



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

POTENTIAL BORROW SOURCES
AND QUARRY SITES ASSESSMENT –
WEMINDJI ACCESS ROAD

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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 the Vision Eeyou Istchee Consortium, focusing on the feasibility design of the following infrastructures:

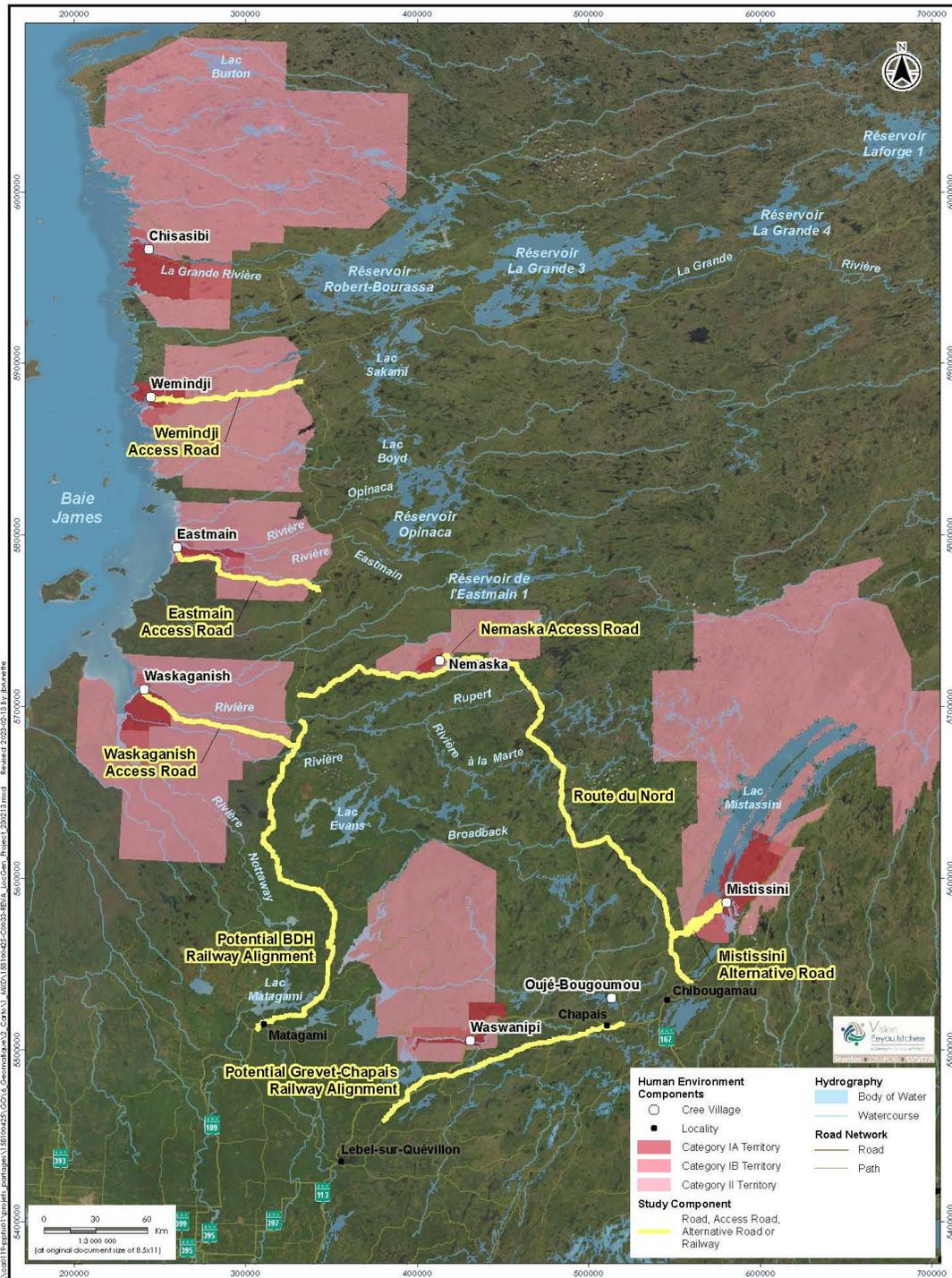
- Upgrade of the existing access roads between the Billy-Diamond Highway and the Cree communities of Waskaganish, Eastmain and Wemindji;
- Upgrade of the existing access road between the Route du Nord and the community of Nemaska;
- New railway along the Billy Diamond Highway (BDH) between the town of 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 post (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



1.2 Scope of Work

One of the objectives of the Eeyou Istchee's 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, Cree Development Corporation (CDC) mandated Stantec to conduct a geotechnical investigation which includes the exploration of potential granular borrow sources and quarry sites previously identified within the feasibility study. This report presents the results of the desktop borrow sources and quarry sites' assessment and the results of the geotechnical investigations of the targeted sites along the Wemindji Access Road.

The main tasks performed regarding the identification of potential borrow sources and quarry sites and the geotechnical investigation 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 material and bedrock);
- Proposal of a field investigation program and identification of field targets for the conduction of boreholes
- Acquisition of the necessary environmental permits and authorization to carry out the geotechnical investigation
- Execution of the geotechnical field program which includes the:
 - o coordination with subcontractors and tallymen;
 - o forest clearing; and
 - o realization of boreholes.
- Laboratory testing to characterize the materials (bedrock) to determine the suitability for the study needs
- 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.



1.3 Material Requirements

Preliminary estimates of borrow materials required for the upgrade of the Wemindji Access Road 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 upgrade of the Wemindji Access Road

| Type of Material | Volume (compacted) (m³) |
|------------------------------|---|
| MG 112 | 225 500 |
| MG 20 | 307 130 |
| Pavement (ESG-10 and ESG-14) | 74 875 |

According to the BNQ-2560-114 standard (BNQ, 2014) used by the ministère des Transports et de la Mobilité durable for aggregates used in civil engineering works, several requirements must be met in order for aggregates to be used as a granular material for the granular base and subbase of the road.

Regarding the intrinsic characteristics, the aggregate must be at most category 5 meaning that the Micro-Deval test result must not exceed 35%, the Los Angeles test result must not exceed 50%, and the sum of the two results must not exceed 80%. As for the manufacturing characteristics, the aggregate can meet any of the categories from a to e. (i.e. with a percentage of fragmentation greater than or equal to 50%).



2.0 Study Area and Background Review

The Wemindji Access Road extends for 96.3 km from the Cree community of the same name on James Bay shore to the Billy Diamond Highway. The study area has a maximum width of 10 km and consists of an offset of 5 km on each side of the Wemindji. 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.

Regional bedrock geology mapping (SIGÉOM, 2023) shows that the study area is underlain by Archean bedrock belonging to the Superior Province. The bedrock encountered along the Wemindji Access Road mostly consists of intrusive igneous rock from the Vieux-Comptoir Granitic Suite, closer to James Bay shore, and the Langelier Complex toward the Billy Diamond Highway. The Vieux-Comptoir Granitic Suite, for the most part, consists of granite, granodiorite, and minor amount of diatexite. As for the Langelier Complex, it mainly consists of tonalite, granodiorite, and a minor amount of granodioritic and tonalitic gneiss.

During the Late Wisconsin 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 across the area. Following the ice melt, the marine transgression of the Tyrrell Sea occurred around 7 900 BP (Hardy, 1977). Glaciomarine silt and clay accumulated on the low-lying areas and coarser deposits accumulated along the former Tyrrell Sea shorelines. Peat bogs and fens have accumulated over the glacial and non-glacial deposits, especially over poorly drained glaciomarine and till deposits.

Locally, since the Wemindji community and access road are located within the altitudinal limit of the Tyrrell Sea, the area was mostly covered by glaciomarine clay in the lower sectors. These poorly drained fine-grained sediments have led to the accumulation of thick organic deposits. Furthermore, as the altitude rises toward the Billy Diamond Highway, some littoral and till deposits of variable thickness, and bedrock exposure occupy the higher reliefs.



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 include littoral deposits from the postglacial Tyrrell Sea.

In addition to granular deposits, potential quarry sites were selected by identifying favorable bedrock hills –approximately ten (10) meters above the surrounding terrain – 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 and colored 1:15 000 to 1:60 000 scale aerial photos. The aerial photos used for the assessment were acquired from Natural Resources Canada (NARCAN, 2023) - National Air Photo Library (NAPL) and are listed in Table 2.

The potential sites were selected based on their distance from the Wemindji Access Road or other existing accesses 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 or 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 (KP) of their location (i.e. GD-5 or Q-28.2).

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

| Year | Roll number | No. of aerial photo | Scale |
|-------------|--------------------|-----------------------------|--------------|
| 1956 | A15260 | 7 to 19 | 1: 60 000 |
| 1956 | A15254 | 18 to 26; 52 to 57 | 1: 60 000 |
| 1986 | A31447 | 1 to 20; 30 to 54; 66 to 80 | 1: 15 000 |
| 2011 | A31816 | 177 to 193 | 1: 15 000 |



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 activities conducted on the territory (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 identification of potential granular borrow sources and quarry sites indicated nine (9) potentially favorable sites, including five (5) potential granular borrow sources (GD-5, GD-66, GD-70, GD-515.3, GD-520) and four (4) potential quarry sites (Q-28.2, Q-47.1, Q-53.5, and Q-60). To evaluate the quantity (volume) and the quality of the materials within the potentially favorable quarry sites, a geotechnical field investigation was undergone. At the current stage of the feasibility study, the geotechnical investigation was limited to the exploration of the potential quarry sites Q-28.2 and Q-47.1.

The fieldwork for the potential quarry site assessment was carried out between July 15 and 17, 2022 and consisted in drilling two boreholes at each potential quarry site for a total of four (4) boreholes (Q-28.2-BH22-01, Q-28.2-BH22-02, Q-47.1-BH22-01, Q-47.1-BH22-02). The boreholes were drilled using a track-mounted CME-55 drill rig to a depth of approximately 10 m. The subsurface stratigraphy encountered was recorded by Stantec field personnel. When encountered, overburden samples were recovered at regular intervals using a B or N sized 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. The bedrock samples collected during the fieldwork investigation were sent to Stantec's laboratory for detailed classification and additional testing.

3.4 Laboratory Testing

All rock samples were subjected to a detailed visual examination and additional classification by a geologist. Laboratory testing conducted on rock cores consisted of eight (8) Micro-Deval (LC 21-070) and Los Angeles tests (LC 21-400).



3.5 Volume Calculation

The volume estimates were calculated by multiplying the potential borrow source or quarry site's area by the estimated average thickness of suitable materials or exploitable bedrock. Photo interpretation and Canadian Digital Surface Models derived from radar data (NRCan, 2000) were used to determine the potential 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 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.).

The site potential classification is provided only for sites where a geotechnical field investigation was conducted as part of this mandate. In this case, only potential quarry sites Q-28.2 and Q-47.1 were classified since no site-specific data is available for the other sites.



4.0 Results

Using aerial photo interpretation, five (5) potential granular borrow sources and four (4) quarry sites were identified as being more likely to contain suitable materials along the Wemindji Access Road. The potential granular borrow sources consist mostly of littoral deposits, while the potential quarry sites consist of small bedrock hills with potential depths of approximately 10 m. Specific attention was given to avoid as much as possible the sites where environmental constraints (proximity to watercourses, waterbodies, or wetlands) were present. The main characteristics of the identified granular borrow sources and quarry sites are listed in Table 3, while their specific description is presented below.

The location of the identified potential quarry site and drilled boreholes is shown on the maps in Appendix B. Detailed borehole descriptions are provided within the borehole records in Appendix C. Laboratory test results are shown in Appendix D while a photographic album of the bedrock cores is provided in Appendix E.



