





Newfoundland and Labrador Hydro Lower Churchill Project Pre-Feed Engineering Services

AC1060 - Field Investigation & Construction Requirements

230 kV Transmission Line Muskrat Falls to Gull Island



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LOWER CHURCHILL PROJECT

TECHNICAL REPORT

AC1060 – Field Investigation & Construction Requirements 230 kV Transmission Line Muskrat Falls to Gull Island

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FINAL

February 2008

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EXECUTIVE SUMMARY

This report presents findings with respect to the location, number of camps, marshalling yards, access routes, and tote roads associated with the proposed construction of a 230 kV transmission line from Muskrat Falls to Gull Island, approximately 66 km. Also presented are the results of a geotechnical investigation program along the route which included test pit excavation, anchor pull out tests, hand augering and bog probes.

Line Routing

The 230 kV line from Muskrat Falls to Gull Island is assumed to parallel (approximately 85 m to the south) the existing 138 kV line running between Happy Valley-Goose Bay and Churchill Falls. As a result of other investigative work for the Lower Churchill Project, the converter station and switchyard were relocated from the south side of Churchill River to the north side. The variant study for Muskrat Falls recommends a stand-alone switchyard at Muskrat Falls. These changes will result in some minor adjustments for the transmission line routing which are reflected on the report drawings.

Access Roads and Tote Roads

Throughout the proposed route of the 230 kV transmission line there is excellent access from the Trans Labrador Highway. In a number of instances the proposed 230 kV line will cross the highway. The line is also adjacent to the existing 138 kV wood pole transmission line running between Churchill Falls and Happy Valley-Goose Bay.

Tote roads or access trails from the Trans Labrador Highway, suitable for the proposed transmission line, were established as part of the construction of the existing 138 kV transmission line. The number of access trails, with one addition at Edward's Brook, is adequate to construct the new 230 kV line. It is anticipated that heavier equipment will be used to construct the new 230 kV line versus the equipment used for construction of the existing 138 kV line. The decision as to the extent of upgrading/improvement required along the existing access routes should be left to the transmission line contractor(s) as part of the competitive bidding process. The best season for transmission line construction is winter when the ground is sufficiently hard to allow movement of heavy equipment, resulting in less environmental disturbance.

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<u>Camps</u>

During construction of the Muskrat Falls Hydroelectric Development, it is assumed that a main camp will be operational at the Muskrat Falls site. Space can be made available in that camp to accommodate transmission line construction personnel, depending on the schedule for constructing the transmission line. In the event space is not available, provision should be made in the main camp to add bunkhouse type trailers for transmission line personnel and have them share the remaining facilities (kitchen, diner, recreational, first aid station, communications etc.) with the main camp.

Marshalling Yards

The most likely scenario for delivery of materials and equipment would be by marine transport to Happy Valley-Goose Bay and then by road to Muskrat Falls. An area of approximately 1.5 hectares would be required to marshall materials. It is proposed that the marshalling yard be part of the laydown area for construction of the main project.

Based on the assumption that the owner will procure materials, it is recommended that the owner provide a fully prepared marshalling yard, where materials can be received, sorted and checked, prior to being turned over to the contractor at the start of construction.

Geotechnical

The geotechnical program included:

- Air photo interpretation combined with base map preparation and fieldwork preparation;
- Two (2) site reconnaissance trips; The first to assess the general outline of the route and the second to examine the ground in some of the remote areas;
- Site Investigations; A total of sixteen (16) test pits, six (6) hand auger holes, several hundred bog probes and two (2) anchor pull out tests were used to inventory the soil and rock conditions along the route;
- Laboratory testing; Index testing was performed on representative samples from along the route;

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The transmission line route follows the Churchill River lowlands which comprise a mixed terrain of mostly glaciofluvial sand with some sand and gravel in the lower elevations. At higher elevations minor rock outcrops and some glacial till with boulders are encountered. Occasionally marine sediments in the form of silt/clay exist in areas where the overlying fluvial material has been eroded away. Rare bedrock outcrops consisted of a hard granite gneiss with some shear zones.

The Allowable Bearing Capacities in the various types of material encountered based on empirical values and test data are:

- Glaciofluvial sand and the sand and gravel deposits 250 kPa;
- Glacial till 300 kPa;
- Marine sediments 50 kPa;
- Submerged high quality fill in bogs or other wet areas 100 kPa.

The unit weight for properly compacted soils ranged from 16 kN/m³ for the sand to over 22 kN/m³ for the glacial till.

The rock tested had excellent holding strength at one (1) test location, however, at another location, deliberately placed in a shear zone, the anchor head would not hold.

Several quarries and borrow pits exist along the proposed route and are accessible from the nearby Trans Labrador Highway. The locations are indicated on the report drawings. Sufficient high quality soil and rock fill materials are available over the entire length of the line.

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1 INTRODUCTION

1.1 TERMS OF REFERENCE

The Scope of Work covered by this report was outlined in Work Task Order (WTO) AC1060 titled Field Investigation and Construction Requirements - 230kV Transmission Line – Muskrat Falls to Gull Island.

In brief, the work included the following:

- Assess the requirements for camps, marshalling yards, access routes and tote roads necessary for the construction of the double circuit 230 kV transmission line from Muskrat Falls to Gull Island;
- Recommend locations for camps, marshalling yards, and typical layout drawings for each;
- Conduct a field investigation program to confirm the geotechnical conditions along the transmission line route and in the area of the proposed supporting infrastructure;
- From the field investigation, establish the availability of construction materials along the route;
- Present the data collected in an ArcGIS compatible format covering the entire line route, associated access routes and other related areas.

1.2 PREVIOUS STUDIES

Information and data for this report were obtained from a review of the 1999 Feasibility Study on Development of EHV Transmission Lines in Labrador¹ and from site visits carried out during the periods July 24 to July 26, 2007 and September 18 to September 21, 2007. Hydro's TL 240 fording location maps provided valuable information for assessing constructability issues.

¹ Feasibility Study on Development of EHV Transmission Lines in Labrador, RSW-EDM, February 1999.

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1.3 CONTENT OF THE REPORT

The report presents the findings with respect to the location and number of camps, marshalling yards, access routes, and tote roads required. Also presented are the results of the geotechnical field investigation program which included test pit excavation, anchor pull out tests, hand augering and bog probes.

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2 LINE ROUTING

2.1 GENERAL

A comprehensive feasibility study on the development of EHV Transmission Lines in Labrador for the Lower Churchill Project (Gull Island and Muskrat Falls) was completed in February 1999¹. The report included a proposed routing of the 230 kV line between Muskrat Falls and Gull Island. Hydro has subsequently decided the 230 kV line routing would parallel (approximately 85 m to the south) the existing 138 kV line running between Happy Valley-Goose Bay and Churchill Falls. See Drawing #'s 722850-AC1060-43DD-0001 to 0005.

2.2 LINE ROUTING ADJUSTMENT

Originally the converter station and switchyard for the Gull Island Project were located on the south side of the Churchill River. As a result of other investigative work for the Lower Churchill Project, the converter station and switchyard were relocated from the south side of Churchill River to the north side. The 230 kV line will now be slightly shorter by about four (4) km. The change in converter station location also results in a change in the routing across the Churchill River for the HVDC line to the Island. It is recommended that when the exact location of the major structures on the HVDC line for the river crossing is better established, a geotechnical investigation should be undertaken for the tower structure foundations.

It is anticipated that, as a result of other investigative work ongoing on the variants for the Muskrat Falls Project, the switchyard will probably be relocated from the powerhouse to a stand-alone switchyard. The drawings show a relocated switchyard near the powerhouse which results in only a minor adjustment for the transmission line routing.

¹ Ibid.

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3 ACCESS ROUTES AND TOTE ROADS

3.1 ACCESS ROADS

Access to the proposed 230 kV transmission line is excellent, as it is adjacent to the Trans Labrador Highway throughout its length. In a number of instances, the proposed 230 kV line will cross the highway. It is also adjacent to the existing 138 kV wood pole transmission line running between Churchill Falls and Happy Valley-Goose Bay.

Tote roads or access tracks from the Trans Labrador Highway to the proposed transmission line were established as part of the original construction of the existing 138 kV transmission line. The location of these access points together with information on fording locations were identified on Hydro's fording location maps. A site reconnaissance was used to look at the access points to determine their adequacy to construct the new 230 kV transmission line.

The maps were relatively accurate with the exception of the access near stream crossing number 15. The existing access is slightly to the east and crosses a wet area. It was agreed that the location shown on the map is the preferred location and, since it is a new access, it will have to be established by the contractor. Also, an additional existing access near Edward's Brook was identified and has been added to the maps.

Between Muskrat Falls and the Gull Island converter station, a total of seven (7) stream/river crossings were identified on the fording location maps as "<u>no fording</u>" <u>locations</u>. Four (4) of these crossings are the major rivers; namely, Lower Brook, Upper Brook, Edward's Brook and Penas River. Access points exist on either side of these river crossings so bridges will not be required at these crossings in order to construct the transmission line. The three (3) remaining locations are subject to the crossing requirements of the regulatory agency, should they be required.

It is anticipated that heavier equipment will be used to construct the new 230 kV line versus the equipment used for construction of the existing 138 kV line. The existing

access points will be upgraded, extended, or improved to handle the heavier traffic. The decision as to the extent of upgrading/improvement should be left to the transmission line contractor as part of the competitive bidding process. The contract specification should describe and define the environmental guidelines and restrictions the contractor has to follow. The contractor should choose the type and size of equipment he wants to use to construct the line. The best season for transmission line construction is winter when the ground is sufficiently hard to allow movement of heavy equipment, resulting in less environmental disturbance.

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4 CAMPS AND MARSHALLING YARDS

4.1 CAMP(S)

4.1.1 General

During the construction of the Muskrat Falls hydroelectric powerstation, it is assumed that a main camp will be operational at Muskrat Falls and space may be available to accommodate transmission line construction personnel, depending on the transmission line construction schedule. Since the actual construction time for the line is relatively short (approximately six (6) months), it could be scheduled during a period when construction activity on the main plant is at its ebb towards the end of the project. There also exists the possibility that camp space may be available at Gull Island depending on the completion schedule for the Gull Island powerstation.

4.1.2 Number of Camps

Since the preferred routing of the proposed 230 kV transmission line is parallel and adjacent to the existing 138 kV wood pole transmission line between Goose Bay and Churchill Falls, as well as to the all weather Trans Labrador Highway, and since the total line length is only 60 kms, a one-camp set-up will be all that is required. The preferred camp location would be at Muskrat Falls. One at Gull Island would also be acceptable.

Another option would be to construct a temporary camp along the Trans Labrador Highway remote from the Muskrat Falls or Gull Island sites. Such a site was not investigated as part of this work; however, a suitable location should not be an issue as there is at least one site where the contractor engaged to upgrade the Trans Labrador Highway had a temporary construction camp. This option has merit should the owner decide the transmission line contractor will provide his own temporary camp.

4.1.3 Camp Layout

It is assumed that either one or both of the Gull Island or Muskrat Falls camp sites erected for the construction of the powerstations will be operational during the time of

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construction of the transmission line. Should lodging space for transmission line construction personnel not be available, the most economical and logical solution would be to add bunkhouse trailers only to the main camp and have transmission line personnel share the remaining facilities (kitchen, diner, recreational, first aid station, communications, etc) with the main camp.

The number of construction workers is based on the construction schedule. For a typical 230 kV transmission line in the terrain conditions existing along the route, an overall construction period of approximately six (6) calendar months plus clean-up time appears reasonable, allowing three (3) months for each of the three (3) overlapping major operations of foundation, tower assembly and erection, and conductor installation.

Based on the above, bunkhouse trailers to accommodate approximately 150 workers would be required. Drawing # 722850-AC1060-43DD-0007 shows a typical layout for bunkhouse type trailers.

The scenario presented assumes the camp facilities will be supplied by the owner. For the construction of this particular transmission line, this is probably the most economic approach as only sleeping accommodations have to be added to the main camp.

4.1.4 Water, Sewer, and Waste Disposal

As it is recommended that accommodations be part of the main construction camp for the project, separate water and sewer services will not be required. Likewise, waste disposal procedures would be part of the operational requirements for the main camp.

4.2 MARSHALLING YARDS

4.2.1 Logistics

Both the Gull Island and Muskrat Falls extremities of the line are situated along the all-weather Trans Labrador Highway linking Baie Comeau, Quebec to Happy Valley-Goose Bay, Labrador, hence all transmission line materials and equipment could be

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transported by road from points west. One advantage of delivery by road would be just in time delivery which would reduce the requirement for marshalling areas.

The most likely scenario is that materials and equipment would be shipped via marine transport to Goose Bay and then by road to Muskrat Falls. Though it is generally more economical transporting by this method, it is limited to the period that the shipping channels are open, roughly between mid June and late November. Since the construction schedule is only approximately six (6) months, this lends itself to a mid summer or early fall delivery schedule with a one-winter construction period.

Construction of the transmission line during the winter may be the more desirable option, not only from the environmental disturbance point of view but also as stated in the 1999 Feasibility Study on page 131¹ "According to recent Hydro-Quebec statistics the production rate for certain equipment in winter is about 20% higher than in other seasons".

