02 consist of a layer of organic matter (respectively of 0.61 m and 0.10 m thick) overlying till deposit of 2.31 m and 5.69 m thick, respectively. The underneath bedrock is composed of black and grey, and black and pink migmatite. The summary of the stratigraphy encountered at each borehole is presented in Table 23.

Laboratory tests results for selected samples from the two (2) boreholes showed that Micro-Deval values range from 7 to 15 % while Los Angeles values range from 21 to 23 %, indicating that the bedrock is suitable for the production of various types of crushed stones (Table 24).

**Site potential:**

Low (not suitable) – The encountered bedrock appears to present suitable geotechnical properties. However, the overburden thickness would involve excessive stripping work that would quickly become unproductive.



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**Table 23 Summary of the Encountered Stratigraphy for Potential Quarry Site Q-246.5**

Borehole ID	Total depth (m)	Stratigraphy (depth-m)		
		Organic matter	Surficial deposit	Migmatite
Q-246.5-BH22-01	13.36	0.00 – 0.61	0.61 – 2.92	2.92 – 13.36
Q-246.5-BH22-02	9.60	0.00 – 0.10	0.10 – 5.79	5.79 – 9.60

**Table 24 Laboratory Results for Potential Quarry Site Q-246.5**

Borehole ID	Sample	Depth (m)	Geotechnical laboratory test results	
			Micro-Deval (%) (LC 21-070)	Los Angeles (%) (LC 21-400)
Q-246.5-BH22-01	DC-06 to DC-08	2.97 – 7.26	13	21
Q-246.5-BH22-01	DC-09 to DC-12	7.26 – 13.36	15	21
Q-246.5-BH22-02	DC-06 to DC-08	5.79 – 9.60	7	23



## **5.0 Discussion and Conclusion**

Potential borrow sources and quarry sites assessment was conducted to meet the material needs for the construction of the potential BHD railway between the city of Matagami and KP 257 (Rupert River Bridge) of the Billy Diamond Highway.

Using aerial photo interpretation, five (5) potential borrow sources (granular material) and six (6) potential quarry sites (bedrock) were identified for geotechnical investigations. Test pits and boreholes were conducted to describe the granular materials or bedrock and to perform laboratory tests (grain size analysis, Micro-Deval, and Los Angeles tests) for detailed classification. Based on the information collected during the desktop assessment and the geotechnical investigations, the quality and quantity of the potentially suitable material were characterized.

Materials encountered within the potential borrow sources GD-25, GD-104.9 and GD-220.3 consisted mainly of sand with variable proportions of gravel and traces to some silt. The cells A, B, and C of the potential borrow source GD-25 could provide suitable granular material to produce MG 112, since most of the materials contain less than 10 % of soils finer than 0.08 mm. However, some layers showed higher fine proportions (10 – 20 %). Material testing (grain size analysis) would be required once the materials are piled up in order to confirm their compliance with the MG 112 granulometric specification.

The potential borrow source GD-104.9 shows a more favorable texture in its northwestern section compared to its southeastern which one shows finer textured materials. The encountered materials could be suitable for the production of MG 112 materials, particularly in the northwest portion but the southeast section of the deposit would require material testing (grain size analysis) to confirm the compliance with the MG 112 granulometric specification once the different material layers are piled up and combined. Some processing may be required to comply with the MG 112 granulometric specification.

The cells A and C of the potential deposit GD-220.3 presented frequent alternating layers with variable proportions of fine particles. Material testing (grain size analysis) would be required once the different materials are stacked to ensure compliance with the MG 112 granulometric specification. The cell B could also be considered for the production of MG 112 materials, if required. However, environmental authorizations would be required to take advantage of the cell within the distances normally permitted since the proximity of wetlands and a waterbody limit the exploitable area. Otherwise, the exploitation of the cell B is not recommended.

Two (2) till deposits were explored along the Billy Diamond Highway (GD-113 and GD-256.4). The test pits excavated within the potential borrow source GD-113 showed the presence of a layer of cohesive material at the surface and the bedrock was reached at a depth of 1.7 m at its eastern extremity. Although some small volumes have previously been extracted previously, the exploitation should not be considered. The test pits excavated within the second till deposit (GD-256.4) showed a thick layer of glacial materials where the water table was not reached. The encountered materials could be used as class B for fill materials.



**LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I  
POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – POTENTIAL BDH  
RAILWAY (MATAGAMI TO RUPERT RIVER BRIDGE)**

A total of six (6) potential and existing quarry sites were explored during the geotechnical investigation. The potential quarry sites Q-22, Q-36.9, and Q-246.5 consisted of unexploited sites (new sites). The laboratory results showed that the drilled bedrock is suitable for the three sites for the production of ballast and sub-ballast materials. While the potential quarry sites Q-22 and Q-36.9 are recommendable for quarry site development, the site Q-246.5 is not recommended due to the significant overburden thickness which would require major soil stripping and earthworks beforehand. Boreholes were also drilled behind the existing quarry faces to confirm the quality of the bedrock in the quarry sites Q-85.5, Q-138.1, and Q-168. The laboratory test results showed that the intersected bedrock appears to be suitable for ballast and sub-ballast material production.

Table 25 summarizes the potential exploitable volumes identified along the Billy Diamond Highway from Matagami to the Rupert River Bridge.

**Table 25 Summary of the Potentially Exploitable Volumes Identified Along the Billy Diamond Highway from Matagami (KP 0) to the Rupert River Bridge (KP 257)**

Site ID	Material Type	Estimated average material thickness (m)	Potential volume with respect to environmental constraints (m <sup>3</sup> )	Potential bedrock volume considering a swell ratio of 1.15 (once compacted)
GD-25-A	Sand	5	> 400 000	N/A
GD-25-B	Sand	3	30 000	
GD-25-C	Sand	5	150 000	
GD-104.9	Sand	3	400 000	
GD-113	Till		Not recommended	
GD-220.3-A	Sand, some silt	2.5	60 000	
GD-220.3-B	Sand, some silt	2	0 (20 000 with an environmental exemption)	
GD-220.3-C	Sand to silty sand	3	300 000	
GD-256.4	Till	4	> 500 000	
Q-246.5	Bedrock		Not recommended	
Q-22	Bedrock	10	225 000	260 000
Q-36.9	Bedrock	10	500 000	575 000
Q-85.5	Bedrock	15	> 1 000 000	> 1 150 000
Q-138.1	Bedrock	12-15	> 1 000 000	> 1 150 000
Q-168	Bedrock	10	200 000	230 000
Total - Granular materials	> 1 340 000 m <sup>3</sup> considering environmental constraints <sup>1</sup>			
Total - Bedrock	3 365 000 m <sup>3</sup> (including a swell ratio of 1.15)			

<sup>1</sup> The sum does not consider the volume of site GD256.4 since the till is not suitable to produce MG 112.



**LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I  
POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – POTENTIAL BDH  
RAILWAY (MATAGAMI TO RUPERT RIVER BRIDGE)**

Based on the actual material requirements, a deficit of approximately 643 000 m<sup>3</sup> of suitable material to produce MG 112 is observed. Other potential borrow sources will need to be identified to meet the current study requirements. This deficit could be addressed by using some of the potential sources of materials identified along the access road to the community of Waskaganish and along the western portion of the Route du Nord. Although additional borrow material sources could be identified along the southern portion of the route, the granular material deficit is mainly located along the northern portion of the potential BHD railway alignment. The identified potential quarry sites appear to present sufficient quantities to produce the volumes of ballast and sub-ballast materials required to support the program.

An update of the available material volumes will have to be conducted before construction works begins as some potential sources may have been used for other purposes, in the meantime. Also, an assessment of the access road conditions should be carried out at the appropriate time to evaluate the extent of the rehabilitation work needed.

Finally, it must be noted that the location and the exploitation of borrow pits and quarries are submitted to the Regulation respecting sand pits and quarries (Chapter Q-2, r 7.1) of the Environment Quality Act. The final selection and delineation of the selected sites should be done according to the applicable regulations in effect at that time.



**LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I  
POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – POTENTIAL BDH  
RAILWAY (MATAGAMI TO RUPERT RIVER BRIDGE)**

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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.

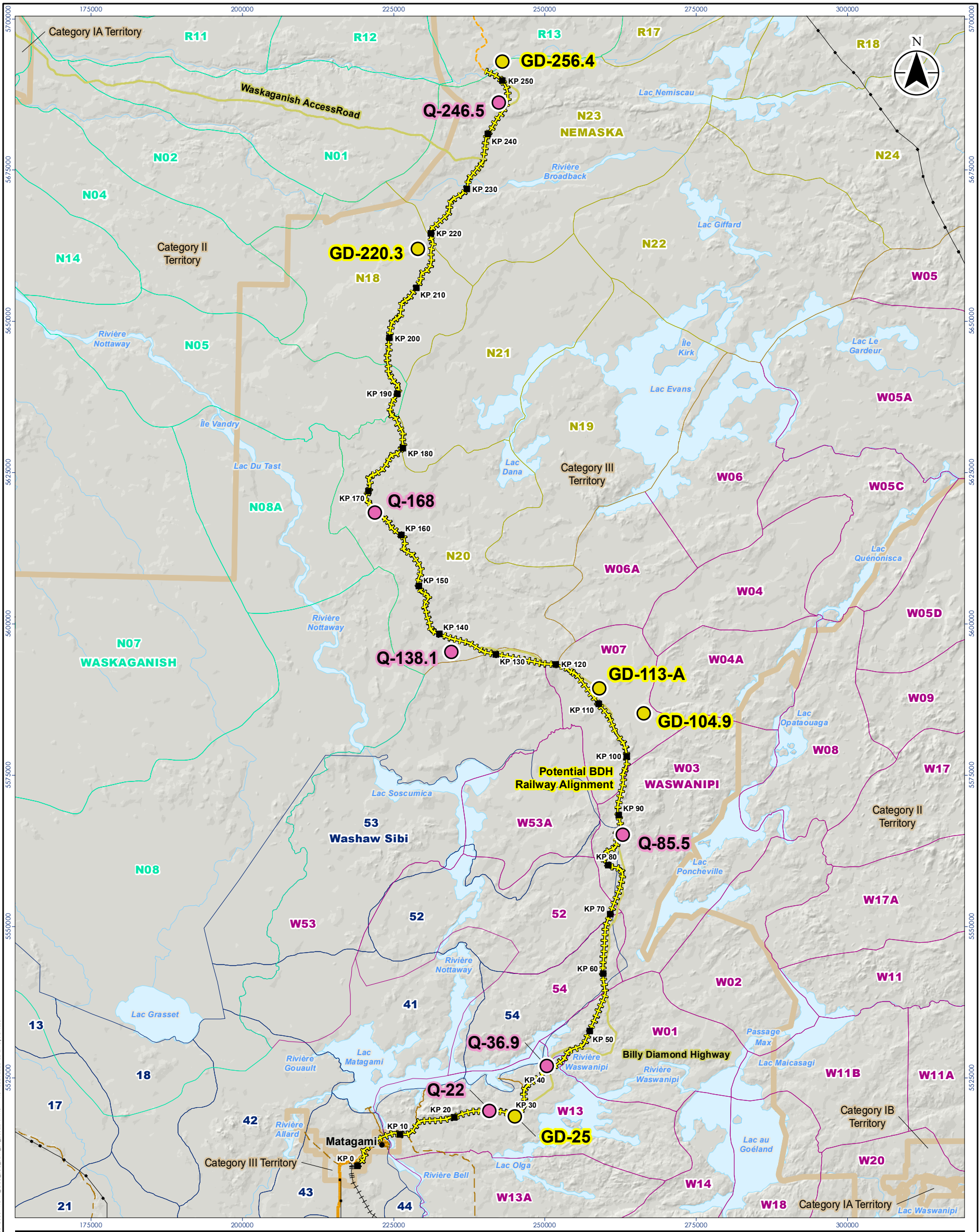
INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Experts-conseils at the time of the work and at the specific testing and/or sampling locations. Classifications 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 Figures



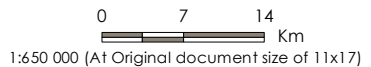


**Notes**

1. Coordinate System: NAD 1983 CSRS MTM 9
2. Geotechnical Investigation: Stantec, 2023
3. Road Network: Adresses Québec, 2021
4. Hydrography: GRHQ, 2017
5. Orthoimagery: ESRI-World Imagery, 2017

- Human Environment Component**
- Locality
  - Power Line
  - ++++ Railway
  - Category I, II or III Territory
- Projected Component**
- Potential BDH Railway Alignment
  - Railway Kilometric Point (Systra, February 2023)
- Potential Material Source**
- Potential Borrow Source (GD)
  - Potential Quarry Site (Q)

- Trapline Limit and Community Name**
- Nemaska
  - Washaw Sibi
  - Waskaganish
  - Waswanipi
- Road Network**
- Road Classification*
- National / Regional
  - Arterial
  - Local
  - Access Path
- Hydrography**
- Body of Water
  - Watercourse



Project Location: Eeyou Istchee, Québec  
 Prepared by Julie Brunette on 2023-02-21  
 Technical Review by E. Ferland on 2023-02-21  
 Independent Review by F. Vinet on 2023-02-21

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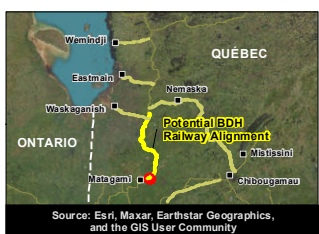
Map No. **B1**

Title: **Potential Borrow Sources and Quarry Sites  
 Potential BDH Railway Alignment**

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3. Road Network: Adresses Québec, 2021
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5. Topography: Forêt Ouverte, 2023 and (MNSC) Modèle numérique de surface Canada, 2023
6. Orthomogery: ESRI-World Imagery, 2017

- Projected Component**
- Potential BDH Railway Alignment
  - Railway Kilometric Point (Systra, February 2023)
  - Proposed Access Road
- Potential Material Source**
- Potential Borrow Source (GD)
- Geotechnical Investigation**
- Test pit

- Road Network**
- Kilometric Point (MTQ, 2021)
- Hydrography**
- Body of Water
  - Watercourse
- Topography**
- Contour line (1 m)
  - Primary
  - Secondary

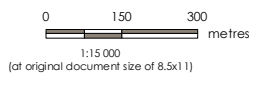


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 Technical Review by E. Ferland on 2023-02-21  
 Independent Review by F. Vinet on 2023-02-21

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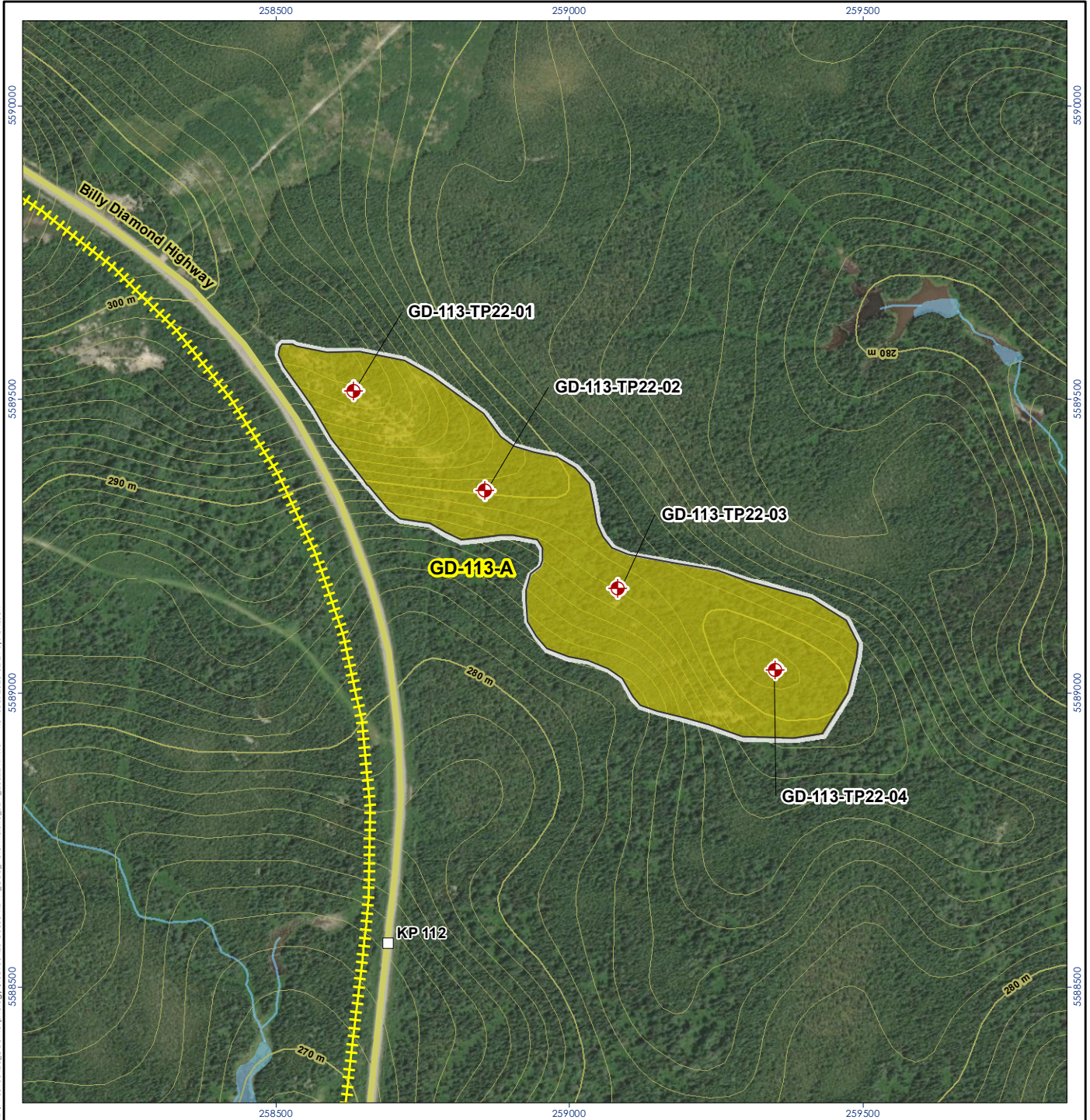
Map No. **B2**

Title: **Potential Borrow Source GD-25**



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**Notes**  
 1. Coordinate System: NAD 1983 CSRS MTM 9  
 2. Geotechnical Investigation: Stantec, 2023  
 3. Road Network: Adresses Québec, 2021  
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 5. Topography: Forêt Ouverte, 2023 and (MNSC) Modèle numérique de surface Canada, 2023  
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- Projected Component**
- Potential BDH Railway Alignment
  - Railway Kilometric Point (Systra, February 2023)
- Potential Material Source**
- Potential Borrow Source (GD)
- Geotechnical Investigation**
- Test pit

- Road Network**
- Kilometric Point (MTQ, 2021)
- Hydrography**
- Body of Water
  - Watercourse
- Topography**
- Contour line (1 m)
  - Primary
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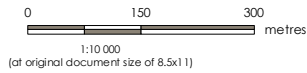


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 Eyou Itchee, Québec  
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 Independent Review by F. Vinet on 2023-02-21

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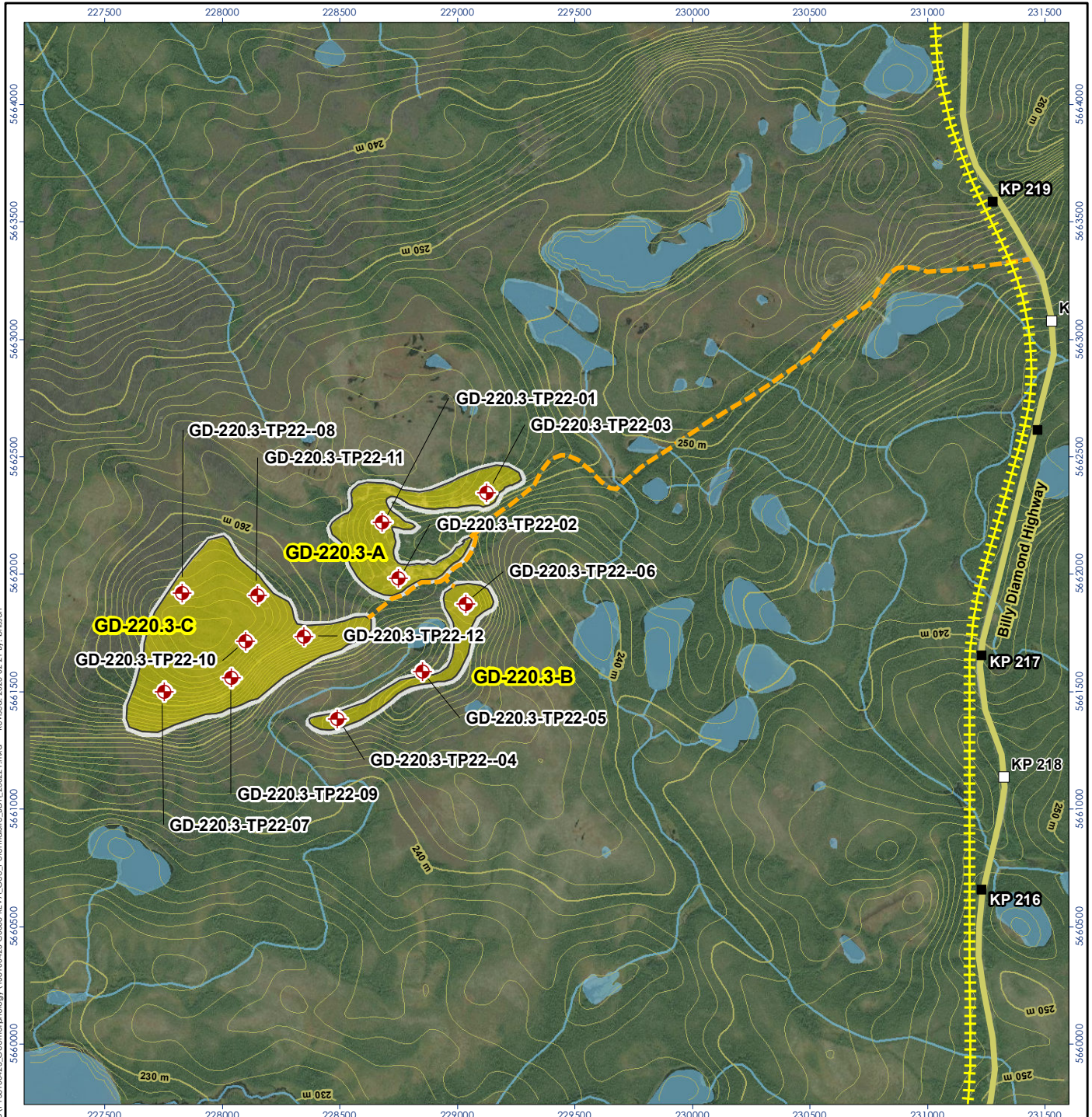
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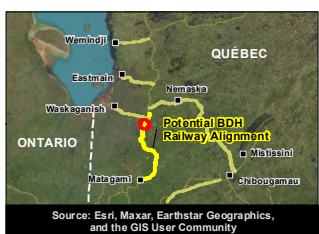


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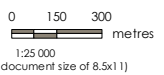
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- Notes**
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  4. Hydrography: GRHQ, 2017
  5. Topography: Forêt Ouverte, 2023 and (MNSC) Modèle numérique de surface Canada, 2023
  6. Orthomogery: ESRI-World Imagery, 2017

- Projected Component**
- ++++ Potential BDH Railway Alignment
  - Railway Kilometric Point (Systra, February 2023)
  - - - Proposed Access Road
- Potential Material Source**
- GD Potential Borrow Source (GD)
- Geotechnical Investigation**
- ⊕ Test pit

- Road Network**
- Kilometric Point (MTQ, 2021)
- Hydrography**
- Body of Water
  - Watercourse
- Topography**
- Contour line (1 m)
  - Primary
  - Secondary



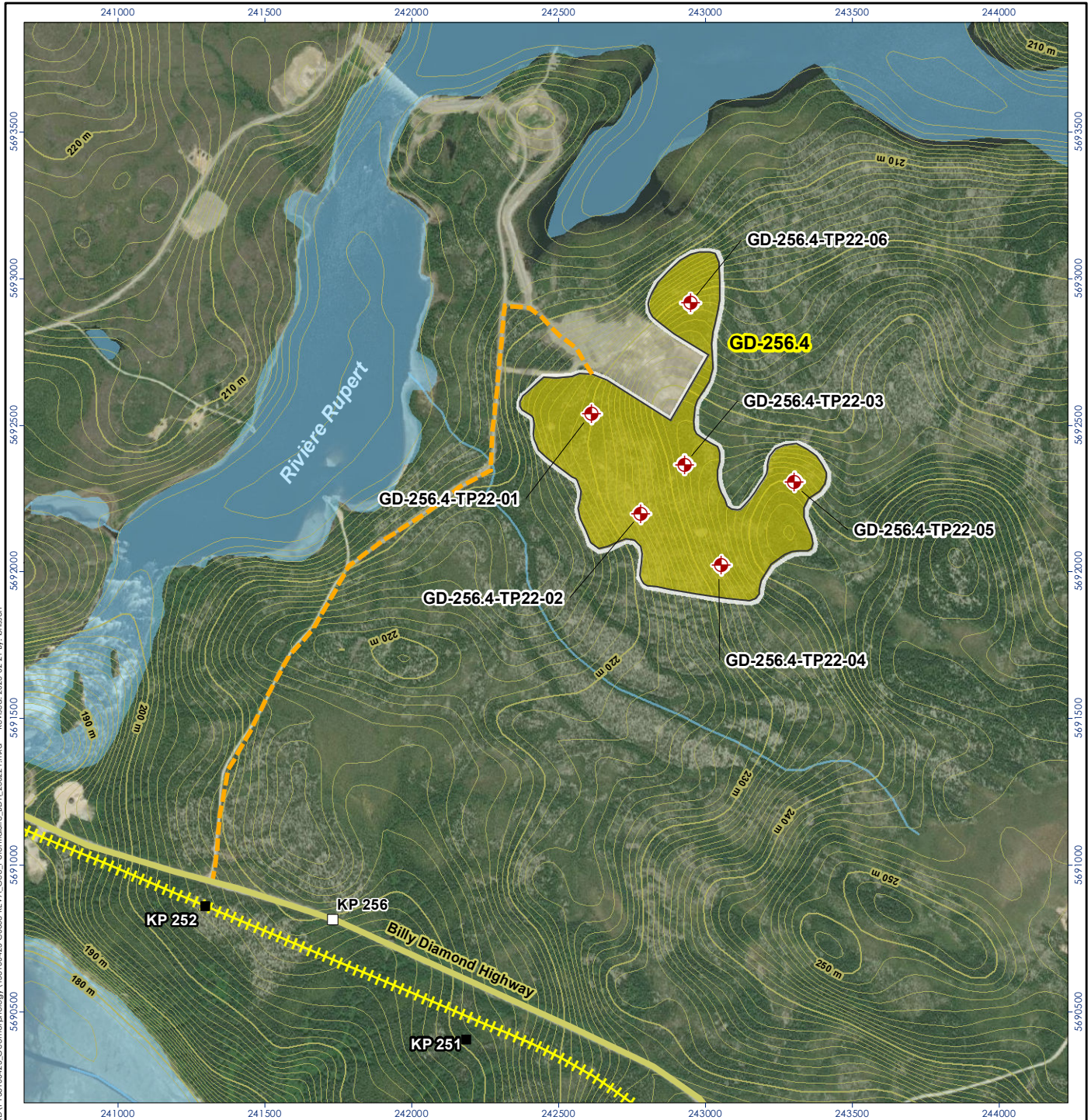
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 Prepared by J. Brunette on 2023-02-21  
 Eeyou Itchee, Québec  
 Technical Review by E. Ferland on 2023-02-21  
 Independent Review by F. Vinet on 2023-02-21

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Map No.: **B5**  
 Title:

**Potential Borrow Source GD-220.3**

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**Projected Component**

- Potential BDH Railway Alignment
- Railway Kilometric Point (Systra, February 2023)
- Proposed Access Road

- Potential Material Source**
- Potential Borrow Source (GD)

- Geotechnical Investigation**
- Test pit

**Road Network**

- Kilometric Point (MTQ, 2021)