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Table 3 Potential Quarry Sites Identified Along the Wemindji Access Road

| Site ID | Cell | Status | Centroid Coordinates (NAD 83 CSRS) | | | No. SMS (lease expiration date) ¹ | Claim (expiration date) ¹ | Material Type | Area (ha) |
|----------|------|----------|---------------------------------------|----------------|-----------------|---|--|-----------------------------------|--------------|
| | | | MTM zone | Easting (m) | Northing (m) | | | | |
| GD-5 | A | Existing | 10 | 356 093 | 5 874 210 | N/A | No | Sand | 4.3 |
| | B | Existing | 10 | 356 465 | 5 874 611 | | | | |
| GD-66 | - | New | 9 | 211 802 | 5 882 259 | N/A | No | Sand | 32.7 |
| GD-70 | - | New | 9 | 214 688 | 5 882 250 | N/A | No | Sand | 9.3 |
| GD-515.3 | - | Existing | 9 | 239 772 | 5 886 707 | N/A | Partially (2023-12-08) | Sand | 19.9 |
| GD-520 | - | New | 9 | 241 974 | 5 889 944 | N/A | Partially (2023-12-08) | Sand | 28.7 |
| Q-28.2 | - | New | 10 | 376 813 | 5 875 034 | N/A | Yes (2025-03-02) | Bedrock (Granite) | 2.7 |
| Q-47.1 | - | Existing | 10 | 394 031 | 5 876 528 | 33E01-18 (expired) | N/A | Bedrock (Granodiorite) | 5.2 |
| Q-53.5 | - | New | 10 | 399 807 | 5 880 421 | N/A | Yes (2025-12-13) | Bedrock (Granite) ² | 4.4 |
| Q-60 | - | New | 9 | 205 102 | 5 881 755 | N/A | No | Bedrock (Granite) ² | 5.3 |

¹ Source: Gestim Plus, 2023

² Bedrock lithology source: SIGÉOM, 2023



4.1 Potential Borrow Sources (Granular Material)

The following sections (4.1.1 to 4.1.5) present the potential granular borrow sources identified along the Wemindji Access Road. Figure B1 (Appendix B) shows an overview of the potential borrow source locations along the road while Figure B2 to B5 (Appendix B) show site-specific maps of each site. The open pits were often completely exploited and some sites that were not exploited were sampled but showed a thin layer of granular deposits. The sites suggested hereafter are those appearing most favorable for granular materials extraction.

4.1.1 Potential Borrow Source GD-5

Landform type: Littoral deposit (beaches)

Material: Sand

Estimated average material thickness: 2 m

Estimated volume: Cell A: 120 000 m³
Cell B: 30 000 m³

Site description:

The potential borrow source GD-5 straddles the Wemindji Access Road (KP 5). The site is divided in two cells – cell A and cell B – one on each side of the road. The landform consists of littoral deposits arranged in a southwest to northeast orientation which is only sparsely forested. The site was previously exploited but a significant volume seems to remain available. Cell A has a length of 1730 m, a width of 540 m, and an area 22.1 ha, while cell B has a length of 300 m, a width of 150 m, and an area 4.3 ha. Except for the respect of a 35 m buffer along the road, no other environmental constraint was identified in the vicinity of the site.

Site access:

The site is directly accessible from the Wemindji Access Road.



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4.1.2 Potential Borrow Source GD-66

Landform type: Undulating littoral deposit

Material: Sand

Estimated average material thickness: 2 m

Estimated volume: 200 000 m³

Site description:

The potential site GD-66 is located approximately 1.5 km north of the Wemindji Access Road between KP 66 and 68. The landform consists of an undulating littoral deposit approximately 1 800 m long, between 140 and 300 m wide, and covers an area of 32.7 ha. The site has not been exploited and is sparsely vegetated. Several environmental constraints were observed in the vicinity of the site: large wetlands were identified to the south while a river flows along its northern boundary. In both cases a 30 m wide buffer should be respected.

Site Access:

There is currently no access to the site. A new access road of approximately 1.2 km would need to be built.

4.1.3 Potential Borrow Source GD-70

Landform type: Undulating littoral deposit

Material: Sand

Estimated average material thickness: 2 m

Estimated volume: 80 000 m³

Site description:

The potential borrow source GD-70 is located approximately 350 m north of the Wemindji Access Road at KP 70. The landform consists of an undulating littoral deposit approximately 565 m long, an average width of 150 m wide, and has an approximate area of 9.3 ha. This site is currently unexploited and is sparsely vegetated. A camp with three (3) cabins is located approximately 35 m south of the eastern section of the site. A river and its tributary flow respectively to the north and west of the site. A buffer distance of 30 m should be respected by both watercourses.

Site access:

The construction of a 250 m access road would be required to allow the exploitation of the site. Another possibility could be to extend the existing trail leading to the camp by 60 m up to the potential borrow source site.



4.1.4 Potential Borrow Source GD-515.3

Landform type: Undulating littoral deposit

Material: Sand

Estimated average material thickness: 2 m

Estimated volume: 125 000 m³

Site description:

The potential site GD-515.3 is located on the east side of the Billy Diamond Highway, between KP 515 and 516. A previously exploited borrow pit is located between the Billy Diamond Highway and the delineated landform. The site presents a length of 880 m, an average width of approximately 250 m, and an area of 19.9 ha. The deposit is higher at the edge of the previously exploited area and tends to drop to the north and northeast of the site. No environmental constraint was observed in the vicinity of the site.

Site access:

The site could be reached by the previously exploited borrow pit. However, an access road of approximately 150 m long would probably have to be rebuilt from the Billy Diamond Highway.

4.1.5 Potential Borrow Source GD-520

Landform type: Littoral undulating deposit (beach ridges)

Material: Sand

Estimated average material thickness: 3 m

Estimated volume: 100 000 m³

Site description:

The proposed borrow source GD-520 is located approximately 1.6 km west of KP 520 of the Billy Diamond Highway. The landform consists of east-west oriented beach ridges approximately 1 km long, between 110 and 370 m wide, and has an area of approximately 28.7 ha. This site has never been exploited but several test pit locations are visible on the available imagery of 2013 and 2014 (Google Earth, 2023). Some wetlands were observed in the vicinity of the site, especially in the northern portion of the landform, but their presence should not significantly reduce the potential extractable volume. A powerline right-of-way is also located approximately 15 m to the west of the site.

Site access:

A new access road at least 1750 m long would need to be built to allow the exploitation of the site. The passage of this new access road under the power line would be inevitable.



4.2 Potential Quarry Sites

The following sections (4.2.1 to 4.2.4) present the potential quarry sites identified along the Wemindji Access Road and the Billy Diamond Highway near the Wemindji Access Road. Figure B1 (Appendix B) shows an overview map of the potential quarry site locations along the Wemindji Access Road and the Billy Diamond Highway while Figure B6 to B9 (Appendix B) show site-specific maps of each site.

4.2.1 Potential quarry site Q-28.2

Landform type: Rocky hill

Material: Bedrock (grey granite)

Estimated average material thickness: 5 m

Estimated volume: 60 000 m³ (69 000 including a swell ratio of 1.15 once compacted)

Site description:

The potential quarry Q-28.2 is located 100 m northwest of the Wemindji Access Road at KP 28.2. The site consists of a rounded rocky hill with a maximum height approximately 6-8 m higher than the surrounding terrain. The site has an approximate length of 215 m, and an average width of approximately 140 m, and an area of 2.7 ha. The surface characterized by a sparse tree cover and extensive areas of bedrock outcrops (Figure 2). The site has not yet been exploited and does not present environmental constraints in its vicinity.



Figure 2 Picture of Site GD-28.2

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Site access:

Since the site has not already been exploited, the construction of a 230 m long access road would be required from the Wemindji Access Road to the site to take advantage of a gentler slope and a working space.

Field investigation program and laboratory testing:

Two boreholes (Q-28.2-BH22-01, Q-28.2-BH22-02) were drilled on site on July 17, 2022, down to depths of 10.69 m and 10.85 m, respectively. Following the description of the bedrock cores by a geologist, representative samples of rock were selected to perform two (2) Micro-Deval tests (LC 21-070), and two (2) Los Angeles tests (LC 21-400) for each borehole.

Subsurface conditions:

Within the two boreholes, the bedrock was encountered from the surface to depths of 10.69 m (BH22-02) and 10.85 m (BH22-02). The bedrock encountered within the two (2) boreholes was described as pink granite.

The laboratory test results for the selected samples showed that the Micro-Deval values ranged from 8 to 10 %, while the Los Angeles results ranged from 35 to 42 % indicating that the bedrock should be suitable to produce various types of aggregates.

The subsurface conditions observed in the two boreholes are summarized in Table 4 and the laboratory test results are provided in Table 5.

Site potential:

Good – The bedrock should be suitable for the production of a decent volume of crushed stone. Only a short access road (~230 m) would need to be built and no environmental constraint was identified.

Table 4 Summary of Observed Stratigraphy for the Potential Quarry Site Q-28.2

| Borehole ID | Total depth (m) | Stratigraphy (depth-m) |
|----------------|-----------------|------------------------|
| | | Granite (m) |
| Q-28.2-BH22-01 | 10.69 | 0.00 – 10.69 |
| Q-28.2-BH22-02 | 10.85 | 0.00 – 10.85 |



**LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I
POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – WEMINDJI ACCESS
ROAD**

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

| Borehole ID | Sample | Depth (m) | Geotechnical laboratory test results | |
|----------------|----------------|-------------|--------------------------------------|-----------------------------|
| | | | Micro-Deval (%) (LC 21-070) | Los Angeles (%) (LC 21-400) |
| Q-28.2-BH22-01 | DC-01 to DC-03 | 0.00 – 4.37 | 9 | 35 |
| Q-28.2-BH22-01 | DC-03 to DC-05 | 4.37 – 7.65 | 8 | 35 |
| Q-28.2-BH22-02 | DC-01 to DC-04 | 0.13 – 5.00 | 10 | 42 |
| Q-28.2-BH22-02 | DC-04 to DC-06 | 5.00 – 9.37 | 10 | 39 |

4.2.2 Potential Quarry Site Q-47.1

Landform type: Residual rocky hill

Material: Bedrock (grey and white granite rock)

Potentially exploitable thickness: 6-8 m

Estimated volume: 120 000 m³ (138 000 m³ including a swell ration of 1.15 once compacted)

Site description:

The potential quarry site Q-47.1 is located approximately 600 m south of the Wemindji Access Road at KP 47.1. The landform consists of a rocky hill that was previously exploited on approximately 1 ha. The hill is approximately 10 m higher than its surrounding terrain which is largely covered by peatlands. The delineated site has an area of approximately 5.2 ha and shows an unusual shape due to the presence of environmental constraints. The landform shows extensive areas of bedrock exposure and a partial overburden cover. The presence of a wetland on the northwest side of the site (on top of the hill) limits the potentially exploitable area. The boundary of the site was positioned to respect the legal distance between a quarry and a wetland (at least 30 m). The volume estimated above considers the reduced size of the site due to the presence of the wetland.

Site access:

The site is easily accessible from the Wemindji Access Road by using the existing quarry access road.

Field investigation program and laboratory testing:

Two boreholes (Q-47.1-BH22-01, Q-47.1-BH22-02) were drilled on site on July 15 and 16, 2022, reaching depths of 10.46 m and 10.92 m, respectively. Following the description of the bedrock cores by a geologist, representative samples of rock were selected to perform two (2) Micro-Deval tests (LC 21-070), and two (2) Los Angeles tests (LC 21-400) for each borehole.



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POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – WEMINDJI ACCESS
ROAD**

Subsurface conditions:

The bedrock was encountered from the surface to a depth of 10.46 m (Q-47.1-BH22-02) and 10.92 m (Q-47.1-BH22-02) and consists of grey granite in both boreholes. The laboratory test results for the selected samples showed that the Micro-Deval results varied between 8 and 9 %, while the Los Angeles results ranged from 36 to 38 %, indicating that the bedrock should be suitable to produce various types of aggregates.

The subsurface conditions observed in the two boreholes are summarized in Table 6 and the laboratory test results are provided in Table 7.

Site potential:

High – The bedrock should be suitable to produce a decent volume of crushed stone. An access road is already available up to the extraction area.

Table 6 Summary of Observed Stratigraphy for Potential Quarry Site Q-47.1

| Borehole ID | Total depth (m) | Stratigraphy (depth-m) |
|----------------|-----------------|------------------------|
| | | Granite (m) |
| Q-47.1-BH22-01 | 10.46 | 0.00 – 10.46 |
| Q-47.1-BH22-02 | 10.92 | 0.00 – 10.92 |

Table 7 Laboratory Results for Potential Quarry Site 47.1

| Borehole ID | Sample | Depth (m) | Geotechnical laboratory test results | |
|----------------|----------------|--------------|--------------------------------------|-----------------------------|
| | | | Micro-Deval (%) (LC 21-070) | Los Angeles (%) (LC 21-400) |
| Q-47.1-BH22-01 | DC-02 to DC-04 | 1.35 – 5.74 | 9 | 38 |
| Q-47.1-BH22-01 | DC-05 to DC-07 | 5.74 – 10.46 | 8 | 36 |
| Q-47.1-BH22-01 | DC-02 to DC-05 | 1.73 – 7.01 | 9 | 38 |
| Q-47.1-BH22-02 | DC-05 to DC-07 | 7.01 – 10.69 | 8 | 38 |



**LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I
POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – WEMINDJI ACCESS
ROAD**

4.2.3 Potential Quarry Site Q-53.5

Landform type: Summit of an elongated bedrock ridge

Material: Bedrock

Potentially exploitable thickness: 8 m

Estimated volume: 100 000 m³ (115 000 m³ including a swell ration of 1.15 once compacted)

Site description:

The potential quarry site Q-53.5 is located approximately 70 m north of the Wemindji Access Road at KP 53.5. The potentially favorable landform consists of the eastern portion of a rocky ridge reaching approximately 10-12 m above the surrounding terrains. The site has a length of approximately 300 m, an average width of 115 m, and an area of 4.4 ha. It was never exploited and only shows sparse vegetated areas between large areas of bedrock exposures. The site is adjacent to a wetland on its north and east boundaries which would impose the respect of a 30 m buffer.