4.2.2 Yard Location

The proposed location for the marshalling yard is in the vicinity of coordinates N 5,904,100, E 648,226 and is located on Drawing # 722850-AC1060-43DD-0002. The site was selected based on the following:

- The gateway to the project is Goose Bay which is reached by road via the Trans Labrador Highway, by air via major carriers, and by sea. Goose Bay is 30 km by road from the Muskrat Falls site.
- Delivery of material, equipment, and supplies to the marshalling yard can be via a combination of land, air, or sea depending on delivery schedules.
- The marshalling yard is part of the lay down area for construction of the main project.

¹ Ibid.

Based on a review of material requirements presented in the 1999 Feasibility Study¹, an area of approximately 1.5 hectares would be required to marshal materials. Drawing # 722850-AC1060-43DD-0006 shows a typical layout of the proposed marshalling area.

4.2.3 Preparation of the Site

It is recommended that Hydro provide a fully prepared, levelled and fenced site to the transmission line contractor especially given that the marshalling area should be part of the main lay down area for the project. The delivery schedule for Hydro supplied permanent line materials (i.e., foundation and tower steel, anchor rods, conductor insulators and accessories, etc.) will dictate whether Hydro or the transmission line contractor will undertake the receiving, sorting, checking and storage of this material prior to the construction start-up.

It is assumed that procurement will be done by the Hydro, hence, it is preferable that Hydro receives, sorts, and checks all material at the marshalling yard and hands all materials over to the contractor prior to construction start-up.

¹ Ibid.

5 GEOTECHNICAL

5.1 GENERAL

The drawings in Appendix A show the specific test locations discussed in this report.

5.2 INVESTIGATION PROCEDURES

The geotechnical program was divided into several tasks:

5.2.1 Task 1 - Air Photo Interpretation/Base Map Prep/Fieldwork Prep

A series of stereo pairs, black and white air photos and colour air photo mosaics were provided by Hydro. These were examined to obtain remote sensing data on the landforms and surficial geology of the route. Hydro also provided route maps that were prepared for the environmental studies. These maps contained the approved stream crossings and locations of access trails, which aided in the planning of the work. During the study it was discovered that surficial geology and geomorphology mapping was being prepared by one of the environmental consultants, Jacques Whitford Ltd. Instead of producing a separate surficial geology map, it was decided to provide field information to Jacques Whitford so they could ground truth the air photo interpretation.

Published reports (see bibliography) of the area on surficial and bedrock geology were reviewed.

When the review of surficial and bedrock geology was completed, plans were finalized for the field investigation program. The intrusive program, that was identified in the original WTO Execution Plan, was modified. A reduction was made in intrusive investigations and more emphasis was placed on areas where varying conditions were expected, such as the area west of Lower Brook, where the line is located on a hillside.

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5.2.2 Task 2 - Reconnaissance

Two (2) reconnaissance trips were made by helicopter. The first trip was on July 25, 2007, to become familiar with the route and any problems with access for testing. The second trip was on September 9, 2007, to examine the topographic features and soil conditions in remote locations. The route maps supplied by Hydro were used during this process to record the surficial geology of the route. Soil/rock conditions, in areas that represented a change in the surficial geology, were examined more closely.

5.2.3 Task 3 - Permits

Hydro had in place permitted access trails and fording sites. Intrusive investigations were limited to those areas where permits were in place and in areas away from streams and water bodies where permits were not required.

5.2.4 Task 4 - Ground Truthing and Geotechnical Investigations

The fieldwork for this investigation was performed between July 25 and September 28, 2007, using helicopter support. Mechanical excavators were used for test pit excavation. Hand auger probing and bog probing were performed by project personnel.

Areas of interest were examined on the ground and intrusive investigations were performed. Representative samples of the materials encountered were obtained and sent to the site laboratory for index testing. In total sixteen (16) test pits were excavated, six (6) hand auger holes were drilled, ten (10) areas of bog were probed and two (2) anchor pull out tests were performed. Eleven (11) samples were also obtained from existing borrow pits or road cuts near the transmission line for moisture density relationship and gradation testing.

Test Pits

Sixteen (16) test pits were excavated in representative areas that provided coverage of the anticipated soil conditions for the 66 km long route. The test pit results are included in Appendix B. The results of the two (2) test pits excavated for the Muskrat

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Falls campsite are also included in the Appendix as they are representative of soil conditions for the transmission line in that area.

Hand Auger Holes

In areas where long mobilizations for heavy equipment were required and where the reconnaissance indicated suitable soil, six (6) hand auger holes were drilled to refusal or to a maximum reach of the apparatus at about three (3) m. The hand auger results are included in Appendix C.

Bog Probes

Although bog probing was not specifically identified in the WTO preparation, nine (9) areas containing bog were identified during the reconnaissance trips that were close to the route and were probed to aid the designers in making decisions on the final routing. Some of the areas had more than one small bog and each bog is reported individually. The probe results are included in Appendix D.

Anchor Pull Out Tests

Two (2) anchor pull out tests were performed along the area of the rocky ridge just west of Lower Brook. This area is the only one along the route where bedrock is expected. The rock bolts were installed in bedrock (granite gneiss). The rock bolts were stressed to determine the ultimate holding capacity of the anchor rod only.

25 mm diameter utility pole rock bolt anchors, with cable eyes removed and the ends threaded, were used for testing.

The anchors were installed approximately 1.8 m into bedrock in 45 mm diameter drill holes. The anchor shells were 50 mm long and ribbed. The shell was anchored by torquing with a 0.6 m long pipe wrench to refusal. No grout was used as the holding resistance of the anchor in the rock was required.

The testing equipment was calibrated in imperial units and the results were reported in the same units. The anchor was then loaded to two (2) tons (short). Every two (2) minutes a load of two (2) tons was added until either the anchor failed or the jack had

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reached its maximum capacity of 18 tonnes. The test results are included in Appendix E.

Moisture Density

All samples collected during the field investigation were tested for gradation. Selected samples from existing borrow pits or road cuts that were representative of the various materials encountered were tested for Standard Proctor Dry Density. All testing was in conformance with applicable ASTM standards. Moisture content results are included in Appendix F.

5.2.5 Task 5 - Reporting

All of the material reviewed, field test results and interpretations are assembled in this technical report.

5.3 SURFICIAL GEOLOGY

The site is located on the Churchill River Lowlands. These lowlands are restricted to the river valley in a band some three (3) to eight (8) km wide. The former glacially scoured valley has been in filled with a combination of glacial till at the bedrock surface which has been overlain by fine-grained estuarine marine sediments (sand/clay) and then by fluvial sand. There are sporadic areas where the lower sediments and bedrock rise through the overlying sands. All of these sediments have been incised by the modern day Churchill River and its tributaries. At the intersection of the tributaries with the Churchill River, sand and gravel has been deposited. Most of the larger rivers in the area are running over a bed of cobbles and boulders.

The upper sides of the Churchill River Valley are covered with generally thin deposits of glacial till. Bedrock is exposed on some steeper hillsides and riverbeds.

Bogs have developed in low-lying flat areas where the marine sediment, some other low permeability soil, or bedrock is located near the ground surface.

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5.4 BEDROCK GEOLOGY

The 66 km long transmission line traverses a Precambrian age geology dominated by crystalline metamorphic rocks composed of granite gneiss with some dark mafic material and numerous pegmatite stringers. Bedrock is at or near the surface on the proposed transmission line route at two (2) locations; both sides of Muskrat Falls and just west of Lower Brook.

5.5 INVESTIGATION RESULTS

Upon completion of the Air Photo Interpretation (API) and terrain analysis, calculations were made for the type of soil, bog, and rock expected along the route in the upper 4 m. This calculation was further upgraded upon completion of the fieldwork for the project. The percentages of the various types may be summarized as follows:

•	Bog lands	4%
•	Bare rock or rock concealed under thin organic soil	3%
•	Areas of thin glacially produced soil	17%
•	Areas of thick glacially produced soils	9%
•	Fluvial sand/sand dunes	55%
•	Fluvial sand and gravel	9%
•	Estuarine marine sediments	3%

The percentages of the various types were determined, based on visual observations, test pit excavation and information from the report "Surficial Geology and Geomorphology, Proposed TL240 Line" and are rounded to the nearest one.

5.6 GEOTECHNICAL DESIGN PARAMETERS

By far, the most common landform throughout the route is fluvial sand. This soil, in all cases observed and tested, is a fine to medium grained material with a trace of fines and some gravel. Some sand and gravel exists along the larger tributaries and in higher elevations at the uppermost fluvial terraces. Sand dunes are common on top of the fluvial sand.

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Glacial till comprising a well graded, diamicton of sand and gravel with varying amounts of fines, cobbles and boulders was encountered near the central portion of the route.

Marine sediments (silt/clay) are evident in eroded areas and deeply incised tributaries of the Churchill River.

Minor bog lands exist throughout the area, however, the route has been carefully chosen to avoid most of it. The bog soil is not suitable for bearing or anchoring or reuse as fill.

Frost penetration in this area is expected to be 2.5 m based on data from the Canadian Foundation Engineering Manual, 3rd Edition. The susceptibility for frost action in glacial till and marine soil containing significant fines is moderate to objectionable. In clean sand and gravel, away from the water table, frost action will be slight.

The geotechnical parameters for soils expected along the route are presented in the following table:

Soil or Rock Type	Allowable Bearing Capacity kP _a	Ka	Kp	SG	γ kN/m³	γ kN/m ³ submerged	φ S _u	Recommended Anchoring Procedure
Fluvial Sand/Dune Sand	250	0.33	3.00	NA	18	8	30°	Gravity
Fluvial Sand and Gravel	250	0.31	3.26	NA	19	9	32°	Gravity
Clay/Silt	50*	0.39	2.56	NA	NA	10	25 kPa	Gravity
Glacial Till [undisturbed]	300	0.24	4.20	NA	22	12	38°	Gravity
Submerged Fill in Bogs or Other Wet Areas	100	0.36	2.77	NA	11	9	28°	Gravity
Granite Gneiss	3000	NA	NA	2.6	25	15	45°	Rock Bolts

 Table 1: Summary of Geotechnical Design Parameters

 K_a, K_p – Rankine Assumptions; SG – Specific Gravity; γ - Unit Weight; ϕ - Friction Angle; S_u – Undrained Shear Strength (clay/silt only); NA – Not Applicable

* This bearing capacity is preliminary. Consolidation testing should be performed during the final design stage of the project to predict the settlement characteristics of this soil which would ultimately determine the bearing capacity.

5.7 CONSTRUCTION CONSIDERATIONS

5.7.1 Materials

Construction of the transmission line will require material for fill and aggregates.

Clean acceptable fill may be found over most of the proposed route in the fluvial soils and in the thin veneer of glacial till that is abundant near the centre section of the line. Proctor values obtained are included in Appendix F.

Natural aggregates that may be suitable for concrete are known to occur at the Penas River. This material is clean fluvial sand and gravel existing in the terraces at that location. However, its proximity to nearby water bodies may preclude its use as aggregate.

Two (2) concrete and crushed aggregate suppliers are located in nearby Goose Bay.

Several quarries are located on the nearby TLH that are suitable for blast rock fill.

5.7.2 Quality Specifications

The quality of construction must be assured. It is suggested that CSA A23.1-00 Concrete Materials and Methods of Construction/Methods of Test for Concrete be followed and used as a minimum standard.

If grades are such that foundations are required on fill, the fill should be a high quality, well graded material, free from organics, with low fines content and placed at optimum moisture content. Granular B as specified by the Newfoundland Department of Transportation and Works would be acceptable. An alternative to Granular B may be used providing its quality is inspected and approved by qualified personnel prior to its use. The fill should be located away from steep embankments and protected from erosion. It must be placed in lifts not exceeding 150 mm thick and on soil which has been proof rolled. The fill must be compacted to 100% of its corrected maximum dry density (ASTM D 698-78). Foundations placed on well-compacted, engineered fill may be designed based on an allowable bearing pressure of 150 kPa, provided its placement is inspected by qualified personnel.

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With this allowable bearing pressure, the total settlement is expected to be less than 25 mm.

5.8 CLOSURE

This report was prepared for the exclusive use of Hydro for specific application to the project site. The field investigations and analyses were performed using generally accepted geological and engineering practices in accordance with the work plan developed and verbal requests from Hydro. No other warranty expressed or implied is made. The limitations of this report are attached in Appendix G.

SELECTED BIBLIOGRAPHY

Feasibility Study on Development of EHV Transmission Lines in Labrador, RSW-EDM, February, 1999.

Bedrock Geology of Newfoundland & Labrador, Department of Mines & Energy, Geological Survey, Government of Newfoundland & Labrador, Maps 1986 – 2001;

Map 2000 - 09 NTS 13F/SW Goose-Penas Rivers Area Map 1986 - 60 NTS 13F/SE Goose Bay Area

Charles F. Gower, Philippe Erdmer, and Richard J. Wardle, 1985; The Double Mer Formation and the Lake Melville rift system, Eastern Labrador.

Newfoundland and Labrador Hydro – 1998, SNC-AGRA Joint Venture, Final Feasibility Study, Muskrat Falls Hydroelectric Development.