**Hydrography**

- Body of Water
- Watercourse

**Topography**

- Contour line (1 m)
- Primary
- Secondary

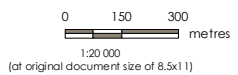


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 Prepared by J. Brunette on 2023-02-21  
 Technical Review by E. Ferland on 2023-02-21  
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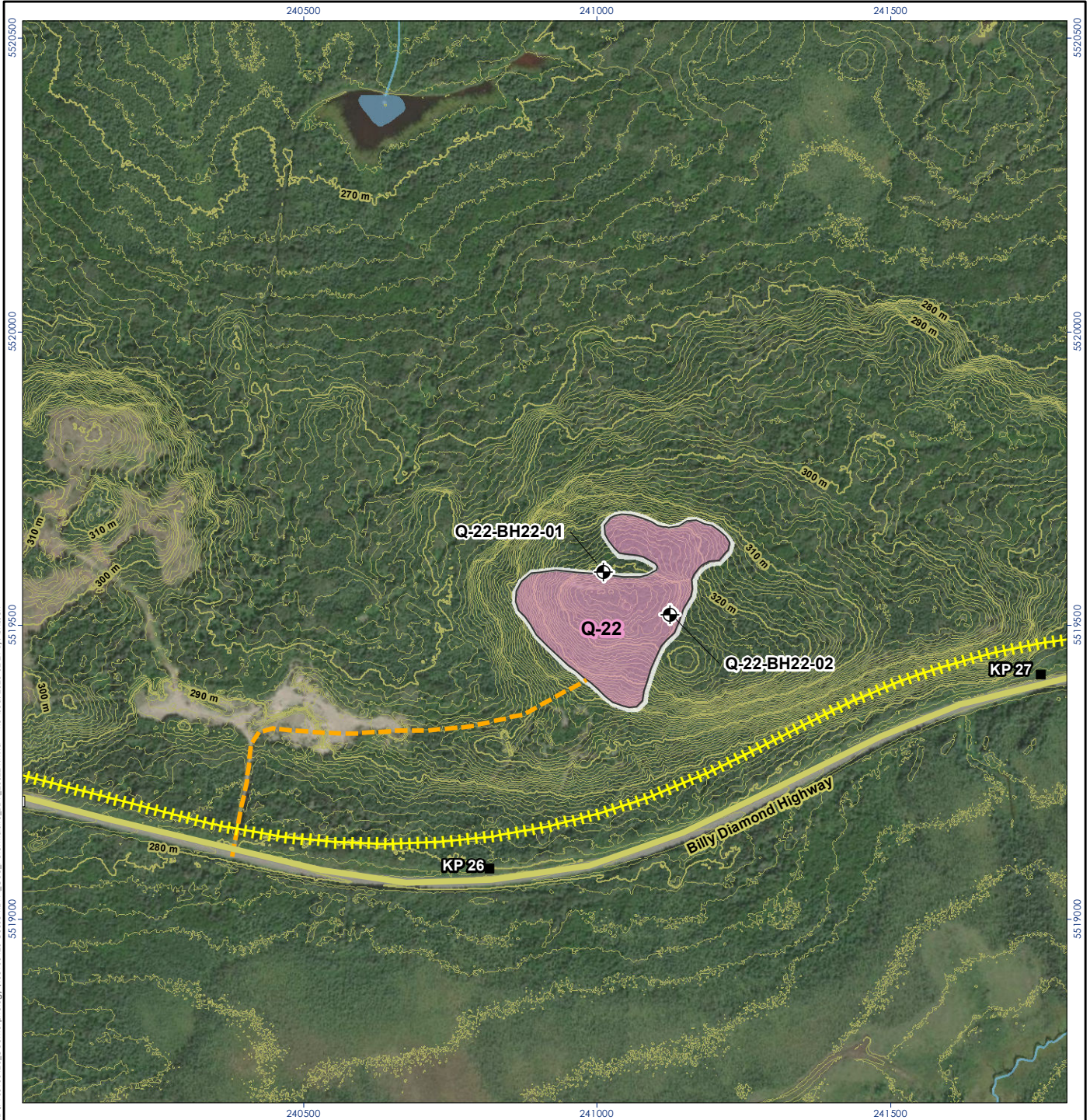
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**Projected Component**

- Potential BDH Railway Alignment
- Railway Kilometric Point (Systra, February 2023)
- Proposed Access Road

**Potential Material Source**

- Potential Quarry Site (Q)

**Geotechnical Investigation**

- Borehole

**Road Network**

- Kilometric Point (MTQ, 2021)

**Hydrography**

- Body of Water
- Watercourse

**Topography**

- Contour line (1 m)
- Primary
- Secondary

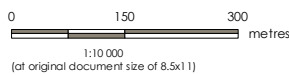


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 Prepared by J. Brunette on 2023-02-21  
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Map No.  
**B7**

Title  
**Potential Quarry Site Q-22**



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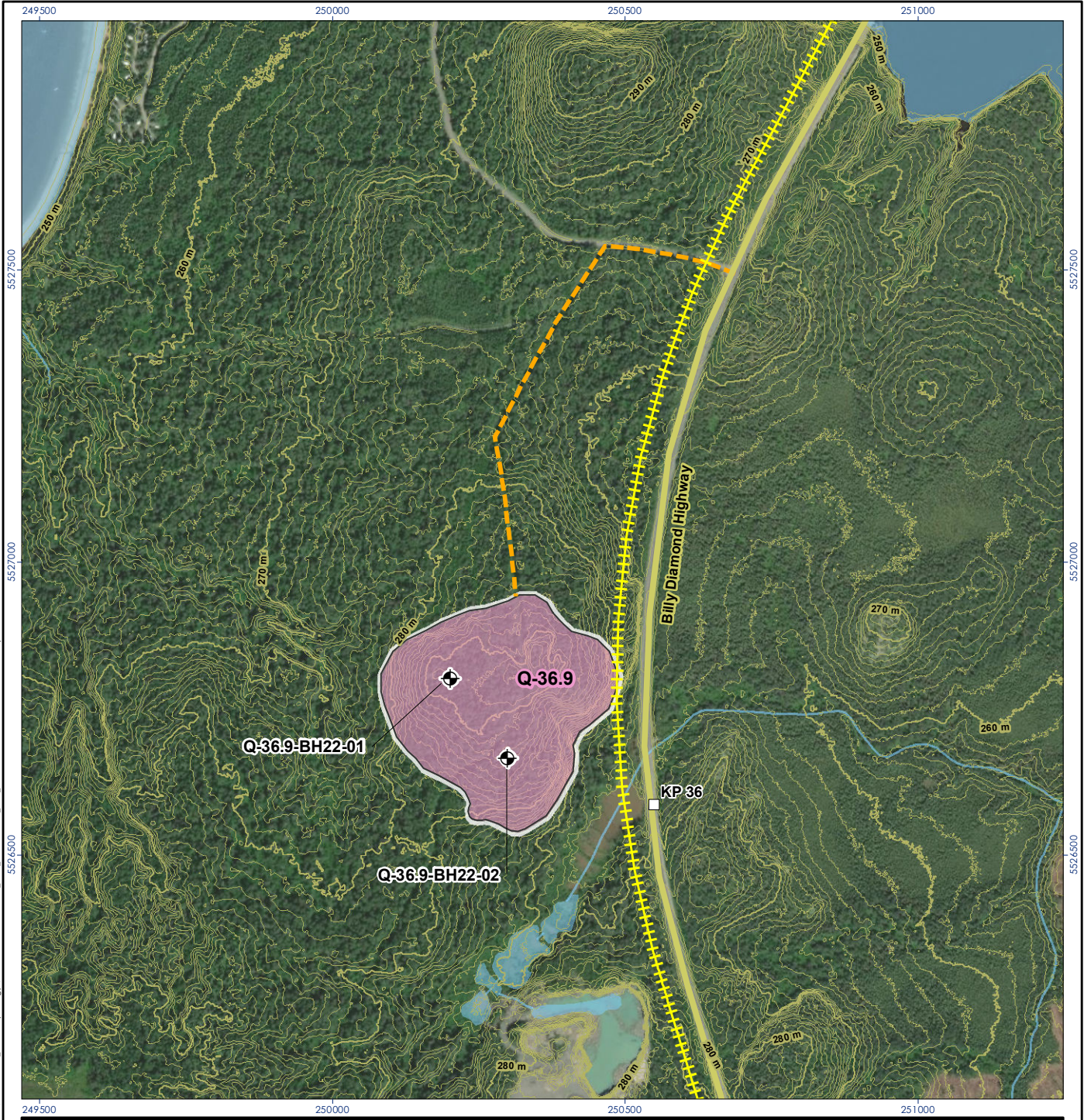
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**Projected Component**

- Potential BDH Railway Alignment
- Railway Kilometric Point (Systra, February 2023)
- Proposed Access Road

- Potential Material Source**
- Potential Quarry Site (Q)

**Geotechnical Investigation**

- Borehole

**Road Network**

- Kilometric Point (MTQ, 2021)

**Hydrography**

- Body of Water
- Watercourse

**Topography**

- Contour line (1 m)
- Primary
- Secondary

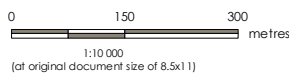


Project Location: 158100425-C0008 REVA  
 Prepared by J. Brunette on 2023-02-21  
 Eeyou Itchee, Québec  
 Technical Review by E. Ferland on 2023-02-21  
 Independent Review by F. Vinet on 2023-02-21

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 Phase 1

Map No.  
**B8**

Title  
**Potential Quarry Site Q-36.9**



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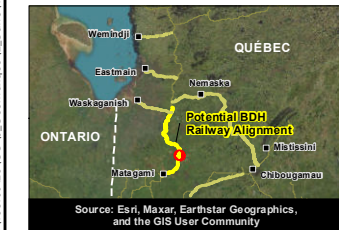
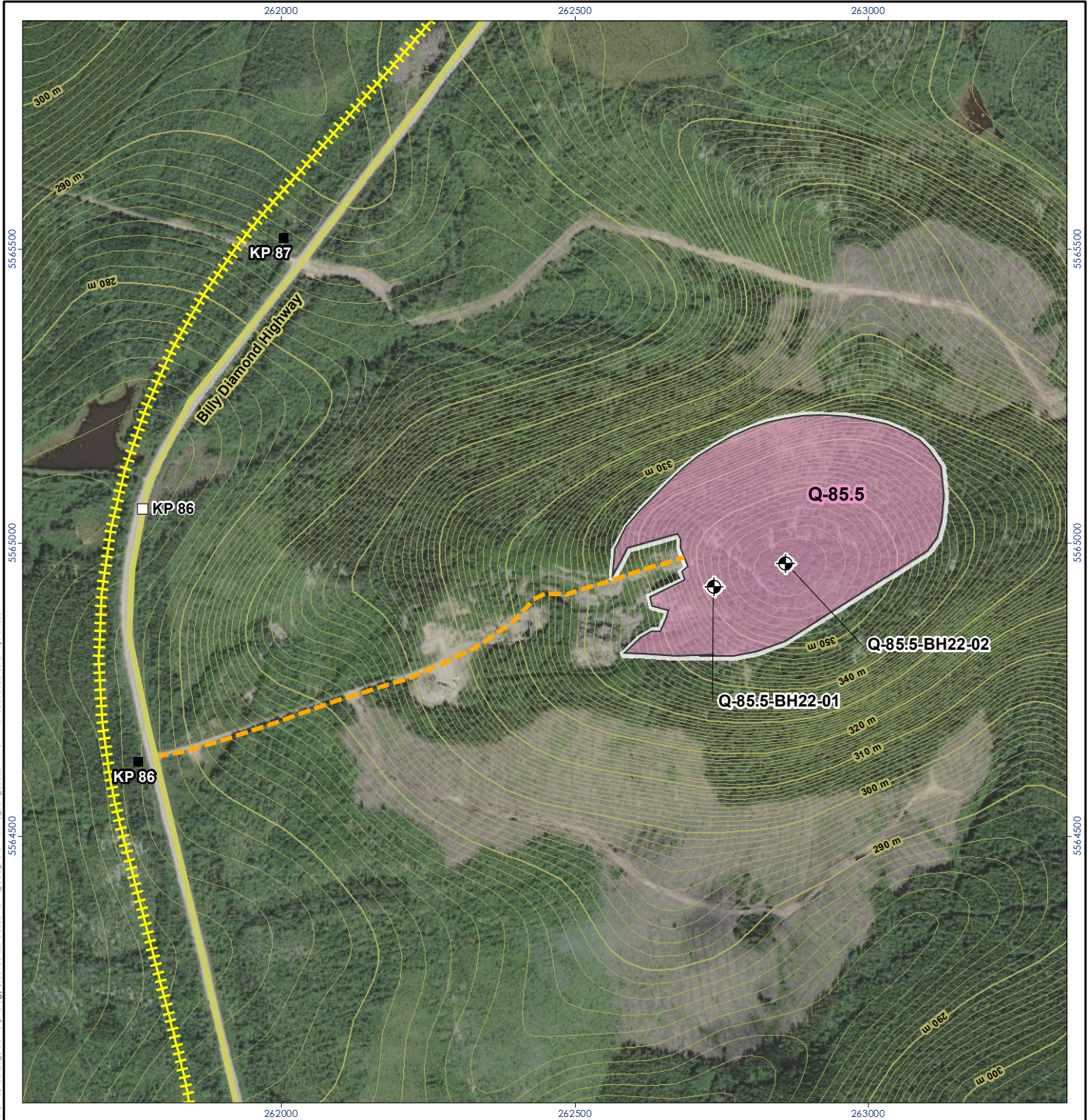
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**Projected Component**

- Potential BDH Railway Alignment
- Railway Kilometric Point (Systra, February 2023)
- Proposed Access Road

- Potential Material Source**
- Potential Quarry Site (Q)

**Geotechnical Investigation**

- Borehole

**Road Network**

- Kilometric Point (MTQ, 2021)

**Hydrography**

- Body of Water
- Watercourse

**Topography**

- Contour line (1 m)**
- Primary
  - Secondary

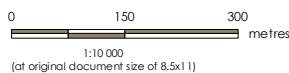


Project Location: 158100425-C0008-REVA  
 Québec, Québec  
 Prepared by J. Brunette on 2023-02-21  
 Technical Review by E. Ferland on 2023-02-21  
 Independent Review by F. Vinet on 2023-02-21

Client/Project: Cree Development Corporation  
 La Grande Alliance – Feasibility Study  
 Phase 1

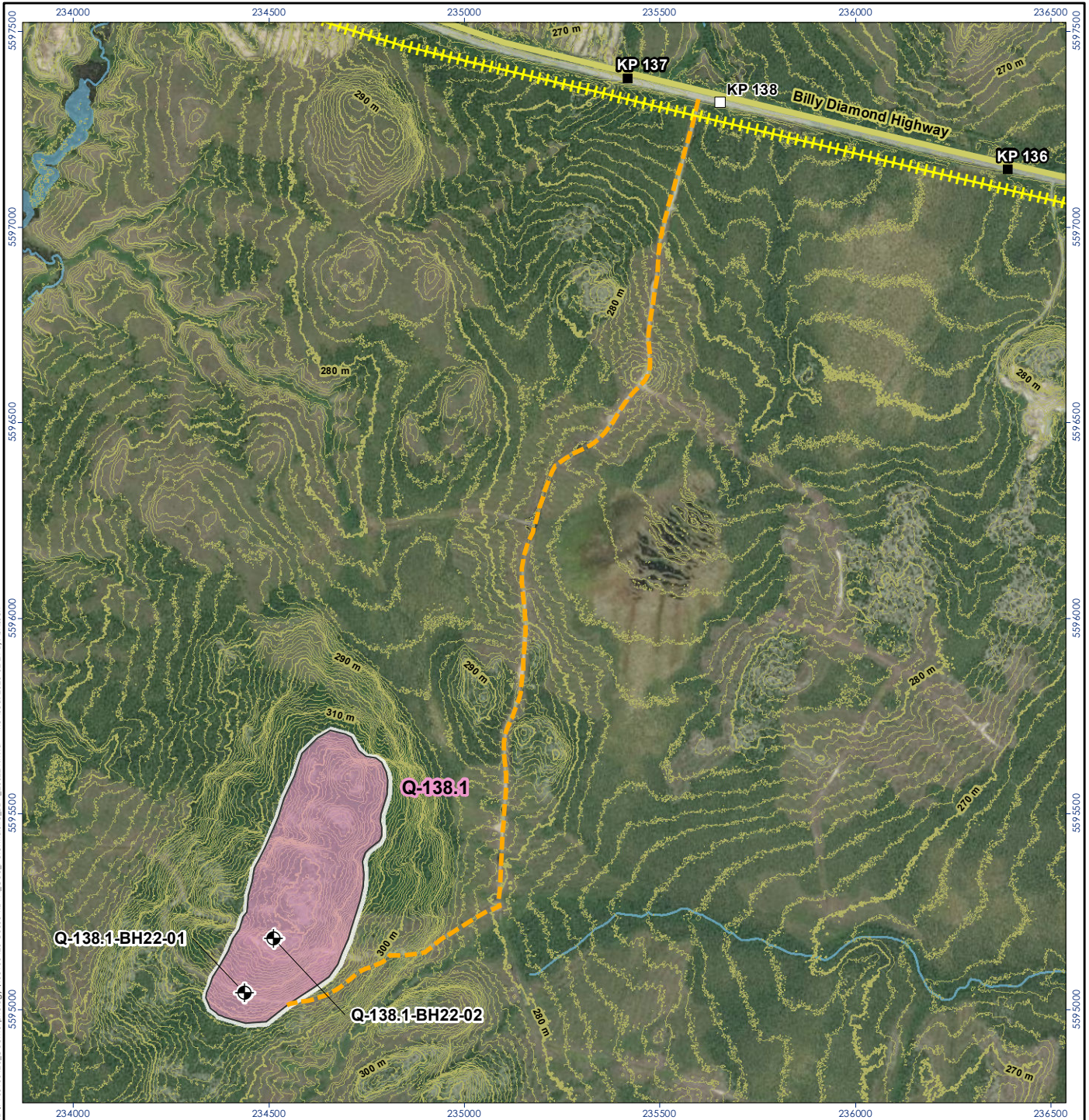
Map No. B9

Title: Potential Quarry Site Q-85.5



\\c00119-epf\p01\158100425-C0008-REVA\_Geo\_PotentialSite\_BDH\_230221.mxd Revised: 2023-02-21 By: bristen

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\\c00119-epf\gd\proj\B10\00425-C0008-REVA\_Geo\_PotentialSite\_BDH\_230221.mxd Revised: 2023-02-21 By: bricam



**Source:** Esri, Maxar, Earthstar Geographics, and the GIS User Community  
**Notes:**  
 1. Coordinate System: NAD 1983 CSRS MTM 9  
 2. Geotechnical Investigation: Stantec, 2023  
 3. Road Network: Adresses Québec, 2021  
 4. Hydrography: GRHQ, 2017  
 5. Topography: Forêt Ouverte, 2023 and (MNSC) Modèle numérique de surface Canada, 2023  
 6. Orthomogery: ESRI-World Imagery, 2017

- Projected Component**
- ++++ Potential BDH Railway Alignment
  - Railway Kilometric Point (Systra, February 2023)
  - - - - Proposed Access Road
- Potential Material Source**
- Potential Quarry Site (Q)
- Geotechnical Investigation**
- ⊕ Borehole

- Road Network**
- Kilometric Point (MTQ, 2021)
- Hydrography**
- Body of Water
  - Watercourse
- Topography**
- Contour line (1 m)
  - Primary
  - Secondary

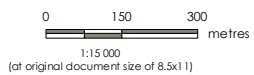


Project Location: 158100425-C0008 REVA  
 Prepared by J. Brunette on 2023-02-21  
 Eeyou Istchee, Québec  
 Technical Review by E. Ferland on 2023-02-21  
 Independent Review by F. Vinet on 2023-02-21

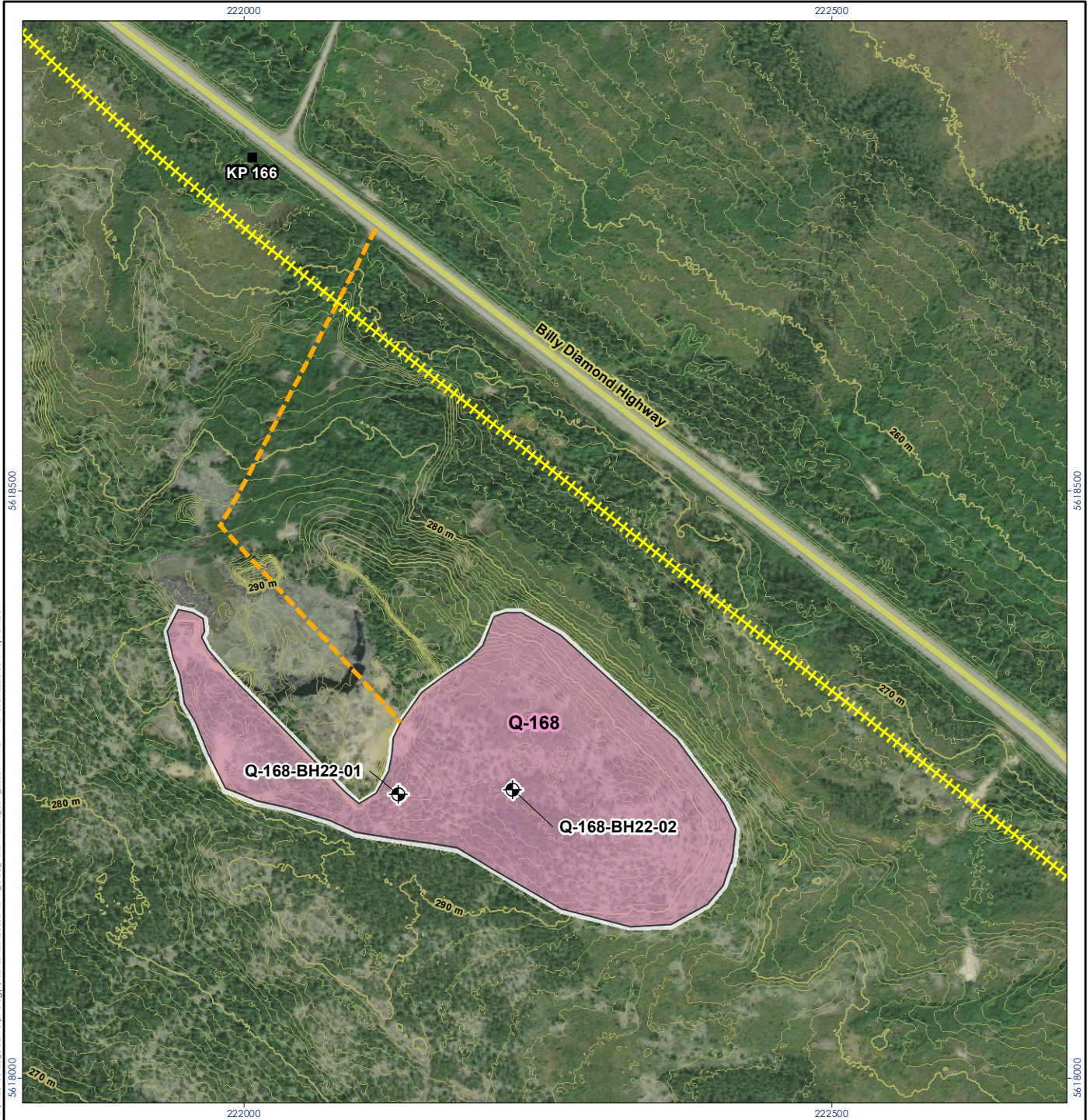
Client/Project: Cree Development Corporation  
 La Grande Alliance – Feasibility Study  
 Phase 1

Map No. **B10**

Title: **Potential Quarry Site Q-138.1**



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**Projected Component**

- Potential BDH Railway Alignment
- Railway Kilometric Point (Systra, February 2023)
- Proposed Access Road
- Potential Quarry Site (Q)

**Potential Material Source**

- Potential Quarry Site (Q)

**Geotechnical Investigation**

- Borehole

**Road Network**

- Kilometric Point (MTQ, 2021)

**Hydrography**

- Body of Water
- Watercourse

**Topography**

- Contour line (1 m)
- Primary
- Secondary

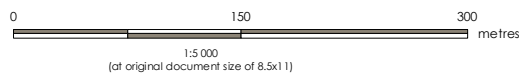


Project Location: 158100425-C0008 REV A  
 Prepared by J. Brunette on 2023-03-17  
 Eeyou Itchee, Québec  
 Technical Review by E. Ferland on 2023-03-17  
 Independent Review by F. Vinet on 2023-03-17

Client/Project: Cree Development Corporation  
 La Grande Alliance – Feasibility Study  
 Phase 1

Map No. **B11**

Title: **Potential Quarry Site Q-168**



- Notes**
1. Coordinate System: NAD 1983 CSRS MTM 9
  2. Geotechnical Investigation: Stantec, 2023
  3. Road Network: Adresses Québec, 2021
  4. Hydrography: GRHQ, 2017
  5. Topography: Forêt Ouverte, 2023 and (MNSC) Modèle numérique de surface Canada, 2023
  6. Orthomogery: ESRI-World Imagery, 2017

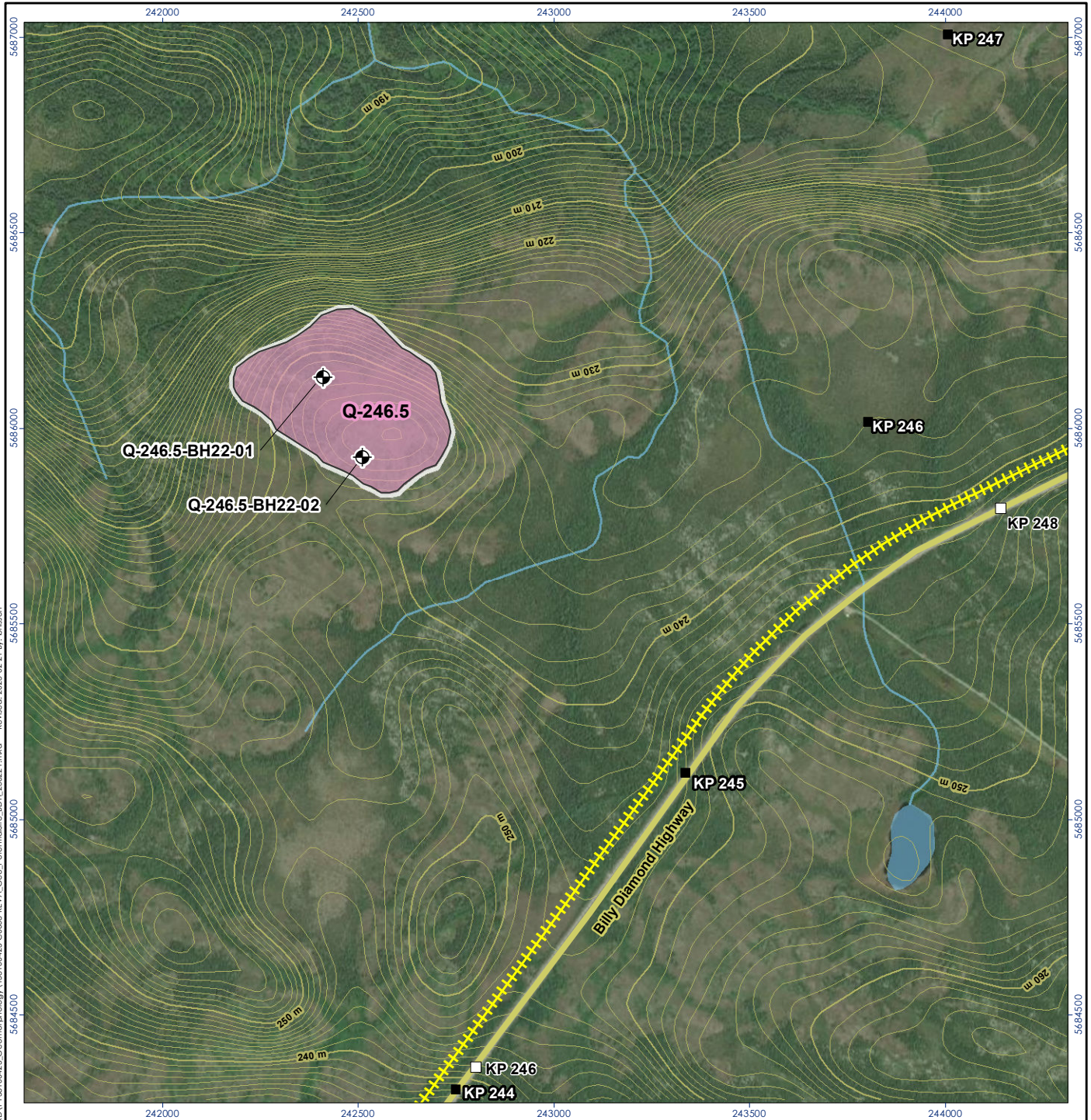
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\\c00119-epf\p01\projets\_potagers\158100425-CO08-REVA\_Geo\_Potentielle\_BDH\_230221.mxd    Revised: 2023-02-21 By: bricem