Site access:

The exploitation of the site would require the construction of a 320 m long access road to reach the site by its west portion to facilitate the exploitation.

4.2.4 Potential Quarry Site Q-60

Landform type: Triangle-shaped rocky outcrop

Material: Bedrock (granite)

Potentially exploitable thickness: 4 m

Estimated volume: 75 000 m³ (86 000 m³ considering a swell factor of 1.15 once compacted)

Site description:

The potential quarry site Q-60 is located approximately 1.2 km north of the Wemindji Access Road at KP 60. The landform consists of a rocky hill reaching 4 m above the surrounding terrain. This triangle-shaped site has a maximum length of 415 m, an average width of 150 m, and an area of 5.3 ha. The site was never exploited for its bedrock but a previously exploited borrow is adjacent to its south boundary. The bedrock is exposed or covered by a very thin overburden layer and is sparsely vegetated. The site is adjacent to a peatland on its northwest side which would impose the respect of a 30 m buffer from the exploitation area.

Site access:

The site could be reached using the existing 1.6 km long access road leading to the previously exploited borrow pit.



5.0 Discussion and Conclusion

This desktop assessment and geotechnical investigation was undertaken to identify potential borrow sources (granular materials) and quarry sites to supply the material needed for the upgrading of the Wemindji Access Road.

Using aerial photo interpretation, five (5) potential granular borrow sources and four (4) quarry sites were identified. Two (2) of the quarry sites (Q-28.2 and Q-47.1) were selected for further geotechnical investigations. Two (2) boreholes were advanced within the potential sites to describe their bedrock and to perform additional laboratory tests (Micro-Deval and Los Angeles tests). Based on the additional information collected during and after the geotechnical investigation, the quality and quantity of the potentially suitable material were characterized. As for the other potential sites identified, their location, landform type, the materials they are expected to contain, their size, vegetation cover, and environmental and other constraints were described. Table 8 summarizes the potential exploitable volumes identified in the sites along the Wemindji Access Road.

Table 8: Summary of the Potentially Exploitable Volumes Identified Along the Wemindji Access Road

| Site ID | Material Type | Estimated average material thickness (m) | Potential volume with respect to environmental constraints (m³) | Potential bedrock volume considering a swell ratio of 1.15 (once compacted) |
|--|---|---|---|--|
| GD-5 | Sand | 2 | 150 000 | N/A |
| GD-66 | Sand | 2 | 200 000 | |
| GD-70 | Sand | 2 | 80 000 | |
| GD-515.3 | Sand | 2 | 125 000 | |
| GD-520 | Sand | 3 | 100 000 | |
| Q-28.2 | Bedrock | 5 | 60 000 | 69 000 |
| Q-47.1 | Bedrock | 6-8 | 120 000 | 138 000 |
| Q-53.5 | Bedrock | 8 | 100 000 | 115 000 |
| Q-60 | Bedrock | 4 | 75 000 | 86 000 |
| Total - Granular materials (m ³) | 655 000 m ³ considering environmental constraints | | | |
| Total - Bedrock | 408 000 m ³ (including a swell ratio of 1.15 once compacted) | | | |



LA GRANDE ALLIANCE FEASIBILITY STUDY – PHASE I POTENTIAL BORROW SOURCES AND QUARRY SITES ASSESSMENT – WEMINDJI ACCESS ROAD

The sites GD-5, GD-515.3, and GD-525 appear to be potentially favorable granular borrow sources containing significant amounts of material and with existing accesses. As for the sites GD-66, GD-70, and GD-520, they also appear to be potentially favorable granular borrow sources but would require the construction of new access roads to allow their exploitation.

The potential quarry sites Q-28.2 consists in an unexploited site (new site), while the site Q-47.1 has been partially exploited (open quarry). The laboratory results indicate that the sites Q-28.2 and Q-47.1 should provide good materials for the pavement of the Wemindji Access Road. However, precautions may have to be taken due to the proximity of both sites to wetlands.

Regarding the potential sites Q-53.5 and Q-60, they appear to be potentially favorable quarry sites since they seem to contain significant amounts of material and would require minimal efforts to build the short access roads to reach the sites.

Based on the actual material requirements, the volumes contained within the delineated potential granular borrow sources and quarry sites would be sufficient to meet the needs for the upgrading and paving of the Wemindji Access Road.

However, an update on the availability of materials from the potential borrow sources and quarry sites should be conducted at later stages of the program as materials may have been used for other purposes in the meantime. Based on this update, a geotechnical investigation campaign should be conducted to confirm the quality and quantity (volumes) of available materials as well as the overburden thickness and the groundwater conditions at sites that were not part of this geotechnical investigation. Also, an assessment of the access road conditions leading to previously exploited sites 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 (Gouvernement du Québec, 2022). The final selection and delineation of the sites should be done according to the applicable regulations in effect at the time of their exploitation.



6.0 References

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APPENDICES

Appendix A Statement of General Conditions



STATEMENT OF GENERAL CONDITIONS

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

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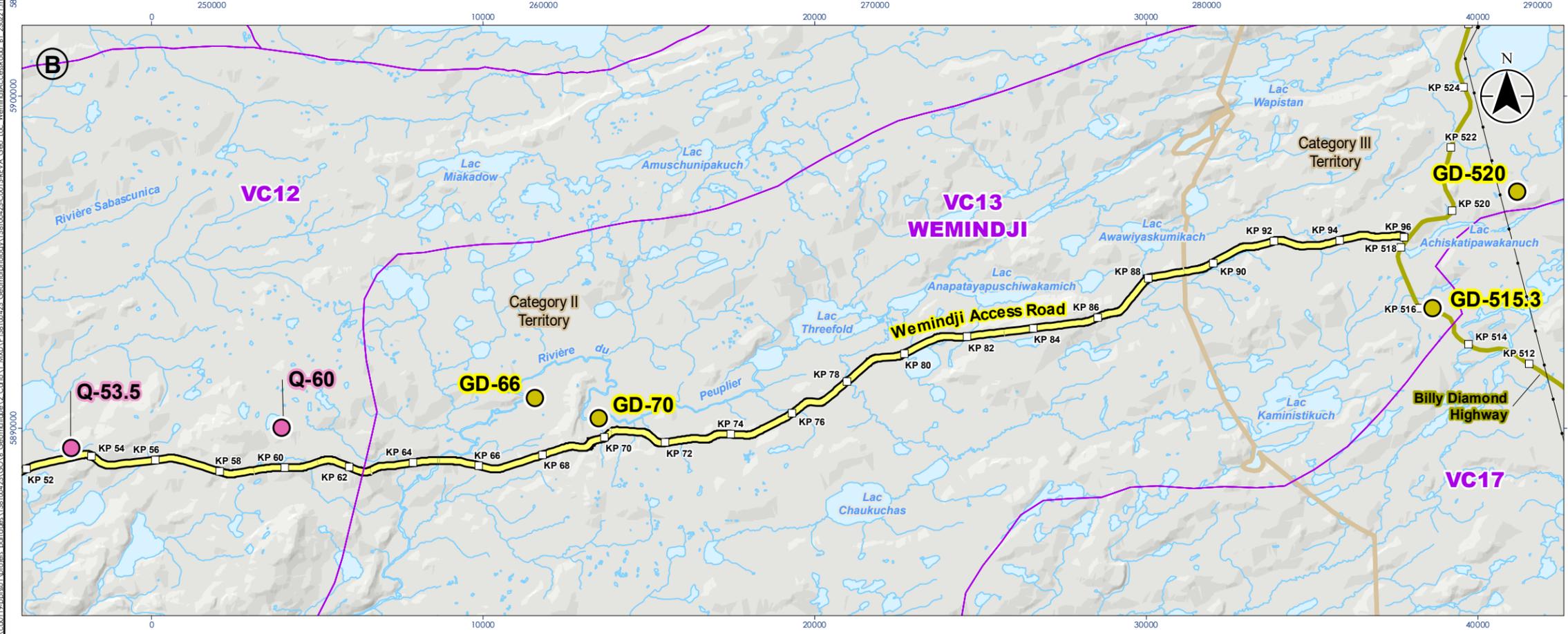
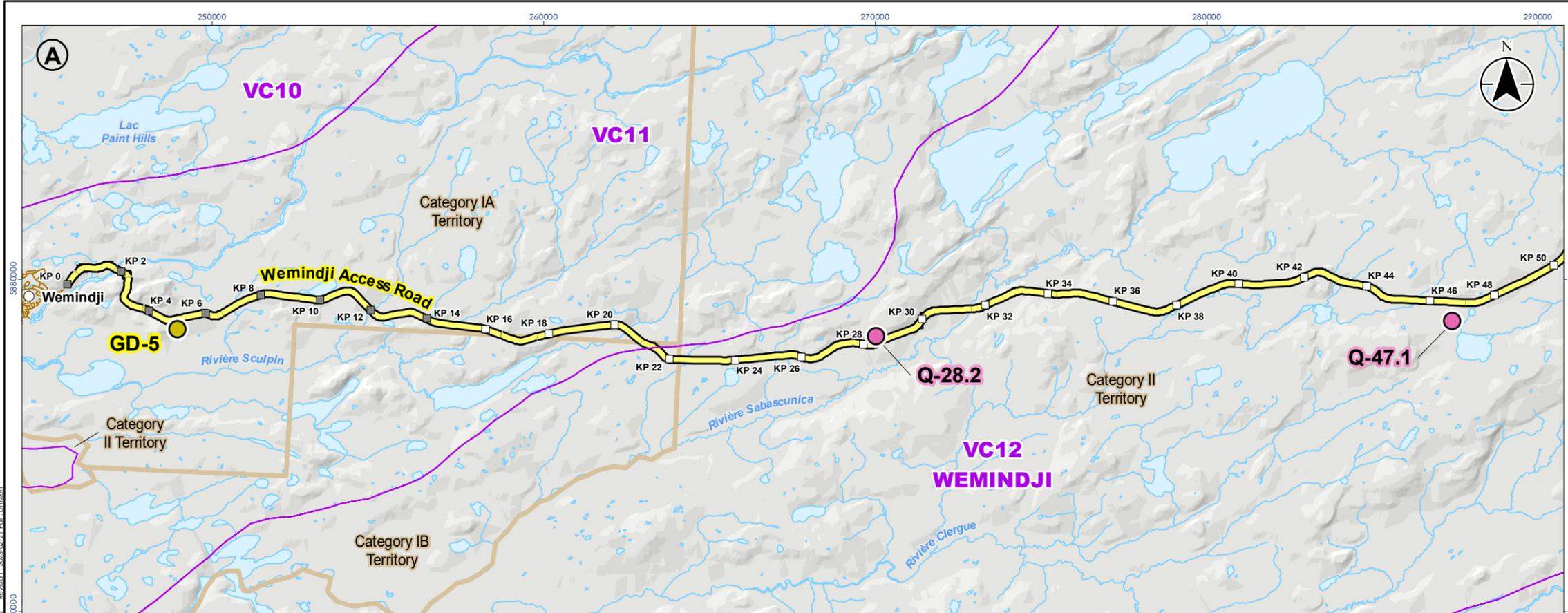
INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Experts-conseils at the time of the work and at the specific testing and/or sampling locations. Classifications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