Newfoundland and Labrador Hydro – 2006, AMEC, TL240 and RSW Fording Location Index Maps.

Newfoundland and Labrador Hydro – 2006, Jacques Woodford, Surficial Geology and Geomorphology, Proposed TL240 Line.

Newfoundland and Labrador Surficial Geology Map Series – 1998, Sheets 13F/7, 13F6, 13F3, 13C/14, Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey.

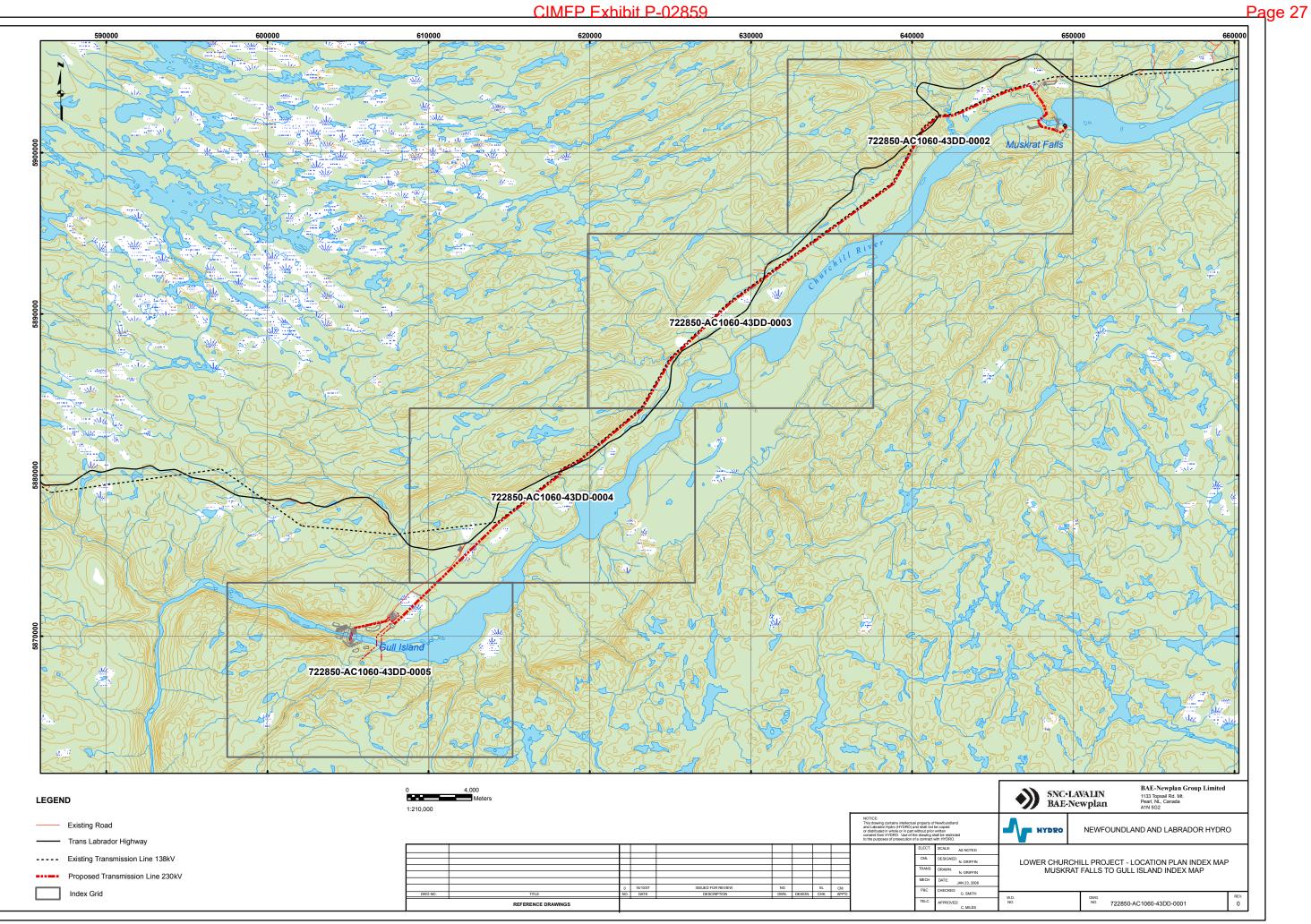
Proctor and Redfern Ltd., 1980; Lower Churchill Hydroelectric Project Reservoir Preparation Study.

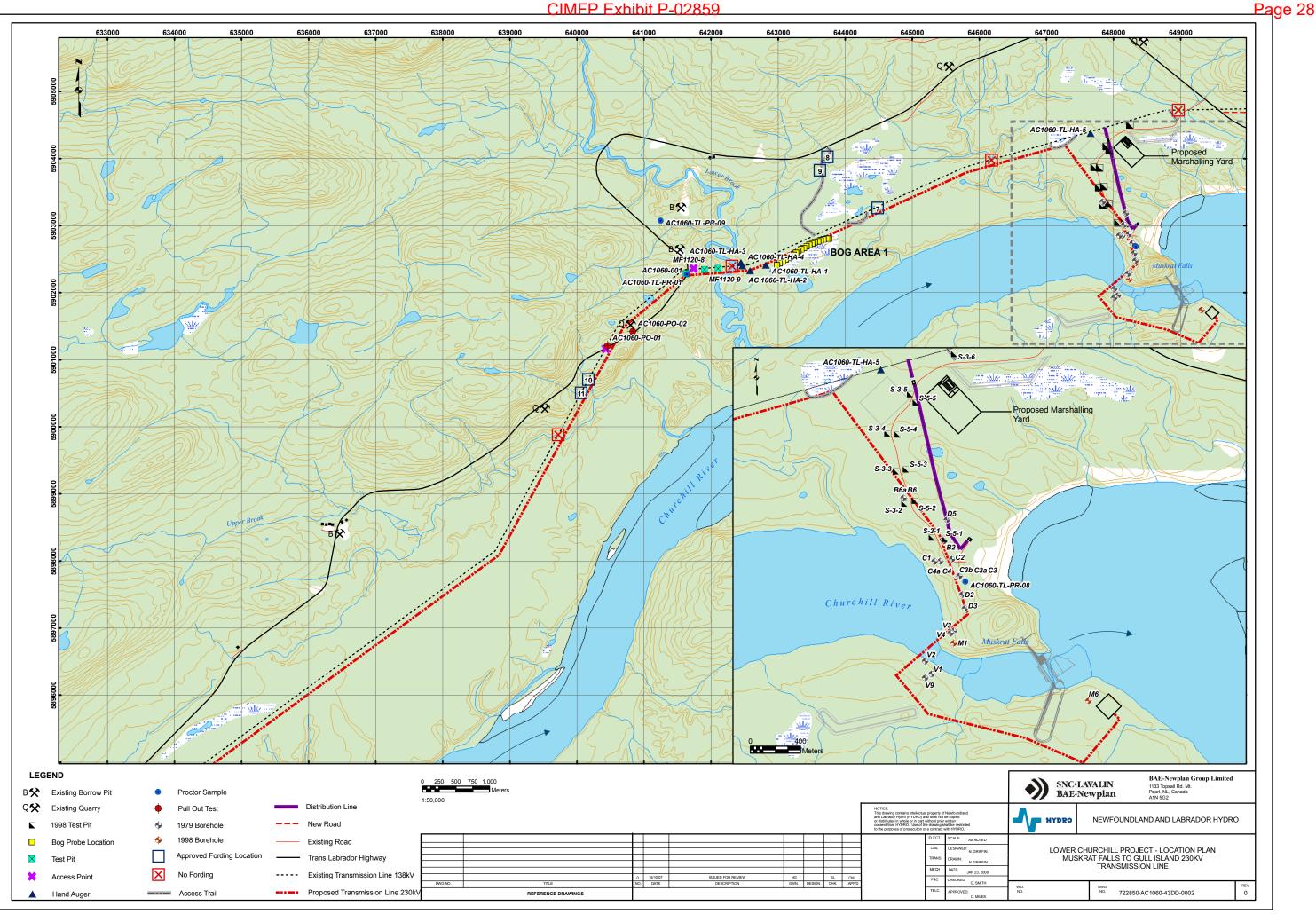
Canadian Foundation Engineering Manual, 3rd Edition.