**Notes**  
 1. Coordinate System: NAD 1983 CSRS MTM 9  
 2. Geotechnical Investigation: Stantec, 2023  
 3. Road Network: Adresses Québec, 2021  
 4. Hydrography: GRHQ, 2017  
 5. Topography: Forêt Ouverte, 2023 and (MNSC) Modèle numérique de surface Canada, 2023  
 6. Orthomogery: ESRI-World Imagery, 2017

- Projected Component**
- ++++ Potential BDH Railway Alignment
  - Railway Kilometric Point (Systra, February 2023)
- Potential Material Source**
- Potential Quarry Site (Q)
- Geotechnical Investigation**
- ⊕ Borehole

- Road Network**
- Kilometric Point (MTQ, 2021)
- Hydrography**
- Body of Water
  - Watercourse
- Topography**
- Contour line (1 m)
  - Primary
  - Secondary

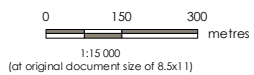


Project Location: 158100425-C0008 REVA  
 Prepared by J. Brunette on 2023-02-21  
 Eeyou Itchee, Québec  
 Technical Review by E. Ferland on 2023-02-21  
 Independent Review by F. Vinet on 2023-02-21

Client/Project  
 Cree Development Corporation  
 La Grande Alliance – Feasibility Study  
 Phase 1

Map No.  
**B12**

Title  
**Potential Quarry Site Q-246.5**



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## **Appendix C Test Pit and Borehole Reports**



Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>244 282</b> Y : <b>5 518 729</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : Plan :	Test Pit : <b>GD-25-TP22-01</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b> Depth : <b>3,75 (m)</b>
Project No.: <b>158100425.500.710.5</b>			
Client: <b>Cree Development Corporation</b>			
Site: <b>Potential BDH Railway</b>			

QUALITATIVE TERMINOLOGY		QUANTITATIVE TERMINOLOGY		MECHANIC CHARACTERISTICS OF SOILS			GROUNDWATER		
Clay	< 0.002 mm	Traces	< 10 %	COMPACTION	CONSISTENCY	Cu OR Su (kPa)		Date	Depth
Silt	0.002 - 0.08 mm	Some	10 - 20 %	Very loose	Very soft	< 12		Reading 1	(m)
Sand	0.08 - 5 mm	Adjective (...y)	20 - 35 %	Loose	Soft	12 - 25		Reading 2	(m)
Gravel	5 - 80 mm	and (ex: and gravel)	> 35 %	Compact	Firm	25 - 50			
Cobbles	80 - 200 mm	Main word	Dominant fraction	Dense	Stiff	50 - 100			
Boulders	> 200 mm			Very dense	Very stiff	100 - 200		Remarks :	
				Hard	Hard	> 200			

STRATIGRAPHY				SAMPLES				TESTS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>l</sub>	REMARKS
		0.00	TOPSOIL.									
		0.15	Native soil: Brown-black frozen to moist SAND with traces of gravel and silt. - Presence of cobbles (2-3 %).			MA-01						
1		1.00	Brown moist SAND with some silt and clay, traces of gravel.			MA-02				GA		
2		2.00	Brown moist SAND with some gravel and traces of silt. - Presence of cobbles.			MA-03						
3	10	3.00	Brown moist SAND with traces of gravel and silt.			MA-04						
4		3.75	END OF TEST PIT									



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>244 550</b> Y : <b>5 518 903</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : Plan :	Test Pit : <b>GD-25-TP22-02</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b> Depth : <b>4,00 (m)</b>
Project No.: <b>158100425.500.710.5</b>			
Client: <b>Cree Development Corporation</b>			
Site: <b>Potential BDH Railway</b>			

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>(m)</td> </tr> <tr> <td></td> <td></td> <td>(m)</td> </tr> </tbody> </table> Remarks :	Reading 1	Date	Depth			(m)			(m)
Reading 1	Date	Depth										
		(m)										
		(m)										

STRATIGRAPHY				SAMPLES				TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>l</sub>
		0,00	TOPSOIL.									
		0,15	Fill : Brown moist CLAY with traces of gravel and sand. - Presence of cobbles (1-5 %).			MA-01						
		1,30	Buried TOPSOIL.									
		1,50	Native soil : Grey moist Clayey SILT with some gravel and traces to some sand.			MA-02						
		2,30	Brown moist Clayey SILT with traces of sand and gravel.			MA-03						
		3,30	Brown moist Clayey SILT with traces of sand.			MA-04						
		4,00	END OF TEST PIT									



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>244 564</b> Y : <b>5 518 432</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : Plan :	Test Pit : <b>GD-25-TP22-03</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b> Depth : <b>3,75 (m)</b>
Project No.: <b>158100425.500.710.5</b>			
Client: <b>Cree Development Corporation</b>			
Site: <b>Potential BDH Railway</b>			

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<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)
	Date	Depth										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>L</sub>	REMARKS
		0.00	TOPSOIL.									
		0.15	Native soil : Brown frozen to moist SAND with traces of silt.			MA-01						
1		1.00	Brown moist SAND with traces of silt and gravel.			MA-02						
5						MA-03				GA		
2						MA-04						
3	10											
4		3.75	END OF TEST PIT									
15												
5												



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b> X : <b>244 933</b> Y : <b>5 518 727</b>	Test Pit : <b>GD-25-TP22-04</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b> Depth : <b>4,00 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : Plan :
Client: <b>Cree Development Corporation</b>		
Site: <b>Potential BDH Railway</b>		

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>Reading 2</td> <td> </td> <td>(m)</td> </tr> </tbody> </table> Remarks :	Reading 1	Date	Depth (m)				Reading 2		(m)
Reading 1	Date	Depth (m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses  ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded  W <sub>p</sub> W   W <sub>L</sub> 20 40 60 80 100 120
		0,00	TOPSOIL.								
		0,25	Native soil : Brown saturated Silty CLAY to Clayey SILT with traces of sand. - Water infiltration at depth of 0,25 m.			MA-01			↑		
		2,00	Grey saturated Silty SAND. - Presence of cobbles (5-7 %).			MA-02					
		2,50	Till : Grey saturated SAND and GRAVEL with traces of silt. - Presence of cobbles (30 %) and boulders 10 %).			MA-03					
		3,10				MA-04					
		4,00	END OF TEST PIT			MA-05					

General remarks:	Verified by : F. Vinet, géo. M. Sc. Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: UTM Zone: 9</b> X : <b>245 095</b> Y : <b>5 518 484</b>	Test Pit : <b>GD-25-TP22-05</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : Plan :
Client: <b>Cree Development Corporation</b>		Depth : <b>3,90 (m)</b>
Site: <b>Potential BDH Railway</b>		

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <th>Reading 2</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table> Remarks :	Reading 1	Date	Depth (m)				Reading 2	Date	Depth (m)			
Reading 1	Date	Depth (m)													
Reading 2	Date	Depth (m)													

STRATIGRAPHY				SAMPLES				TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM: organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>
		0,00	TOPSOIL.									
		0,15	Native soil : Brown frozen to moist Gravelly SAND with traces of silt. - Présence of cobbles (2 %).			MA-01						
1		1,00	Brown moist SAND with traces of gravel and silt.			MA-02					GA	
2						MA-03						
3						MA-04					GA	
4		3,90	END OF TEST PIT									
		15										
5												



General remarks:	Verified by : F. Vinet, géo. M. Sc. Date : 2023-01-30
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: UTM Zone: 9</b> X : <b>245 072</b> Y : <b>5 518 228</b>	Test Pit : <b>GD-25-TP22-06</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : Plan :
Client: <b>Cree Development Corporation</b>		Depth : <b>3,80 (m)</b>
Site: <b>Potential BDH Railway</b>		

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS		REMARKS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>		
		0.00	TOPSOIL.											
		0.15	Native soil : Grey moist SAND with traces of silt. - Traces of oxidation.			MA-01								
		0.50	Brown moist Silty CLAY to Clayey SILT with traces of sand and gravel.			MA-02								
		1.60	Brown to grey moist SAND with traces of gravel and silt.			MA-03								
		2.60	Brown moist SAND with some silt and traces of gravel.			MA-04								
		3.80	END OF TEST PIT			MA-05								



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: UTM Zone: 9</b> X : <b>245 574</b> Y : <b>5 517 935</b> Type : <b>Test Pit</b>	Test Pit : <b>GD-25-TP22-07</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b>
Project No.: <b>158100425.500.710.5</b>	Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : Plan :
Client: <b>Cree Development Corporation</b>		Depth : <b>4,00 (m)</b>
Site: <b>Potential BDH Railway</b>		

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table> Remarks :	Reading 1	Date	Depth (m)						
Reading 1	Date	Depth (m)										

STRATIGRAPHY				SAMPLES				TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM: organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W <sub>L</sub>
		0.00	TOPSOIL.									
		0.15	Native soil : Brown frozen to moist SAND with traces of silt. - Traces of oxidation.			MA-01						
		1.00	Grey moist SAND with traces of silt.			MA-02						
						MA-03						
						MA-04						
		4.00	END OF TEST PIT									



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: UTM Zone: 9</b> X : <b>245 887</b> Y : <b>5 517 965</b>	Test Pit : <b>GD-25-TP22-08</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b>	Depth : <b>3,75 (m)</b>
Client: <b>Cree Development Corporation</b>	Equipment :	
Site: <b>Potential BDH Railway</b>	Width : (m) Length : (m)	Walls : Plan :

QUALITATIVE TERMINOLOGY		QUANTITATIVE TERMINOLOGY		MECHANIC CHARACTERISTICS OF SOILS			GROUNDWATER		
Clay	< 0.002 mm	Traces	< 10 %	COMPACTION	CONSISTENCY	Cu OR Su (kPa)		Date	Depth
Silt	0.002 - 0.08 mm	Some	10 - 20 %	Very loose	Very soft	< 12		Reading 1	(m)
Sand	0.08 - 5 mm	Adjective (...y)	20 - 35 %	Loose	Soft	12 - 25		Reading 2	(m)
Gravel	5 - 80 mm	and (ex: and gravel)	> 35 %	Compact	Firm	25 - 50		Remarks :	
Cobbles	80 - 200 mm	Main word	Dominant fraction	Dense	Stiff	50 - 100			
Boulders	> 200 mm			Very dense	Very stiff	100 - 200			
				Hard	Hard	> 200			

STRATIGRAPHY				SAMPLES				TESTS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	REMARKS
		0.00	TOPSOIL.								
		0.15	Native soil : Brown to grey moist SAND and GRAVEL. - Presence of cobbles (5 %). - Traces of oxidation.			MA-01					
1		1.00	Grey moist SAND with some gravel and traces of silt. - Presence of cobbles.			MA-02				GA	
2		2.00	Grey moist SAND with traces of silt.			MA-03					
3		2.75	Grey moist SAND with traces of gravel and silt.			MA-04					
4		3.75	END OF TEST PIT								



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b> X : <b>245 887</b> Y : <b>5 517 965</b> Type : <b>Test Pit</b>	Test Pit : <b>GD-25-TP22-09</b> Page : <b>1 of 1</b> Start date : <b>2022-03-30</b> Inspector : <b>M. Frigon, tech.</b>
Project No.: <b>158100425.500.710.5</b>	Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : Plan :
Client: <b>Cree Development Corporation</b>		Depth : <b>4,00 (m)</b>
Site: <b>Potential BDH Railway</b>		

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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) and (ex: and gravel) 20 - 35 % Main word Dominant fraction > 35 %	COMPACTION Very loose Loose Compact Dense Very dense CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Reading 1	Date	Depth (m)						
Reading 1	Date	Depth (m)										
Remarks :												

STRATIGRAPHY				SAMPLES				TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM: organic matter CA : chemical analyses
		0,00	TOPSOIL.								
		0,10	Native soil :			MA-01					
		0,30	Brown moist SAND with some clay. Brown moist Clayey SILT and SAND with traces of gravel.			MA-02					
1											
		5									
2						MA-03				GA	
		2,60	Grey-brown moist SAND with some silt and traces of gravel.			MA-04					
3		10									
		3,50	Grey moist SAND with traces of silt.			MA-05					
4											
		4,00	END OF TEST PIT								
		15									
5											



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: La Grande Alliance - Feasibility Study - Phase I	Coordinate : X : 265 830 Y : 5 586 011 Type : Test Pit Equipment : Mechanical shovel Width : 1,0 (m) Length : 4,0 (m)	Geo System.: MTM-NAD83 Zone: 9	Test Pit : <b>GD-104.9-TP22-01</b> Page : 1 of 1 Start date : 2022-04-02 Inspector : T. Coulaux, ing. Depth : 5,00 (m)
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) and (ex: and gravel) 20 - 35 % Main word > 35 % Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION Very loose Loose Compact Dense Very dense CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <th>Reading 2</th> <td> </td> <td> </td> </tr> </table> Remarks :	Reading 1	Date	Depth (m)				Reading 2		
Reading 1	Date	Depth (m)										
Reading 2												

STRATIGRAPHY			SAMPLES				TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>L</sub>		
		0,00	TOPSOIL.											
		0,15	- Presence of roots. Native soil : Brown to brown-grey moist SAND with traces of silt and gravel. - Traces of oxidation between a depth 0,15 and 0,30 m.			MA-01								
						MA-02								
						MA-03								
						MA-04								
		5,00	END OF TEST PIT											



General remarks:	Verified by : F. Vinet, géo. M. Sc. Date : 2023-01-30
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>265 936</b> Y : <b>5 585 721</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : Plan :	Test Pit : <b>GD-104.9-TP22-02</b> Page : <b>1 of 1</b> Start date : <b>2022-04-02</b> Inspector : <b>T. Coulaux, ing.</b> Depth : <b>5,00 (m)</b>
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>		
		0,00	TOPSOIL.											
		0,15	Native soil : Brown to grey moist SAND with traces of silt and gravel. - Traces of oxidation between 0,15 and 0,30 m.			MA-01 MA-02								
1						MA-03								
5														
2														
3														
10														
4						MA-04								
15														
5		5,00	END OF TEST PIT											



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b> X : <b>266 284</b> Y : <b>5 585 265</b> Type : <b>Test Pit</b>	Test Pit : <b>GD-104.9-TP22-03</b> Page : <b>1 of 1</b> Start date : <b>2022-04-02</b> Inspector : <b>T. Coulaux, ing.</b>
Project No.: <b>158100425.500.710.5</b>	Equipment : Width : (m) Length : (m)	Walls : Plan :
Client: <b>Cree Development Corporation</b>		Depth : <b>3,10 (m)</b>
Site: <b>Potential BDH Railway</b>		

QUALITATIVE TERMINOLOGY		QUANTITATIVE TERMINOLOGY		MECHANIC CHARACTERISTICS OF SOILS			GROUNDWATER		
Clay	< 0.002 mm	Traces	< 10 %	COMPACTION	CONSISTENCY	Cu OR Su (kPa)		Date	Depth
Silt	0.002 - 0.08 mm	Some	10 - 20 %	Very loose	Very soft	< 12	Reading 1		(m)
Sand	0.08 - 5 mm	Adjective (...y)	20 - 35 %	Loose	Soft	12 - 25	Reading 2		(m)
Gravel	5 - 80 mm	and (ex: and gravel)	> 35 %	Compact	Firm	25 - 50	Remarks :		
Cobbles	80 - 200 mm	Main word	Dominant fraction	Dense	Stiff	50 - 100			
Boulders	> 200 mm			Very dense	Very stiff	100 - 200			
				Hard	Hard	> 200			

STRATIGRAPHY				SAMPLES				TESTS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>l</sub>	REMARKS
		0,00	TOPSOIL. - Presence of roots.									
		0,30	Native soil : Brown-grey Silty SAND with traces of gravel, moist. - Presence of cobbles and boulders. - Traces of oxidation.			MA-01						
1		1,00	Grey-brown SAND with some to traces of silt, traces of gravel, moist.			MA-02						
5		1,50	Grey SAND with some silt, clay and gravel, moist. - Presence of cobbles and boulders.			MA-03						
3	10	3,10	END OF TEST PIT									



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>266 519</b> Y : <b>5 585 117</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : Plan :	Test Pit : <b>GD-104.9-TP22-04</b> Page : <b>1 of 1</b> Start date : <b>2022-04-01</b> Inspector : <b>M. Frigon, tech.</b> Depth : <b>4,00 (m)</b>
Project No.: <b>158100425.500.710.5</b>			
Client: <b>Cree Development Corporation</b>			
Site: <b>Potential BDH Railway</b>			

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS			GROUNDWATER		
Clay < 0.002 mm	Traces < 10 %	COMPACTION	CONSISTENCY	Cu OR Su (kPa)	Date	Depth	
Silt 0.002 - 0.08 mm	Some 10 - 20 %	Very loose	Very soft	< 12	Reading 1	(m)	
Sand 0.08 - 5 mm	Adjective (...y) 20 - 35 %	Loose	Soft	12 - 25	Reading 2	(m)	
Gravel 5 - 80 mm	and (ex: and gravel) > 35 %	Compact	Firm	25 - 50	Remarks :		
Cobbles 80 - 200 mm	Main word Dominant fraction	Dense	Stiff	50 - 100			
Boulders > 200 mm		Very dense	Very stiff	100 - 200			
			Hard	> 200			

STRATIGRAPHY				SAMPLES				TESTS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W <sub>L</sub>	REMARKS
		0,00	TOPSOIL.									
		0,25	Native soil : Brown moist SAND and GRAVEL with traces of silt. - Presence of cobbles (10-15 %).			MA-01						
1		1,00	Brown to grey moist SAND and SILT with traces of gravel. - Presence of cobbles and boulders (5 %).			MA-02				GA		
2		2,00	Brown moist SAND with traces of gravel and silt. - Presence of cobbles (5-10 %).			MA-03						
3	10	3,00	Grey-brown moist SAND with some gravel and traces of silt. - Presence of cobbles and boulders (15-20 %).			MA-04						
4		4,00	END OF TEST PIT									
5		15										



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>267 068</b> Y : <b>5 584 925</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>UTM Zone: 9</b>	Test Pit : <b>GD-104.9-TP22-05</b> Page : <b>1 of 1</b> Start date : <b>2022-04-01</b> Inspector : <b>M. Frigon, tech.</b> Depth : <b>2,40 (m)</b>
Project No.: <b>158100425.500.710.5</b>			
Client: <b>Cree Development Corporation</b>			
Site: <b>Potential BDH Railway</b>		Walls : Plan :	

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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) and (ex: and gravel) 20 - 35 % Main word > 35 % Dominant fraction	COMPACTION Very loose Loose Compact Dense Very dense CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Reading 1	Date	Depth (m)						
Reading 1	Date	Depth (m)										
Remarks :												

STRATIGRAPHY				SAMPLES				TESTS		REMARKS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM: organic matter CA : chemical analyses	∇ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W <sub>L</sub>		
		0,00	TOPSOIL. - Presence of roots.											
		0,30	Native soil : Brown moist SAND with some gravel and traces of silt. - Presence of cobbles (15 %).			MA-01								
		0,80	Brown moist Silty CLAY with some sand and traces of gravel.			MA-02								
		1,80	Till : Grey-brown moist Silty SAND with some gravel. - Presence of cobbles and boulders (10 %).			MA-03								
		2,40	END OF TEST PIT (Refusal on inferred bedrock)											



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b> X : <b>264 496</b> Y : <b>5 586 519</b>	Test Pit : <b>GD-104.9-TP22-06</b> Page : <b>1 of 1</b> Start date : <b>2022-04-02</b> Inspector : <b>T. Coulaux, ing.</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : Plan :
Client: <b>Cree Development Corporation</b>		Depth : <b>0,90 (m)</b>
Site: <b>Potential BDH Railway</b>		

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> Remarks :	Reading 1	Date	Depth (m)						
Reading 1	Date	Depth (m)										

STRATIGRAPHY				SAMPLES				TESTS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses  ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded  W <sub>p</sub> W   W <sub>L</sub> 20 40 60 80 100 120	REMARKS
		0.00	TOPSOIL. - Traces of oxidation.								
		0.30	Native soil : Brown-grey moist Silty and Gravelly SAND with traces of clay. - Presence of cobbles and boulders (50-60 %).			MA-01					
		0.90	END OF TEST PIT (Refusal on bedrock)								
1											
5											
2											
3											
10											
4											
15											
5											

General remarks:	Verified by :
	F. Vinet, géo. M. Sc.
	Date : 2023-01-30





Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b> X : <b>264 651</b> Y : <b>5 586 420</b>	Test Pit : <b>GD-104.9-TP22-07</b> Page : <b>1 of 1</b> Start date : <b>2022-04-02</b> Inspector : <b>T. Coulaux, ing.</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b>	Depth : <b>0,30 (m)</b>
Client: <b>Cree Development Corporation</b>	Equipment : <b>Mechanical shovel</b>	
Site: <b>Potential BDH Railway</b>	Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : Plan :

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION Very loose Loose Compact Dense Very dense CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Reading 1	Date	Depth (m)						
Reading 1	Date	Depth (m)										
Remarks :												

STRATIGRAPHY				SAMPLES				TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>l</sub> 20 40 60 80 100 120
		0,00	TOPSOIL. - Presence of roots.									
		0,20 0,30	Native soil : Brown moist Silty SAND with some gravel. - Presence of cobbles and boulders (0-5 %). END OF TEST PIT (Refusal on bedrock)									
1												
5												
2												
3		10										
4												
5		15										

General remarks:	Verified by :
	F. Vinet, géo. M. Sc.
	Date : 2023-01-30



Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b> X : <b>258 633</b> Y : <b>5 589 515</b>	Test Pit : <b>GD-113-TP22-01</b> Page : <b>1 of 1</b> Start date : <b>2022-03-31</b> Inspector : <b>M. Frigon, tech.</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b>	
Client: <b>Cree Development Corporation</b>	Equipment : <b>Mechanical shovel</b>	
Site: <b>Potential BDH Railway</b>	Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : Plan :

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </tbody> </table>	Reading 1	Date	Depth (m)				Reading 2		(m)
Reading 1	Date	Depth (m)										
Reading 2		(m)										
Remarks :												

STRATIGRAPHY				SAMPLES				TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>l</sub>			
		0.00	TOPSOIL. - Presence of roots.												
		0.20	Native soil : Brown frozen to moist SAND with traces of silt. - Presence of cobbles (10 %).			MA-01									
		0.60	Till : Grey moist SAND and GRAVEL with traces of silt. - Presence of cobbles (30-35 %) and boulders (20 %).			MA-02									
		1				MA-03									
		5				MA-04									
		2													
		3													
		10													
		3.10	END OF TEST PIT (Refusal on boulders)												
		4													
		15													
		5													



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>258 856</b> Y : <b>5 589 346</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b>	Test Pit : <b>GD-113-TP22-02</b> Page : <b>1 of 1</b> Start date : <b>2022-03-31</b> Inspector : <b>M. Frigon, tech.</b> Depth : <b>3,90 (m)</b>
Project No.: <b>158100425.500.710.5</b>			
Client: <b>Cree Development Corporation</b>			
Site: <b>Potential BDH Railway</b>			

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>Reading 2</td> <td> </td> <td>(m)</td> </tr> </tbody> </table> Remarks :	Reading 1	Date	Depth (m)				Reading 2		(m)
Reading 1	Date	Depth (m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>
		0,00	TOPSOIL.									
		0,25	Native soil : Brown frozen to moist Silty CLAY with traces of gravel and sand. - Presence of boulders.			MA-01						
		1,00	Brown moist Silty SAND and CLAY.			MA-02						
		1,90	Till : Grey moist SAND and GRAVEL with traces of silt. - Presence of cobbles (20-25 %).			MA-03						
		3,90	END OF TEST PIT			MA-04						



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b>	Test Pit : <b>GD-113-TP22-03</b>
Project No.: <b>158100425.500.710.5</b>	X : <b>259 082</b>	Page : <b>1 of 1</b>
Client: <b>Cree Development Corporation</b>	Y : <b>5 589 179</b>	Start date : <b>2022-04-01</b>
Site: <b>Potential BDH Railway</b>	Type : <b>Test Pit</b>	Inspector : <b>M. Frigon, tech.</b>
	Equipment : <b>Mechanical shovel</b>	Depth : <b>3,80 (m)</b>
	Width : <b>1,0 (m)</b>	
	Length : <b>4,0 (m)</b>	
	Walls :	
	Plan :	

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER
Clay < 0.002 mm	Traces < 10 %	COMPACTION	Date
Silt 0.002 - 0.08 mm	Some 10 - 20 %	Very loose	Depth
Sand 0.08 - 5 mm	Adjective (...y) 20 - 35 %	Very soft	Reading 1 (m)
Gravel 5 - 80 mm	and (ex: and gravel) > 35 %	Loose	Reading 2 (m)
Cobbles 80 - 200 mm	Main word Dominant fraction	Compact	Remarks :
Boulders > 200 mm		Dense	
		Very dense	
		Hard	
		Cu OR Su (kPa)	
		< 12	
		12 - 25	
		25 - 50	
		50 - 100	
		100 - 200	
		> 200	

STRATIGRAPHY				SAMPLES				TESTS		REMARKS										
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>								
		0.00	TOPSOIL. - Presence of roots.																	
		0.20	Native soil : Brown moist Silty CLAY with traces of sand.																	
		2.00	Grey moist CLAY and SILT with traces of sand. - Presence of cobbles (1-2 %).				MA-01													
		2.80	Grey moist Silty SAND and CLAY. - Presence of boulders (30-40 %).				MA-02													
		3.30	Till : Grey moist SAND and GRAVEL with traces of silt. - Presence of cobbles (25 %) and boulders (30 %).				MA-03													
		3.80	END OF TEST PIT (Refusal on boulders)				MA-04													
							MA-05													



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b>
	Date : <b>2023-01-30</b>

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>259 350</b> Y : <b>5 589 041</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : Plan :	Test Pit : <b>GD-113-TP22-04</b> Page : <b>1 of 1</b> Start date : <b>2022-04-01</b> Inspector : <b>M. Frigon, tech.</b> Depth : <b>1,70 (m)</b>
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QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<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)
	Date	Depth										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>l</sub>	REMARKS
		0.00	TOPSOIL. - Presence of roots.									
		0.20	Native soil : Brown moist Gravelly SAND with traces of silt. - Presence of cobbles (15 %) and boulders.			MA-01						
		1.00	Till : Grey moist SAND and GRAVEL with traces of silt. - Presence of cobbles (30 %).			MA-02						
		1.70	END OF TEST PIT (Refusal on bedrock)									



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>228 680</b> Y : <b>5 662 224</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-01</b> Page : <b>1 of 1</b> Start date : <b>2022-07-16</b> Inspector : <b>É. Ferland</b> Depth : <b>2,74 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Client: <b>Cree Development Corporation</b>	Site: <b>Potential BDH Railway</b>	

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) and (ex: and gravel) 20 - 35 % Main word > 35 % Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th></th> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :		Date	Depth	Reading 1		(m)	Reading 2		(m)
	Date	Depth										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>		
		0.00	Native soil : Brown moist SAND with traces of silt and gravel.			MA-01								
						MA-02					GA			
						MA-03								
		1.83	Brown moist Gravelly SAND. - Presence of boulders (5-10 %).			MA-04								
		2.29	Brown moist SAND with traces of silt and gravel. - Presence of boulders (0-5 %).			MA-05								
		2.74	END OF TEST PIT											



General remarks:	Verified by : F. Vinet, géo. M. Sc. Date : 2023-01-30
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>228 476</b> Y : <b>5 661 985</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-02</b> Page : <b>1 of 1</b> Start date : <b>2022-07-16</b> Inspector : <b>É. Ferland</b> Depth : <b>3,66 (m)</b>
Project No.: <b>158100425.500.710.5</b>			
Client: <b>Cree Development Corporation</b>			
Site: <b>Potential BDH Railway</b>			

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS			GROUNDWATER		
Clay < 0.002 mm	Traces < 10 %	COMPACTION	CONSISTENCY	Cu OR Su (kPa)	Date	Depth	
Silt 0.002 - 0.08 mm	Some 10 - 20 %	Very loose	Very soft	< 12	Reading 1	(m)	
Sand 0.08 - 5 mm	Adjective (...y) 20 - 35 %	Loose	Soft	12 - 25	Reading 2	(m)	
Gravel 5 - 80 mm	and (ex: and gravel) > 35 %	Compact	Firm	25 - 50	Remarks :		
Cobbles 80 - 200 mm	Main word Dominant fraction	Dense	Stiff	50 - 100			
Boulders > 200 mm		Very dense	Very stiff	100 - 200			
			Hard	> 200			