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Appendix B Figures





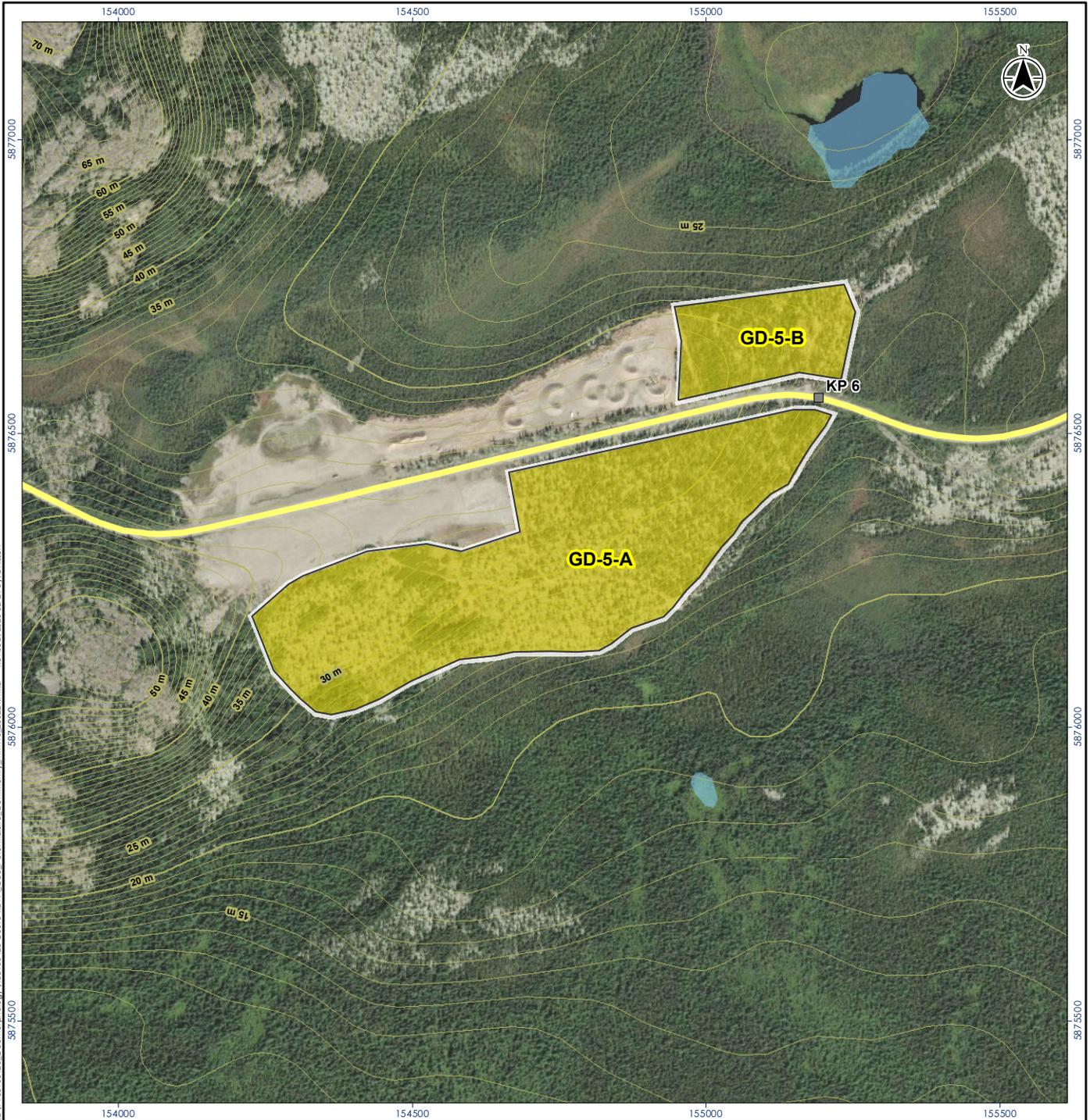
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 Client/Project Cree Development Corporation
 La Grande Alliance – Feasibility Study
 Phase 1
 Project Location 158100425-C001.5 REVA
 Eeyou Itchee, Québec Prepared by Julie Brunette le 2023-02-21
 Québec Verified by E. Ferland on 2023-02-21
 Independent Review by F. Vinet on 2023-02-21

- Human Environment Component**
- Cree Village
 - ▭ Category I, II or III Territory
 - Power Line
- Study Component**
- Wemindji Access Road
- Potential Material Source**
- Potential Quarry Site (Q)
 - Potential Borrow Source (GD)
- Trapline Limit and Community Name**
- ▭ Wemindji
- Hydrography**
- Body of water
 - - - Intermittent Watercourse
 - Permanent Watercourse
- Road Network**
- Kilometric Point (MTQ, 2021)
 - Kilometric Point (Created by Stantec)
- Road Classification**
- - - Collector
 - Local



- Notes**
1. Coordinate System: NAD 1983 CSRS MTM 8
 2. Geotechnical Investigation: Stantec, 2023
 3. Road Network: Adresses Québec, 2021
 4. Hydrography: GRHQ, 2017
 5. Orthoimagery: ESRI-World Imagery, 2017

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Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Geotechnical Investigation: Stantec, 2023
3. Road Network: Adresses Québec, 2021
4. Hydrography: GRHQ, 2017
5. Topography: Forêt Ouverte, 2023
6. Orthomogry: ESRI-World Imagery, 2017

Study Component

- Wemindji Access Road

Potential Material Source

- Potential Borrow Source (GD)

Road Network

- Kilometric Point (Created by Stantec)

Hydrography

- Body of Water
- Watercourse

Topography

- Contour line (1 m)
- Primary
- Secondary

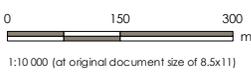


Project Location: 158100425-C0013 REV A
 Prepared by J. Brunette on 2023-02-21
 Eeyou Itchee, Québec
 Technical Review by E. Ferland on 2023-02-21
 Independent Review by F. Vinet on 2023-02-21

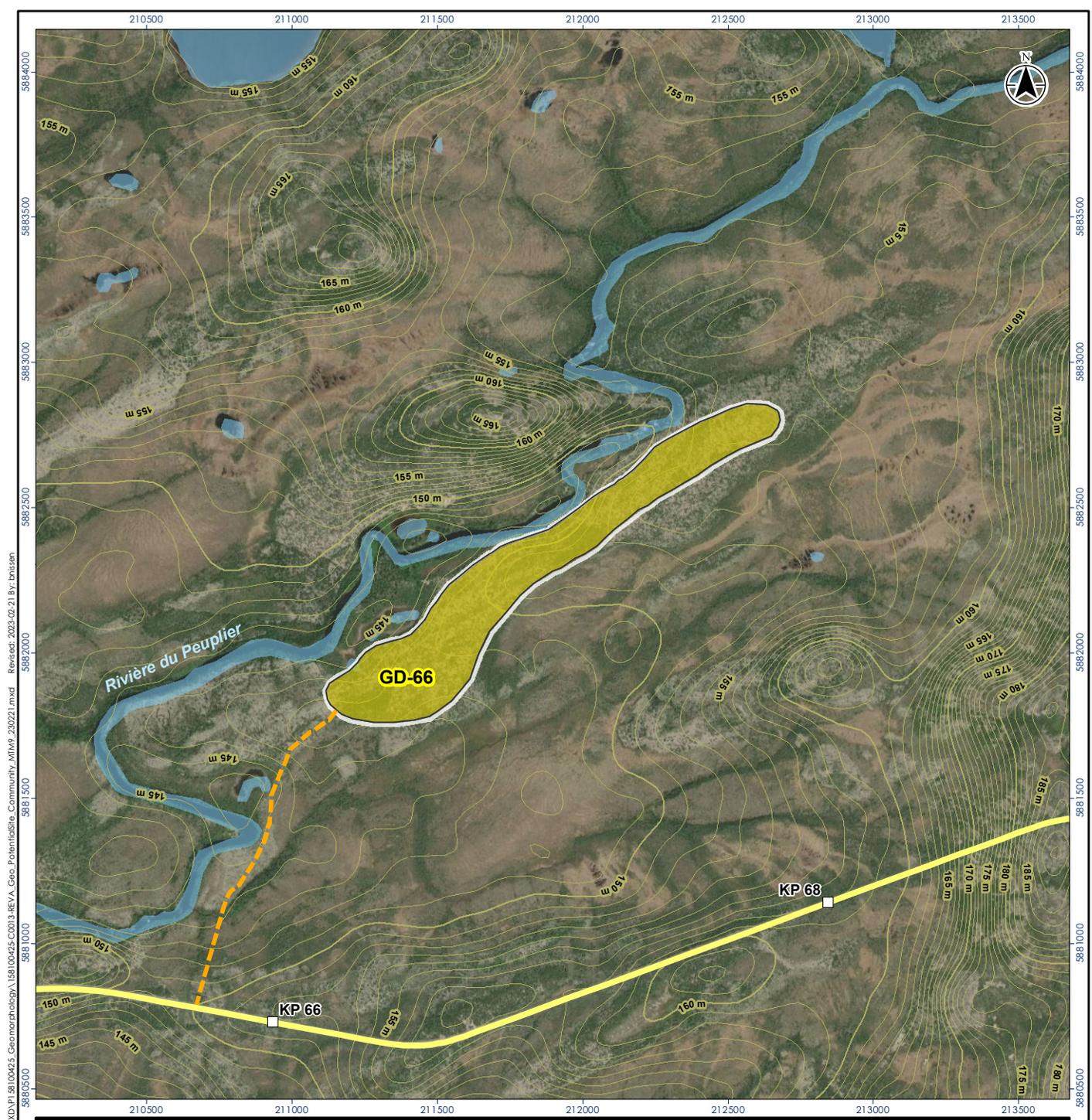
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 Phase 1

Map No. **B2**

Title: **Potential Borrow Source GD-5**



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 Revised: 2023-02-21 By: bris/en



- Study Component**
- Wemindji Access Road
- Projected Component**
- Proposed Access Road
- Potential Material Source**
- Potential Borrow Source (GD)

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

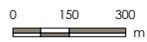


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 Prepared by J. Brunette on 2023-02-21
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 Independent Review by F. Vinet on 2023-02-21

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 La Grande Alliance – Feasibility Study
 Phase 1

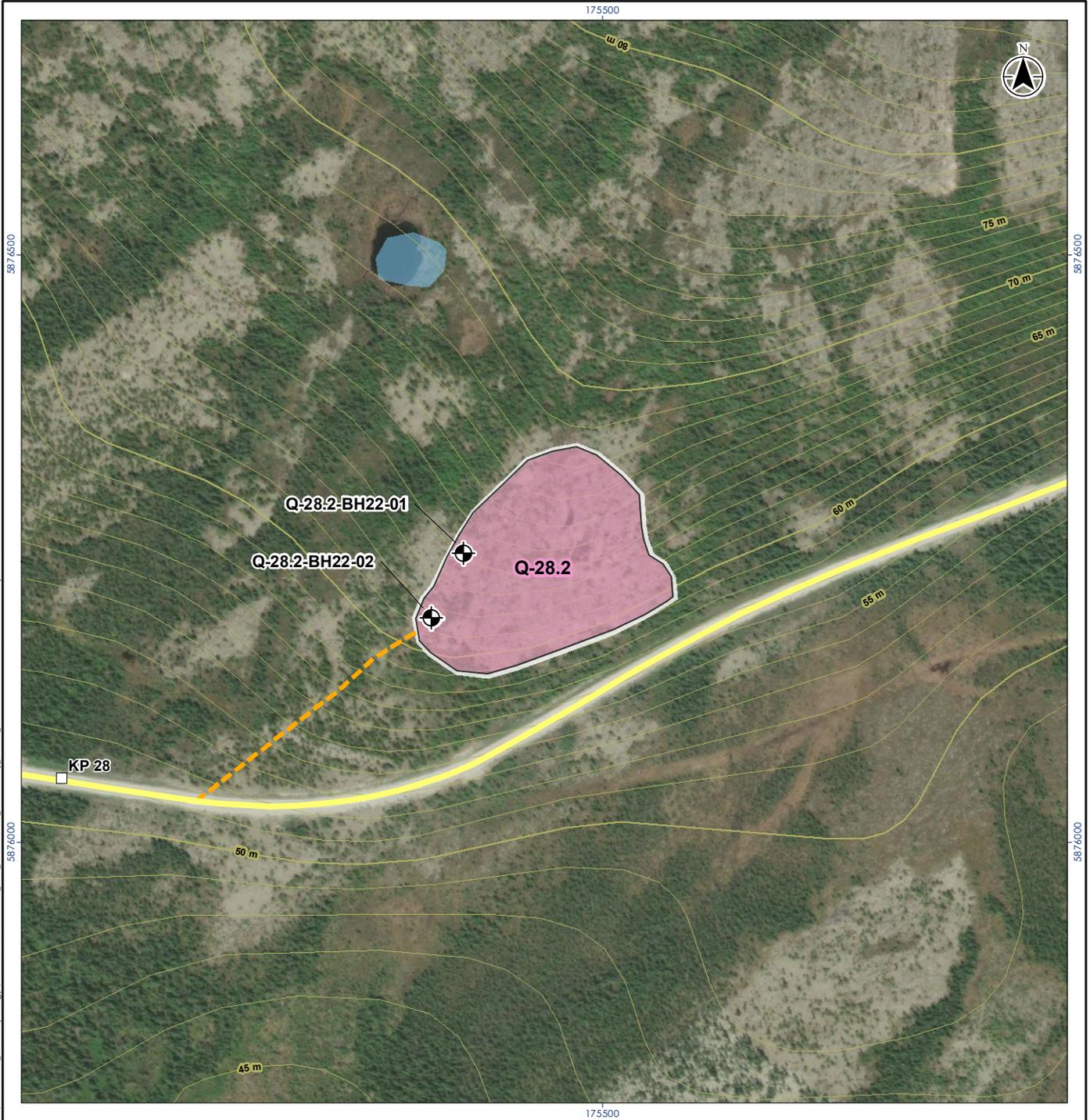
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- Notes**
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 - Geotechnical Investigation: Stantec, 2023
 - Road Network: Adresses Québec, 2021
 - Hydrography: GRHQ, 2017
 - Topography: Forêt Ouverte, 2023
 - Orthoimagery: ESRI-World Imagery, 2017