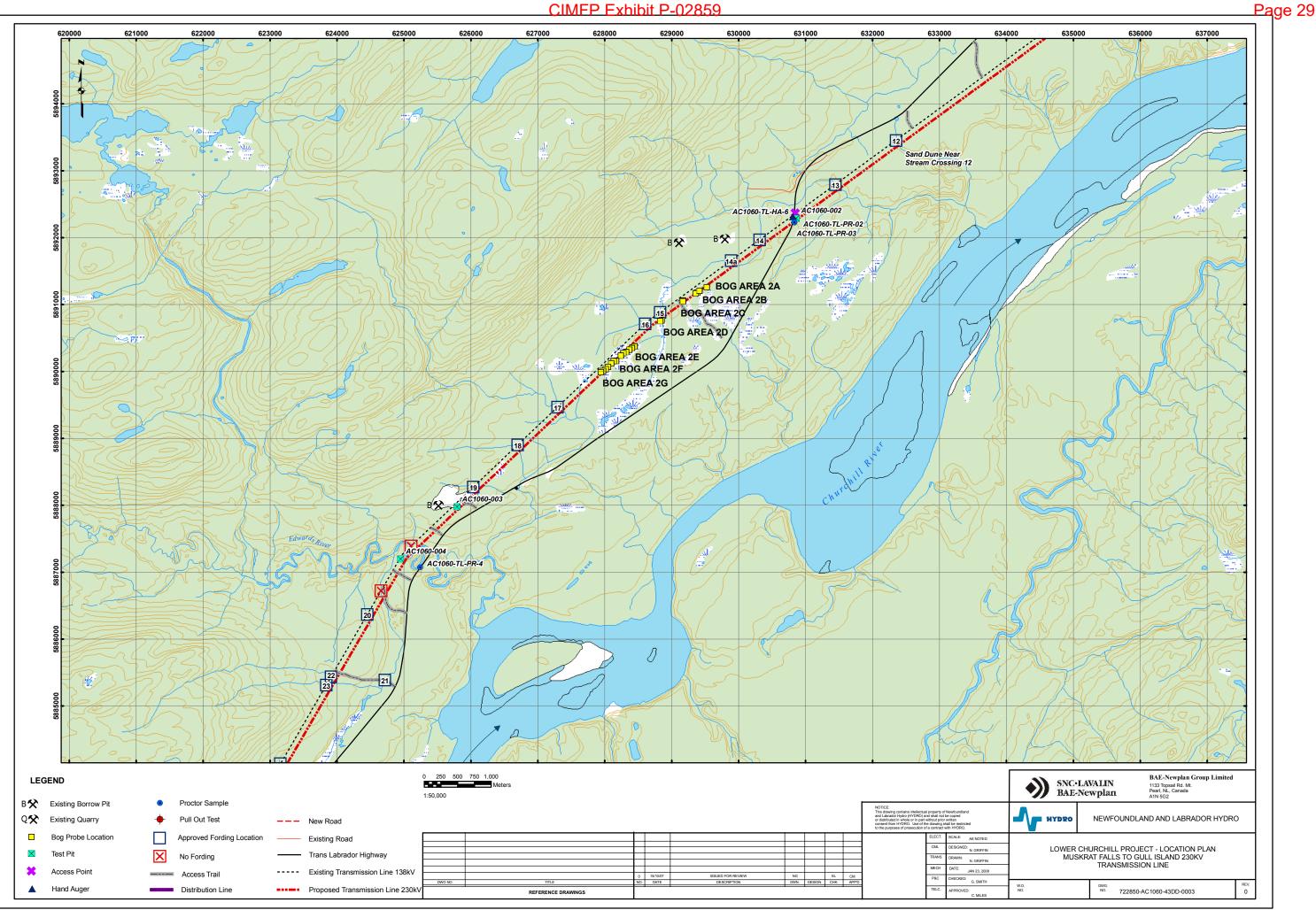
Page 26

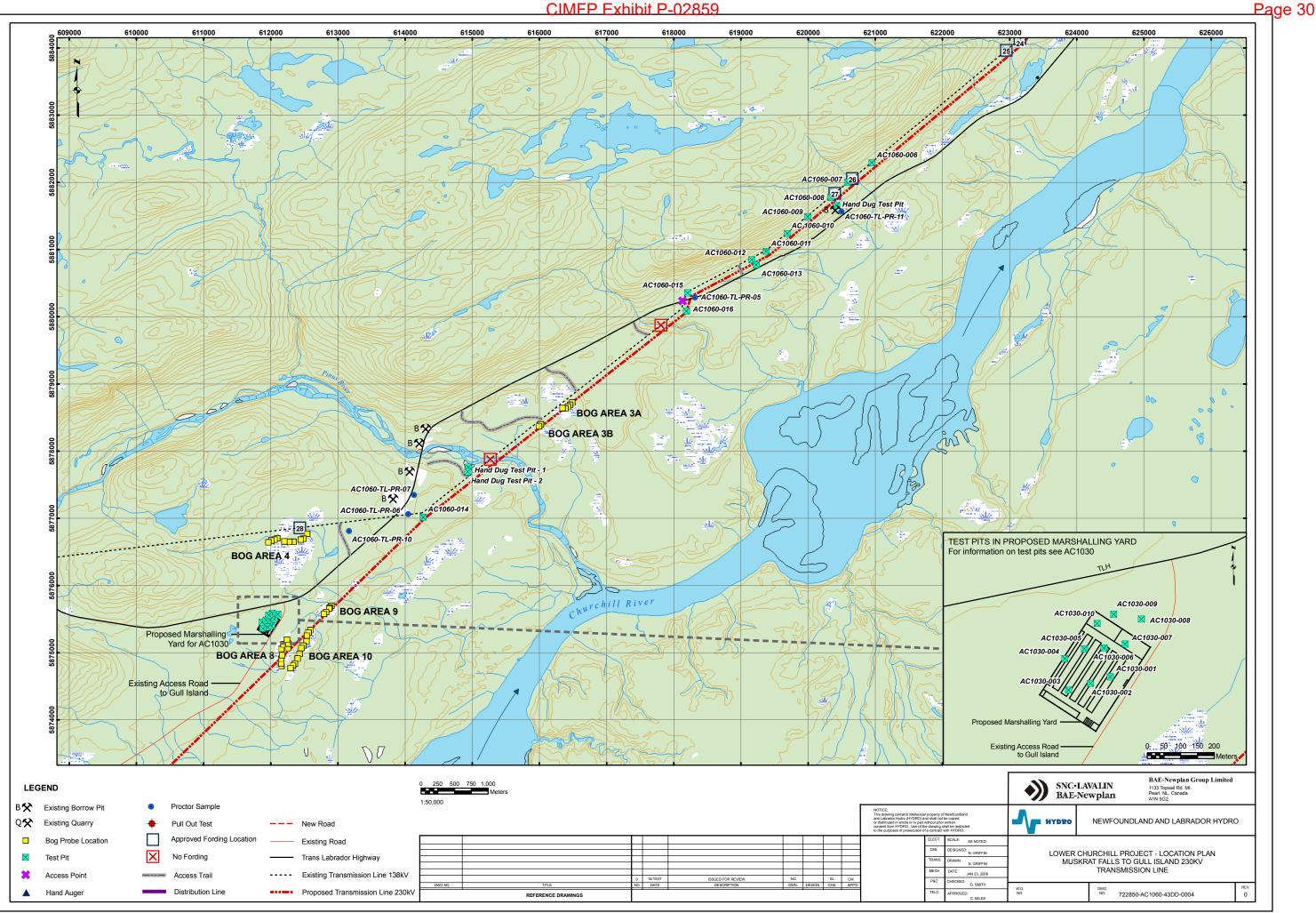
Appendix A

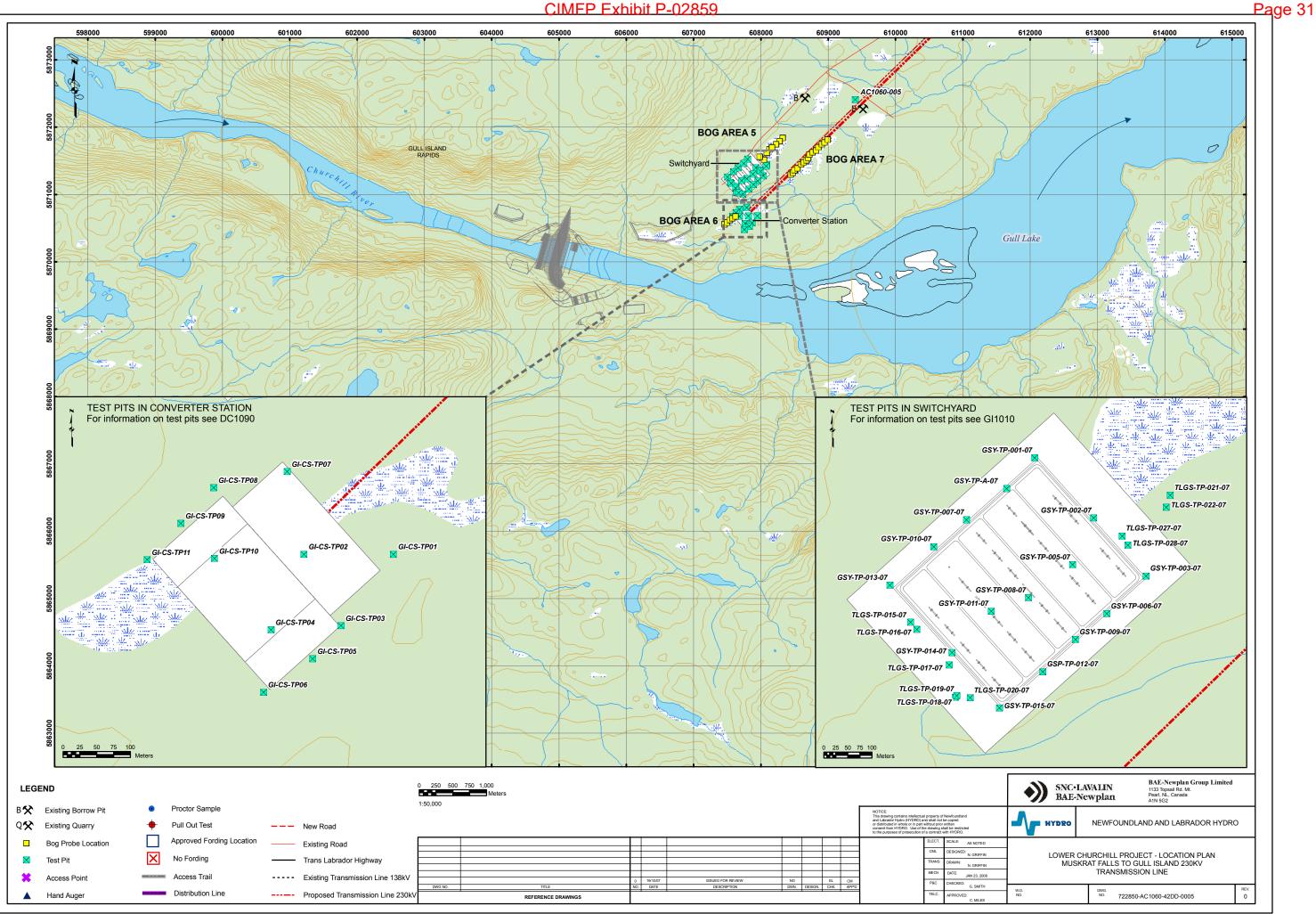
Drawings

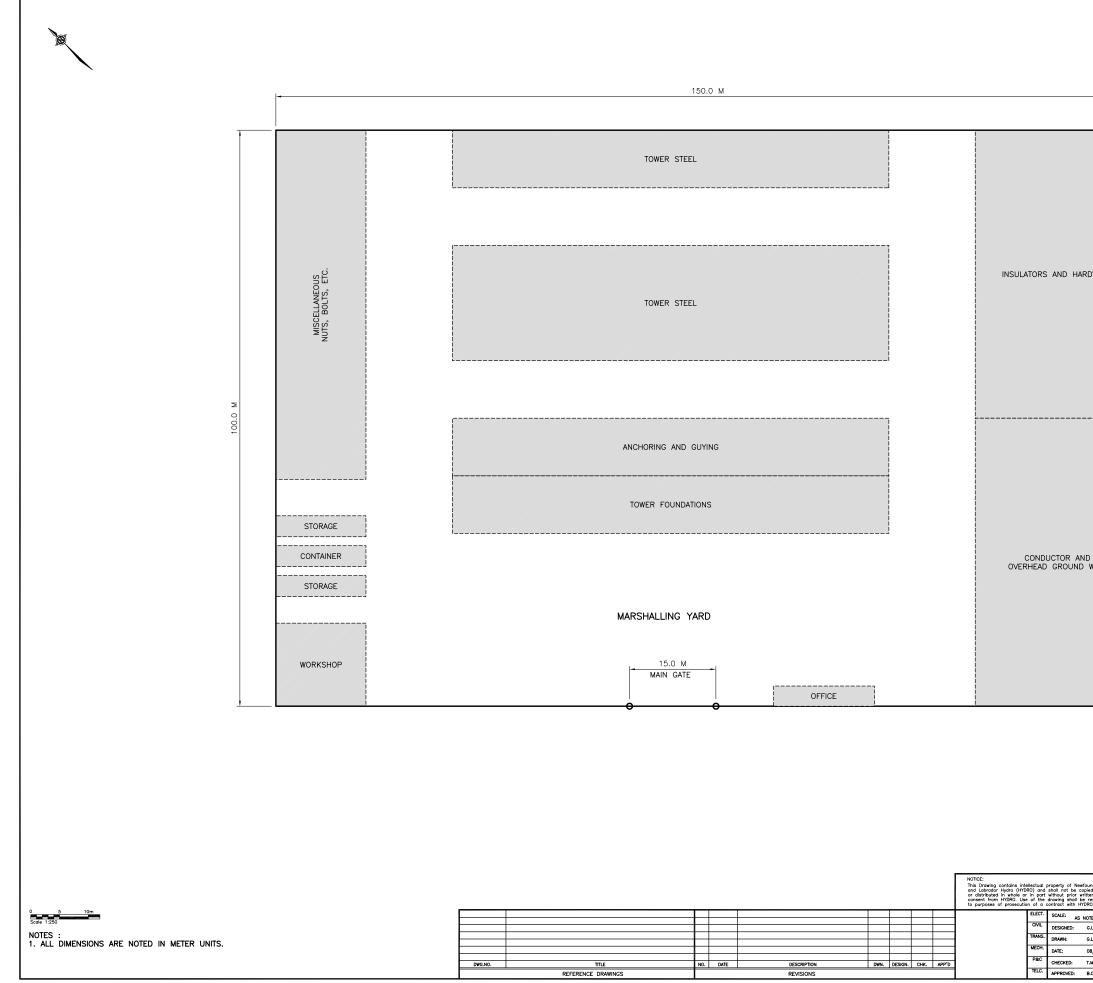




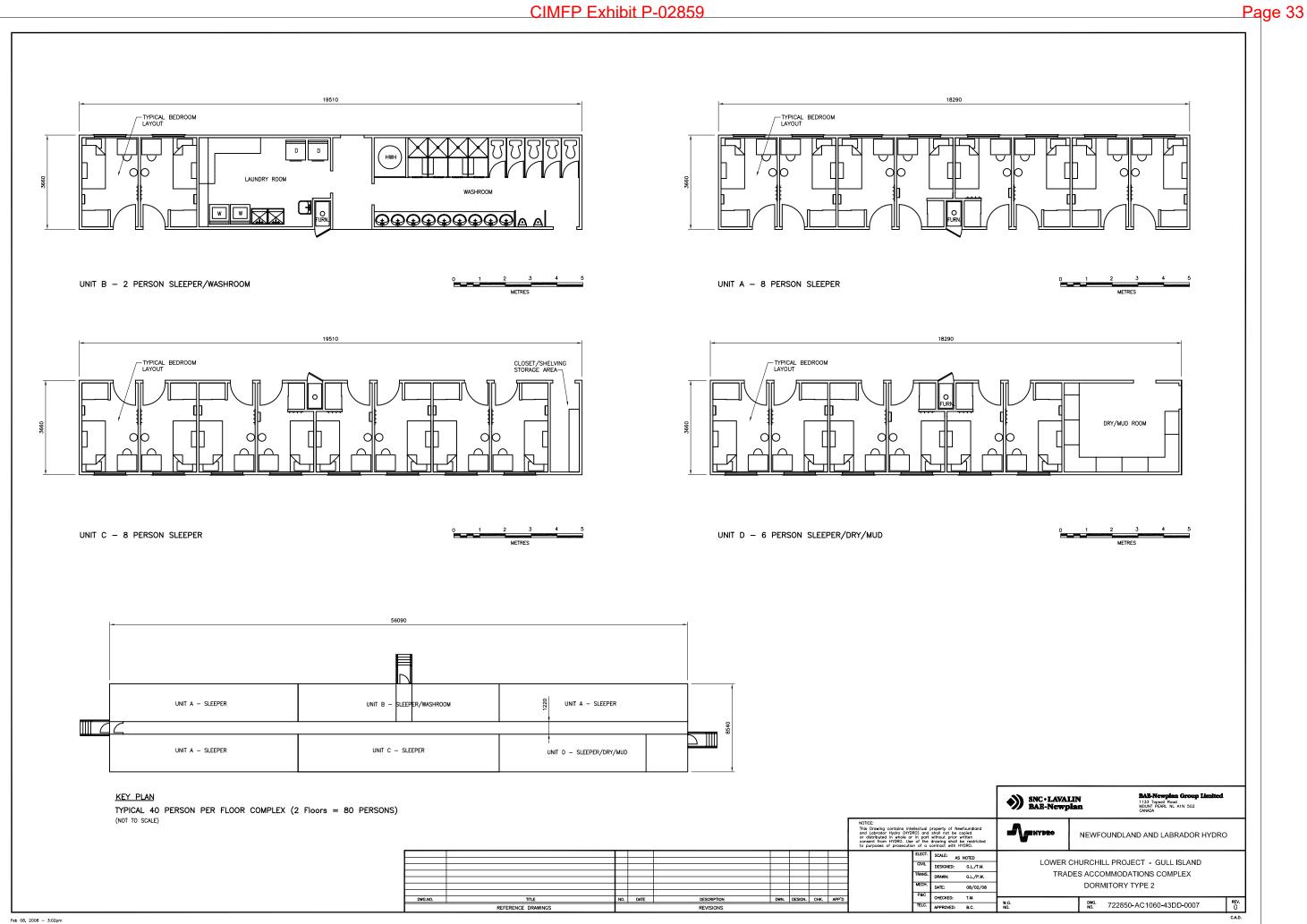








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awfoundland copied written be restricted HYDRO.		NEWFOUN	IDLAND AND LABRA	DOR HYDRO			
S NOTED G.L./T.M. G.L./P.W. 08/02/08		S TO GULL ISL	CT - TRANSMISSION AND 230kV TRANSM NG YARD LAYOUT				
Т.М. В.С.	- W.O. NO.	DWG. 72 NO. 72	2850-AC1060-43DD-	0006 REV 0 CAU			