STRATIGRAPHY				SAMPLES				TESTS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>L</sub>	REMARKS	
		0,00	Native soil : Brown moist SAND with traces of gravel and silt. - Presence of cobbles. - Presence of organic matters.			MA-01							
		0,74	Brown moist SAND and GRAVEL with some silt. - Presence of cobbles (0-5 %).			MA-02							
1		1,52	Brown moist SAND with some gravel. - Presence of boulders (5-10 %).			MA-03				GA			
2		2,13	Brown moist SAND with some silt and traces of gravel. - Presence of boulders (0-5 %).			MA-04							
3		3,66	END OF TEST PIT			MA-05							
4						MA-06				GA			



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b>
	Date : <b>2023-01-30</b>

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>229 126</b> Y : <b>5 662 349</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-03</b> Page : <b>1 of 1</b> Start date : <b>2022-07-16</b> Inspector : <b>É. Ferland</b> Depth : <b>3,66 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Client: <b>Cree Development Corporation</b>	Site: <b>Potential BDH Railway</b>	

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>L</sub>		
		0.00	Native soil : Brown moist SAND with traces of gravel and silt. - Presence of organic matters. - Traces of oxidation.			MA-01								
		1.22	Brown moist SAND with traces of silt and gravel. - Presence of boulders.			MA-02								
		5				MA-03								
		10				MA-04								
		15				MA-05								
		3.66	END OF TEST PIT			MA-06								

General remarks:	Verified by :
	F. Vinet, géo. M. Sc.
	Date : <b>2023-01-30</b>





Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>228 490</b> Y : <b>5 661 384</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-04</b> Page : <b>1 of 1</b> Start date : <b>2022-07-16</b> Inspector : <b>É. Ferland</b> Depth : <b>3,66 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Client: <b>Cree Development Corporation</b>	Site: <b>Potential BDH Railway</b>	

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>l</sub>
		0.00	Brown moist TOPSOIL.									
		0.15	Native soil :			MA-01						
		0.36	Brown-grey moist SAND with some gravel. - Presence of organic matters. - Traces of oxidation.			MA-02						
		0.99	Brown moist SAND with some silt and traces of gravel.			MA-03						
		1.22	Brown moist SAND with some gravel and traces of silt. - Presence of cobbles (0-5 %) and boulders (0-5 %).			MA-04						
						MA-05						
						MA-06						
						MA-07						
		3.35	Brown moist SAND with some silt and gravel.			MA-08						
		3.66	END OF TEST PIT									

General remarks:	Verified by :
	F. Vinet, géo. M. Sc.
	Date : 2023-01-30



Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>228 852</b> Y : <b>5 661 589</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Unstable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-05</b> Page : <b>1 of 1</b> Start date : <b>2022-07-16</b> Inspector : <b>É. Ferland</b> Depth : <b>2,44 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Client: <b>Cree Development Corporation</b>	Site: <b>Potential BDH Railway</b>	

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word <b>Dominant fraction</b>	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>l</sub>		
		0.00	Brown moist TOPSOIL.											
		0.20	Native soil : Brown moist SAND with traces of silt and gravel.			MA-01								
		0.46	- Presence of organic matters. - Traces of oxidation. Brown moist SAND with some silt and traces of gravel.			MA-02								
		0.91	Brown saturated SAND with traces to some silt and traces of gravel. - Presence of boulders (0-5 %).			MA-03								
						MA-04								
						MA-05								
		2.44	END OF TEST PIT											



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>229 034</b> Y : <b>5 661 875</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-06</b> Page : <b>1 of 1</b> Start date : <b>2022-07-16</b> Inspector : <b>É. Ferland</b> Depth : <b>3,66 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Client: <b>Cree Development Corporation</b>	Site: <b>Potential BDH Railway</b>	

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) and (ex: and gravel) 20 - 35 % Main word > 35 % Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION      CONSISTENCY      Cu OR Su (kPa) Very loose      Very soft      < 12 Loose      Soft      12 - 25 Compact      Firm      25 - 50 Dense      Stiff      50 - 100 Very dense      Very stiff      100 - 200 Hard      > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th></th> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :		Date	Depth	Reading 1		(m)	Reading 2		(m)
	Date	Depth										
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Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>L</sub>		
		0,00	Brown moist TOPSOIL.											
		0,20	Native soil : Grey-black moist SAND with some gravel. - Presence of organic matters.			MA-01								
		0,56	- Traces of oxidation. Brown moist Gravelly SAND with some silt. - Presence of boulders (0-5 %). - Traces of oxidation.			MA-02								
		1				MA-03								
		5				MA-04								
		1,78	Brown moist to saturated SAND with traces of gravel and silt.			MA-05								
		2				MA-06								
		3				MA-07								
		10												
		3,66	END OF TEST PIT											



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b> X : <b>227 751</b> Y : <b>5 661 504</b>	Test Pit : <b>GD-220.3-TP22-07</b> Page : <b>1 of 1</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b>	Start date : <b>2022-07-15</b>
Client: <b>Cree Development Corporation</b>	Equipment : <b>Mechanical shovel</b>	Inspector : <b>É. Ferland</b>
Site: <b>Potential BDH Railway</b>	Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : <b>Stable</b> Plan : <b>01</b> Depth : <b>3,66 (m)</b>

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION Very loose Loose Compact Dense Very dense CONSISTENCY Very soft Soft Firm Stiff Very stiff Hard Cu OR Su (kPa) < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>Reading 2</td> <td> </td> <td>(m)</td> </tr> </tbody> </table>	Reading 1	Date	Depth (m)				Reading 2		(m)
Reading 1	Date	Depth (m)										
Reading 2		(m)										
Remarks :												

STRATIGRAPHY				SAMPLES				TESTS		REMARKS	
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses
		0,00	Native soil :								
		0,46	Brown moist Gravelly SAND with traces of silt. - Presence of organic matters. - Traces of oxidation.			MA-01 MA-02 MA-03 MA-04 MA-05 MA-06 MA-07 MA-08 MA-09 MA-10 MA-11				GA	
		0,61	Brown moist Gravelly SAND with traces of silt. - Presence of cobbles (10 %).								
		0,81	Brown moist SAND with some silt and traces of gravel. Brown moist Gravelly to some gravel SAND with traces of silt. - Presence of cobbles (20 %).			MA-12 MA-13				GA	
		1,52	Brown moist Silty SAND with traces of gravel.			MA-14 MA-15					
		2,74	Brown moist SAND with some gravel and traces of silt. - Presence of cobbles and boulders (0-5 %).								
		3,66	END OF TEST PIT								



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>227 828</b> Y : <b>5 661 924</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-08</b> Page : <b>1 of 1</b> Start date : <b>2022-07-15</b> Inspector : <b>É. Ferland</b> Depth : <b>3,66 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Client: <b>Cree Development Corporation</b>	Site: <b>Potential BDH Railway</b>	

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) and (ex: and gravel) 20 - 35 % Main word > 35 % Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>	REMARKS
		0,00	Brown moist TOPSOIL.									
		0,10	Native soil : Brown moist Gravelly SAND with traces of silt. - Presence of organic matters. - Traces of oxidation.			MA-01						
		0,66	Brown moist Gravelly to some gravel SAND with traces of silt. - Presence of boulders (0-5 %).			MA-02						
1						MA-03						
		5				MA-04						
2						MA-05						
		2,44	Brown moist SAND with traces to some gravel.			MA-06						
		3,05	Brown moist SAND and GRAVEL.			MA-07						
		3,66	END OF TEST PIT									



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>228 039</b> Y : <b>5 661 560</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-09</b> Page : <b>1 of 1</b> Start date : <b>2022-07-15</b> Inspector : <b>É. Ferland</b> Depth : <b>3,66 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Client: <b>Cree Development Corporation</b>	Site: <b>Potential BDH Railway</b>	

<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>l</sub>
		0,00	Brown moist TOPSOIL.									
		0,15	Native soil :			MA-01						
		0,41	Brown moist SAND with some gravel to gravelly. - Presence of organic matters. - Presence of boulders (10-20 %). - Traces of oxidation. - Presence of indurated horizon.			MA-02						
		1	Brown moist SAND with traces of silt and gravel. - Presence of boulders at depth of 0,40 m to 1,22 m.			MA-03						
		5				MA-04						
		2				MA-05						
		3				MA-06						
		10										
		3,66	END OF TEST PIT									
		4										
		15										
		5										



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>228 098</b> Y : <b>5 661 716</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-10</b> Page : <b>1 of 1</b> Start date : <b>2022-07-15</b> Inspector : <b>É. Ferland</b> Depth : <b>3,35 (m)</b>
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS					
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>		
		0,00	Brown moist TOPSOIL.											
		0,10	Native soil :			MA-01								
		0,36	Brown-black moist SAND with some gravel. - Traces of oxidation. - Presence of indurated horizon.			MA-02								
			Brown moist SAND with some gravel. - Presence of cobbles.			MA-03					GA			
						MA-04								
						MA-05								
						MA-06								
		3,35	END OF TEST PIT											



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>228 148</b> Y : <b>5 661 914</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-11</b> Page : <b>1 of 1</b> Start date : <b>2022-07-15</b> Inspector : <b>É. Ferland</b> Depth : <b>3,66 (m)</b>
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS				
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	∇ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>	REMARKS
		0,00	Brown moist TOPSOIL.									
		0,08	Native soil :			MA-01						
		0,33	Brown-black moist SAND with some gravel and traces of silt. - Traces of oxidation. - Presence of indurated horizon.			MA-02						
		1	Brown moist Silty SAND with traces of gravel. - Presence of cobbles (0-1 %).			MA-03						
		5				MA-04						
		2				MA-05						
		3				MA-06						
		10										
		3,66	END OF TEST PIT									



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>228 347</b> Y : <b>5 661 738</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-220.3-TP22-12</b> Page : <b>1 of 1</b> Start date : <b>2022-07-15</b> Inspector : <b>É. Ferland</b> Depth : <b>3,66 (m)</b>
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th></th> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :		Date	Depth	Reading 1		(m)	Reading 2		(m)
	Date	Depth										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses	REMARKS
		0,00	Brown moist TOPSOIL.								
		0,13	Native soil : Brown-orange moist Gravelly SAND with traces of silt. - Presence of organic matters. - Traces of oxidation.			MA-01					
		0,61	Brown moist Silty SAND with traces of gravel.  - Presence of boulders (0-1 %).			MA-02 MA-03 MA-04 MA-05 MA-06 MA-07 MA-08					
		3,66	END OF TEST PIT								



General remarks:	Verified by : F. Vinet, géo. M. Sc. Date : 2023-01-30
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>242 611</b> Y : <b>5 692 538</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-256.4-TP22-01</b> Page : <b>1 of 1</b> Start date : <b>2022-04-06</b> Inspector : <b>T. Coulaux, ing.</b> Depth : <b>5,00 (m)</b>
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th></th> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :		Date	Depth	Reading 1		(m)	Reading 2		(m)
	Date	Depth										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	REMARKS
		0,00	Brown-black moist TOPSOIL.								
		0,30	Native soil : Till :Brown moist Gravelly to some gravel SAND with traces of silt. - Presence of boulders (10-20 %) and cobbles (30-40 %). - Traces of oxidation.			MA-01					
		0,90	Grey-brown moist Silty and Gravelly SAND. - Presence of boulders (0-10 %) and cobbles (5-20 %).			MA-02				GA	
						MA-03					
						MA-04					
		5,00	END OF TEST PIT								



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>242 779</b> Y : <b>5 692 199</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-256.4-TP22-02</b> Page : <b>1 of 1</b> Start date : <b>2022-04-06</b> Inspector : <b>T. Coulaux, ing.</b> Depth : <b>5,00 (m)</b>
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th></th> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :		Date	Depth	Reading 1		(m)	Reading 2		(m)
	Date	Depth										
Reading 1		(m)										
Reading 2		(m)										

STRATIGRAPHY				SAMPLES				TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>
		0,00	Brown-black moist TOPSOIL.									
		0,30	Native soil : Till : Brown moist Gravelly SAND with traces of silt. - Presence of boulders (0-10 %) and cobbles (30-40 %). - Traces of oxidation.			MA-01						
		0,80	Brown moist Gravelly to some gravel SAND with traces of silt. - Presence of cobbles (0-10 %).			MA-02						
		1,50	Brown moist SAND with some silt and traces of gravel. - Presence of cobbles (0-10 %).			MA-03						
		5,00	END OF TEST PIT			MA-04						

General remarks:	Verified by :
	F. Vinet, géo. M. Sc.
	Date : 2023-01-30



Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo System.: MTM-NAD83 Zone: 9</b> X : <b>242 930</b> Y : <b>5 692 367</b>	Test Pit : <b>GD-256.4-TP22-03</b> Page : <b>1 of 1</b> Start date : <b>2022-04-06</b> Inspector : <b>T. Coulaux, ing.</b> Depth : <b>5,00 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Walls : <b>Stable</b> Plan : <b>01</b>
Client: <b>Cree Development Corporation</b>		
Site: <b>Potential BDH Railway</b>		

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>Reading 2</td> <td> </td> <td>(m)</td> </tr> </tbody> </table> Remarks :	Reading 1	Date	Depth (m)				Reading 2		(m)
Reading 1	Date	Depth (m)										
Reading 2		(m)										

STRATIGRAPHY			SAMPLES				TESTS		REMARKS			
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	RECOVERY (%)		WATER LEVEL / WATER INFLOW	GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W   W <sub>l</sub>
		0,00	Brown-black moist TOPSOIL.									
		0,30	Native soil : Till : Brown moist GRAVEL and SAND with traces of silt.			MA-01					GA	
		0,60	- Presence of boulders (20-30 %) and cobbles (40-50 %). - Traces of oxidation.									
		1	Grey-brown moist Silty SAND with some gravel. - Presence of boulders (0-10 %) and cobbles (10-30 %).			MA-02						
		5										
		2										
		3				MA-03					GA	
		10										
		4										
		15				MA-04						
		5	5,00	END OF TEST PIT								



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>243 053</b> Y : <b>5 692 024</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-256.4-TP22-04</b> Page : <b>1 of 1</b> Start date : <b>2022-04-06</b> Inspector : <b>T. Coulaux, ing.</b> Depth : <b>5,00 (m)</b>
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word Dominant fraction	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th></th> <th>Date</th> <th>Depth</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :		Date	Depth	Reading 1		(m)	Reading 2		(m)
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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	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability fc : compressive str. OM : organic matter CA : chemical analyses
		0,00	Brown-black moist TOPSOIL.								
		0,30	Native soil : Till : Brown moist Gravelly SAND with traces of silt. - Presence of boulders (0-10 %) and cobbles (30-40 %). - Traces of oxidation.			MA-01					
		0,80	Brown-grey moist Gravelly to some gravel SAND with traces of silt. - Presence of cobbles (0-10 %).			MA-02					
		1,50	Brown-grey moist SAND with some silt and traces of gravel. - Presence of cobbles (0-10 %).			MA-03					
		5,00	END OF TEST PIT			MA-04				GA	



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>243 301</b> Y : <b>5 692 309</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-256.4-TP22-05</b> Page : <b>1 of 1</b> Start date : <b>2022-04-06</b> Inspector : <b>T. Coulaux, ing.</b> Depth : <b>5,00 (m)</b>
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<b>QUALITATIVE TERMINOLOGY</b> 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	<b>QUANTITATIVE TERMINOLOGY</b> Traces < 10 % Some 10 - 20 % Adjective (...y) 20 - 35 % and (ex: and gravel) > 35 % Main word <b>Dominant fraction</b>	<b>MECHANIC CHARACTERISTICS OF SOILS</b> COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<b>GROUNDWATER</b> <table border="1"> <tr> <th>Reading</th> <th>Date</th> <th>Depth (m)</th> </tr> <tr> <td>Reading 1</td> <td></td> <td>(m)</td> </tr> <tr> <td>Reading 2</td> <td></td> <td>(m)</td> </tr> </table> Remarks :	Reading	Date	Depth (m)	Reading 1		(m)	Reading 2		(m)
Reading	Date	Depth (m)										
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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	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded 
		0,00	Brown-black moist TOPSOIL.									
		0,30	Native soil : Till : Brown moist SAND with some silt and traces of gravel.			MA-01						
		0,70	- Traces of oxidation. Grey-brown moist SAND with some silt. - Presence of cobbles (0-10 %).			MA-02						
		1										
		5										
		2										
		3				MA-03						
		10										
		4										
		15				MA-04						
		5	5,00	END OF TEST PIT								

General remarks:	Verified by : F. Vinet, géo. M. Sc. Date : 2023-01-30
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : X : <b>242 950</b> Y : <b>5 692 918</b> Type : <b>Test Pit</b> Equipment : <b>Mechanical shovel</b> Width : <b>1,0 (m)</b> Length : <b>4,0 (m)</b>	Geo System.: <b>MTM-NAD83</b> Zone: <b>9</b> Walls : <b>Stable</b> Plan : <b>01</b>	Test Pit : <b>GD-256.4-TP22-06</b> Page : <b>1 of 1</b> Start date : <b>2022-04-06</b> Inspector : <b>T. Coulaux, ing.</b> Depth : <b>4,00 (m)</b>
Project No.: <b>158100425.500.710.5</b>	Client: <b>Cree Development Corporation</b>	Site: <b>Potential BDH Railway</b>	

QUALITATIVE TERMINOLOGY	QUANTITATIVE TERMINOLOGY	MECHANIC CHARACTERISTICS OF SOILS	GROUNDWATER									
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	COMPACTION CONSISTENCY Cu OR Su (kPa) Very loose Very soft < 12 Loose Soft 12 - 25 Compact Firm 25 - 50 Dense Stiff 50 - 100 Very dense Very stiff 100 - 200 Hard > 200	<table border="1"> <thead> <tr> <th>Reading 1</th> <th>Date</th> <th>Depth (m)</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> Remarks :	Reading 1	Date	Depth (m)						
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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	RECOVERY (%)	WATER LEVEL / WATER INFLOW		GA : grain size analysis S : sedimentometry C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : compressive str. OM : organic matter CA : chemical analyses	▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded W <sub>p</sub> W W <sub>L</sub>
		0,00	Brown-black moist TOPSOIL.									
		0,30	Native soil : Till : Brown moist SAND with some silt and gravel. - Presence of boulders (10-20 %) and cobbles (10-20 %). - Traces of oxidation.			MA-01						
		0,80	Brown-grey moist SAND and SILT with some gravel. - Presence of boulders (10-20 %) and cobbles (10-20 %).			MA-02				GA		
		5				MA-03						
		2,00	Brown-grey moist Gravelly SAND with some silt. - Presence of boulders (10-20 %) and cobbles (20-30 %).			MA-04				GA		
		4,00	END OF TEST PIT									



General remarks:	Verified by : <b>F. Vinet, géo. M. Sc.</b> Date : <b>2023-01-30</b>
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Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo. System : MTM-NAD83 Zone: 9</b> X : <b>241 011</b> Y : <b>5 519 593</b>	Borehole : <b>Q-22-BH22-01</b> Page : <b>1 of 2</b> Start date : <b>2022-03-30</b> Inspector : <b>K. Haiek, ing.</b> Depth : <b>12,06 m</b>
Project No.: <b>158100425.500.710.5</b>	Type of borehole : <b>Hollow Stem Auger + Diamond Core</b>	
Client: <b>Cree Development Corporation</b>	Equipment : <b>CME 55</b>	
Site: <b>Potential BDH Railway</b>	Sampling type : <b>B</b>	
	Corer : <b>HQ</b>	Figure :







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></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>		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 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	Brown-black moist ORGANIC MATTERS. - Presence of roots.			SS-01	B	25	9		1-6-3-10		
		0.61	Native soil : Brown moist SAND and GRAVEL with some silt, compact.			SS-02	B	63	18		8-8-10-23		
		1.22	Brown to grey moist SAND and GRAVEL, very dense. - Presence of cobbles and boulders.			SS-03	B	88	R		25-37-50 /10 cm		
		15				DC-04	HQ		21				

General remarks:	Verified by : B. Cyr, géo. Date : 2023-01-30
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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
6	20												
7													
8		7.57	Bedrock : Schisty BASALT, very fractured, of poor to very poor quality. - Traces of oxidation.										
9	30											LA + MD (7.57 - 9.68 m)	
10													
11	35												LA + MD (9.68 - 12.06 m)
12	40	12.06	END OF BOREHOLE										
13													



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	20					DC-07	HQ	100	25				
7						DC-08	HQ	100	27				
8	25					DC-09	HQ	100	31				
9	30											LA + MD (6.11 - 9.73 m)	
9.42			END OF BOREHOLE										
10													
11	35												
12	40												
13													

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo. System : MTM-NAD83 Zone: 9</b>	Borehole : <b>Q-36.9-BH22-01</b>
Project No.: <b>158100425.500.710.5</b>	X :	Page : <b>1 of 2</b>
Client: <b>Cree Development Corporation</b>	Y :	Start date : <b>2022-03-24</b>
Site: <b>Potential BDH Railway</b>	Type of borehole : <b>Hollow Stem Auger + Diamond Core</b>	Inspector : <b>K. Haiek, ing.</b>
	Equipment : <b>CME 55</b>	Depth : <b>9,63 m</b>
	Sampling type : <b>B</b>	
	Corer : <b>HQ</b>	Figure :

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"> <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>	Date	Depth	Reading 1	m	Reading 2	m
Date	Depth									
Reading 1	m									
Reading 2	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" 0 - 4	QUALIFICATIVE RQD < 25 %	Very tight < 20 mm
Intact (thin wall sampler)	Very loose 0 - 4	Very poor < 25 %	Tight 20 - 60 mm
Lost	Loose 4 - 10	Poor 25 - 50 %	Close 60 - 200 mm
Core (diamond rock core)	Compact 10 - 30	Fair 50 - 75 %	Moderately spaced 200 - 600 mm
	Dense 30 - 50	Good 75 - 90 %	Spaced 600 - 2000 mm
	Very dense > 50	Excellent 90 - 100 %	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	Native soil : Brown moist some to Silty SAND, loose to compact.			SS-01		B	50	6	1-2-4-9		<p>LA + MD (2.13 - 4.42 m)</p>
		1.22	Brown to grey moist SAND with some gravel, very dense.			SS-02		B	63	10	6-5-5-15		
		1.70	Bedrock : Pink and white massive QUARTZ DIORITE, of poor to excellent quality. - Presence of oblic joint and light alteration.			SS-03		B	68	72	8-31-41-60 /3 cm		
						DC-04		HQ	71	47			
						DC-05		HQ	100	100			
						DC-06		HQ	100	100			

General remarks:	Verified by :  B. Cyr, géo. #786
	Date : 2023-01-30

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	
6	20					DC-07	HQ	100	81				
7						DC-08	HQ	100	100				
8		8,13	Pink and white Mafic DYKE, of good quality.										
9	30					DC-09	HQ	93	78				
10		9,63	END OF BOREHOLE										
11	35												
12	40												
13													

GA : grain size analysis  
 H : hydrometer test  
 C : consolidation  
 W : water content  
 W<sub>l</sub> : liquid limit  
 W<sub>p</sub> : 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<sub>p</sub>   W   W<sub>l</sub>

20 40 60 80 100 120

LA + MD  
(4.42 - 6.63 m)

LA + MD  
(8.13 - 9.62 m)

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo. System : MTM-NAD83 Zone: 9</b> X : <b>250 299</b> Y : <b>5 526 667</b>	Borehole : <b>Q-36.9-BH22-02</b> Page : <b>1 of 2</b> Start date : <b>2022-03-29</b> Inspector : <b>K. Haiek, ing.</b> Depth : <b>11,10 m</b>
Project No.: <b>158100425.500.710.5</b>	Type of borehole : <b>Hollow Stem Auger + Diamond Core</b>	
Client: <b>Cree Development Corporation</b>	Equipment : <b>CME 55</b>	
Site: <b>Potential BDH Railway</b>	Sampling type : <b>B</b>	
	Corer : <b>HQ</b>	Figure :

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></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>		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 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 Silty SAND. - Presence of roots.			SS-01		B	25	3	1-1-2-3		
		0.61	Native soil : Brown moist SAND with some silt, dense.			SS-02		B	13	44	4-16-28-32		
						SS-03		B	10	R	24-50 / 10 cm		
		1.83	Brown moist Gravelly SAND with some silt, very dense.			SS-04		B	84	R	23-26-50 / 3 cm		
		2.16	Bedrock : Grey and white massive QUARTZ DIORITE, of fair to excellent quality.			DC-05		HQ	100	100			
						DC-06		HQ	100	71			LA + MD (3.61 - 5.11 m)

General remarks:	Verified by :
	Date : 2023-01-30

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	
6	20						DC-07	HQ	100	63			
7							DC-08	HQ	100	100			
8		8,10	Grey massive GABBRO, of excellent quality.				DC-09	HQ	100	92		LA + MD (5.79 - 8.10 m)	
9							DC-10	HQ	100	88		LA + MD (9.60 - 11.10 m)	
10		9,60	Grey and white massive QUARTZ DIORITE, of good quality.										
11		35											
11		11,10	END OF BOREHOLE										
12													
13		40											

GA : grain size analysis  
 H : hydrometer test  
 C : consolidation  
 W : water content  
 W<sub>l</sub> : liquid limit  
 W<sub>p</sub> : plastic limit  
 Dr : specific gravity  
 k : permeability  
 f<sub>c</sub> : 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<sub>p</sub>   W   W<sub>l</sub>

20 40 60 80 100 120

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo. System : MTM-NAD83 Zone: 9</b> X : <b>262 737</b> Y : <b>5 564 930</b>	Borehole : <b>Q-85.5-BH22-01</b> Page : <b>1 of 2</b> Start date : <b>2022-03-28</b> Inspector : <b>K. Haiek, ing.</b> Depth : <b>8,03 m</b>
Project No.: <b>158100425.500.710.5</b>	Type of borehole : <b>Hollow Stem Auger + Diamond Core</b>	
Client: <b>Cree Development Corporation</b>	Equipment : <b>CME 55</b>	
Site: <b>Potential BDH Railway</b>	Sampling type : <b>B</b>	
	Corer : <b>HQ</b>	Figure :

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></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>		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 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	Brown-black moist ORGANIC MATTERS and SAND. - Presence of roots.			SS-01		B	29	3	3-2-1-1		LA + MD (2.03 - 3.83 m)  LA + MD (3.91 - 6.52 m)
		0,61	Native soil :			SS-02		B	43	R	1-50 / 3 cm		
		0,79	Brown moist to saturated SAND. Bedrock : Coarse grain pink GRANITE, of good quality.					A	HQ	100	71		
		1,98	Grey fine grain QUARTZ GRANITOID, of good quality.					B					
		3,91	White massive QUARTZ DIORITE, of excellent quality.					A					
						DC-03		B					
						DC-04		HQ	100	95			
						DC-05		HQ	100	100			

General remarks:	Verified by :
	Date : <b>2023-01-30</b>



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	
6	20					DC-06		HQ	100	100			
7		6.83	Fine grain pink GRANITE, of excellent quality.				A						
8			- Becoming coarse grain at 7,72 m.			DC-07	B	HQ	97	93			
8		8.03	END OF BOREHOLE										
9	30												
10													
11	35												
12	40												
13													

GA : grain size analysis  
 H : hydrometer test  
 C : consolidation  
 W : water content  
 W<sub>l</sub> : liquid limit  
 W<sub>p</sub> : 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<sub>p</sub>   W   W<sub>l</sub>





20 40 60 80 100 120


LA + MD  
(6.83 - 8.03 m)

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo. System : MTM-NAD83 Zone: 9</b> X : <b>262 859</b> Y : <b>5 564 960</b>	Borehole : <b>Q-85.5-BH22-02</b> Page : <b>1 of 2</b> Start date : <b>2022-03-27</b> Inspector : <b>K. Haiek, ing.</b> Depth : <b>9,53 m</b>
Project No.: <b>158100425.500.710.5</b>	Type of borehole : <b>Hollow Stem Auger + Diamond Core</b>	
Client: <b>Cree Development Corporation</b>	Equipment : <b>CME 55</b>	
Site: <b>Potential BDH Railway</b>	Sampling type : <b>B</b>	
	Corer : <b>HQ</b>	Figure :