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- Notes**
1. Coordinate System: NAD 1983 UTM Zone 18N
 2. Geotechnical Investigation: Stantec, 2023
 3. Road Network: Adresses Québec, 2021
 4. Hydrography: GRHQ, 2017
 5. Topography: Forêt Ouverte, 2023
 6. Orthomogery: ESRI-World Imagery, 2017

Study Component

Wemindji Access Road

Projected Component

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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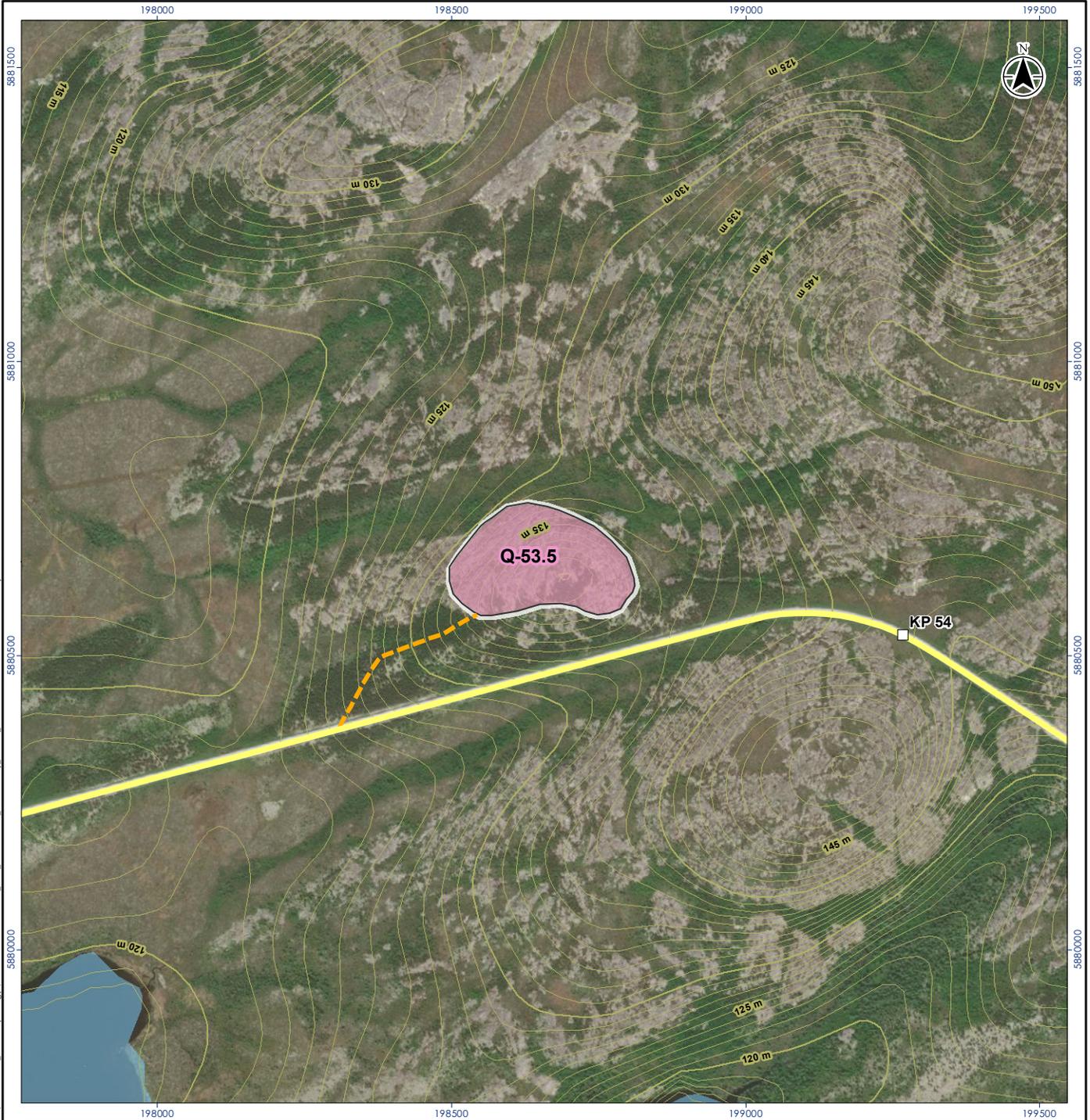


Project Location: 158100425-C0013 REV1A
 Prepared by J. Brunette on 2023-02-21
 Technical Review by E. Ferland on 2023-02-21
 Independent Review by F. Vinet on 2023-02-21

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

Map No. B6

Title: Potential Quarry Site Q-28.2



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- Study Component**
- Wemindji Access Road
- Projected Component**
- Proposed Access Road
- Potential Material Source**
- Potential Quarry Site (Q)

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



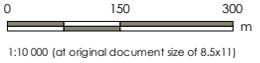
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 Prepared by J. Brunette on 2023-02-21
 Eeyou Istchee, Québec
 Technical Review by E. Ferland on 2023-02-21
 Independent Review by F. Vinet on 2023-02-21

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

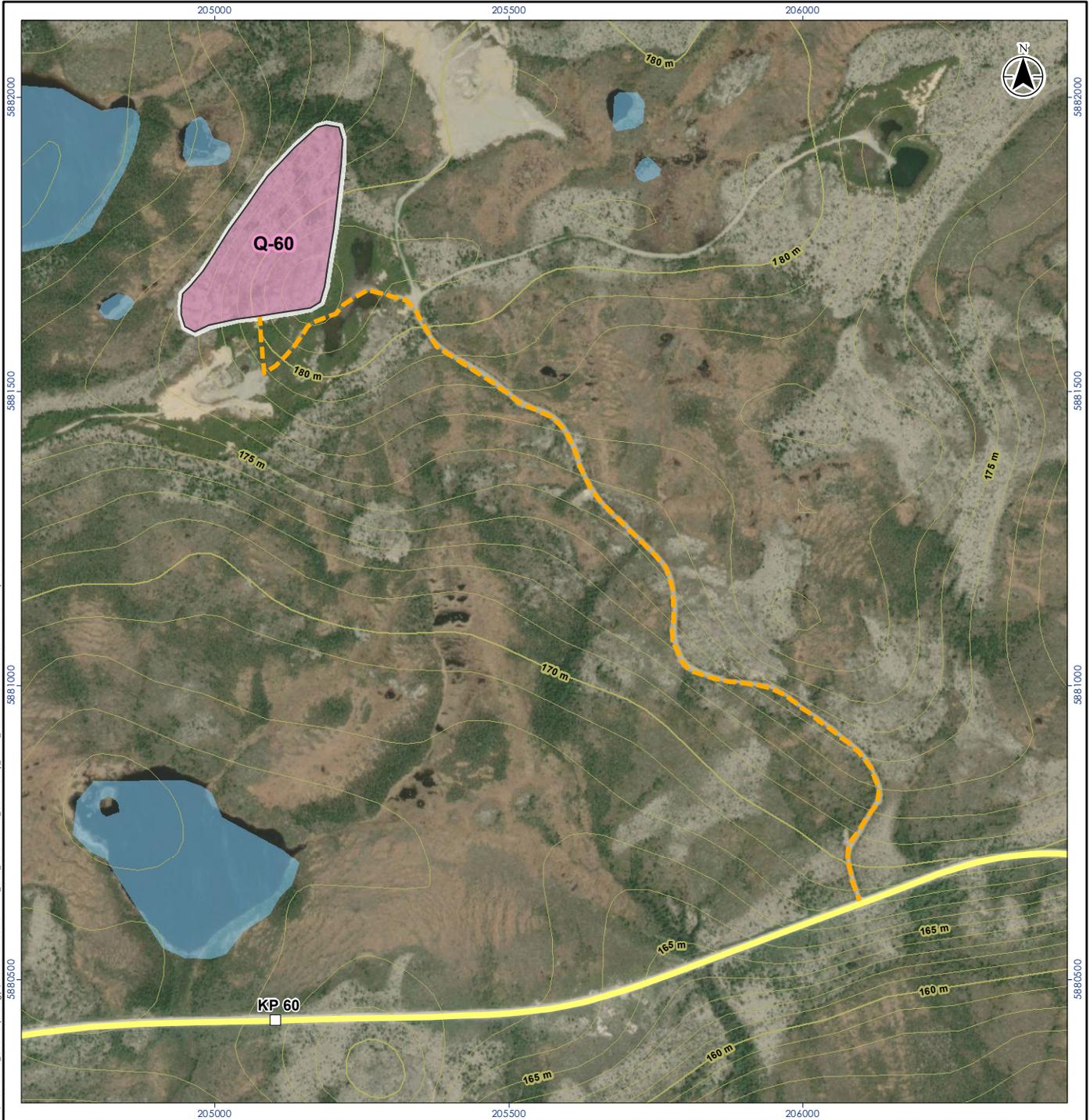
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- Notes**
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 2. Geotechnical Investigation: Stantec, 2023
 3. Road Network: Adresses Québec, 2021
 4. Hydrography: GRHQ, 2017
 5. Topography: Forêt Ouverte, 2023
 6. Orthoimagery: ESRI-World Imagery, 2017



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- Study Component**
- Wemindji Access Road
- Projected Component**
- Proposed Access Road
- Potential Material Source**
- Potential Quarry Site (Q)

- Road Network**
- Kilometric Point (MTQ, 2021)
- Hydrography**
- Body of Water
 - Watercourse
- Topography**
- Contour line (1 m)**
- Primary
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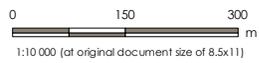
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 Prepared by J. Brunette on 2023-02-21
 Eeyou Itchee, Québec
 Technical Review by E. Ferland on 2023-02-21
 Independent Review by F. Vinet on 2023-02-21

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

Map No.: **B9**

Title: **Potential Quarry Site Q-60**

- 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
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Appendix C Borehole Reports



| STRATIGRAPHY | | | SAMPLES | | | | | | TESTS | | REMARKS | | | |
|--------------|------------|-----------|-------------------------------|--------|-------|---------|--------------|---------|--------------|---------|---------|--|-------------------------------|--|
| DEPTH (m) | DEPTH (ft) | DEPTH (m) | DESCRIPTION OF SOILS AND ROCK | SYMBOL | STATE | TYPE N° | SUB - SAMPLE | CALIBER | RECOVERY (%) | N - RQD | | Standard penetration test BLOWS/150mm | WATER LEVEL / WATER INFLOW | GA : grain size analysis H : hydrometer test C : consolidation W : water content W _l : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM: organic matter CA : chemical analyses |
| 6 | 20 | | | + | | | DC-04 | NQ | 100 | 79 | | | | |
| 7 | | | | + | | | DC-05 | NQ | 99 | 53 | | | | |
| 8 | | | | + | | | | | | | | | | |
| 9 | 30 | | | + | | | DC-06 | NQ | 63 | 0 | | | | |
| 10 | | | | + | | | | | | | | | | |
| 11 | | 10,69 | END OF BOREHOLE | + | | | DC-07 | NQ | 63 | 0 | | | | |
| 12 | 40 | | | | | | | | | | | | | |
| 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 | GA : grain size analysis H : hydrometer test C : consolidation W : water content W _l : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses |
| 6 | 20 | | | + | | DC-04 | | NQ | 100 | 100 | | | | |
| 7 | | | | + | | DC-05 | | NQ | 100 | 99 | | | LA + MD (5.74 - 10.46 m) | |
| 8 | | | | + | | DC-06 | | NQ | 100 | 100 | | | | |
| 9 | 30 | | | + | | DC-07 | | NQ | 100 | 98 | | | | |
| 10 | | | | + | | | | | | | | | | |
| 11 | 35 | 10,46 | END OF BOREHOLE | | | | | | | | | | | |
| 12 | 40 | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | |

| | | |
|--|--|---|
| Project: La Grande Alliance - Feasibility Study - Phase I | Coordinate : Geo. System : MTM-NAD83 Zone: 10 X : 394 084 Y : 5 876 638 | Borehole : Q-47.1-BH22-02 Page : 1 of 2 Start date : 2022-07-16 Inspector : H. Desrochers, CPI Depth : 10,92 m |
| Project No.: 158100425.500.710.2 | Type of borehole : Diamond Core | |
| Client: Cree Development Corporation | Equipment : CME | |
| Site: Wemindji Access Road | Sampling type : NQ | Figure : |
| | Corer : NQ | |