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Appendix B

Test Pit Logs & Gradation Analysis



	Test Pit: AC10	60 - 1				
Newfoundland ar	nd Labrador Hydro		Date: 11-Sep-07			
Lower Churchill F	Project – 230 kV Transmission Lir	ne – Mu	uskrat Falls to G	ull Island		
AC1060	Location: N 5902284	EC	0641626	Inspector: Dave Oldford		
	Soil and Groundwater	r Cond	litions			
	Description		Sample ID.	Sample Depth (m)	Sample Type	
	<i>v</i> ith some fines, some cobbles, da	ımp,	1	2.0 - 4.0	Grab	
light grey, angula						
light grey, angula Bedrock.			NA	NA	NA	
	Estimated Boulders (%) 5 - 1	10	NA Estimated Max			
Bedrock.		10		Diameter (m) 1		
Bedrock. obbles (%) 15 : 10:05 am	Estimated Boulders (%) 5 -		Estimated Max Estimated Exca	Diameter (m) 1	.0	
Bedrock. obbles (%) 15 : 10:05 am	Estimated Boulders (%) 5 - 1 End Time: 10:30 am	es	Estimated Max Estimated Exca Volume (m ³)	Diameter (m) 1	.0	
		Description	Description	· · · · ·	Description Sample ID. Sample Depth (m)	

TEST PIT AC 1060-001

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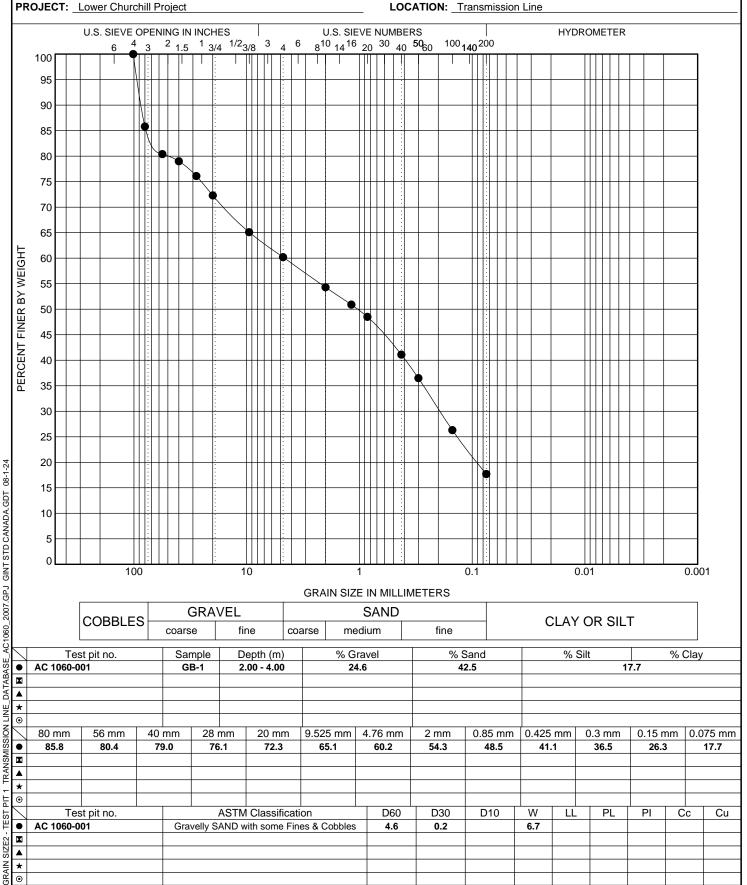
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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project





		Test Pit: AC106	0-2								
Firm:		nd Labrador Hydro		Date: 11-	Sep-07						
Project:		Project – 230 kV Transmission Line	e – Muskrat Falls to G								
Contract No.	AC1060	Location: N 5892290	E 0630859	Inspector	: Dave Oldford						
			Carlos and		Press.						
		Soil and Groundwater	Conditions								
Depth (m) From - To		Soil and Groundwater Description	Conditions Sample ID.	Sample Depth (m)	Sample Type						
	Roots and organ		Sample ID.		Sample Type NA						
From - To	-	Description	vn. NA	Depth (m)							
From - To 0.0 - 0.5 0.5 - 6.0	SILT (ML) - firm	Description ics, previously grubbed area, brow	vn. NA	Depth (m) NA 1.0 - 6.0	NA Grab						
From - To 0.0 - 0.5 0.5 - 6.0 Estimated	SILT (ML) - firm greenish olive.	Description ics, previously grubbed area, brow to stiff, wet, low plastic, very moist	vn. NA , 1	Depth (m) NA 1.0 - 6.0 Diameter (m)	NA Grab						
From - To 0.0 - 0.5 0.5 - 6.0 Estimated Start Tim	SILT (ML) - firm greenish olive. Cobbles (%) 0 re: 11:30 am	Description ics, previously grubbed area, brow to stiff, wet, low plastic, very moist Estimated Boulders (%) 0 End Time: 12:00 pm General Note	vn. NA , 1 Estimated Max Volume (m ³)	Depth (m) NA 1.0 - 6.0 Diameter (m)	NA Grab						
From - To 0.0 - 0.5 0.5 - 6.0 Estimated Start Tim	SILT (ML) - firm greenish olive. Cobbles (%) 0 e: 11:30 am	Description ics, previously grubbed area, brow to stiff, wet, low plastic, very moist Estimated Boulders (%) 0 End Time: 12:00 pm General Note	vn. NA , 1 Estimated Max Volume (m ³)	Depth (m) NA 1.0 - 6.0 Diameter (m)	NA Grab						
From - To 0.0 - 0.5 0.5 - 6.0 Estimated Start Tim	SILT (ML) - firm greenish olive. Cobbles (%) 0 e: 11:30 am	Description ics, previously grubbed area, brow to stiff, wet, low plastic, very moist Estimated Boulders (%) 0 End Time: 12:00 pm General Note	vn. NA , 1 Estimated Max Volume (m ³)	Depth (m) NA 1.0 - 6.0 Diameter (m)	NA Grab						

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TEST PIT AC 1060-002

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PERCENT FINER BY WEIGHT

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island LOCATION: Transmission Line U.S. SIEVE OPENING IN INCHES U.S. SIEVE NUMBERS HYDROMETER $6 \quad \overset{4}{3} \quad \overset{2}{2} \quad \overset{1}{1.5} \quad \overset{1}{3/4} \quad \overset{1/2}{1/2} \quad \overset{3}{3/8} \quad \overset{3}{4} \quad \overset{6}{6} \quad \overset{8}{8} \quad \overset{10}{14} \quad \overset{16}{20} \quad \overset{30}{30} \quad \overset{40}{40} \quad \overset{50}{50} \quad \overset{100}{140} \quad \overset{100}{200} \quad \overset{100}{140} \quad \overset{200}{200} \quad \overset{100}{140} \phantom{\overset{100}{140} \phantom{\overset{10}{140} \phantom{\overset{100}{140} \phantom{\overset{10}{140} \phantom{\overset{10}{$ Т Τ C Þ

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N SIZE																				\mp										
GRAIN SIZE2																														

Test Pit: AC1060 - 3



Firm:	Newfoundland ar	d Labrador Hydro				Son_07
Project:		Project – 230 kV Transmissio	n Line – Mi	iskrat Falls to Gi	Date: 11-3	
Contract No.	AC1060	Location: N 5887978)625794		: Dave Oldford
				,020,01	mopootor	
	-OK-	Soil and Ground	water Cond	litions		
Depth (m) From - To		Soil and Groundy Description	water Cond	itions Sample ID.	Sample Depth (m)	Sample Type
	compact, poorly	Description D – some fines, some grave graded, orange to light brow	l, loose to n, oxidized.			Sample Type NA
From - To	compact, poorly	Description D – some fines, some grave	l, loose to n, oxidized. ines, trace	Sample ID.	Depth (m)	
From - To 0.0 – 0.5	compact, poorly SAND and GRA boulders, subang compact. Sitly SAND with s	Description D – some fines, some grave graded, orange to light brow /EL - some cobbles, some f	l, loose to n, oxidized. ines, trace d, moist, trace	Sample ID.	Depth (m) NA	NA
From - To 0.0 - 0.5 0.5 - 1.0 1.0 - 3.0	compact, poorly SAND and GRA boulders, subang compact. Sitly SAND with s boulders, subang	Description D – some fines, some grave graded, orange to light brow /EL - some cobbles, some f gular, light brown, well grade some gravel, trace cobbles,	l, loose to n, oxidized. ines, trace d, moist, trace pact.	Sample ID. NA NA	Depth (m) NA NA 2.0 m	NA NA Grab
From - To 0.0 – 0.5 0.5 - 1.0 1.0 - 3.0 Estimated Co	compact, poorly SAND and GRA boulders, subang compact. Sitly SAND with s boulders, subang	Description D – some fines, some grave graded, orange to light brow /EL - some cobbles, some f gular, light brown, well grade some gravel, trace cobbles, gular, light grey, moist, comp	l, loose to n, oxidized. ines, trace d, moist, trace pact. b) 1 - 5	Sample ID. NA NA 1	Depth (m) NA NA 2.0 m Diameter (m)	NA NA Grab
From - To 0.0 – 0.5 0.5 - 1.0 1.0 - 3.0 Estimated Co Start Tim	compact, poorly SAND and GRAN boulders, subang compact. Sitly SAND with s boulders, subang bbles (%)10 - 15 e: 12:50 pm	Description D – some fines, some grave graded, orange to light brow /EL - some cobbles, some f gular, light brown, well grade some gravel, trace cobbles, gular, light grey, moist, comp Estimated Boulders (% End Time: 1:25 p Genera	l, loose to n, oxidized. ines, trace d, moist, trace pact. b) 1 - 5 m	Sample ID. NA NA 1 Estimated Max Estimated Exca	Depth (m) NA NA 2.0 m Diameter (m)	NA NA Grab
From - To 0.0 – 0.5 0.5 - 1.0 1.0 - 3.0 Estimated Co Start Tim	compact, poorly SAND and GRAN boulders, subang compact. Sitly SAND with s boulders, subang bbles (%)10 - 15 e: 12:50 pm	Description D – some fines, some grave graded, orange to light brow /EL - some cobbles, some f gular, light brown, well grade some gravel, trace cobbles, gular, light grey, moist, comp Estimated Boulders (% End Time: 1:25 p Genera s dry upon completion.	l, loose to n, oxidized. ines, trace d, moist, trace bact. b) 1 - 5 m I Notes	Sample ID. NA NA 1 Estimated Max Estimated Exca Volume (m ³)	Depth (m) NA NA 2.0 m Diameter (m)	NA NA Grab
From - To 0.0 – 0.5 0.5 - 1.0 1.0 - 3.0 Estimated Co Start Tim Very little sloug End of test pit	compact, poorly SAND and GRAN boulders, subang compact. Sitly SAND with s boulders, subang bbles (%)10 - 15 e: 12:50 pm ghing. Test pit was at 3.0 m (REFUSA	Description D – some fines, some grave graded, orange to light brow /EL - some cobbles, some f gular, light brown, well grade some gravel, trace cobbles, gular, light grey, moist, comp Estimated Boulders (% End Time: 1:25 p Genera	I, loose to n, oxidized. ines, trace d, moist, trace pact. b) 1 - 5 m I Notes	Sample ID. NA NA 1 Estimated Max Estimated Exca Volume (m ³)	Depth (m) NA NA 2.0 m Diameter (m)	NA NA Grab