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></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>		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)	<b>COMPACTION</b> Very loose Loose Compact Dense Very dense <b>INDEX "N"</b> 0 - 4 4 - 10 10 - 30 30 - 50 > 50 <b>CONSISTENCY</b> Very soft Soft Firm Stiff Very stiff Hard <b>Cu OR Su (kPa)</b> < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	<b>QUALIFICATIVE</b> Very poor Poor Fair Good Excellent <b>RQD</b> < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	<b>JOINTS SPACING</b> 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	Brown-black moist ORGANIC MATTERS. - Presence of roots.		X	SS-01		B	24	R	2-1-50 /13 cm		
		0.43	Bedrock : Grey and pink massive QUARTZ DIORITE, of good quality.				A						
1		0.91	Coarse grain pink GRANITE, of excellent quality.			DC-02	B	HQ	100	78		LA + MD (0.91- 3.25 m)	
2													
3	10					DC-03	A	HQ	100	95			
4		3,35	Grey massive QUARTZ DIORITE, of excellent quality.				B					LA + MD (3.53 - 5.03 m)	
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													

General remarks:	Verified by :  B. Cyr, géo. Date : 2023-01-30
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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
6	20					DC-05	HQ	100	97				
7						DC-06	HQ	98	98				
8	25												
9	30					DC-07	HQ	100	100				
10		9,53	END OF BOREHOLE										
11	35												
12	40												
13													

LA + MD  
(7.18 - 9.53 m)

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo. System : MTM-NAD83 Zone: 9</b> X : <b>234 438</b> Y : <b>5 595 044</b>	Borehole : <b>Q-138.1-BH22-01</b> Page : <b>1 of 2</b> Start date : <b>2022-04-05</b> Inspector : <b>K. Haiek, ing.</b> Depth : <b>9,20 m</b>
Project No.: <b>158100425.500.710.5</b>	Type of borehole : <b>Hollow Stem Auger + Diamond Core</b>	
Client: <b>Cree Development Corporation</b>	Equipment : <b>CME 55</b>	
Site: <b>Potential BDH Railway</b>	Sampling type : Corer : <b>HQ</b> Figure :	

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"> <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>	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 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					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	Black moist ORGANIC MATTERS with some sand.										GA : grain size analysis H : hydrometer test C : consolidation W : water content W <sub>L</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f'c : compressive str. OM : organic matter CA : chemical analyses SAV : soil aggressivity value
		1.32	Bedrock : Pink massive GNEISS, of poor to excellent quality.			DC-01	HQ	100	46			LA + MD (1.32 - 3.53 m)	X : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded
						DC-02	HQ	100	83				
						DC-03	HQ	100	88			LA + MD (3.53 - 6.52 m)	

General remarks:	Verified by :
	Date : <b>2023-01-30</b>

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	20			~			DC-04	HQ	100	98			
7				~			DC-05	HQ	100	90			
8				~			DC-06	HQ	100	70			
9	30	9.20	END OF BOREHOLE	~								LA + MD (8.03 - 9.20 m)	
10													
11	35												
12	40												
13													

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo. System : MTM-NAD83 Zone: 9</b> X : <b>234 512</b> Y : <b>5 595 183</b>	Borehole : <b>Q-138.1-BH22-02</b> Page : <b>1 of 2</b> Start date : <b>2022-04-03</b> Inspector : <b>K. Haiek, ing.</b> Depth : <b>9,30 m</b>
Project No.: <b>158100425.500.710.5</b>	Type of borehole : <b>Hollow Stem Auger + Diamond Core</b>	
Client: <b>Cree Development Corporation</b>	Equipment : <b>CME 55</b>	
Site: <b>Potential BDH Railway</b>	Sampling type : <b>B</b>	
	Corer : <b>HQ</b>	Figure :

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></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>		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 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)	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 <sub>L</sub> : liquid limit W <sub>p</sub> : 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
		0.00												
		0.76												
		1												
		5												
		10												
		15												

General remarks:	Verified by :  B. Cyr, géo. Date : 2023-01-30
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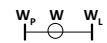
STRATIGRAPHY			SAMPLES						TESTS		REMARKS		
DEPTH (m)	DEPTH (ft)	DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD		Standard penetration test BLOWS/150mm	WATER LEVEL / WATER INFLOW
6	20			~			DC-06	HQ	100	97			
7				~			DC-07	HQ	95	95			
8				~									
9	30			~			DC-08	HQ	98	96			
10		9,30	END OF BOREHOLE										
11	35												
12	40												
13													

LA + MD  
(6.30 - 9.30 m)

20 40 60 80 100 120





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 <sub>l</sub> : liquid limit W <sub>p</sub> : plastic limit Dr : specific gravity k : permeability f <sub>c</sub> : 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	20						DC-06	HQ	100	85		LA + MD (3.40 - 6.40 m)		
7							DC-07	HQ	100	97				
8	25											LA + MD (6.40 - 9.40 m)		
9	30						DC-08	HQ	100	80				
9.40			END OF BOREHOLE											
10														
11	35													
12	40													
13														

Project: <b>La Grande Alliance - Feasibility Study - Phase I</b>	Coordinate : <b>Geo. System : MTM-NAD83 Zone: 9</b> X : <b>222 228</b> Y : <b>5 618 246</b>	Borehole : <b>Q-168-BH22-02</b> Page : <b>1 of 2</b> Start date : <b>2022-04-01</b> Inspector : <b>K. Haiek, ing.</b> Depth : <b>9,32 m</b>
Project No.: <b>158100425.500.710.5</b>	Type of borehole : <b>Hollow Stem Auger + Diamond Core</b>	
Client: <b>Cree Development Corporation</b>	Equipment : <b>CME 55</b>	
Site: <b>Potential BDH Railway</b>	Sampling type : <b>B</b>	
	Corer : <b>HQ</b>	Figure :

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></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>		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)	<b>COMPACTION</b> Very loose Loose Compact Dense Very dense <b>INDEX "N"</b> 0 - 4 4 - 10 10 - 30 30 - 50 > 50 <b>CONSISTENCY</b> Very soft Soft Firm Stiff Very stiff Hard <b>Cu OR Su (kPa)</b> < 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	<b>QUALIFICATIVE</b> Very poor Poor Fair Good Excellent <b>RQD</b> < 25 % 25 - 50 % 50 - 75 % 75 - 90 % 90 - 100 %	<b>JOINTS SPACING</b> 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	Native soil : Brown moist SAND and SILT, loose. - Presence of organic matters and roots.			SS-01		B	25	7	3-3-4-5								
		0.61	Grey moist SAND and GRAVEL, loose.			SS-02		B	38	R	10-3-50 /3 cm								
		0.94	Bedrock : META-BASALT with fine grain, of poor to excellent quality.			DC-03		HQ	46	40									
						DC-04		HQ	100	97									
						DC-05		HQ	100	95									

General remarks:	Verified by :  Géo B. Cyr, géo. Date : 2023-01-30
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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	20						DC-06	HQ	100	81			LA + MD (4.83 - 7.16 m)	
7							DC-07	HQ	100	100				
8													LA + MD (7.16 - 9.32 m)	
9	30						DC-08	HQ	100	100				
9,32			END OF BOREHOLE											
10														
11	35													
12	40													
13														

GA : grain size analysis  
 H : hydrometer test  
 C : consolidation  
 W : water content  
 W<sub>l</sub> : liquid limit  
 W<sub>p</sub> : 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

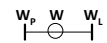

W<sub>p</sub>   W   W<sub>l</sub>

20 40 60 80 100 120







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 <sub>l</sub> : liquid limit W <sub>p</sub> : 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 		
		5,79	Bedrock : Black and pink MIGMATITE, of good to excellent quality.		DC-06		A									
6	20	B					NQ	100	85							
7							DC-07			NQ	100	100				
8	25				DC-08		NQ	100	100							
9	30	9,60	END OF BOREHOLE													
10																
11	35															
12	40															
13																

LA + MD  
(5.79 - 9.60 m)

## **Appendix D Laboratory Test Results**













































































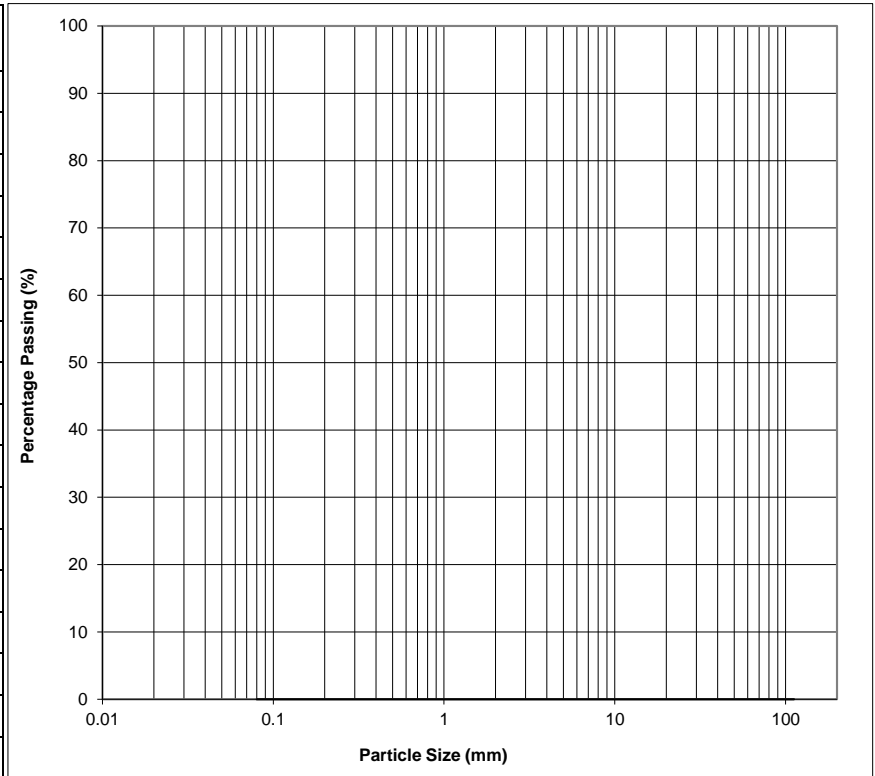




Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 30, 2022
Sample No : Q-22-BH22-01 DC-07 and DC-08	
Depth : 7,57 - 9,68m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**

Openings Dimensions	Cumulative Results		
mm	% Passing	Minimum	Maximum
112			
80.0			
56.0			
40.0			
31.5			
28.0			
20.0			
14.0			
10.0			
5.00			
2.50			
1.25			
0.630			
0.315			
0.160			
0.080			



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

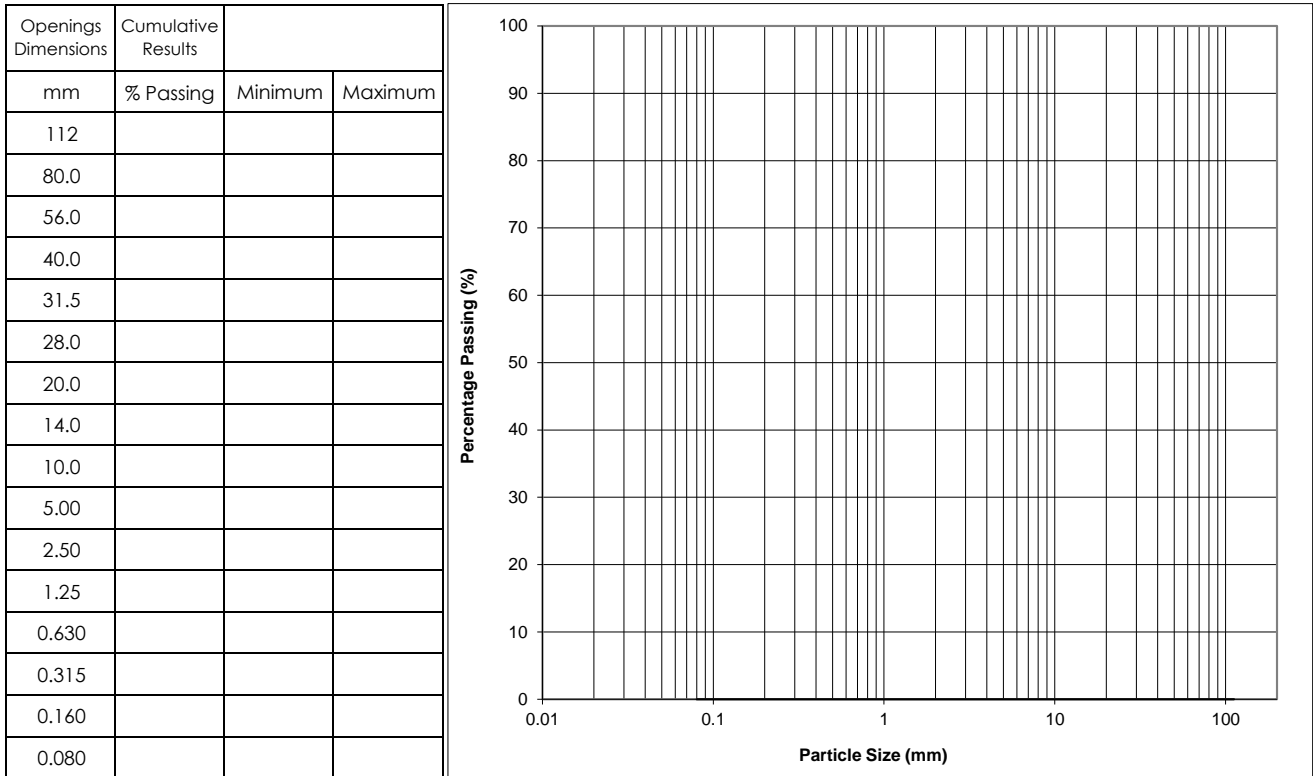
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	14						
Micro Deval (grading F) (LC 21-070) (%)	7						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .GEO #786      Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 30, 2022
Sample No : Q-22-BH22-01 DC-08 and DC-09	
Depth : 9,68 - 12,06m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

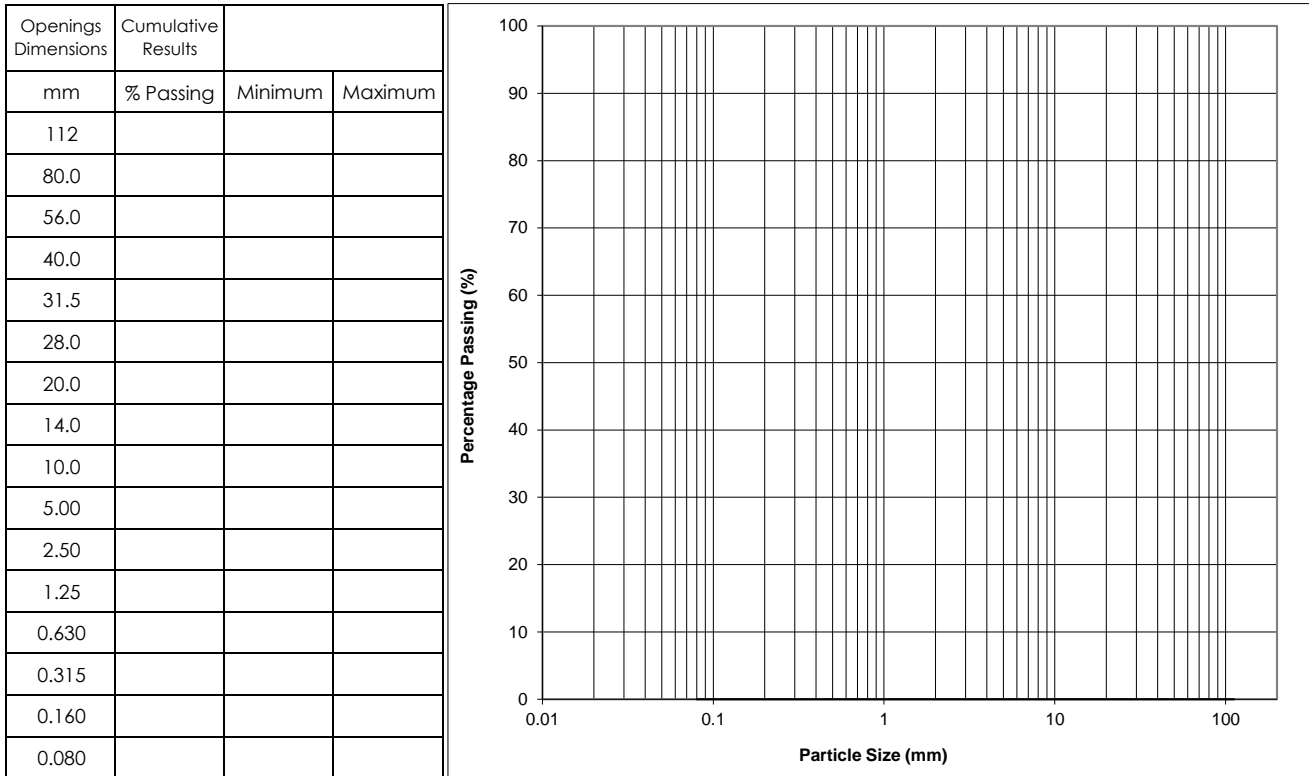
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	11						
Micro Deval (grading F) (LC 21-070) (%)	7						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #186 Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 29, 2022
Sample No : Q-22-BH22-02 DC-05 and DC-06	
Depth : 2,21 - 4,93m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	13						
Micro Deval (grading F) (LC 21-070) (%)	4						

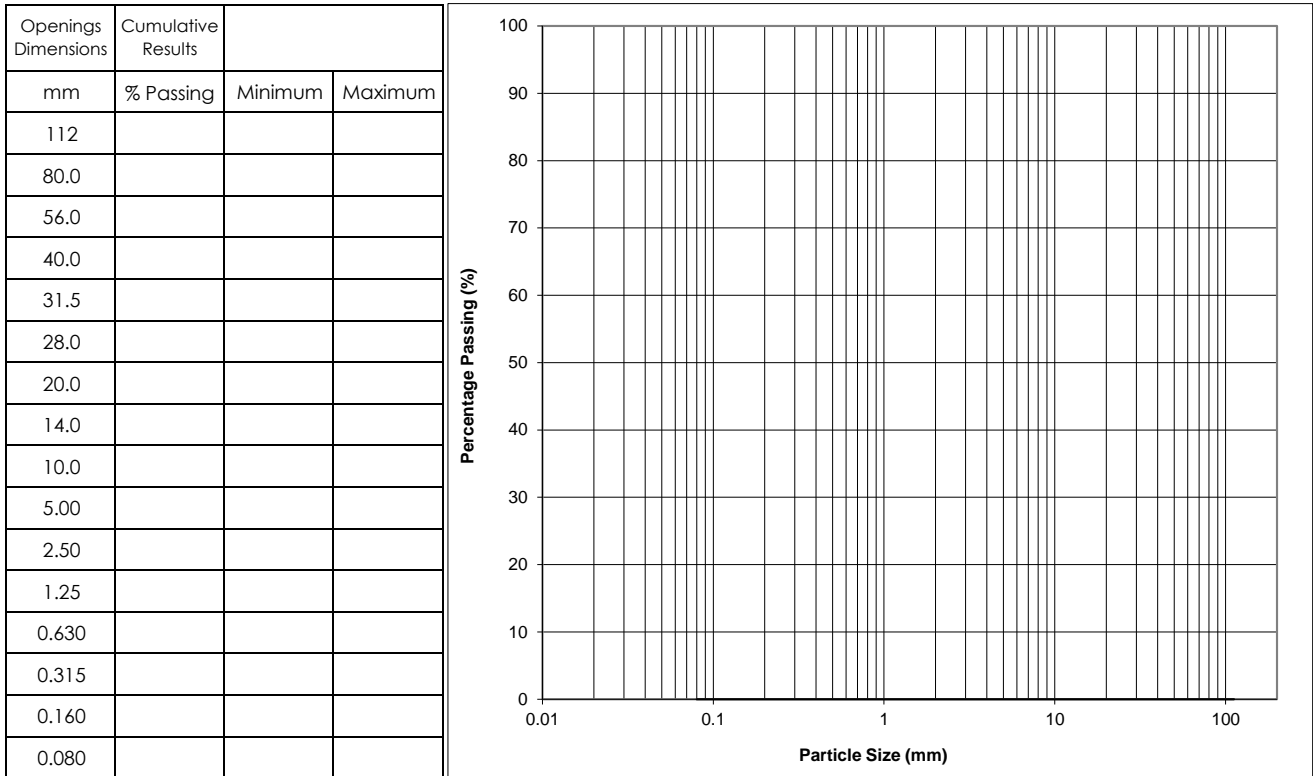
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #486

Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 29, 2022
Sample No : Q-22-BH22-02 DC-07 to DC-09	
Depth : 6,11 - 9,73m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

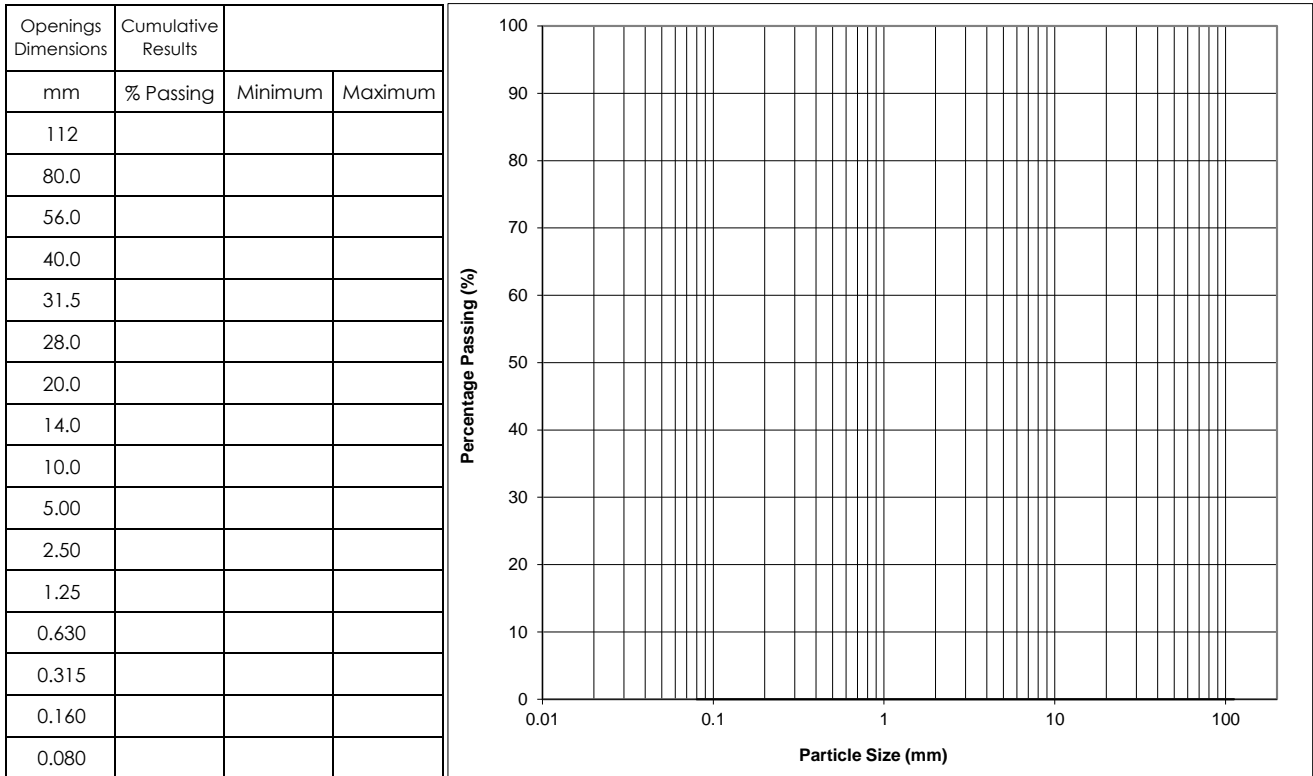
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	13						
Micro Deval (grading F) (LC 21-070) (%)	4						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #486      Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 24, 2022
Sample No : Q-36.9-BH22-01 DC-05 and DC-06	
Depth : 2,13 - 4,42m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

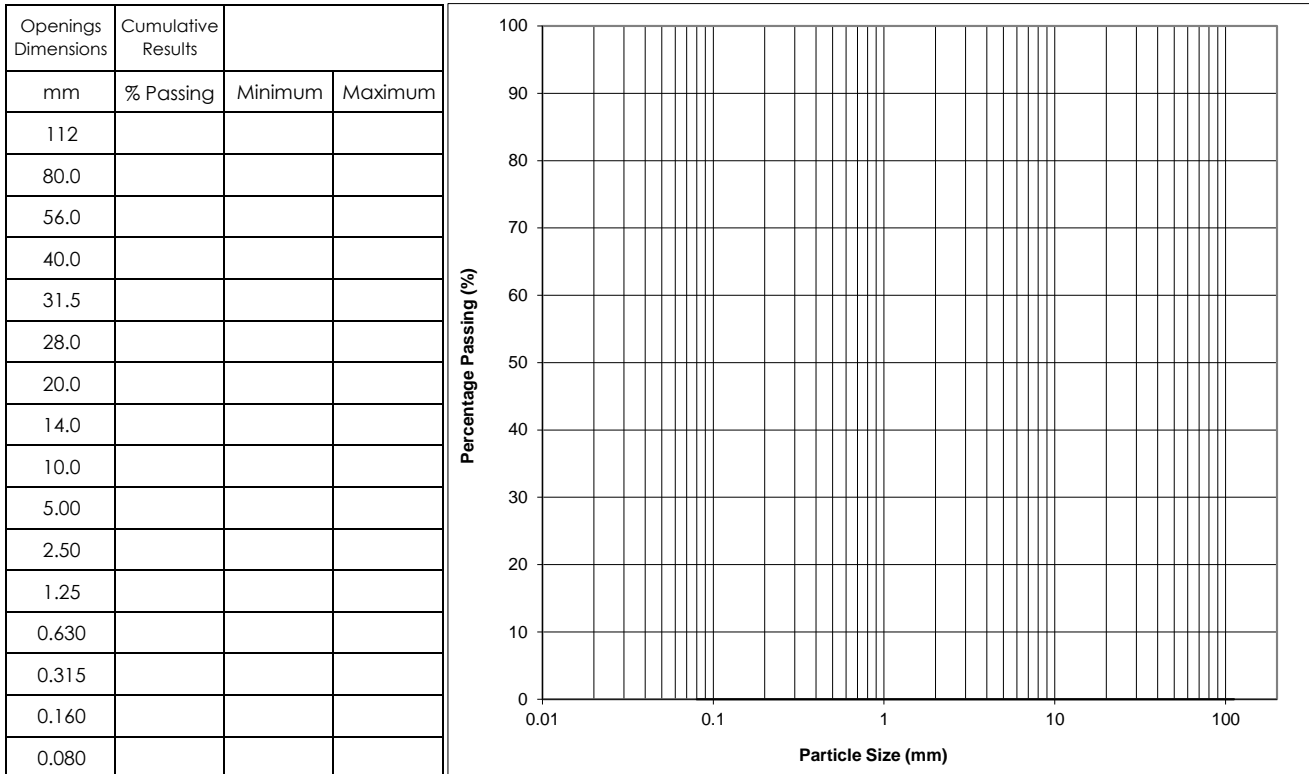
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	17						
Micro Deval (grading F) (LC 21-070) (%)	6						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* <sup>Geo</sup> #186 \_\_\_\_\_ Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 24, 2022
Sample No : Q-36.9-BH22-01 DC-06 and DC-07	
Depth : 4,42 - 6,63m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	17						
Micro Deval (grading F) (LC 21-070) (%)	6						

Remarks :

\_\_\_\_\_

\_\_\_\_\_

Prepared By:

Benoit Cyr, Geo. *BJ* .Geo  
#186

Date: December 19, 2022

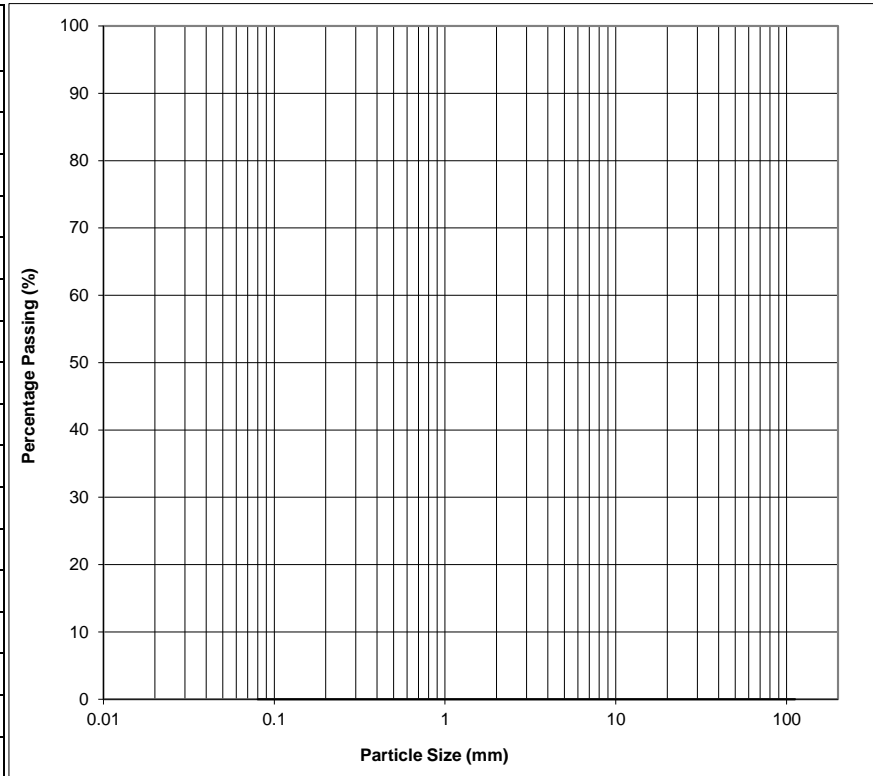
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Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 24, 2022
Sample No : Q-36.9-BH22-01 DC-09	
Depth : 8,13 - 9,63m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**