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

| SAMPLE STATE | MECHANIC CHARACTERISTICS OF SOILS | ROCK QUALITY DESIGNATION | JOINTS SPACING |
|--|---|---|---|
| <input type="checkbox"/> Remoulded <input checked="" type="checkbox"/> Intact (thin wall sampler) <input type="checkbox"/> Lost <input type="checkbox"/> 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 % |
| | | | JOINTS SPACING Very tight < 20 mm Tight 20 - 60 mm Close 60 - 200 mm Moderately spaced 200 - 600 mm Spaced 600 - 2000 mm Very spaced 2000 - 6000 mm Wide > 6000 mm |

| STRATIGRAPHY | | | SAMPLES | | | | | | TESTS | | REMARKS | | | |
|--------------|------------|-----------|--|--------|-------|---------|--------------|---------|--------------|---------|---------|---------------------------------------|----------------------------|--|
| DEPTH (m) | DEPTH (ft) | DEPTH (m) | DESCRIPTION OF SOILS AND ROCK | SYMBOL | STATE | TYPE N° | SUB - SAMPLE | CALIBER | RECOVERY (%) | N - RQD | | Standard penetration test BLOWS/150mm | WATER LEVEL / WATER INFLOW | GA : grain size analysis H : hydrometer test C : consolidation W : water content W _l : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM: organic matter CA : chemical analyses |
| | | 0.00 | Bedrock : Grey GRANITE, of good to excellent quality. | + | | | | | | | | | | |
| 1 | | | | + | | DC-01 | | NQ | 97 | 79 | | | | |
| 5 | | | | + | | | | | | | | | | |
| 2 | | | | + | | DC-02 | | NQ | 100 | 88 | | | LA + MD (1.73 - 7.01 m) | |
| 3 | | 10 | | + | | | | | | | | | | |
| 4 | | | | + | | DC-03 | | NQ | 100 | 100 | | | | |
| 15 | | | | + | | | | | | | | | | |

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|------------------|-------------------|
| General remarks: | Verified by : |
| | Date : 2023-01-23 |

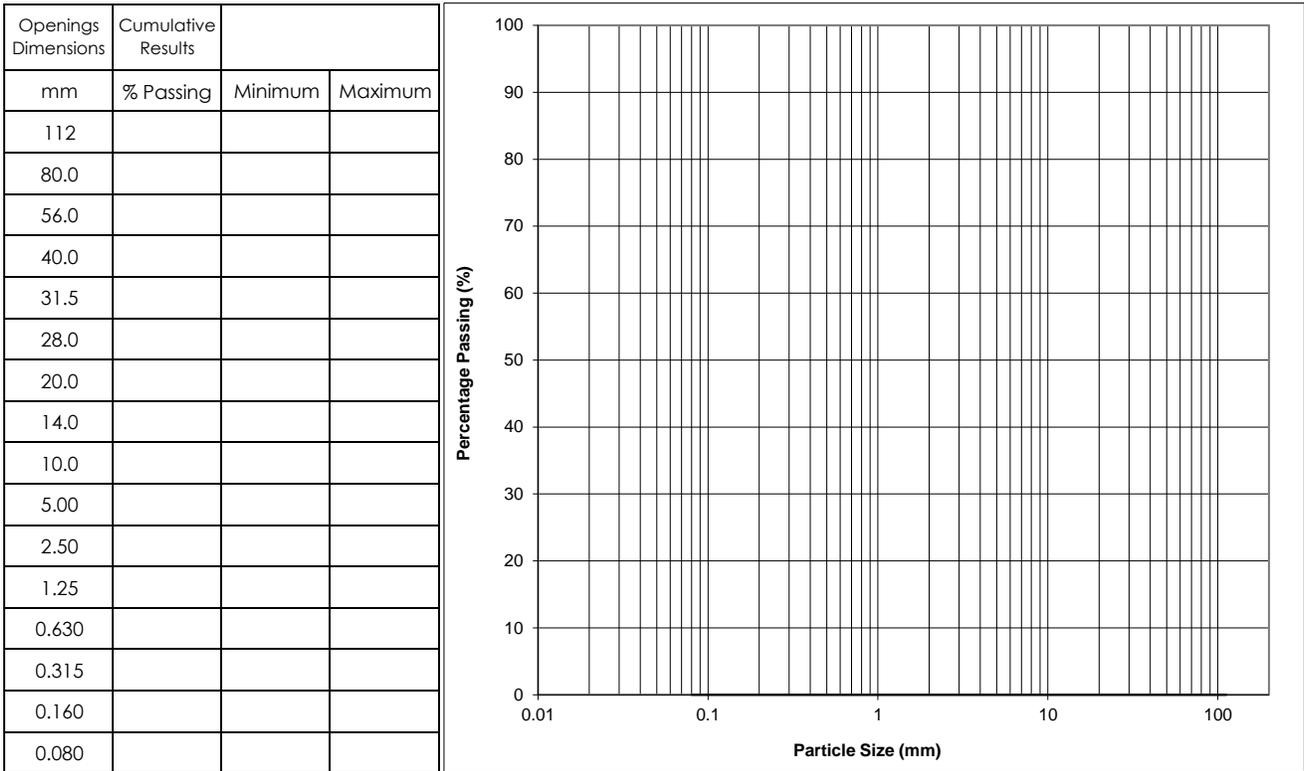
| STRATIGRAPHY | | | SAMPLES | | | | | | TESTS | | REMARKS | | | | | | | | | | |
|--------------|------------|-----------|-------------------------------|--------|-------|---------|--------------|---------|--------------|---------|---------|--|-------------------------------|---|--|--|--|--|--|--|--|
| DEPTH (m) | DEPTH (ft) | DEPTH (m) | DESCRIPTION OF SOILS AND ROCK | SYMBOL | STATE | TYPE N° | SUB - SAMPLE | CALIBER | RECOVERY (%) | N - RQD | | Standard penetration test BLOWS/150mm | WATER LEVEL / WATER INFLOW | GA : grain size analysis H : hydrometer test C : consolidation W : water content W _l : liquid limit W _p : plastic limit Dr : specific gravity k : permeability f _c : compressive str. OM : organic matter CA : chemical analyses | X : N (standard pen.) ▽ : Nc (dyn. pen.) ■ : Cu intact □ : Cu remoulded ◆ : Su intact ◇ : Su remoulded  | | | | | | |
| 6 | 20 | | | + | | | DC-04 | NQ | 100 | 93 | | | | | | | | | | | |
| 7 | | | | + | | | DC-05 | NQ | 98 | 95 | | | | | | | | | | | |
| 8 | | | | + | | | | | | | | | | | | | | | | | |
| 9 | | | | + | | | DC-06 | NQ | 100 | 93 | | | | | | | | | | | |
| 10 | | | | + | | | | | | | | | | | | | | | | | |
| 11 | | 10,92 | END OF BOREHOLE | + | | | DC-07 | NQ | 100 | 100 | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | |
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Appendix D Laboratory Test Results



| | |
|--|---------------------------------------|
| Client : Cree Development Corporation | Type of material : Crushed rock cores |
| Project : La Grande Alliance - Feasibility Study - Phase I Wemindji Access Road | Sampled by : Khaled Haiek |
| Project No : 158100425.500.710.2 | Sampling Date : July 17, 2022 |
| Sample No : Q-28.2-BH22-01 DC-01 to DC-03 | |
| Depth : 0,00 - 4,37m | |

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 ³) | |
| % Fine Particles | | Optimum Moisture Content (%) | |

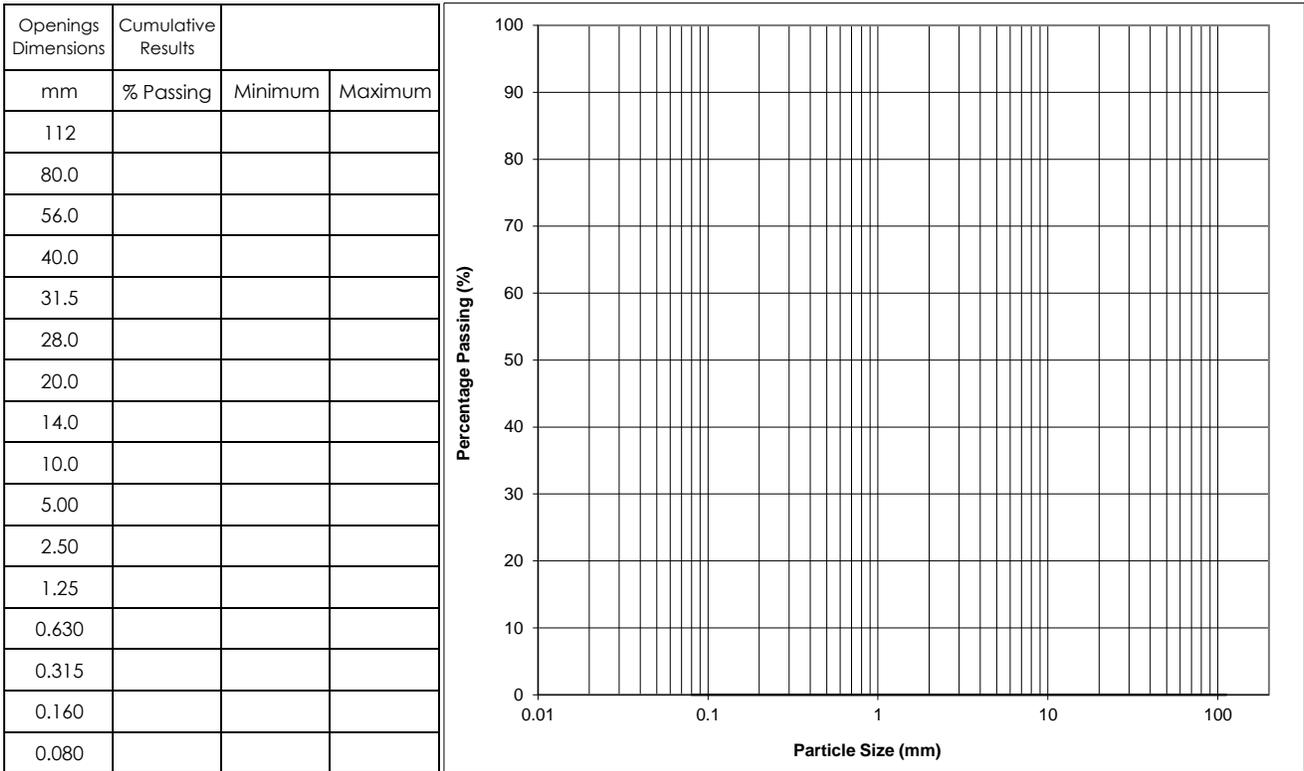
| Other Tests | | | | | | | |
|---|---------|--------------|-----|-----------------|---------|--------------|-----|
| Test / Standard | Results | Requirements | | Test / Standard | Results | Requirements | |
| | | Min | Max | | | Min | Max |
| Los Angeles (grading B) (LC 21-400) (%) | 35 | | | | | | |
| Micro Deval (grading F) (LC 21-070) (%) | 9 | | | | | | |
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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 Wemindji Access Road | Sampled by : Khaled Haiek |
| Project No : 158100425.500.710.2 | Sampling Date : July 17, 2022 |
| Sample No : Q-28.2-BH22-01 DC-03 to DC-05 | |
| Depth : 4,37 - 7,65m | |

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 ³) | |
| % Fine Particles | | Optimum Moisture Content (%) | |