TEST PIT AC 1060-003

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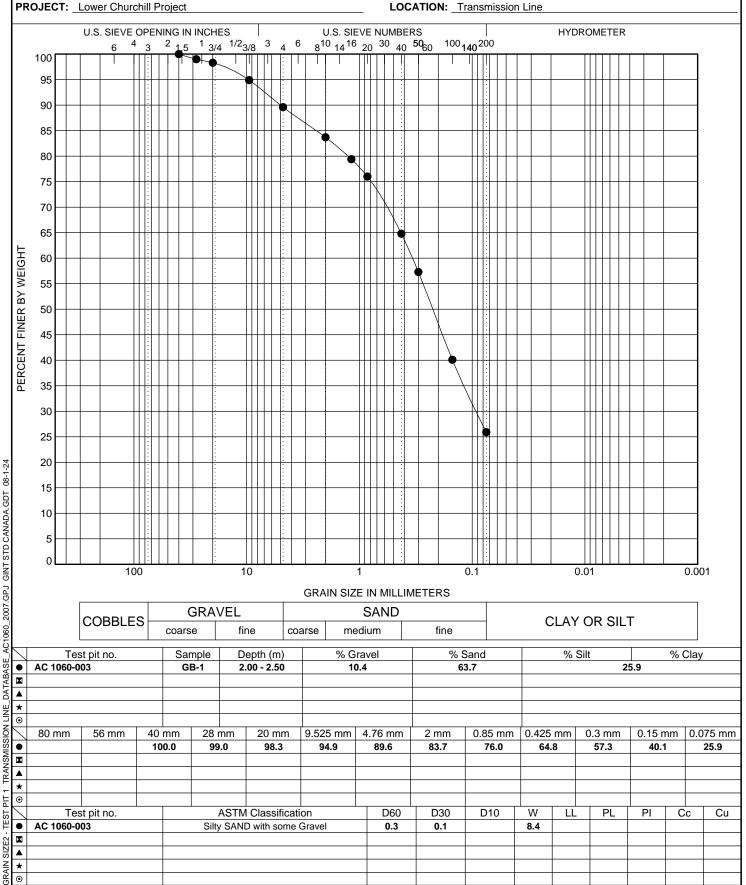
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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project





	Test Pit: AC1060 - 4														
Firm: Newfoundland and Labrador Hydro Date: 11-Sep-07															
Project:	Project: Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island														
Contract No.	AC1060	Location:	N 5887199	E 0624950	Inspector: Dave Oldford										



Soil and Groundwater Conditions

Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type
0.0 - 0.1	PEAT - dark brow	wn, organic soil, rootlets, moist, loose.	NA	NA	NA
0.1 - 0.5	Topsoil - brown v	vith organics/tree roots and branches.	NA	NA	NA
0.5 - 4.0		e fines, trace gravel - light grey, moist, lowly seeping (trickle) into test pit at	1	1.0 - 4.0	Grab
4.0 - 4.5	Marine SAND wit	th tree stumps and wood debris.	NA	NA	NA
Estimated (Cobbles (%) 0	Estimated Boulders (%) 0	Estimated Max	Diameter (m) N	A
Start Tim	e: 2:30 pm	End Time: 3:35 pm	Estimated Exca Volume (m ³)	vated	30
		General Notes	-		
Moderate sloug	phing at 2.0 m.				
Tree stump pre	esent at bottom of t	test pit. Test Pit was excavated next to	Upper Brook.		
North and East	coordinates obtai	ned using Garmin Etrex Legend Cx GF	PS.		

TEST PIT AC 1060-004

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

P	ROJE	CT:	Lower	Chur	chill P	roject	t							_	L	-0C	ATIO	N:	ans	missior	n Line								
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C1060						coar		fir	ne		CO	arse		ediun			f	ine											
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	1																												
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		mm	56 r	nm	40	mm	20	3 mm		0 m	m		5 mm 0.0		99.8		2 n 99			35 mm 97.8	0.42	2.8		.3 m 84.:		0.15	2.5)75 mm 1 2.5
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GRAIN SIZE2 - TEST PIT 1 TRANSMISSION LINE_DATABASE_AC1060_2007. [6] 노 [노] 머 [소] 오 [노] 노] 머 [소] 오 [노] 노] 머 [쇼] 노] 2	' 	Т	est pit no	э.				ASTM	Cla	assif	icati	on			D6	50	D	30	C	D10	W		 -	P	۲L	PI		Cc	Cu
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		Test Pit: A	AC1060 - 5			
Firm:	Newfoundland ar	nd Labrador Hydro			Date: 11-	Sep-07
Project:	Lower Churchill F	Project – 230 kV Transmissio	on Line – M	uskrat Falls to G	ull Island	
Contract No.	AC1060	Location: N 5872412	E	0609404	Inspector	: Dave Oldford
		Soil and Ground	water Conc	litions		
Depth (m) From - To		Description		Sample ID.	Sample Depth (m)	Sample Type
0.0 - 2.0	SAND - trace fine	es, brown, loose, moist, poo	rly graded.	NA	NA	NA
2.0 - 6.0	SILT (ML) -stiff, I	1	2.0 - 6.0	Grab		
Estimated	Cobbles (%) 0	Estimated Boulders ((%) 0	Estimated Max	Diameter (m) N	JA
Start Tim	ne: 4:15 pm	End Time: 4:40 p	m	Estimated Exca Volume (m ³)	vated	35
		Genera	I Notes			
-	ing in first 2.0 m of		10.07			
North and Eas	t coordinates obtai	ned using Garmin Etrex Leg	end Cx GP	5.		

TEST PIT AC 1060-005

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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION: Transmission Line

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		Teg	st pit	no						AST	-M (<u>) ae</u>	sific	atio	n				D6	50		D30		D1(0	W				Р	1		PI) C	Cu
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	Test Pit: AC1060 - 6														
Firm: Newfoundland and Labrador Hydro Date: 12-Sep-07															
Project:	Lower Churchill F	Project – 23	0 kV Transmission Line ·	 Muskrat Falls to Gull Is 	land										
Contract No.	AC1060	Location:	N 5882293	E 0620950	Inspector: Dave Oldford										



		Soil and Groundwater Con	ditions		
Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type
0.0 - 0.1	PEAT, dark brow	n, moist, fibrous, frequent rootlets	NA	NA	NA
0.1 - 0.5	Weathered SAN oxidized, orange	D, moist, frequent roots, slightly to light brown.	NA	NA	NA
0.5 - 4.5		th some fines, trace gravel, trace gular, damp, compact, grey.	1	0.5 - 4.5	Grab
Estimated C	obbles (%) 20	Estimated Boulders (%) 1 - 10	Estimated Max I	Diameter (m)	0.6
Start Tim	e: 9:37 am	End Time: 10:00 am	Estimated Excav Volume (m ³)	vated	20
		General Notes			
No sloughing.	Test pit was dry u	oon completion.			
North and East	coordinates obtai	ned using Garmin Etrex Legend Cx GF	PS.		

TEST PIT AC 1060-006

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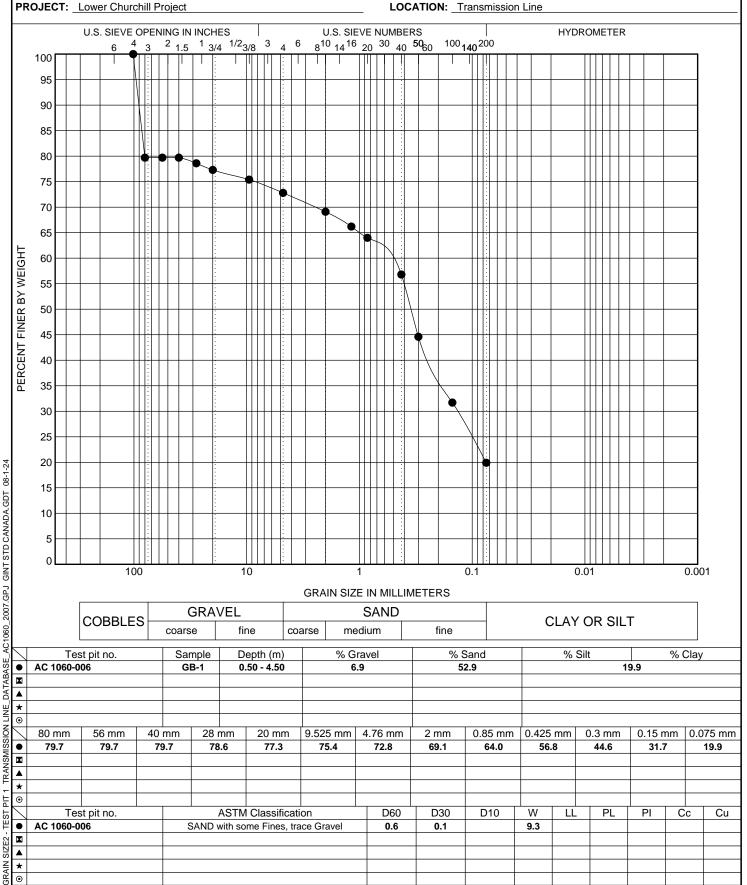
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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project





	Test Pit: AC1060 - 7														
Firm: Newfoundland and Labrador Hydro Date: 12-Sep-07															
Project:	Project: Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island														
Contract No.	AC1060	Location:	N 5882001	E 0620589	Inspector: Dave Oldford										



Soil and Groundwater Conditions								
Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type			
0.0 - 0.02	PEAT, dark brow	n, moist, fibrous, frequent rootlets.	NA	NA	NA			
0.02 - 0.3		rootlets and organic soil, some sand, e gravel, moist, loose to compact,	NA	NA	NA			
0.3 - 3.5 Cobbly SAND and GRAVEL with some boulders, trace fines, subangular, moist, compact, light brown.			1	2.0 - 4.0	Grab			
3.5 - 4.0	SAND COBBLES	S and BOULDERS - subangular.	NA	NA	NA			
Estimated C	obbles (%) 20	Estimated Boulders (%) 15	Estimated Max I	Diameter (m)	1.5			
Start Time: 10:15 am End Time: 10:45 am			Estimated Excav Volume (m ³)	vated	20			
General Notes								
End of test pit at 4.0 m (REFUSAL) - probable bedrock from excavator response.								
Moderate sloug	hing when boulde	rs were moved out of hole. Test Pit wa	s dry upon compl	etion.				
North and East	coordinates obtain	ned using Garmin Etrex Legend Cx GP	S.					

TEST PIT AC 1060-007

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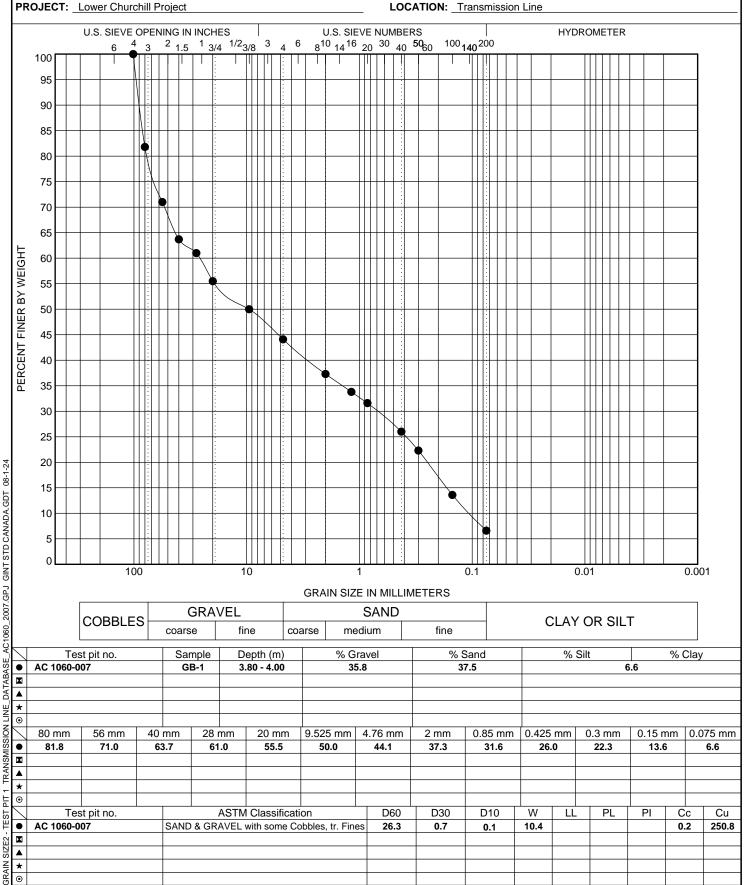
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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project





Test Pit: AC1060 - 8					
Firm: Newfoundland and Labrador Hydro Date: 12-Sep-07					Date: 12-Sep-07
Project:	Project: Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island				
Contract No.	AC1060	Location:	N 5881778	E 0620343	Inspector: Dave Oldford



Soil and Groundwater Conditions

Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type		
0.0 - 0.1	PEAT, dark brow	n, moist, fibrous, frequent rootlets.	NA	NA	NA		
0.1 - 0.8		es, trace gravel, trace cobbles, trace loose to compact, well graded, light	NA	NA	NA		
0.8 - 4.5 Cobbly, gravelly, SAND with some fines, some boulders, subangular, compact, moist, light grey.			1	0.5 - 4.0	Grab		
Estimated C	obbles (%) 20	Estimated Boulders (%) 10	Estimated Max	Diameter (m)	1.0		
Start Time: 10:50 am		End Time: 11:20 am	Estimated Exca Volume (m ³)	vated	20		
General Notes							
End of test pit at 4.5 m (REFUSAL) - probable bedrock from excavator response.							
Minor sloughing	y within first meter	of test pit. Test pit was dry upon com	pletion.				
North and East	coordinates obtain	ned using Garmin Etrex Legend Cx Gl	PS.				