Openings Dimensions	Cumulative Results		
mm	% Passing	Minimum	Maximum
112			
80.0			
56.0			
40.0			
31.5			
28.0			
20.0			
14.0			
10.0			
5.00			
2.50			
1.25			
0.630			
0.315			
0.160			
0.080			



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	13						
Micro Deval (grading F) (LC 21-070) (%)	5						

Remarks :

\_\_\_\_\_

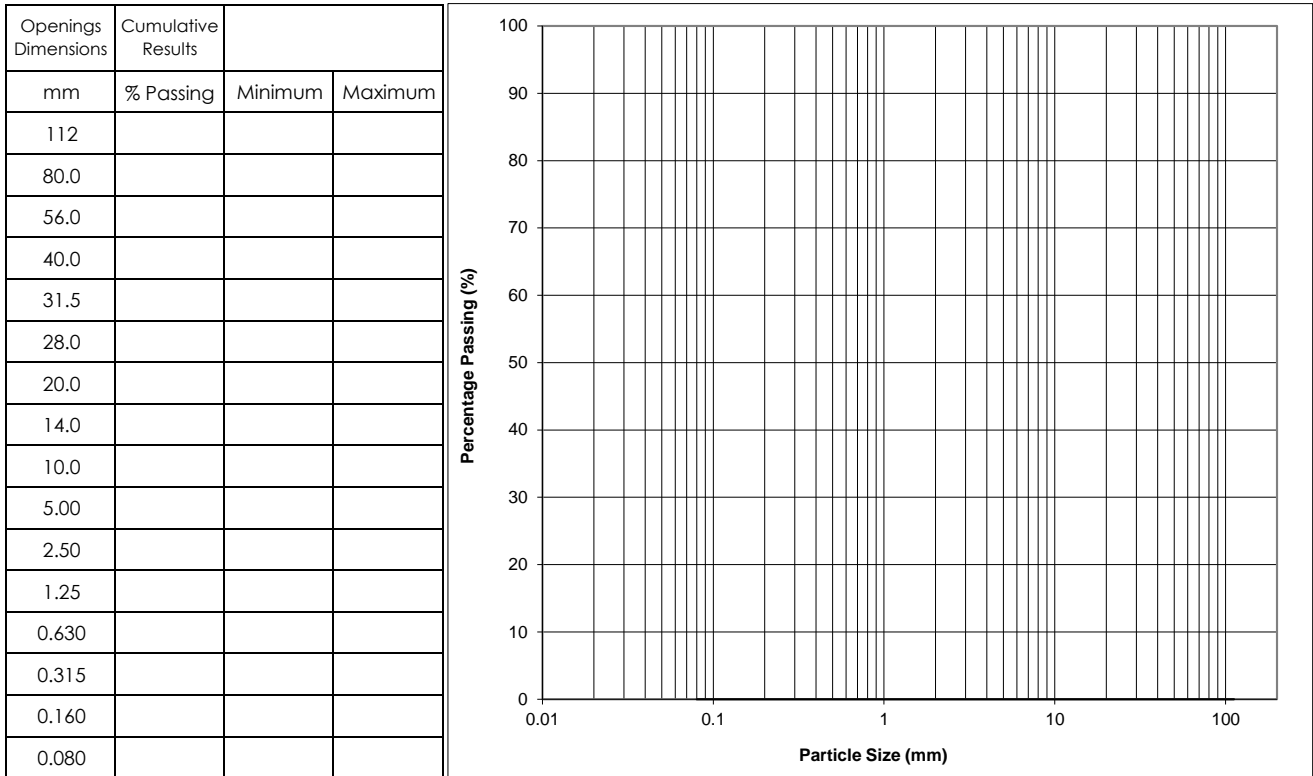
Prepared By:

Benoit Cyr, Geo. *BJ* .Geo  
#486

Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 24, 2022
Sample No : Q-36.9-BH22-02 DC-06	
Depth : 3,61 - 5,11m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	18						
Micro Deval (grading F) (LC 21-070) (%)	9						

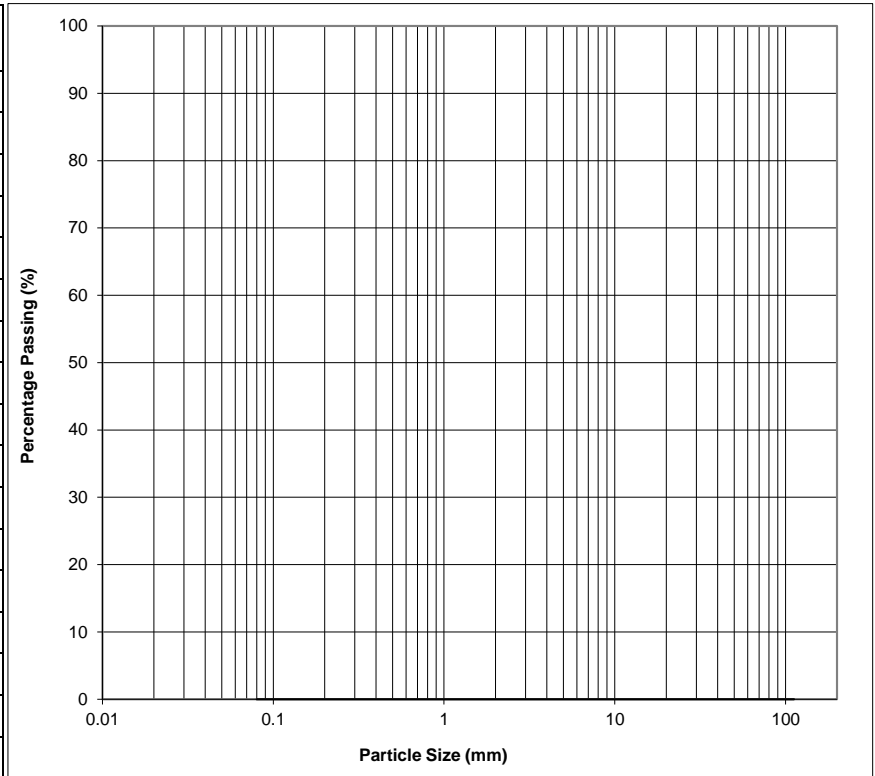
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #486 Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 24, 2022
Sample No : Q-36.9-BH22-02 DC-07 and DC-08	
Depth : 5,79 - 8,10m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**

Openings Dimensions	Cumulative Results		
mm	% Passing	Minimum	Maximum
112			
80.0			
56.0			
40.0			
31.5			
28.0			
20.0			
14.0			
10.0			
5.00			
2.50			
1.25			
0.630			
0.315			
0.160			
0.080			



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	19						
Micro Deval (grading F) (LC 21-070) (%)	9						

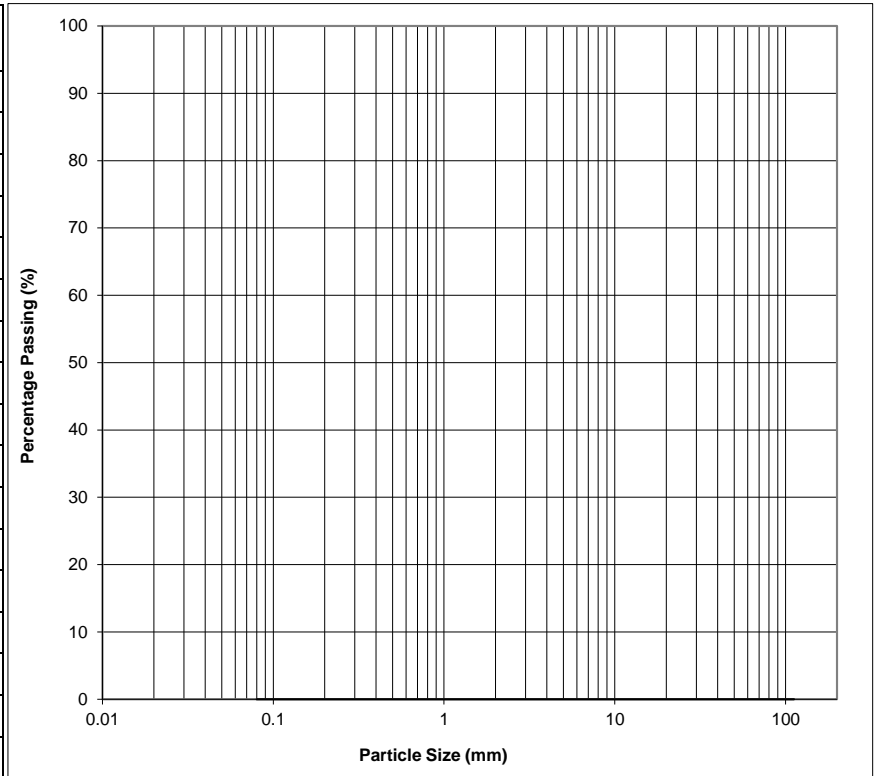
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #786      Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 24, 2022
Sample No : Q-36.9-BH22-02 DC-11	
Depth : 9,60 - 11,10m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**

Openings Dimensions	Cumulative Results		
mm	% Passing	Minimum	Maximum
112			
80.0			
56.0			
40.0			
31.5			
28.0			
20.0			
14.0			
10.0			
5.00			
2.50			
1.25			
0.630			
0.315			
0.160			
0.080			



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

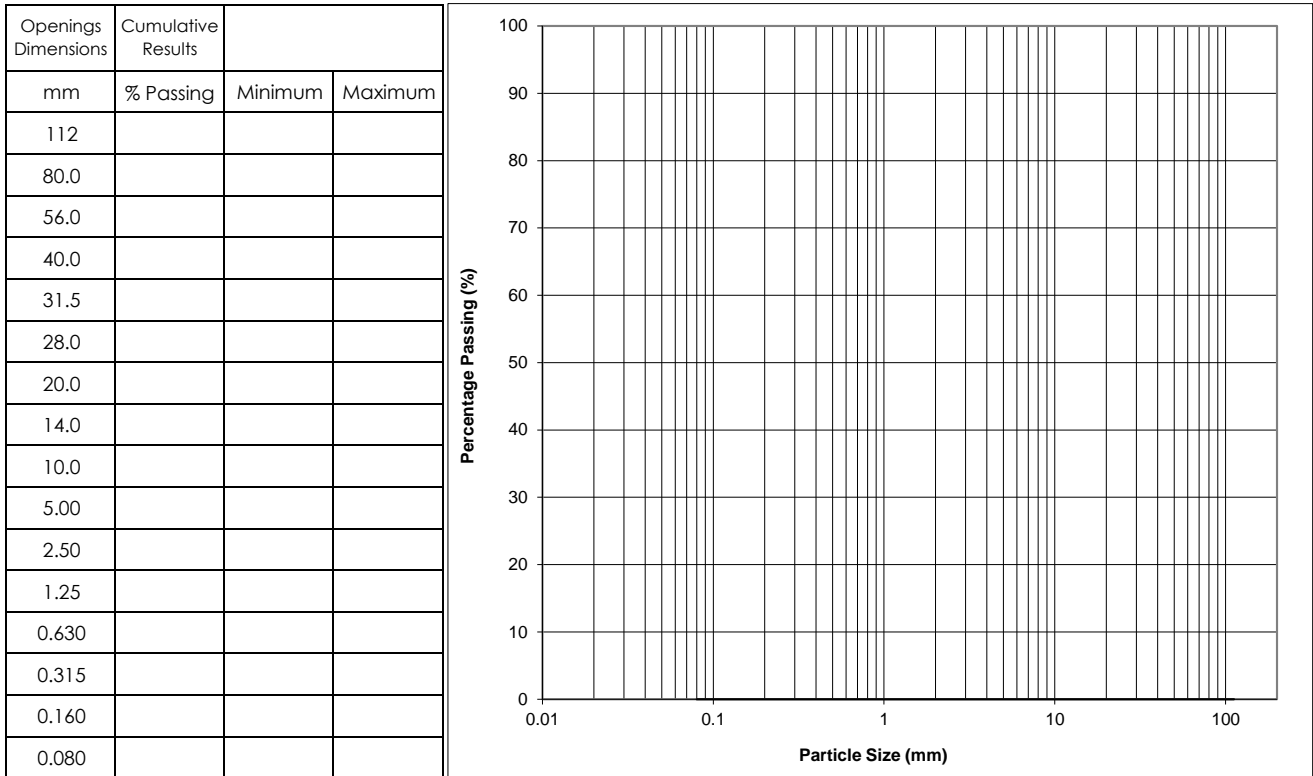
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	20						
Micro Deval (grading F) (LC 21-070) (%)	9						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 28, 2022
Sample No : Q-85.5-BH22-01 DC-04	
Depth : 2,03 - 3,83m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	31						
Micro Deval (grading F) (LC 21-070) (%)	7						

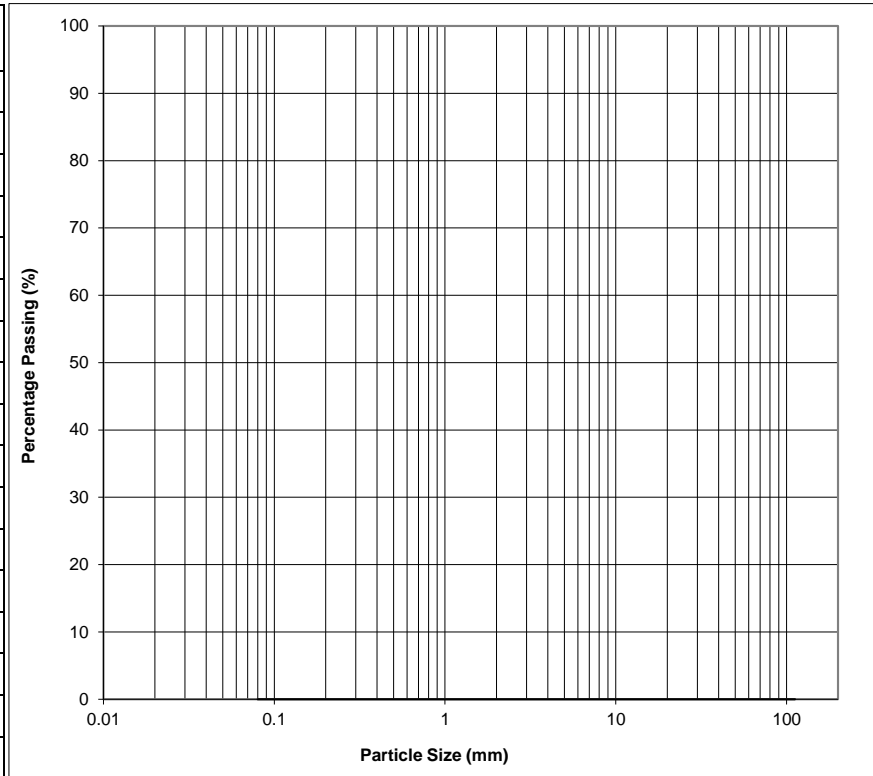
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #786 \_\_\_\_\_ Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 28, 2022
Sample No : Q-85.5-BH22-01 DC-05 and DC-06	
Depth : 3,91 - 6,52m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**

Openings Dimensions	Cumulative Results		
mm	% Passing	Minimum	Maximum
112			
80.0			
56.0			
40.0			
31.5			
28.0			
20.0			
14.0			
10.0			
5.00			
2.50			
1.25			
0.630			
0.315			
0.160			
0.080			



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	29						
Micro Deval (grading F) (LC 21-070) (%)	8						

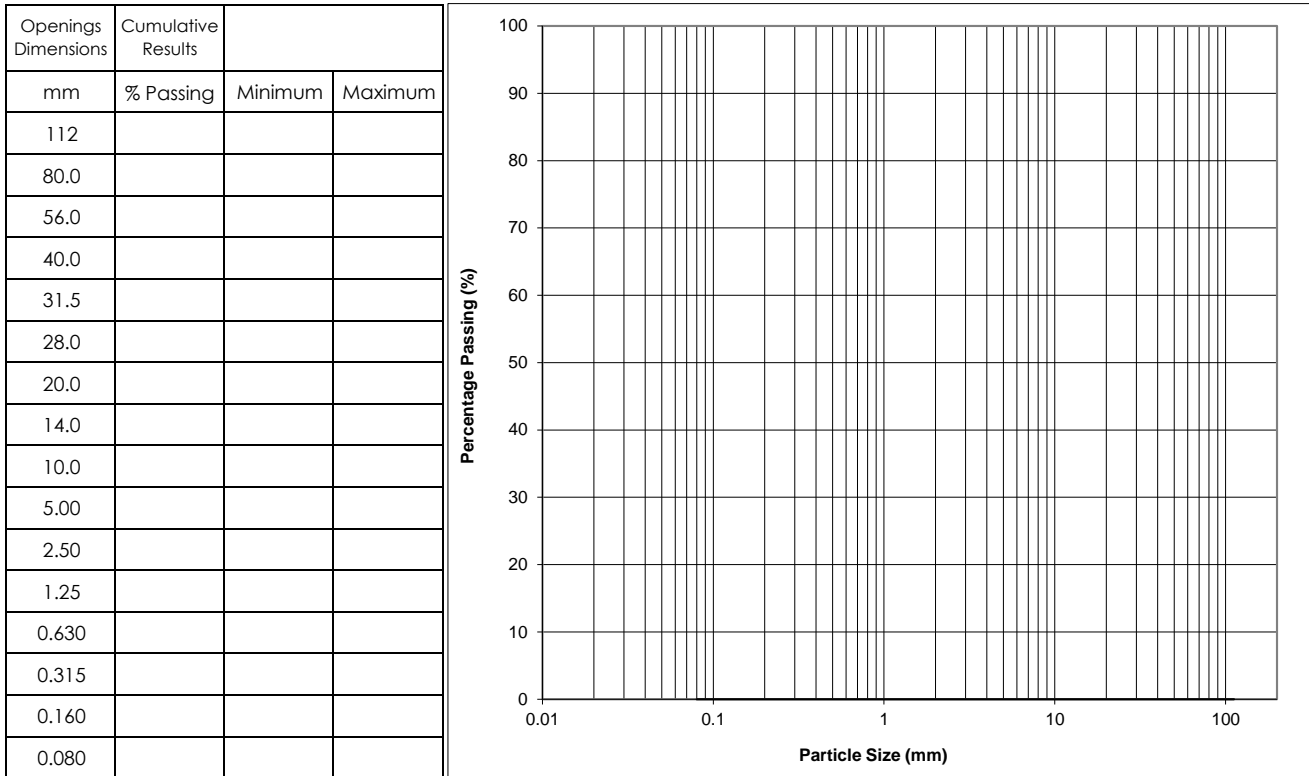
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #186

Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 28, 2022
Sample No : Q-85.5-BH22-01 DC-07	
Depth : 6,83 - 8,03m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Micro Deval (grading F) (LC 21-070) (%)	6						

Remarks :

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Prepared By:

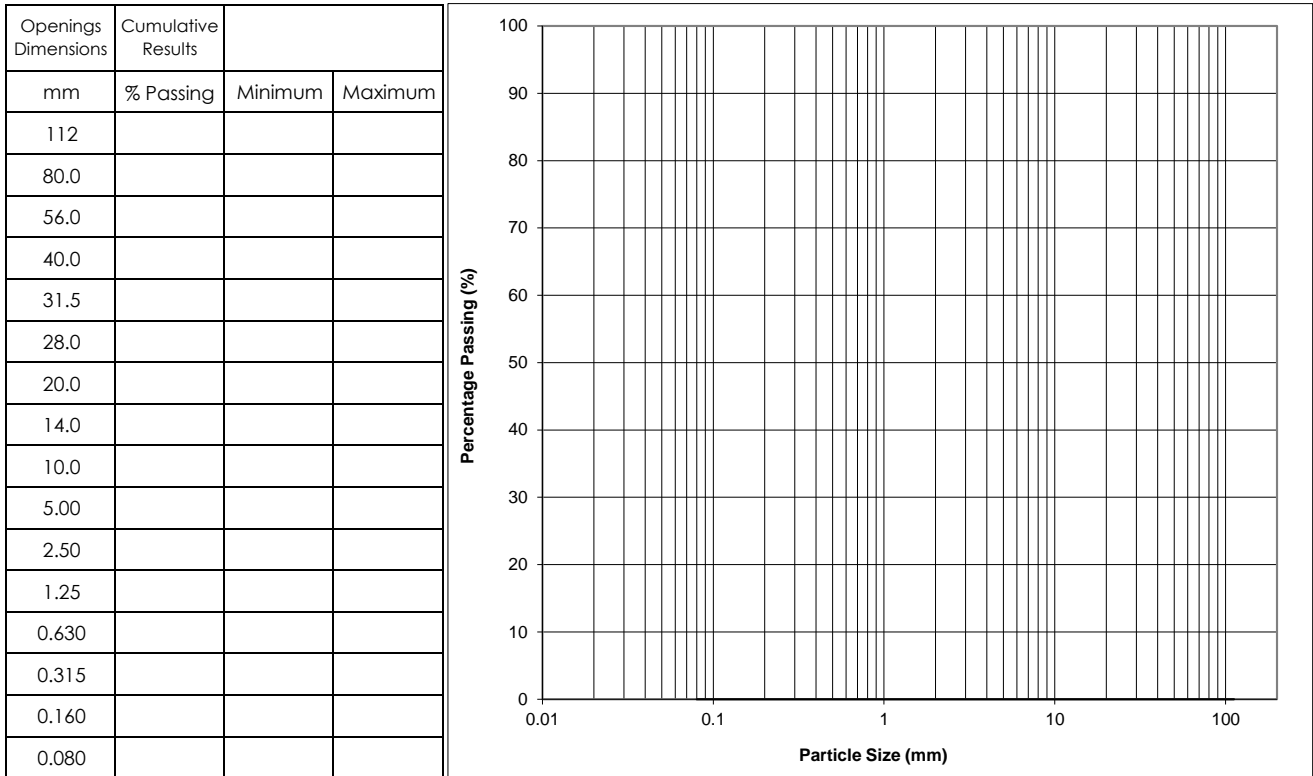
Benoit Cyr, Geo. *BJ* .Geo  
#486

Date: January 27, 2023

\_\_\_\_\_

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 28, 2022
Sample No : Q-85.5-BH22-02 DC-02 and DC-03	
Depth : 0,91 - 3,25m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	29						
Micro Deval (grading F) (LC 21-070) (%)	6						

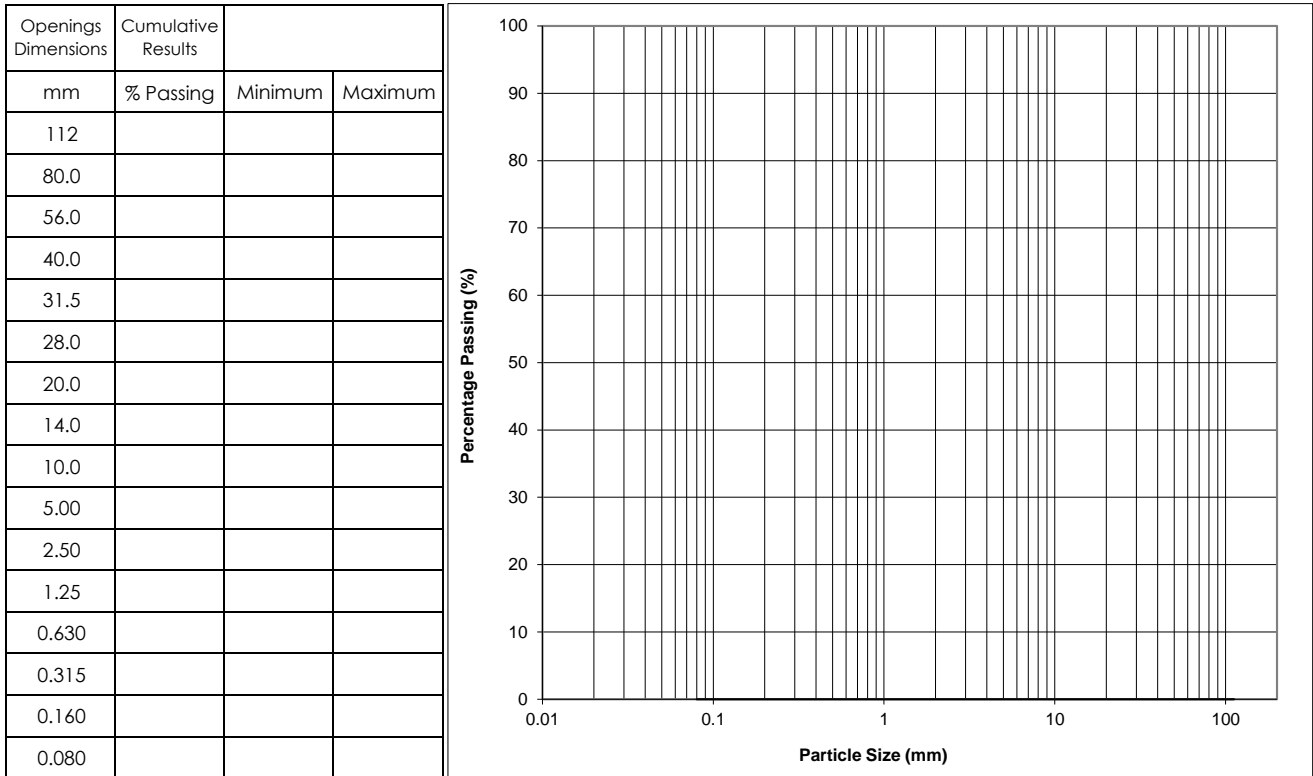
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .GEO #486      Date: December 19, 2022



Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 28, 2022
Sample No : Q-85.5-BH22-02 DC-04	
Depth : 3,53 - 5,03m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025)**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

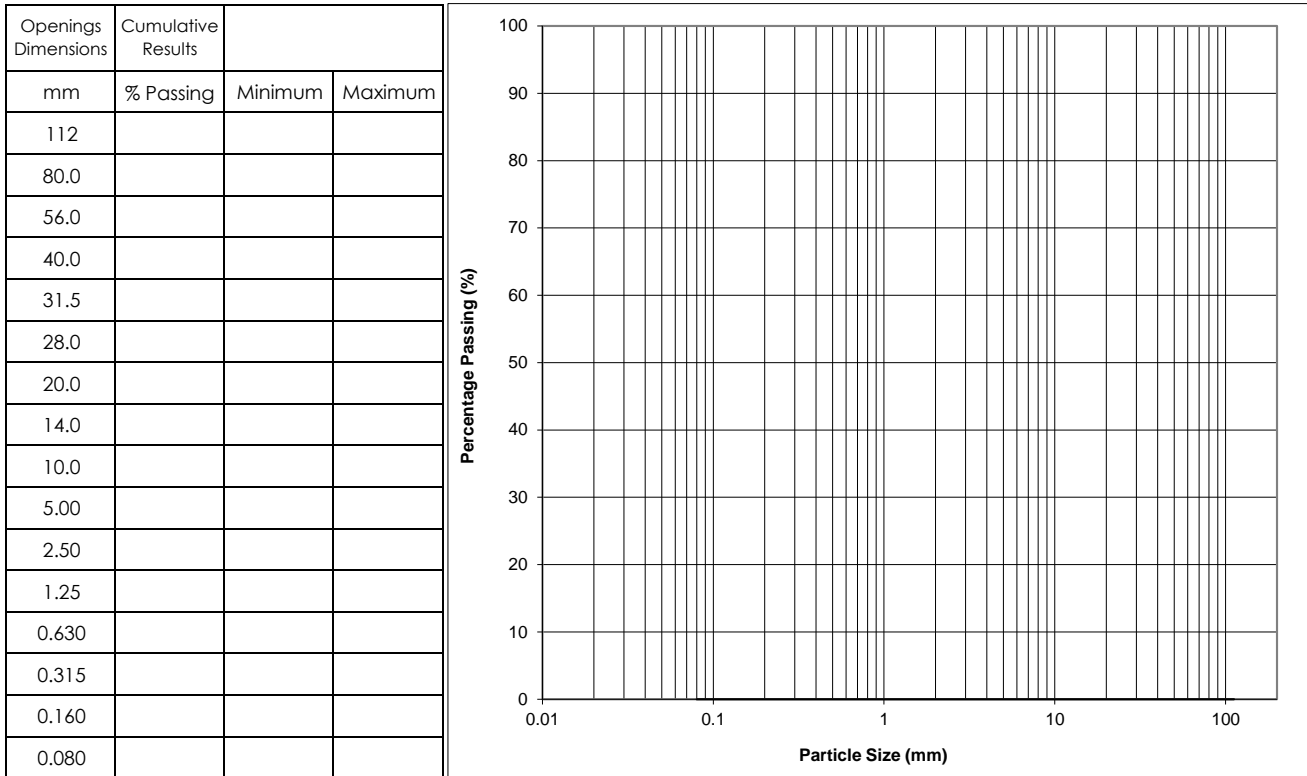
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	24						
Micro Deval (grading F) (LC 21-070) (%)	9						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #186 \_\_\_\_\_ Date: January 27, 2023 \_\_\_\_\_