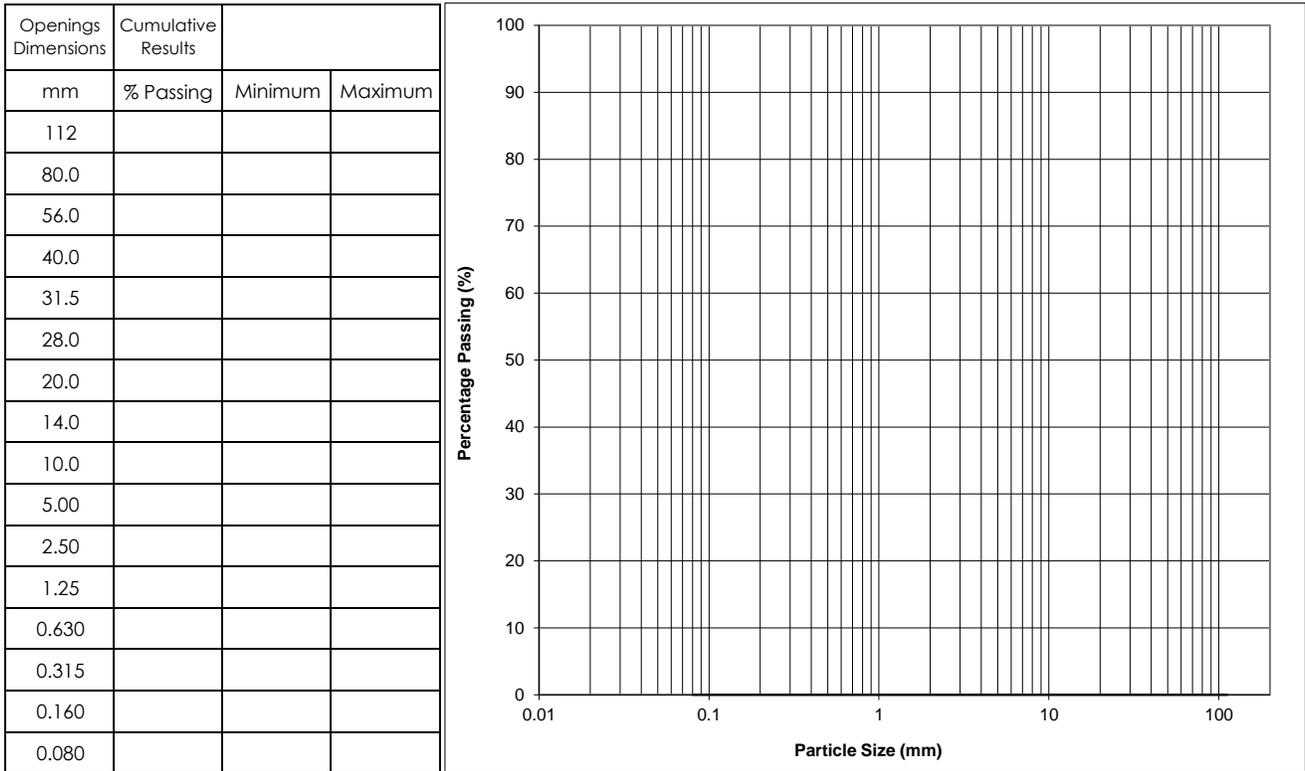
| Other Tests | | | | | | | |
|---|---------|--------------|-----|-----------------|---------|--------------|-----|
| Test / Standard | Results | Requirements | | Test / Standard | Results | Requirements | |
| | | Min | Max | | | Min | Max |
| Los Angeles (grading B) (LC 21-400) (%) | 35 | | | | | | |
| Micro Deval (grading F) (LC 21-070) (%) | 8 | | | | | | |
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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 Wemindji Access Road | Sampled by : Khaled Haiek |
| Project No : 158100425.500.710.2 | Sampling Date : July 18, 2022 |
| Sample No : Q-28.2-BH22-02 DC-01 to DC-04 | |
| Depth : 0,13 - 5,00m | |

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 ³) | |
| % Fine Particles | | Optimum Moisture Content (%) | |

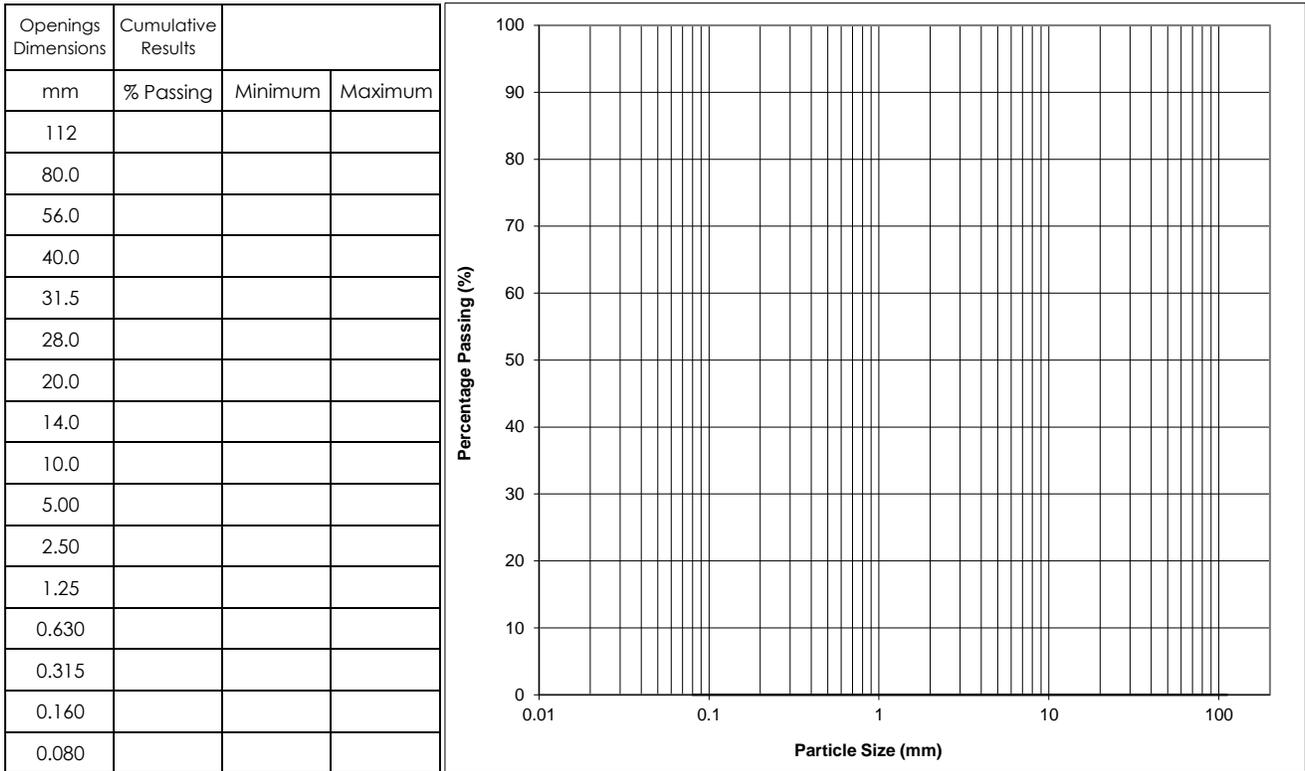
| Other Tests | | | | | | | |
|---|---------|--------------|-----|-----------------|---------|--------------|-----|
| Test / Standard | Results | Requirements | | Test / Standard | Results | Requirements | |
| | | Min | Max | | | Min | Max |
| Los Angeles (grading B) (LC 21-400) (%) | 42 | | | | | | |
| Micro Deval (grading F) (LC 21-070) (%) | 10 | | | | | | |
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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 Wemindji Access Road | Sampled by : Khaled Haiek |
| Project No : 158100425.500.710.2 | Sampling Date : July 18, 2022 |
| Sample No : Q-28.2-BH22-02 DC-04 to DC-06 | |
| Depth : 5,00 - 9,37m | |

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 ³) | |
| % Fine Particles | | Optimum Moisture Content (%) | |

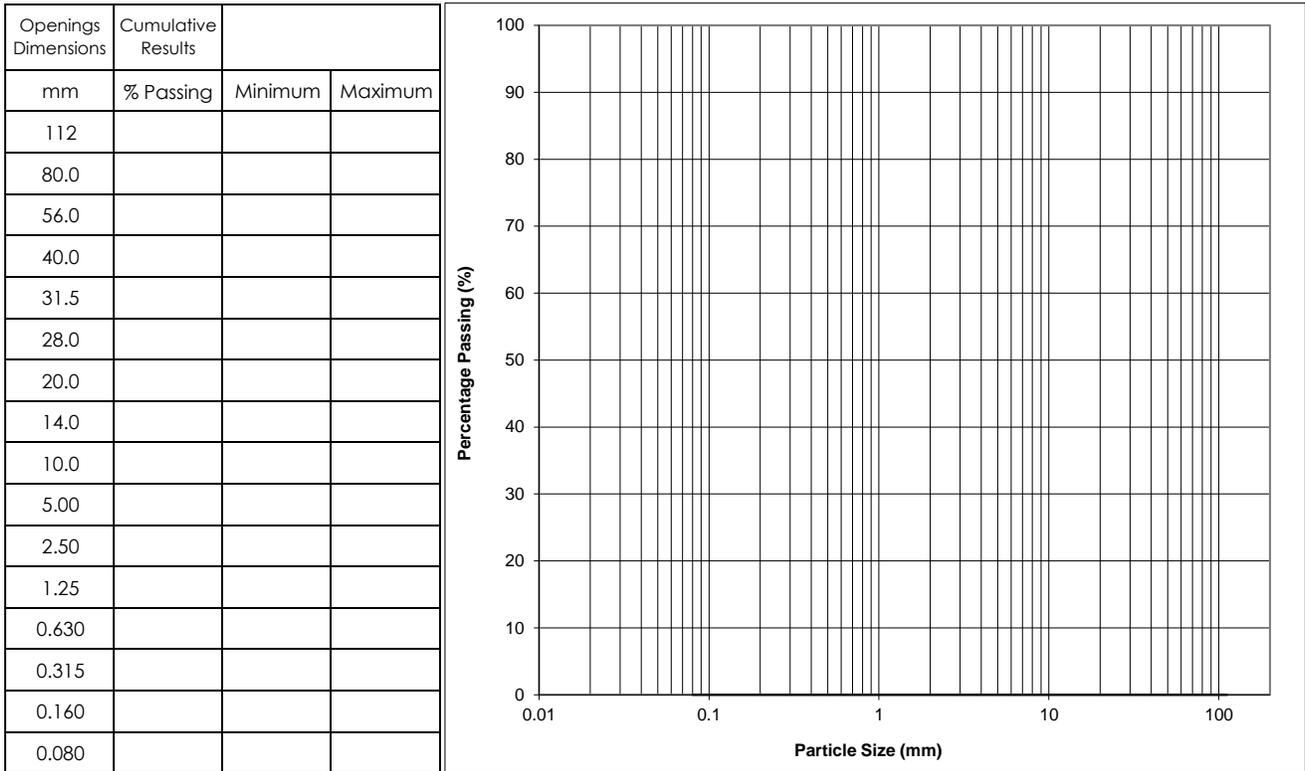
| Other Tests | | | | | | | |
|---|---------|--------------|-----|-----------------|---------|--------------|-----|
| Test / Standard | Results | Requirements | | Test / Standard | Results | Requirements | |
| | | Min | Max | | | Min | Max |
| Los Angeles (grading B) (LC 21-400) (%) | 39 | | | | | | |
| Micro Deval (grading F) (LC 21-070) (%) | 10 | | | | | | |
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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 Wemindji Access Road | Sampled by : Khaled Haiek |
| Project No : 158100425.500.710.2 | Sampling Date : July 15, 2022 |
| Sample No : Q-47.1-BH22-01 DC-02 to DC-04 | |
| Depth : 1,35 - 5,74m | |

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 ³) | |
| % Fine Particles | | Optimum Moisture Content (%) | |