TEST PIT AC 1060-008

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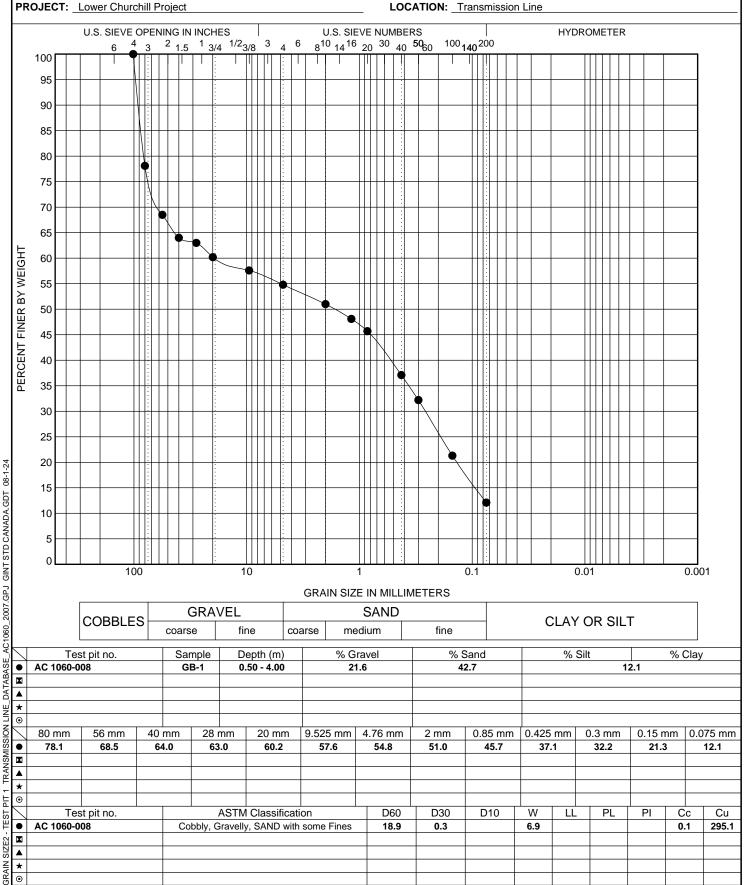
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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project





Test Pit: AC1060 - 9					
Firm: Newfoundland and Labrador Hydro Date: 12-Sep-07					Date: 12-Sep-07
Project:	Project: Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island				
Contract No.	AC1060	Location:	N 5881490	E 0619994	Inspector: Dave Oldford



Soil and	Groundwater	Conditions
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Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type		
0.0 - 0.2	PEAT - black, mo	bist, fibrous, frequent rootlets.	NA	NA	NA		
0.2 - 1.5		VEL - trace fines, trace cobbles, ubangular, moist, compact, light brown.	NA	NA	NA		
1.5 - 5.0		rith some fines, some cobbles, some jular, moist, compact, light grey.	1	1.5 – 5.0	Grab		
Estimated C	obbles (%) 15	Estimated Boulders (%) 10	Estimated Max Diameter (m) 0.8				
Start Time	e: 11:30 am	End Time: 12:00 pm	Estimated Excavated Volume (m ³)		20		
General Notes							
End of test pit at 5.0 m (REFUSAL) - probable bedrock from excavator response.							
Slight sloughing	g above 2 m. Test	pit was dry upon completion.					
North and East	coordinates obtain	ned using Garmin Etrex Legend Cx GPS	S.				

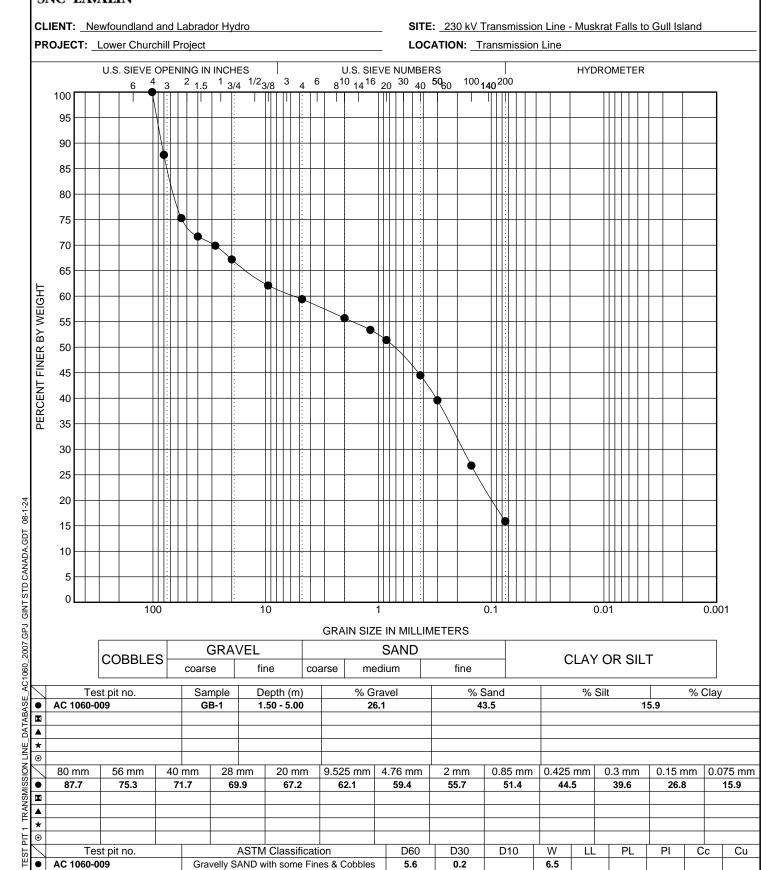
TEST PIT AC 1060-009

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GRAIN SIZE2 -⊙ ★ ♥ 🛛

GRAIN SIZE DISTRIBUTION





Test Pit: AC1060 - 10					
Firm:	Newfoundland a	nd Labrador	Hydro		Date: 12-Sep-07
Project:	Project: Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island				
Contract No.	AC1060	Location:	N 5881242	E 0619694	Inspector: Dave Oldford



Soll and Grou	undwater Conditions

Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type	
0.0 - 0.1	PEAT - black, mo	pist, fibrous, frequent rootlets.	NA	NA	NA	
0.1 - 0.5	Weathered SANI oxidized, orange	D - moist, frequent rootlets, slightly to light brown.	NA	NA	NA	
0.5 - 2.5		es, some gravel, trace cobbles, vell graded, subangular, moist, own.	NA	NA	NA	
2.5 - 5.0		some gravel, trace cobbles, trace jular, moist, compact, grey.	1	2.5 - 5.0	Grab	
Estimated Co	bbles (%) 5 - 10	Estimated Boulders (%) 2 - 5	Estimated Max Diameter (m) 0.5			
Start Time	e: 12:20 pm	End Time: 12:50 pm	Estimated Excar Volume (m ³)	vated	30	
		General Notes				
End of test pit a	at 5.0 m (REFUSA	L) - probable bedrock from excavator	response.			
Moderate sloug	hing within first m	eter of test pit.				
Water slowly er	ntering test pit at 2	.5 meter mark where soil transition or	curs between brow	vn and grey.		
North and East	coordinates obtai	ned using Garmin Etrex Legend Cx C	GPS.			

TEST PIT AC 1060-010

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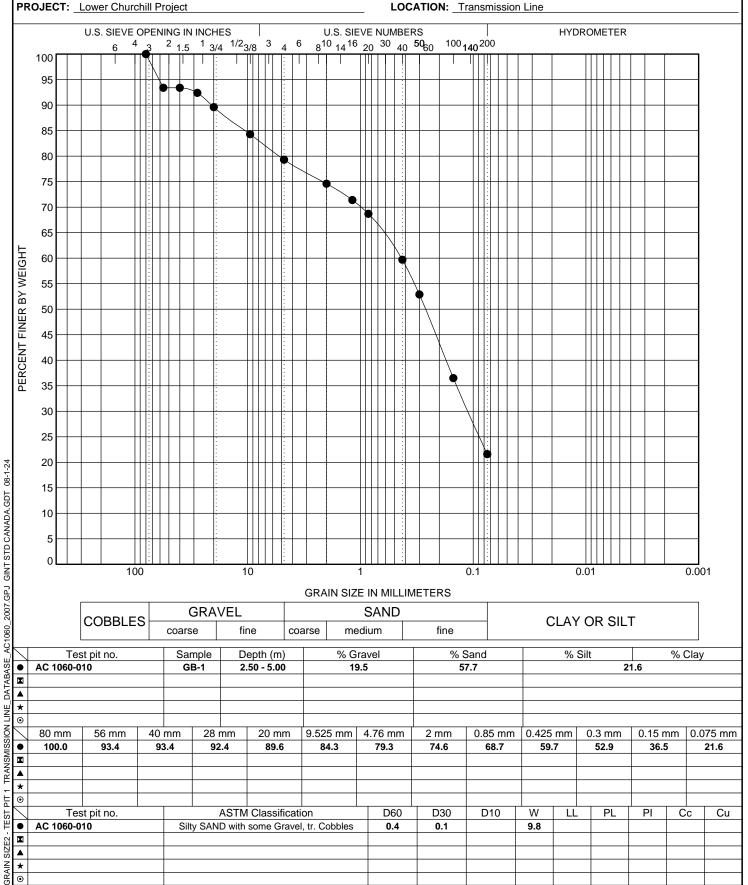


GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project





Test Pit: AC1060 - 11					
Firm: Newfoundland and Labrador Hydro Date: 12-Sep-07					Date: 12-Sep-07
Project:	Project: Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island				
Contract No.	AC1060	Location:	N 5880975	E 0619376	Inspector: Dave Oldford



		Soil and Groundwater Conc	litions		
Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type
0.0 - 0.03	PEAT - black, mo	ist, fibrous, frequent rootlets.	NA	NA	NA
0.03 - 0.08		D – moist, trace roots, slightly oxidized, , orange to light brown.	NA	NA	NA
0.08 - 0.3	SAND - moist, co trace gravel, light	mpact, poorly graded, trace fines,	NA	NA	NA
0.3 - 1.5	SAND and GRAN very dense, mois	/EL with some fines, trace cobbles, t, olive grey.	1	0.3 - 1.5	Grab
1.5 - 1.6		ne grained cemented, very dense, amp, olive grey, trace cobbles.	2	1.6 - 3.5	Grab
1.6 - 3.5	SAND - trace fine	es, poorly graded, damp.	NA	NA	NA
3.5 - 4.5	SAND - some co trace fines, loose	bbles, trace boulders, trace gravel, to compact.	NA	NA	NA
4.5 - 5.0	Sandy clayey SIL	T - moist, medium stiff, grey.	3	4.5 - 5.0	Grab
Estimated Co	bbles (%) 5 - 10	Estimated Boulders (%) 1 to 5	Estimated Max	Diameter (m)	0.5
Start Time: 1:10 pm		End Time: 2:10 pm	Estimated Excavated Volume (m ³)		30
		General Notes			
Water entering	test pit at a depth	of 4.5 m moderate to trickle to steady fl	ow.		
Moderate sloug	ghing in first meter	of soil.			
North and East	coordinates obtain	ned using Garmin Etrex Legend Cx GP	S.		

TEST PIT AC 1060-011

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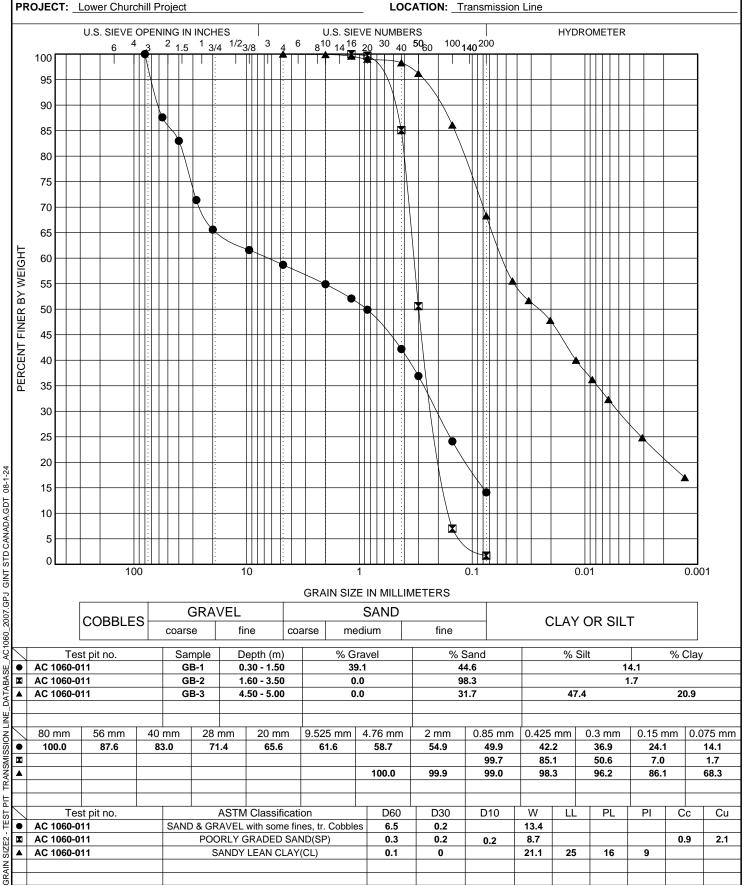


GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project





			Test Pit: AC1060	- 12									
Firm:	Firm: Newfoundland and Labrador Hydro Date: 12-Sep-07												
Project:	Lower Churchill I	Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island											
Contract No.	AC1060	Location:	N 5880852	E 0619162	2 Inspector: Dave Oldford								



		Soil and Groundwater Cond	ditions									
Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type							
0.0 - 0.1	PEAT – dark bro	wn, moist, fibrous, frequent rootlets.										
0.1 - 0.2	SAND with trace oxidized, orange	fines, damp, loose, frequent rootlets, to light brown.	1	0.1- 0.2	Grab							
0.2 - 4.5	SAND with trace grey.	fines, damp, loose to compact, light	2	0.2 - 4.5	Grab							
Estimated 0	Cobbles (%) 0	Estimated Boulders (%) 0	Estimated Max Diameter (m) NA									
Start Tim	e: 2:30 pm	End Time: 3:00 pm	End Time: 3:00 pm Estimated Excavat Volume (m ³)									
		General Notes										
Slight sloughing	Slight sloughing above 3.5 m and moderate sloughing below 3.5 m. Test pit was dry upon completion.											
North and East	lorth and East coordinates obtained using Garmin Etrex Legend Cx GPS.											