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : March 28, 2022
Sample No : Q-85.5-BH22-02 DC-06 and DC-07	
Depth : 7,18 - 9,53m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

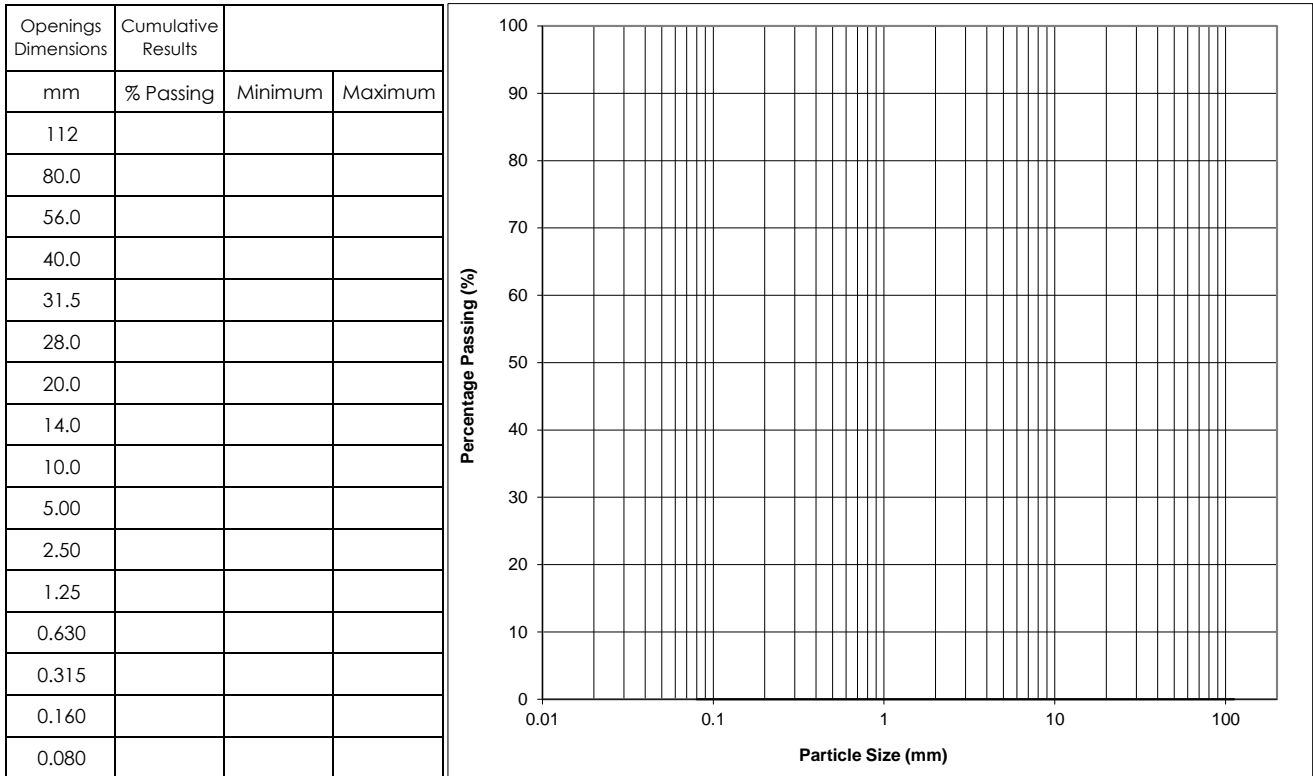
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	28						
Micro Deval (grading F) (LC 21-070) (%)	10						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ Geo #786* Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 05, 2022
Sample No : Q-138.1-BH22-01 DC-01 and DC-02	
Depth : 1,32 - 3,53m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

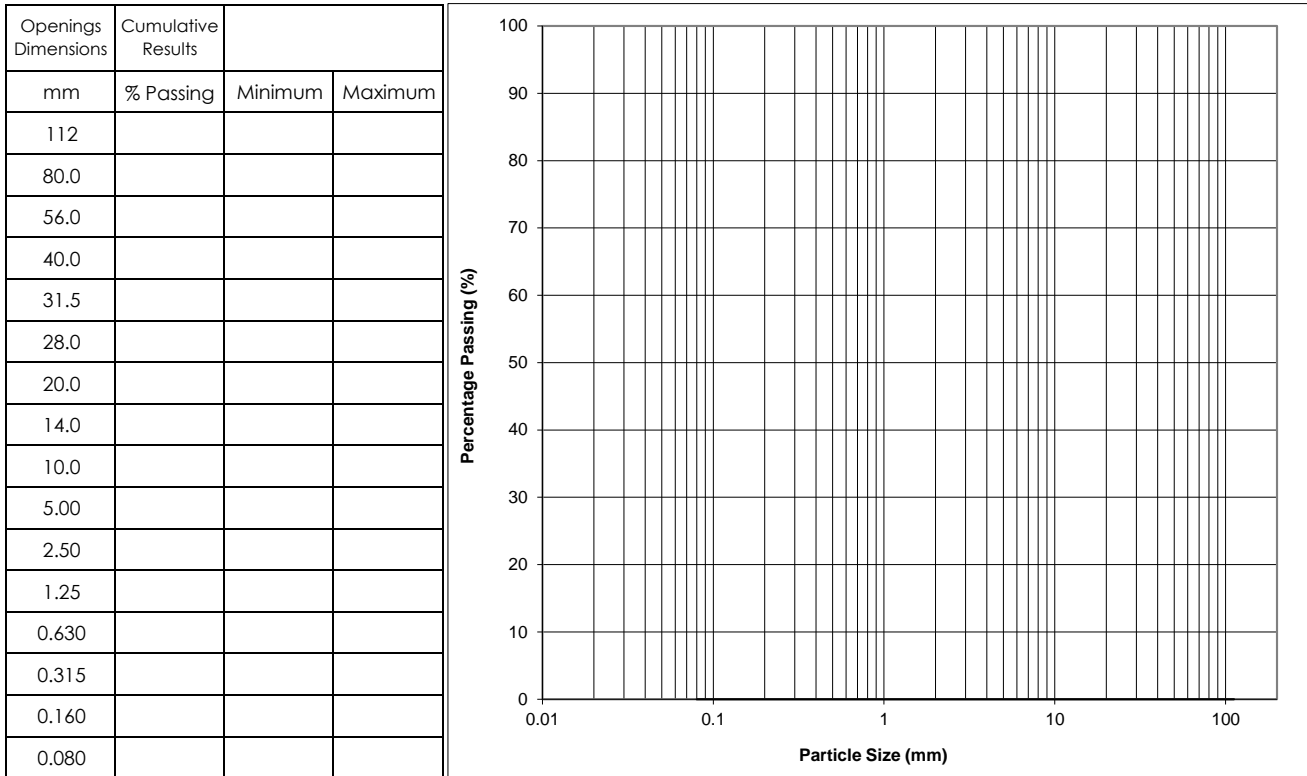
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	34						
Micro Deval (grading F) (LC 21-070) (%)	9						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #786 Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 05, 2022
Sample No : Q-138.1-BH22-01 DC-03 and DC-04	
Depth : 3,53 - 6,52m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

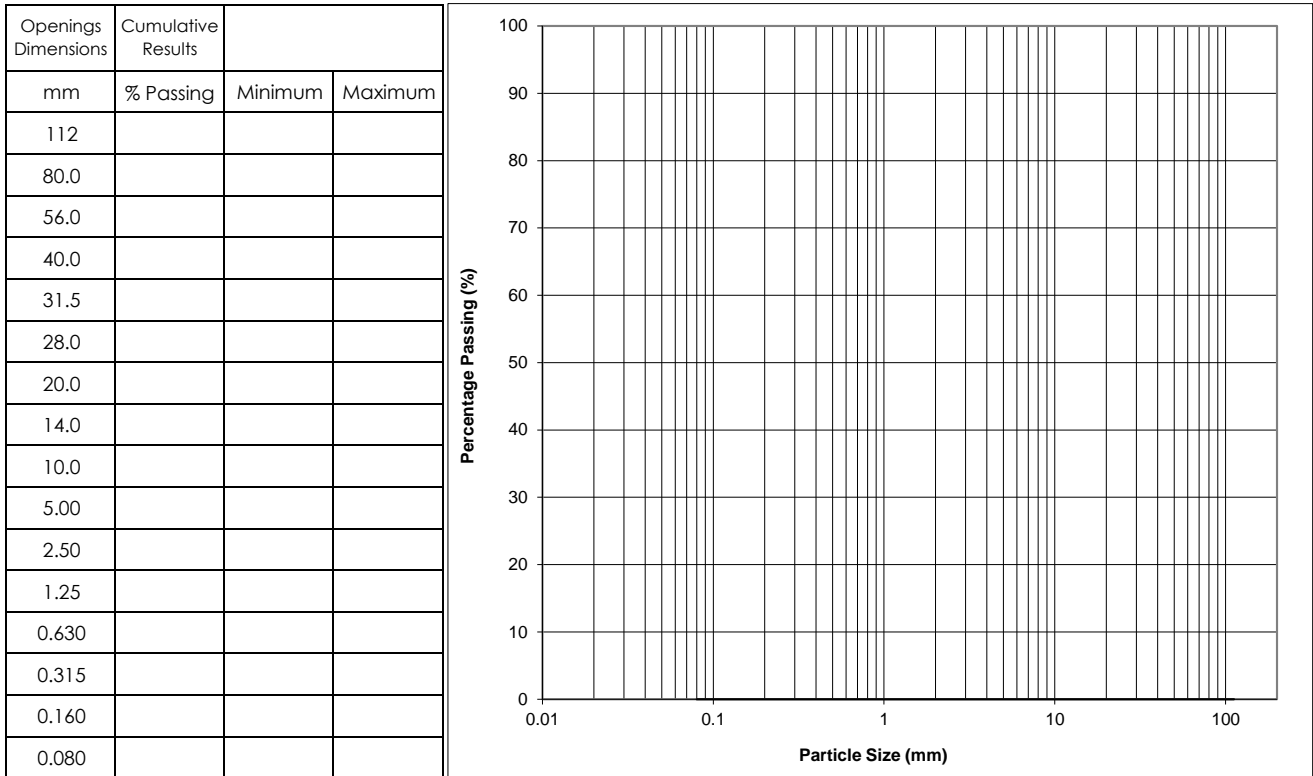
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	27						
Micro Deval (grading F) (LC 21-070) (%)	6						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #786 Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 05, 2022
Sample No : Q-138.1-BH22-01 DC-06	
Depth : 8,03 - 9,20m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

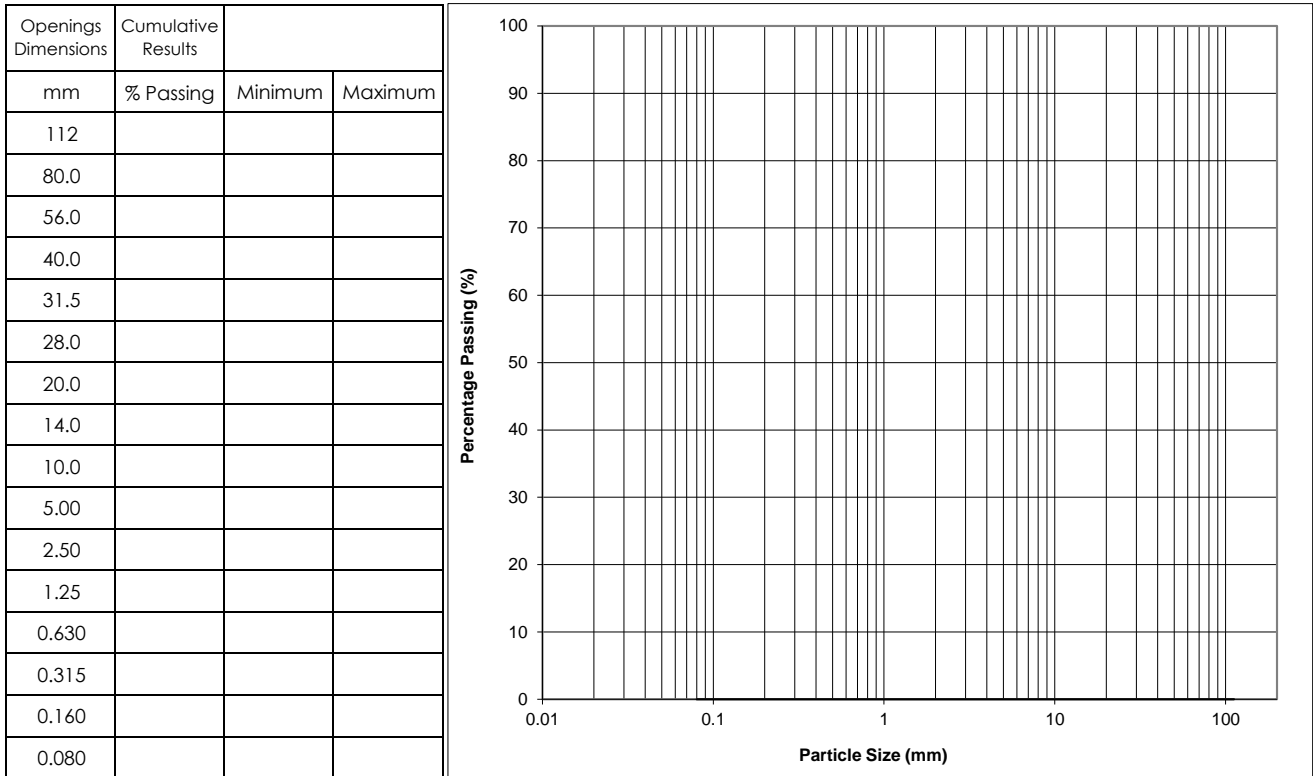
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	24						
Micro Deval (grading F) (LC 21-070) (%)	8						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #786 Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 03, 2022
Sample No : Q-138.1-BH22-02 DC-03 to DC-04	
Depth : 0,94 - 3,33m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

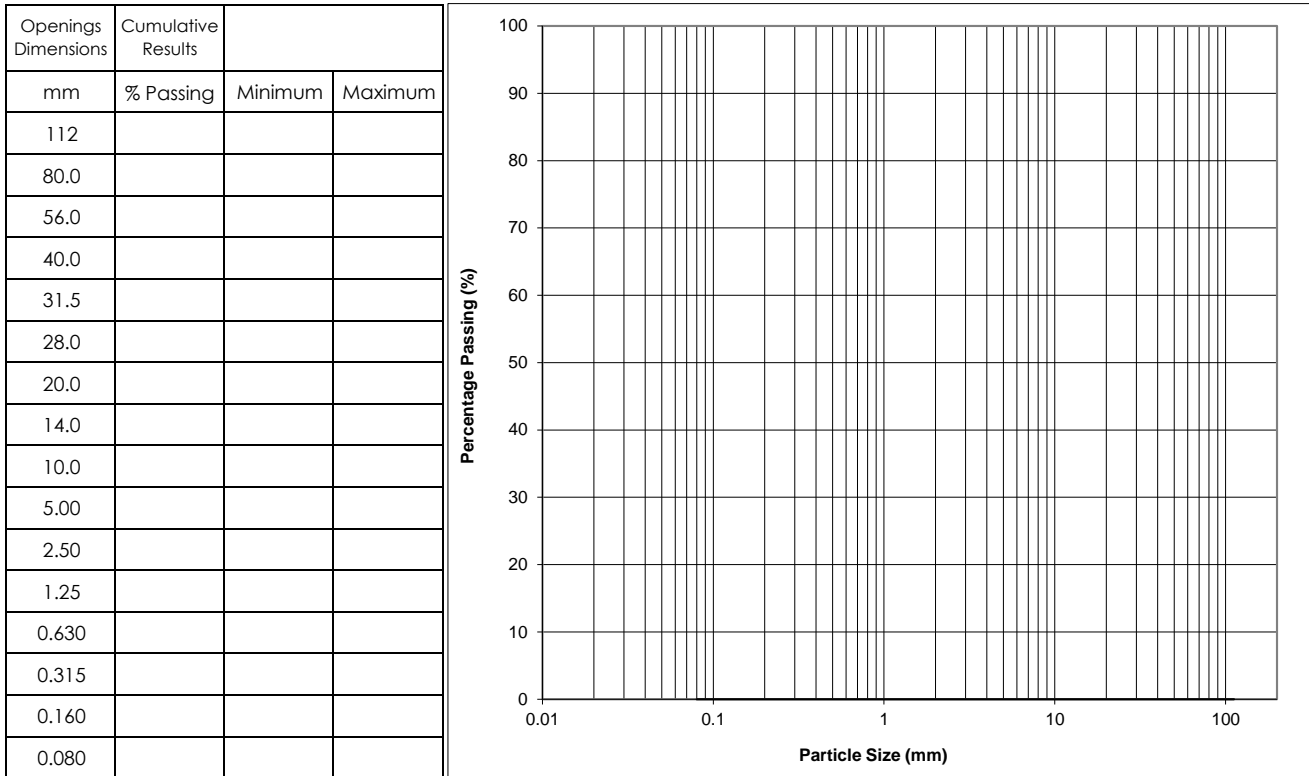
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	33						
Micro Deval (grading F) (LC 21-070) (%)	9						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. BJC .Geo #486 Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 03, 2022
Sample No : Q-138.1-BH22-02 DC-05 to DC-06	
Depth : 3,33 - 6,05m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	32						
Micro Deval (grading F) (LC 21-070) (%)	7						

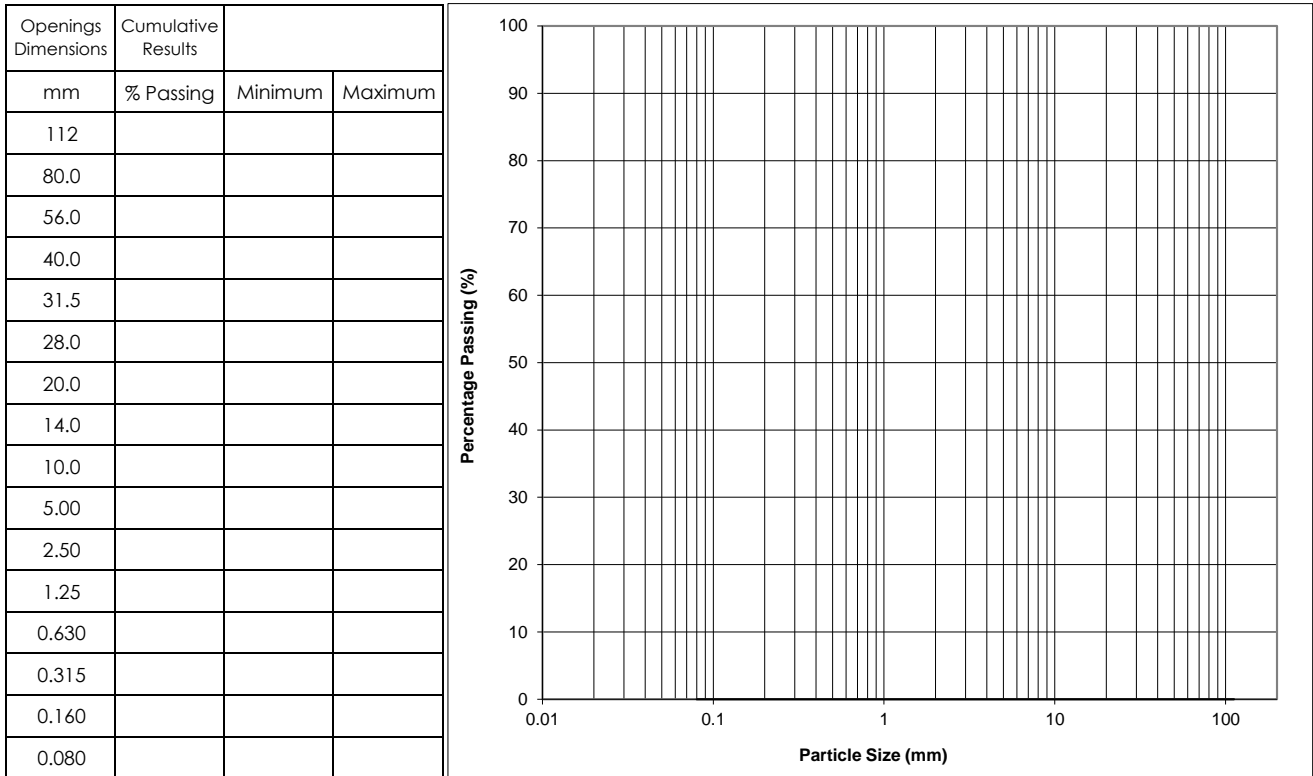
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ Geo #786*

Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 03, 2022
Sample No : Q-138.1-BH22-02 DC-07 and DC-08	
Depth : 6,30 - 9,30m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	30						
Micro Deval (grading F) (LC 21-070) (%)	7						

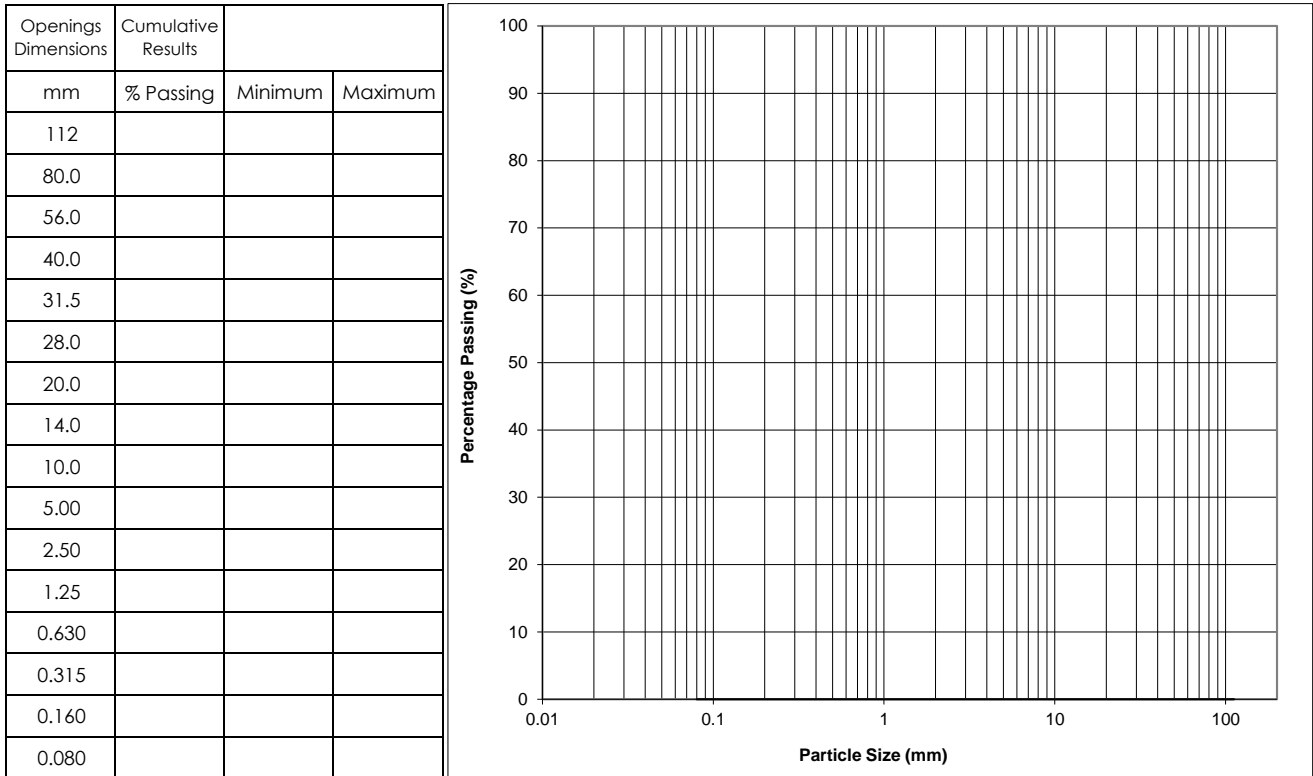
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #786 \_\_\_\_\_ Date: December 19, 2022 \_\_\_\_\_



Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 02, 2022
Sample No : Q-168-BH22-01 DC-03 and DC-04	
Depth : 0,99 - 3,40m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

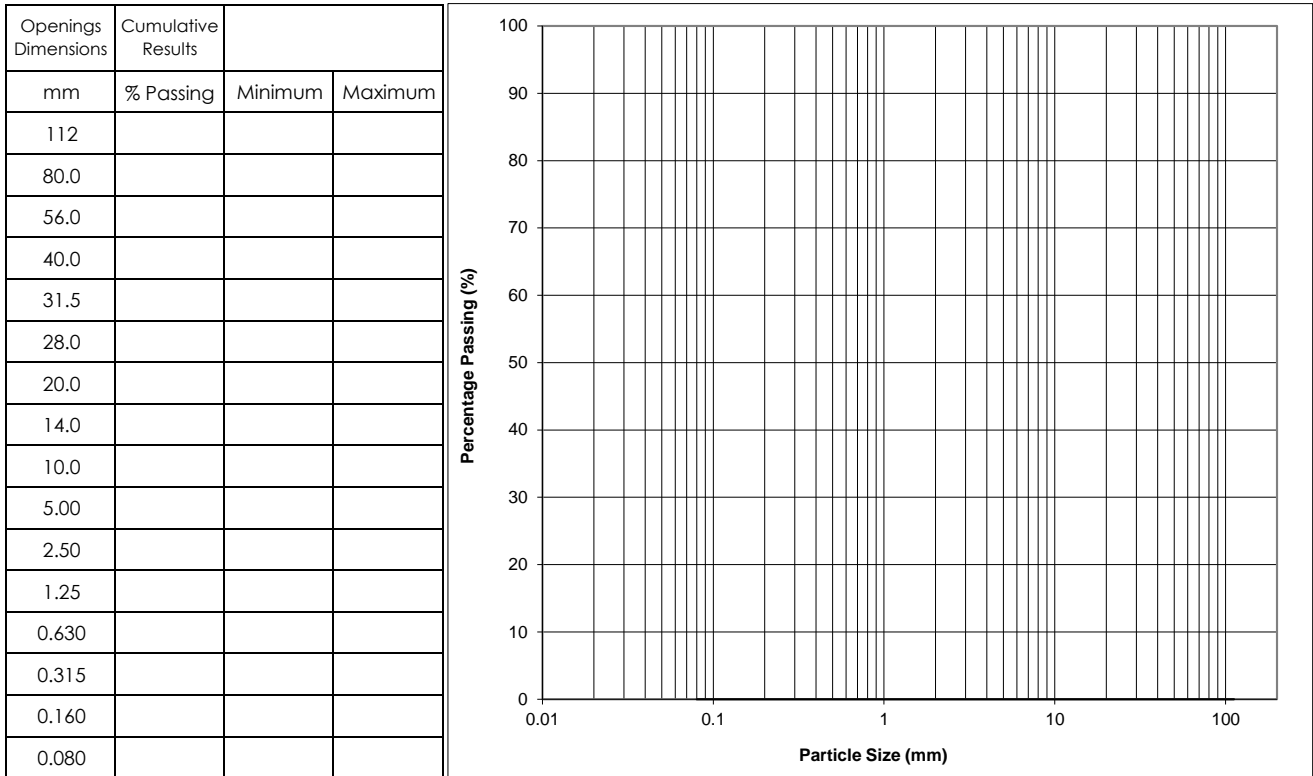
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	17						
Micro Deval (grading F) (LC 21-070) (%)	12						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* *.Geo* *#786* Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 02, 2022
Sample No : Q-168-BH22-01 DC-05 and DC-06	
Depth : 3,40 - 6,40m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	18						
Micro Deval (grading F) (LC 21-070) (%)	12						