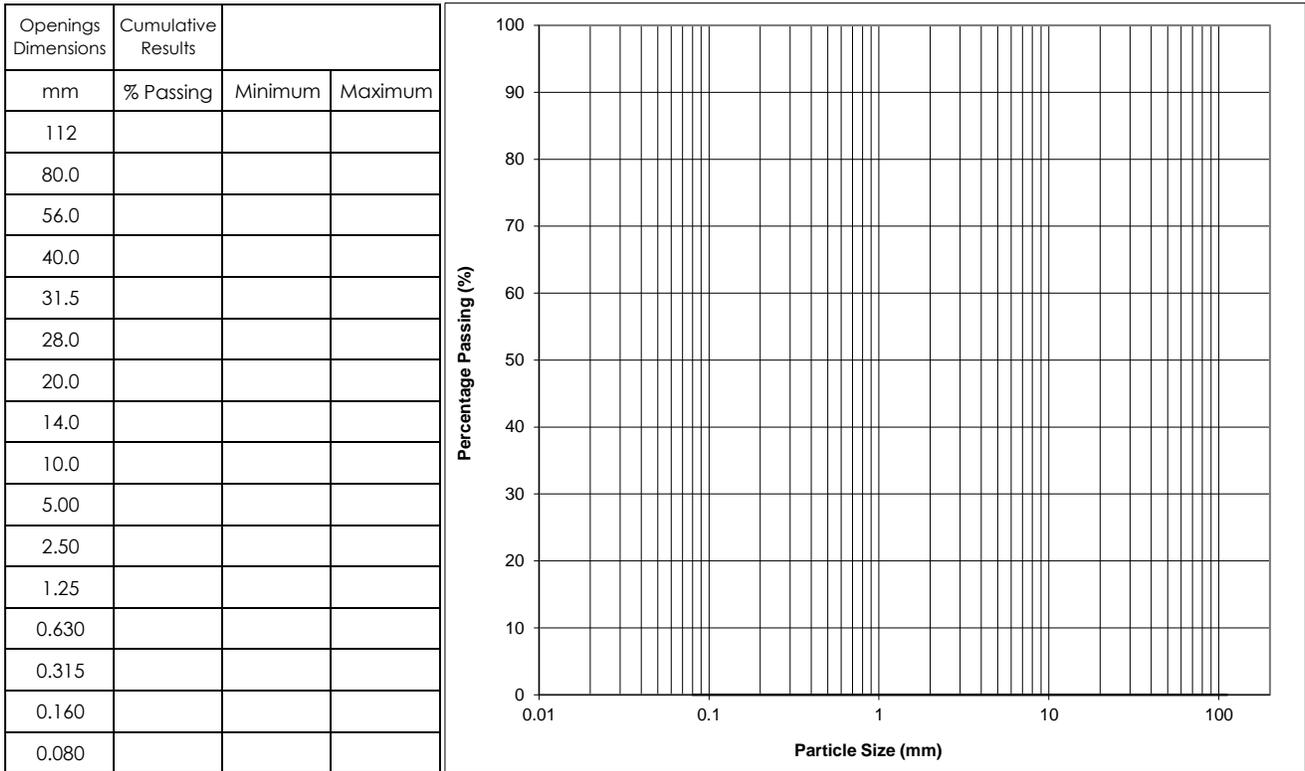
| Other Tests | | | | | | | |
|---|---------|--------------|-----|-----------------|---------|--------------|-----|
| Test / Standard | Results | Requirements | | Test / Standard | Results | Requirements | |
| | | Min | Max | | | Min | Max |
| Los Angeles (grading B) (LC 21-400) (%) | 38 | | | | | | |
| Micro Deval (grading F) (LC 21-070) (%) | 9 | | | | | | |
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Remarks : _____

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

| | |
|--|---------------------------------------|
| Client : Cree Development Corporation | Type of material : Crushed rock cores |
| Project : La Grande Alliance - Feasibility Study - Phase I Wemindji Access Road | Sampled by : Khaled Haiek |
| Project No : 158100425.500.710.2 | Sampling Date : July 15, 2022 |
| Sample No : Q-47.1-BH22-01 DC-05 to DC-07 | |
| Depth : 5,74 - 10,46m | |

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 ³) | |
| % Fine Particles | | Optimum Moisture Content (%) | |

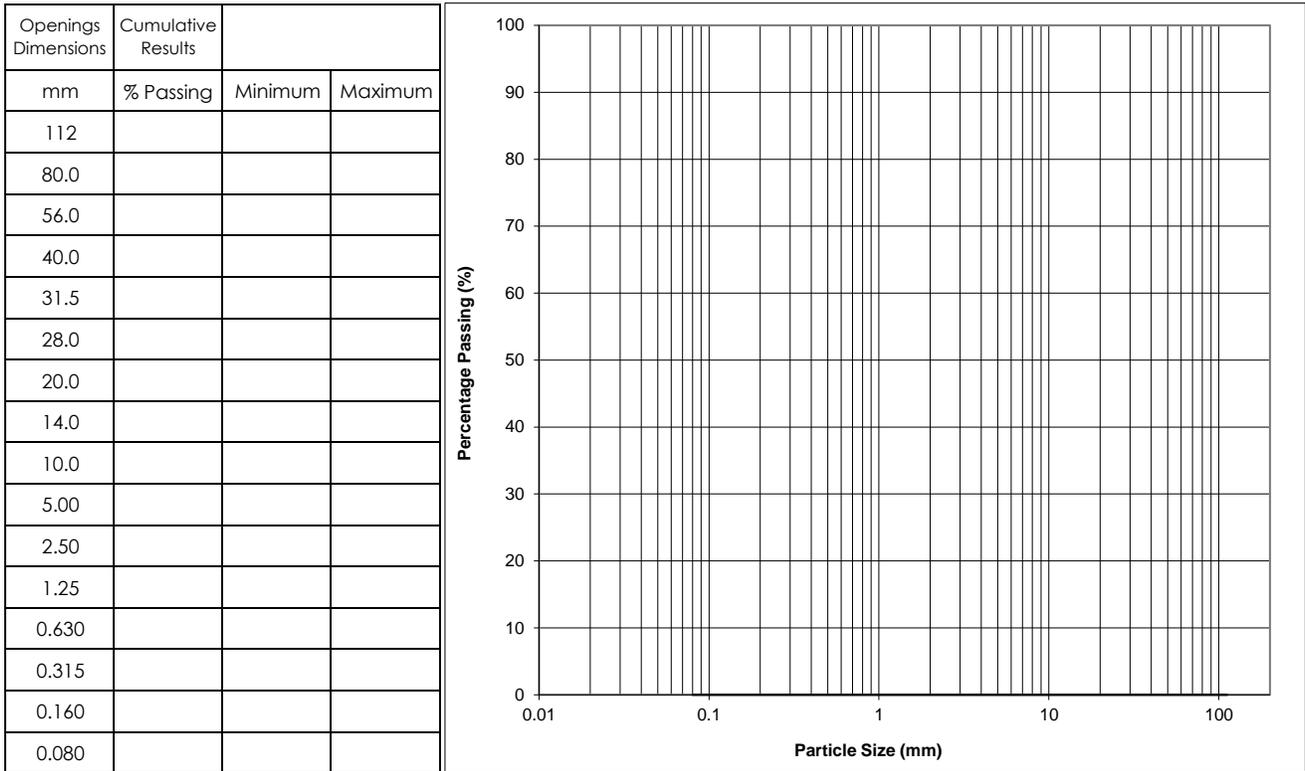
| Other Tests | | | | | | | |
|---|---------|--------------|-----|-----------------|---------|--------------|-----|
| Test / Standard | Results | Requirements | | Test / Standard | Results | Requirements | |
| | | Min | Max | | | Min | Max |
| Los Angeles (grading B) (LC 21-400) (%) | 36 | | | | | | |
| Micro Deval (grading F) (LC 21-070) (%) | 8 | | | | | | |
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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 Wemindji Access Road | Sampled by : Khaled Haiek |
| Project No : 158100425.500.710.2 | Sampling Date : July 16, 2022 |
| Sample No : Q-47.1-BH22-02 DC-02 to DC-05 | |
| Depth : 1,73 - 7,01m | |

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 ³) | |
| % Fine Particles | | Optimum Moisture Content (%) | |

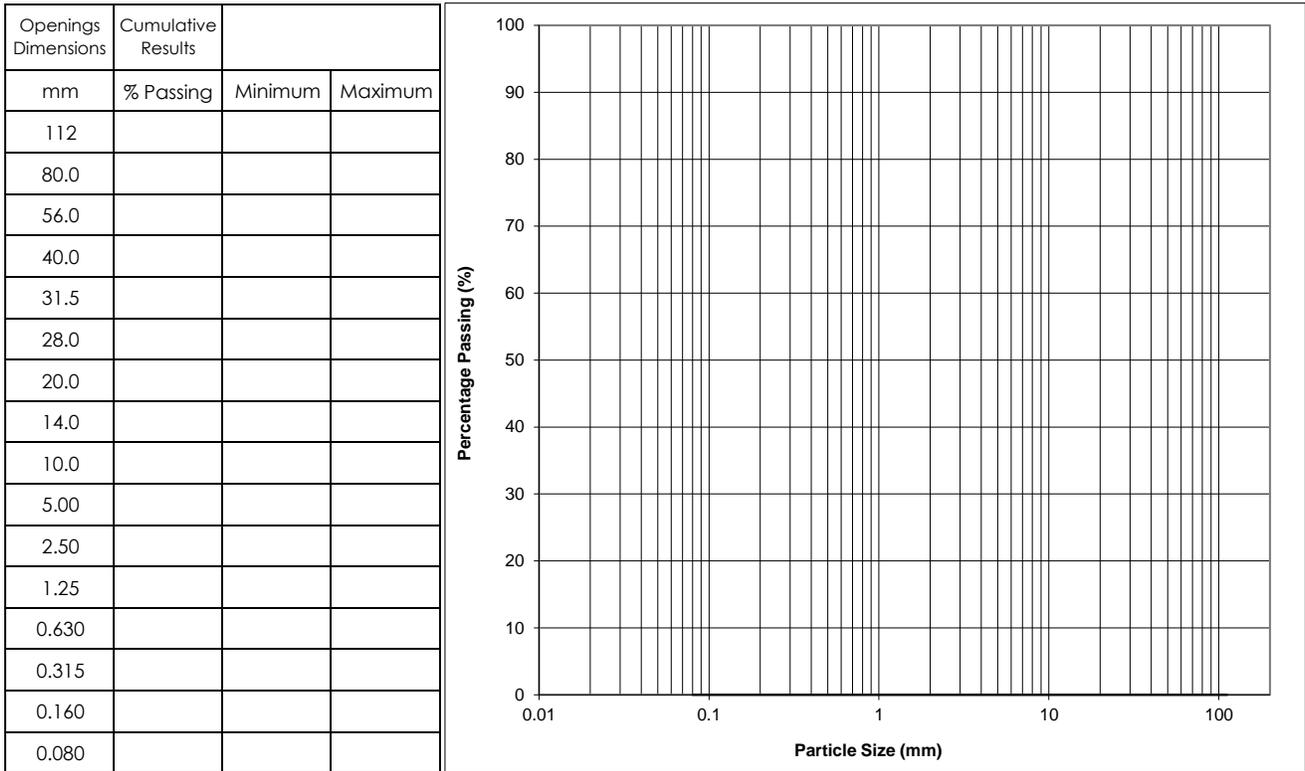
| Other Tests | | | | | | | |
|---|---------|--------------|-----|-----------------|---------|--------------|-----|
| Test / Standard | Results | Requirements | | Test / Standard | Results | Requirements | |
| | | Min | Max | | | Min | Max |
| Los Angeles (grading B) (LC 21-400) (%) | 38 | | | | | | |
| Micro Deval (grading F) (LC 21-070) (%) | 9 | | | | | | |
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Remarks : _____

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

| | |
|--|---------------------------------------|
| Client : Cree Development Corporation | Type of material : Crushed rock cores |
| Project : La Grande Alliance - Feasibility Study - Phase I Wemindji Access Road | Sampled by : Khaled Haiek |
| Project No : 158100425.500.710.2 | Sampling Date : July 16, 2022 |
| Sample No : Q-47.1-BH22-02 DC-05 to DC-07 | |
| Depth : 7,01 - 10,69m | |

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 ³) | |
| % 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) (%) | 38 | | | | | | |
| Micro Deval (grading F) (LC 21-070) (%) | 8 | | | | | | |
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Remarks : _____

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

Appendix E Photographic Album





Photo 1: Q-28.2-BH22-01 (Wet)

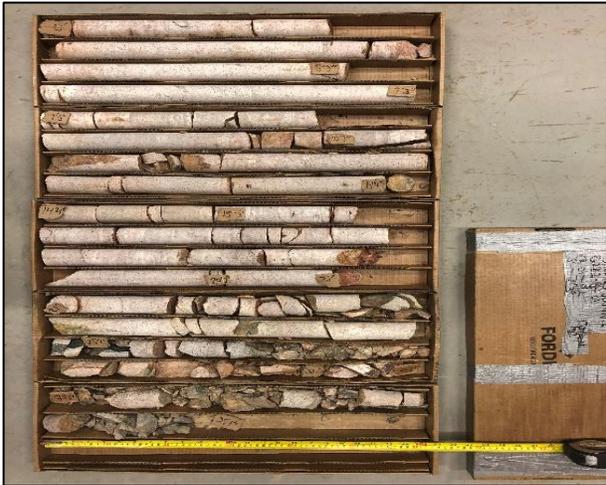


Photo 2: Q-28.2-BH22-01 (Dry)



Photo 3: Q-28.2-BH22-02 (Wet)



Photo 4: Q-28.2-BH22-02 (Dry)





Photo 1: Q-47.1-BH22-01 (Wet)



Photo 2: Q-47.1-BH22-01 (Dry)



Photo 3: Q-47.1-BH22-02 (Wet)



Photo 4: Q-47.1-BH22-02 (Dry)