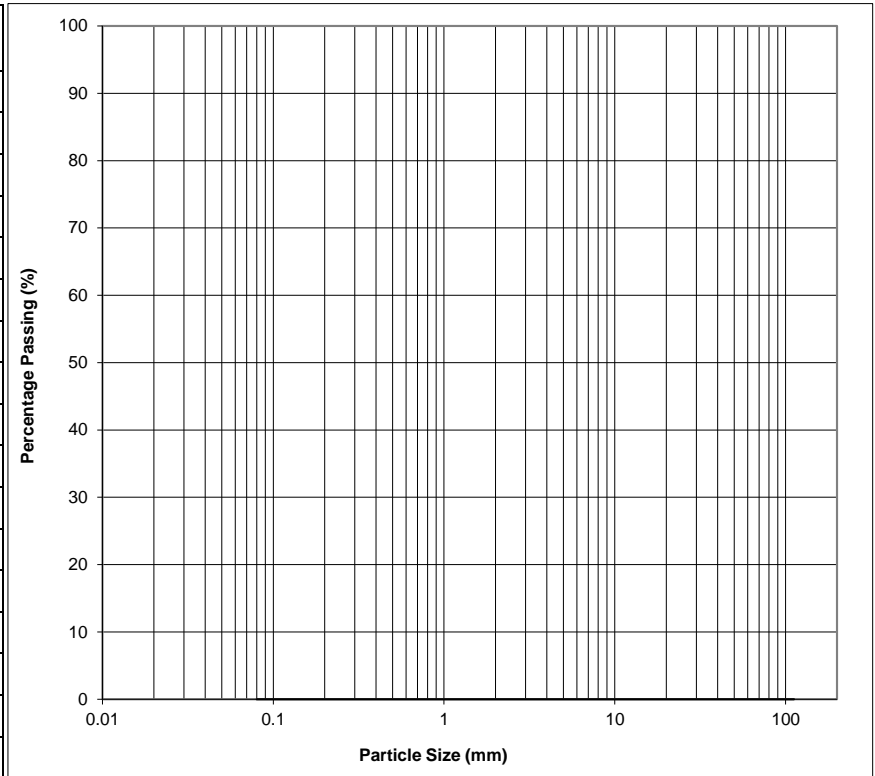
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ Geo #186* Date: December 19, 2022

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 02, 2022
Sample No : Q-168-BH-2201 DC-07 to DC-08	
Depth : 6,40 - 9,40m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**

Openings Dimensions	Cumulative Results		
mm	% Passing	Minimum	Maximum
112			
80.0			
56.0			
40.0			
31.5			
28.0			
20.0			
14.0			
10.0			
5.00			
2.50			
1.25			
0.630			
0.315			
0.160			
0.080			



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

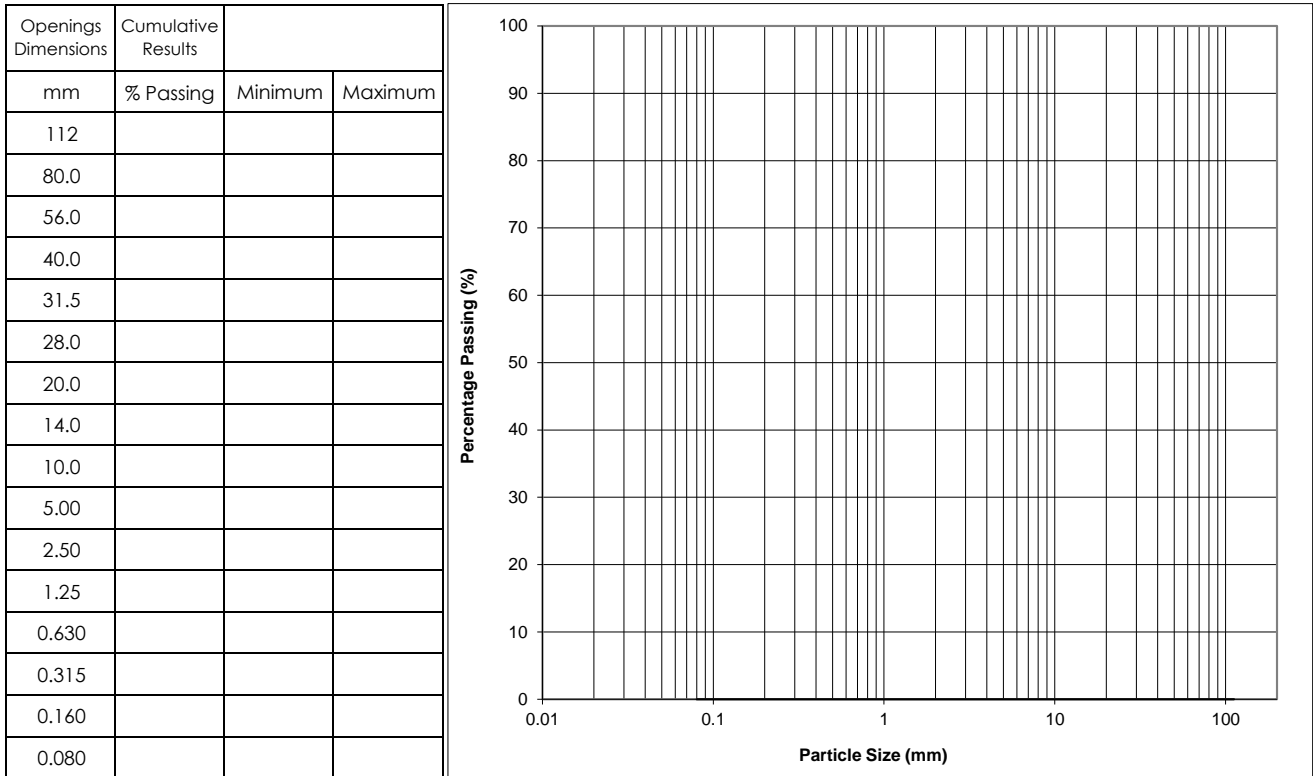
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	21						
Micro Deval (grading F) (LC 21-070) (%)	13						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #386      Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 01, 2022
Sample No : Q-168-BH22-02 DC-04 to DC-05	
Depth : 1,83 - 4,01m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

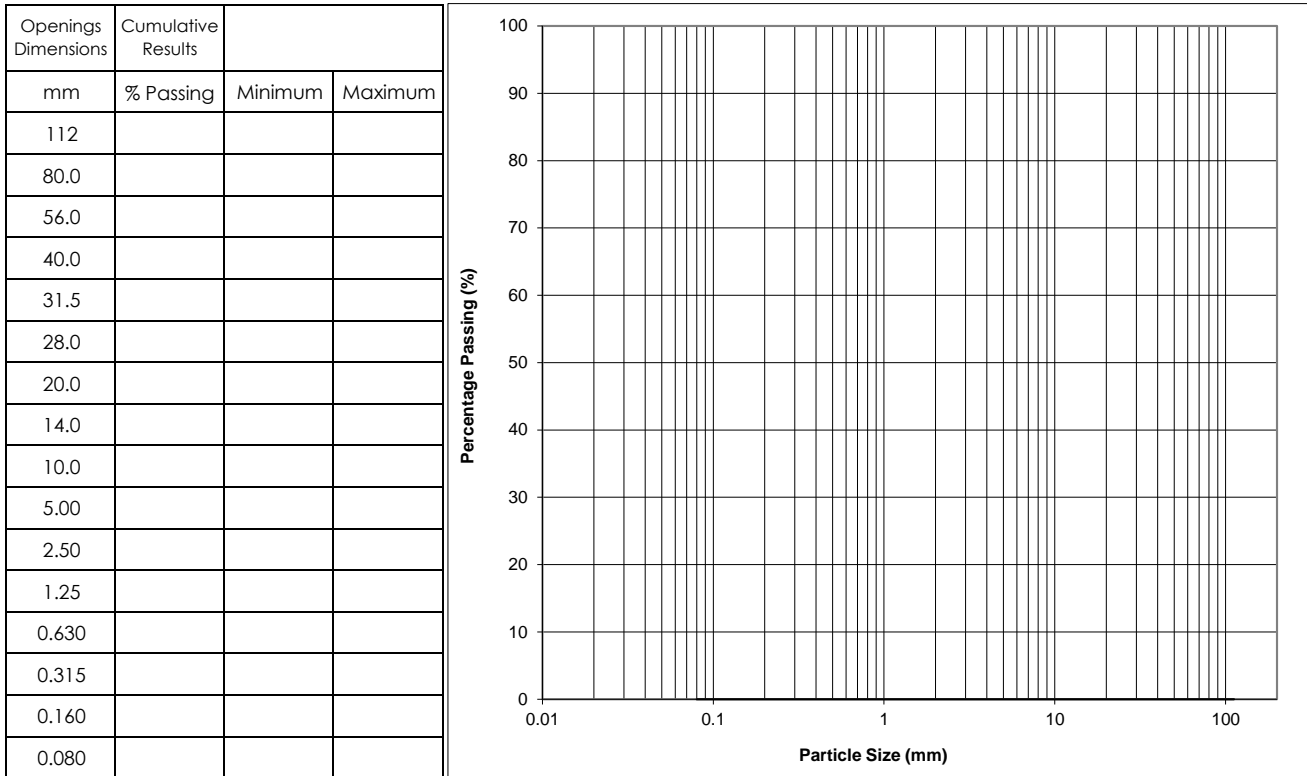
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	11						
Micro Deval (grading F) (LC 21-070) (%)	9						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .GEO #786 Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 01, 2022
Sample No : Q-168-BH22-02 DC-06 to DC-07	
Depth : 4,83 - 7,16m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



**Soils Classification**

**Modified Proctor (BNQ 2501-255)**

% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

**Other Tests**

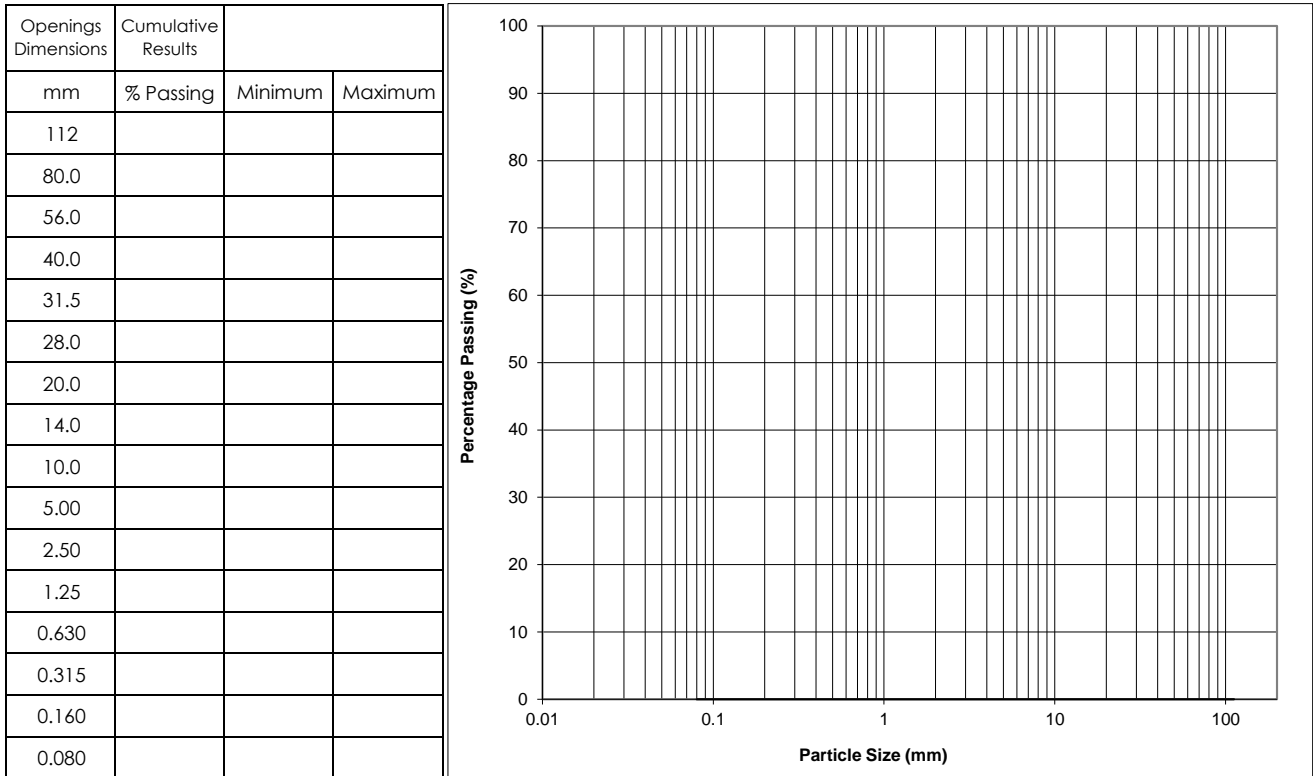
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	13						
Micro Deval (grading F) (LC 21-070) (%)	5						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #186 Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : April 01, 2022
Sample No : Q-168-BH22-02 DC-07 to DC-08	
Depth : 7,16 - 9,32m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

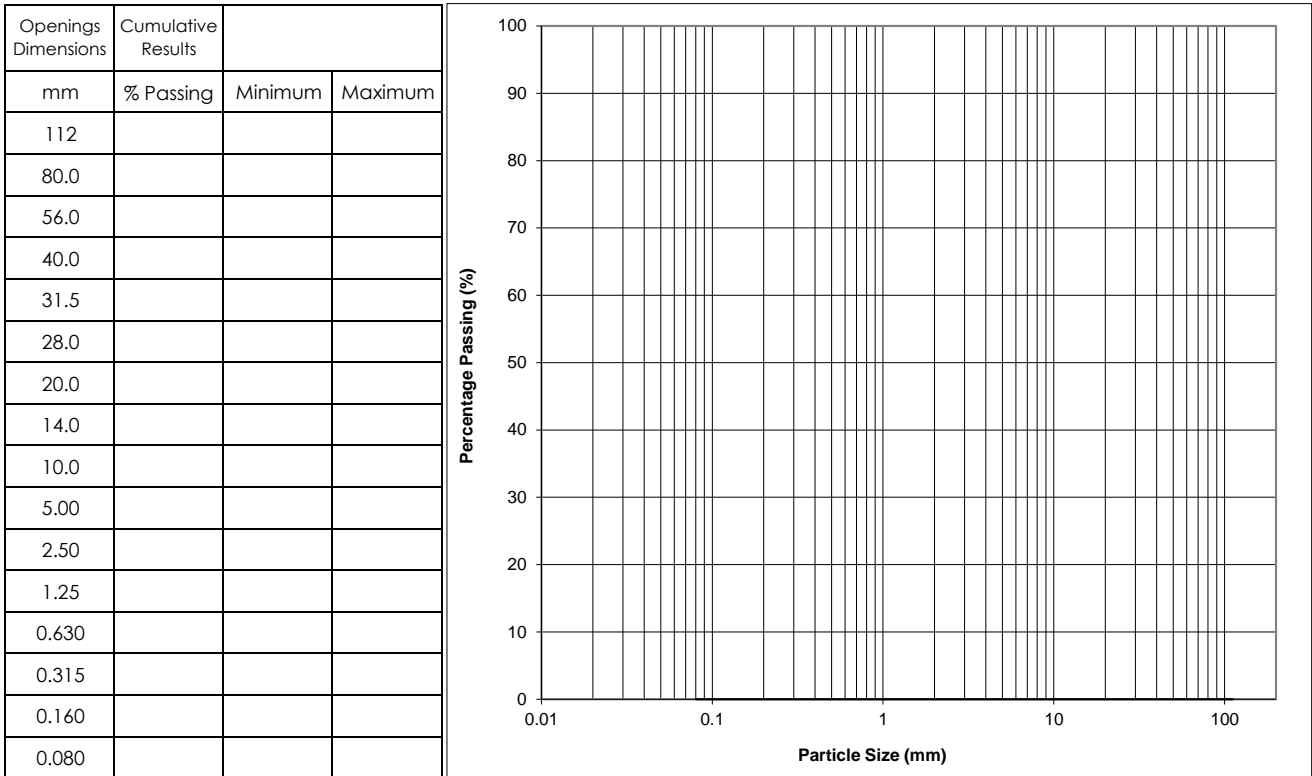
Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	12						
Micro Deval (grading F) (LC 21-070) (%)	5						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .GEO #786 \_\_\_\_\_ Date: January 27, 2023 \_\_\_\_\_

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : July 21, 2022
Sample No : Q-246.5-BH22-01 DC-06 to DC-08	
Depth : 2,97 - 7,26m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading A) (LC 21-400) (%)	21						
Micro Deval (grading F) (LC 21-070) (%)	13						

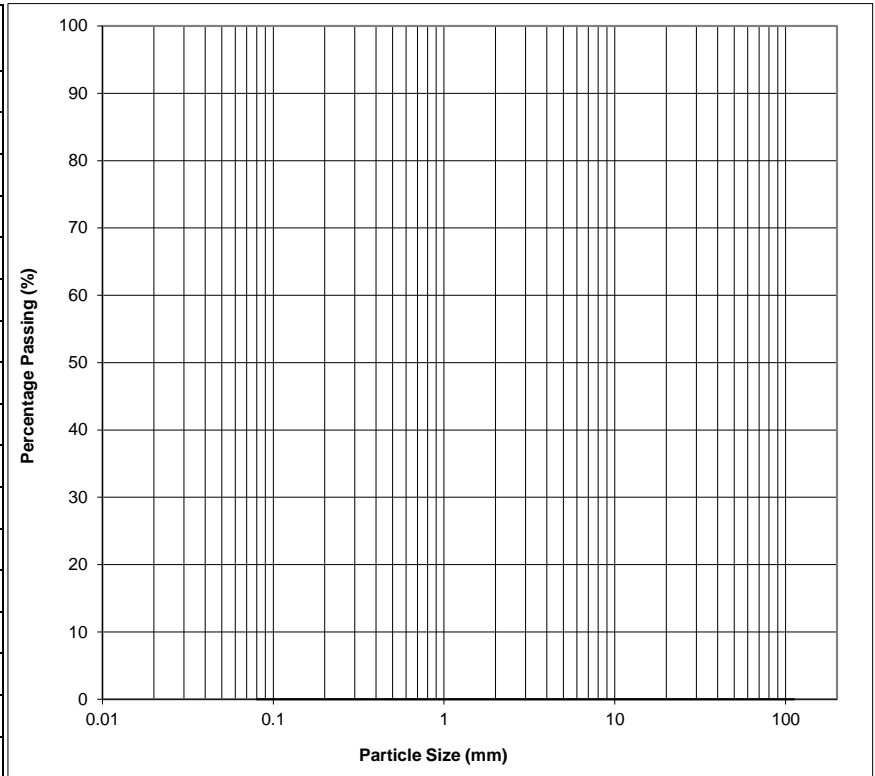
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ Geo #186* Date: January 27, 2023

Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : July 21, 2022
Sample No : Q-246.5-BH22-01 DC-09 to DC-12	
Depth : 7,26 - 13,36m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**

Openings Dimensions	Cumulative Results		
mm	% Passing	Minimum	Maximum
112			
80.0			
56.0			
40.0			
31.5			
28.0			
20.0			
14.0			
10.0			
5.00			
2.50			
1.25			
0.630			
0.315			
0.160			
0.080			



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	21						
Micro Deval (grading F) (LC 21-070) (%)	15						

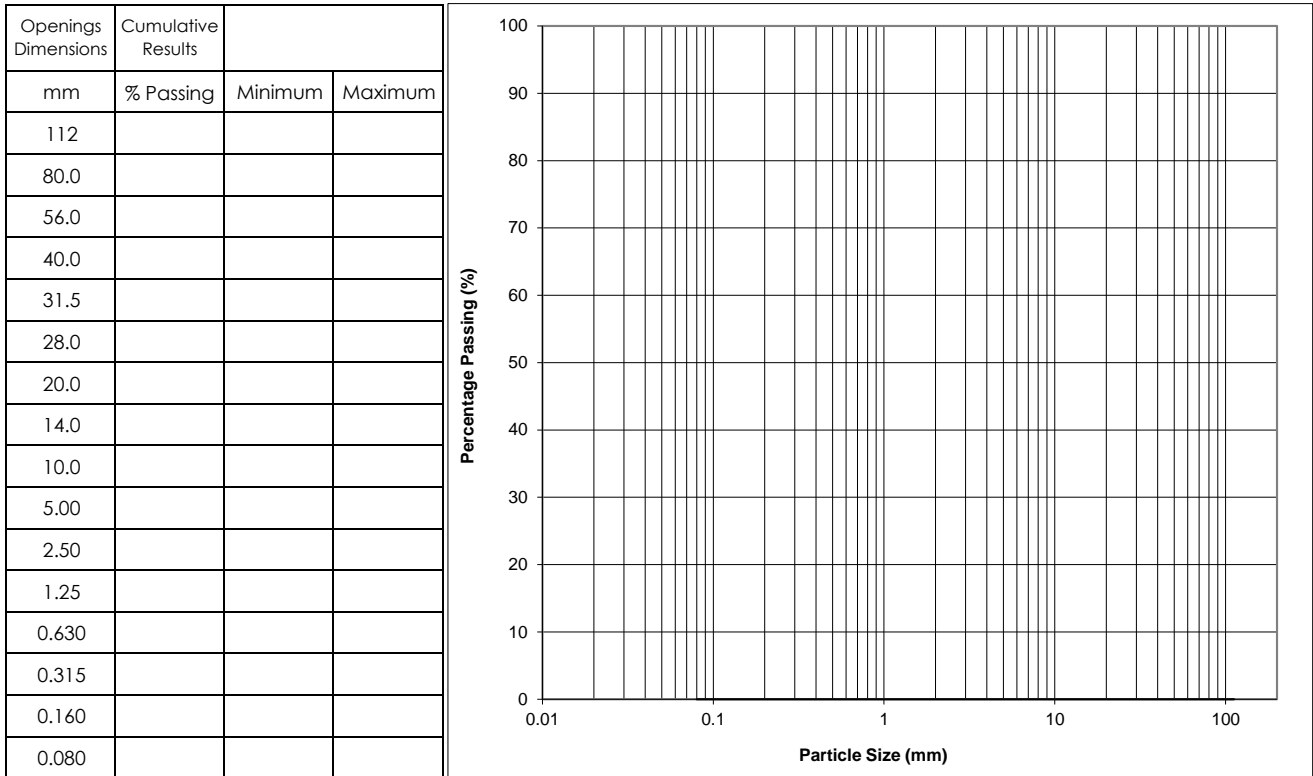
Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .Geo #186      Date: January 27, 2023



Client : Cree Development Corporation	Type of material : Crushed rock cores
Project : La Grande Alliance - Feasibility Study - Phase I	
Potential BDH Railway	Sampled by : Khaled Haiek
Project No : 158100425.500.710.5	Sampling Date : July 22, 2022
Sample No : Q-246.5-BH22-02 DC-06 to DC-08	
Depth : 5,79 - 9,60m	

**Sieve Analysis (LC 21-040 / BNQ 2501-025 )**



Soils Classification		Modified Proctor (BNQ 2501-255)	
% Gravel		Testing Method used	
% Sand		Maximum Dry Unit Weight (kg/m <sup>3</sup> )	
% Fine Particles		Optimum Moisture Content (%)	

Other Tests							
Test / Standard	Results	Requirements		Test / Standard	Results	Requirements	
		Min	Max			Min	Max
Los Angeles (grading B) (LC 21-400) (%)	23						
Micro Deval (grading F) (LC 21-070) (%)	7						

Remarks : \_\_\_\_\_

Prepared By: Benoit Cyr, Geo. *BJ* .GEO #786 Date: January 27, 2023

## **Appendix E Photographic Album**





Photo 1: GD-25-TP22-01



Photo 2: GD-25-TP22-02



Photo 3: GD-25-TP22-03



Photo 4: GD-25-TP22-04

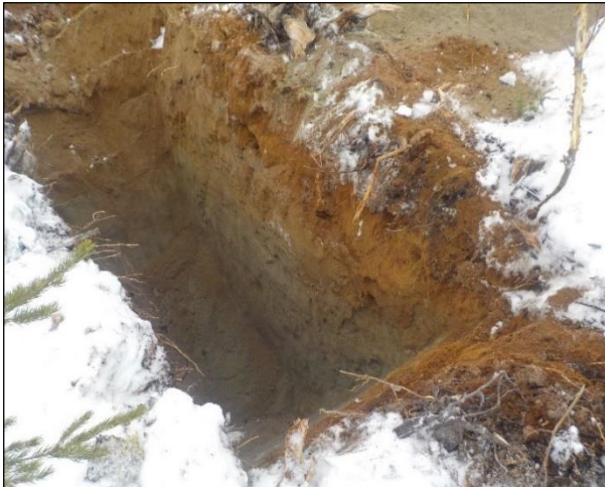


Photo 5: GD-25-TP22-05



Photo 6: GD-25-TP22-06





**Photo 7: GD-25-TP22-07**



**Photo 8: GD-25-TP22-08**



**Photo 9: GD-25-TP22-09**



Photo 1: GD-104.9-TP22-01



Photo 2: GD-104.9-TP22-02



Photo 3: GD-104.9-TP22-03



Photo 4: GD-104.9-TP22-04



Photo 5: GD-104.9-TP22-05



Photo 6: GD-104.9-TP22-06





**Photo 7: GD-104.9-TP22-07**



**Photo 1: GD-113-TP22-01**



**Photo 2: GD-113-TP22-02**



**Photo 3: GD-113-TP22-03**



**Photo 4: GD-113-TP22-04**

f



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Appendix E Page 1 of 1

Title LA GRANDE ALLIANCE FEASIBILITY STUDY - PHASE I GD-113 PHOTOGRAPHIC ALBUM



Photo 1: GD-220.3-TP22-01



Photo 2: GD-220.3-TP22-02



Photo 3: GD-220.3-TP22-03



Photo 4: GD-220.3-TP22-04



Photo 5: GD-220.3-TP22-05



Photo 6: GD-220.3-TP22-06







Photo 7: GD-220.3-TP22-07



Photo 8: GD-220.3-TP22-08



Photo 9: GD-220.3-TP22-09



Photo 10: GD-220.3-TP22-10



Photo 11: GD-220.3-TP22-11



Photo 12: GD-220.3-TP22-12





**Photo 1: GD-256.4-TP22-01**



**Photo 2: GD-256.4-TP22-02**



**Photo 3: GD-256.4-TP22-03**



**Photo 4: GD-256.4-TP22-04**



**Photo 5: GD-256.4-TP22-05**



**Photo 6: GD-256.4-TP22-06**





Photo 1: Q-22-BH22-01 (Wet)



Photo 2: Q-22-BH22-01 (Dry)



Photo 3: Q-22-BH22-02 (Wet)



Photo 4: Q-22-BH22-02 (Dry)





Photo 1: Q-36.9-BH22-01 (Wet)



Photo 2: Q-36.9-BH22-01 (Dry)



Photo 3: Q-36.9-BH22-02 (Wet)



Photo 4: Q-36.9-BH22-02 (Dry)





Photo 1: Q-85.5-BH22-01 (Wet)



Photo 2: Q-85.5-BH22-01 (Dry)



Photo 3: Q-85.5-BH22-02 (Wet)



Photo 4: Q-85.5-BH22-02 (Dry)





Photo 1: Q-138.1-BH22-01 (Wet)



Photo 2: Q-138.1-BH22-01 (Dry)



Photo 3: Q-138.1-BH22-02 (Wet)



Photo 4: Q-138.1-BH22-02 (Dry)





Photo 1: Q-168-BH22-01 (Wet)



Photo 2: Q-168-BH22-01 (Dry)



Photo 3: Q-168-BH22-02 (Wet)



Photo 4: Q-168-BH22-02 (Dry)



Photo 1: Q-246.5-BH22-01 (Wet)



Photo 2: Q-246.5-BH22-01 (Dry)



Photo 3: Q-246.5-BH22-02 (Wet)



Photo 4: Q-246.5-BH22-02 (Dry)