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TEST PIT AC 1060-012

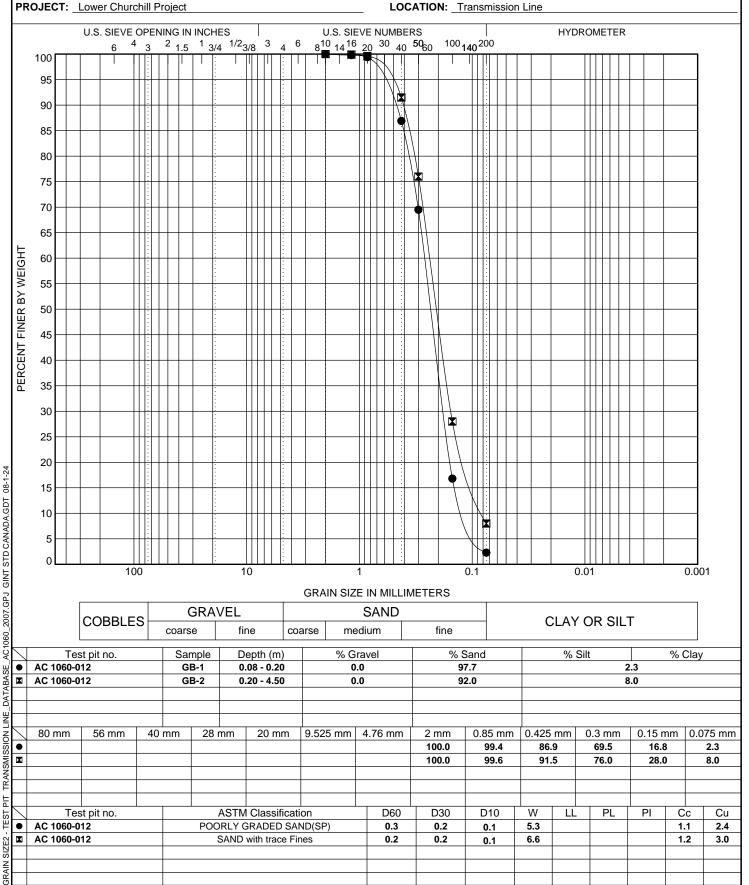
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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT:	Lower Churchill Project	





	nd Labrador Hydro				
ower Churchill	,			Date: 12-9	Sep-07
	Project – 230 kV Transmission L	ine – Muskrat Fall	s to Gu	ıll Island	
AC1060	Location: N 5880774	E 0619227		Inspector:	Dave Oldford
and the state of the	Soil and Groundwat	er Conditions			
	Description	Sample	D.	Sample Depth (m)	Sample Type
PEAT - black, m	oist, fibrous, frequent rootlets.	NA	\	NA	NA
			\	NA	NA
		mp, 1		0.3 - 3.5	Grab
obbles (%) 0	Estimated Boulders (%)	0 Estimate	d Max	Diameter (m)	NA
. 0.15 pm	End Time: 3:45 pm	Estimate Volume (vated	25
e: 3:15 pm		volume (
. 3.15 pm	General No				
	Weathered SAN loose, frequent r POORLY GRAD loose to compac	Description PEAT - black, moist, fibrous, frequent rootlets. Weathered SAND - trace fines, damp, poorly gra loose, frequent rootlets, oxidized, orange to light POORLY GRADED SAND (SP) - trace fines, da loose to compact, light brown.	PEAT - black, moist, fibrous, frequent rootlets. NA Weathered SAND - trace fines, damp, poorly graded, loose, frequent rootlets, oxidized, orange to light brown. NA POORLY GRADED SAND (SP) - trace fines, damp, loose to compact, light brown. 1	DescriptionSample ID.PEAT - black, moist, fibrous, frequent rootlets.NAWeathered SAND - trace fines, damp, poorly graded, loose, frequent rootlets, oxidized, orange to light brown.NAPOORLY GRADED SAND (SP) - trace fines, damp, loose to compact, light brown.1	DescriptionSample ID.Sample Depth (m)PEAT - black, moist, fibrous, frequent rootlets.NANAWeathered SAND - trace fines, damp, poorly graded, loose, frequent rootlets, oxidized, orange to light brown.NANAPOORLY GRADED SAND (SP) - trace fines, damp, loose to compact, light brown.10.3 - 3.5

TEST PIT AC 1060-013

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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

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			Test Pit: AC1060	- 14										
Firm:	Newfoundland and Labrador Hydro Date: 14-Sep-07													
Project:	Lower Churchill I	Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island												
Contract No.	AC1060	Location:	N 5877018	E 0614267	Inspector: Dave Oldford									



		Soil and Groundwater Cond	litions								
Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type						
0.0 - 0.1	PEAT - black org	anic soil, rootlets, moist, loose.	NA	NA	NA						
0.1 - 0.25		trace fines, trace rootlets, poorly compact, orange to light brown.	NA	NA	NA						
0.25 – 0.6		ED SAND (SP)- trace fines, trace compact, olive grey to light grey, moist.	1	0.1 – 0.6	Grab						
0.6 - 1.0		ED SAND (SP) trace fines, trace compact, olive grey to light grey, moist.	2	0.6 - 1.0	Grab						
1.0 - 4.5		ED SAND (SP) trace fines, trace compact, olive grey to light grey, moist.	3	3.5 - 4.5	Grab						
Estimated C	Cobbles (%) 0	Estimated Boulders (%) 0	Estimated Max I	Diameter (m)	NA						
Start Time	e: 11:50 am	End Time: 1:00 pm	vated	35							
		General Notes									
Severe sloughi	ng within test pit.	Test pit was dry upon completion.									
North and East coordinates obtained using Garmin Etrex Legend Cx GPS.											

TEST PIT AC 1060-014

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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION: Transmission Line

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GRAIN SIZEZ - TEST PIT TRANSMISSION LINE_DATABASE_		1060-0												ID(SP) ID(SP)).6		0.3		0.2 0.2	-	3.2 4.5							1.4	3.3
GKAII																																

Test Pit: AC1060 - 15



Newfoundland and Labrador Hydro			Date: 14-	Sep-07
Lower Churchill Project – 230 kV Transmissio	on Line – Mu	uskrat Falls to Gu	ull Island	
AC1060 Location: N 5880359	EC	0618206	Inspector	: Dave Oldford
		itians		
Description		Sample ID.	Sample	Sample Type
-	200			NA
	13E.	IN/A	INA	INA
Oxidized SAND - trace fines, trace rootlets, p				
	Lower Churchill Project – 230 kV Transmission AC1060 Location: N 5880359 Image: Constraint of the second	Lower Churchill Project – 230 kV Transmission Line – Mu AC1060 Location: N 5880359 E 0	Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Git AC1060 Location: N 5880359 E 0618206 Image: Character Control of Con	Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island AC1060 Location: N 5880359 E 0618206 Inspector

From - To		Description	Sample ID.	Depth (m)	Sample Type							
0.0 - 0.04	PEAT - black org	anic soil, rootlets, moist, loose.	NA	NA	NA							
0.04 - 0.3			NA	NA	NA							
0.3 - 3.5			1	0.3 - 3.5	Grab							
Estimated C	Cobbles (%) 0	Estimated Boulders (%) 0	Estimated Max [Diameter (m)	NA							
Start Time	e: 1:50 pm	End Time: 2:20 pm	Estimated Excav Volume (m ³)	vated	30							
		General Notes										
Severe sloughing	0.04 = 0.3 graded, loose to compact, orange to light brown. INA INA INA 0.3 - 3.5 POORLY GRADED SAND (SP) - trace fines, trace gravels, loose to compact, olive grey to light grey, moist. 1 0.3 - 3.5 Grab Estimated Cobbles (%) 0 Estimated Boulders (%) 0 Estimated Max Diameter (m) NA Start Time: 1:50 pm End Time: 2:20 pm Estimated Excavated Volume (m ³) 30 General Notes											
0.04 - 0.3Oxidized SAND - trace fines, trace rootlets, poorly graded, loose to compact, orange to light brown.NANANA0.3 - 3.5POORLY GRADED SAND (SP) - trace fines, trace gravels, loose to compact, olive grey to light grey, moist.10.3 - 3.5GrabEstimated Cobbles (%) 0Estimated Boulders (%) 0Estimated Max Diameter (m) NAStart Time: 1:50 pmEnd Time: 2:20 pmEstimated Excavated Volume (m ³)30												

TEST PIT AC 1060-015

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SNC·LAVALIN

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island LOCATION: Transmission Line

PF	PROJECT: Lower Churchill Project																												
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		Test Pit: A	C1060 - 16			
Firm:		nd Labrador Hydro			Date: 14-	Sep-07
Project:		Project – 230 kV Transmissic	on Line – M	uskrat Falls to	o Gull Island	
Contract No.	AC1060	Location: N 5880086	E	0618187	Inspector	: Dave Oldford
		Soil and Groundy	water Conc	litions		
Depth (m) From - To		Soil and Groundy Description	water Conc	Aitions Sample I	D. Sample Depth (m)	Sample Type
	PEAT - black org					Sample Type NA
From - To	Oxidized SAND - compact, orange	Description ganic soil, rootlets, moist, loo trace fines, trace rootlets, lo to light brown.	se. pose to	Sample I	D. Depth (m)	
From - To 0.0 - 0.1	Oxidized SAND compact, orange POORLY GRAD	Description ganic soil, rootlets, moist, loo - trace fines, trace rootlets, lo - to light brown. ED SAND (SP) - trace fines, bbles, loose to compact, oliv	se. Dose to	Sample I	Depth (m)	NA
From - To 0.0 - 0.1 0.1 - 0.3 0.3 - 3.5	Oxidized SAND compact, orange POORLY GRAD gravels, trace co	Description ganic soil, rootlets, moist, loo - trace fines, trace rootlets, lo - to light brown. ED SAND (SP) - trace fines, bbles, loose to compact, oliv	ose. Dose to trace re grey to	Sample I NA NA 1	Depth (m) NA NA	NA NA Grab
From - To 0.0 - 0.1 0.1 - 0.3 0.3 - 3.5 Estimated	Oxidized SAND compact, orange POORLY GRAD gravels, trace co light grey, moist.	Description ganic soil, rootlets, moist, loo - trace fines, trace rootlets, lo - to light brown. ED SAND (SP) - trace fines, bbles, loose to compact, oliv	se. bose to trace ve grey to %) 0	Sample I NA NA 1	Depth (m) NA NA 2.0 - 3.5 Ax Diameter (m) N	NA NA Grab
From - To 0.0 - 0.1 0.1 - 0.3 0.3 - 3.5 Estimated Start Tim	Oxidized SAND compact, orange POORLY GRAD gravels, trace co light grey, moist. Cobbles (%) 5 ne: 2:30 pm	Description ganic soil, rootlets, moist, loo - trace fines, trace rootlets, lo - to light brown. ED SAND (SP) - trace fines, bbles, loose to compact, oliv Estimated Boulders (End Time: 3:00 p Genera	ose. bose to , trace ve grey to %) 0 m I Notes	Sample I NA NA 1 Estimated M Estimated E	Depth (m) NA NA 2.0 - 3.5 Ax Diameter (m) N	NA NA Grab
From - To 0.0 - 0.1 0.1 - 0.3 0.3 - 3.5 Estimated Start Tim Severe slough	Oxidized SAND compact, orange POORLY GRAD gravels, trace co light grey, moist. Cobbles (%) 5 ne: 2:30 pm	Description ganic soil, rootlets, moist, loo - trace fines, trace rootlets, lo - to light brown. ED SAND (SP) - trace fines, bbles, loose to compact, oliv Estimated Boulders (End Time: 3:00 p	se. bose to trace ve grey to %) 0 m I Notes leting	Sample I NA NA 1 Estimated M Estimated E Volume (m ³)	Depth (m) NA NA 2.0 - 3.5 Ax Diameter (m) N	NA NA Grab

TEST PIT AC 1060-016

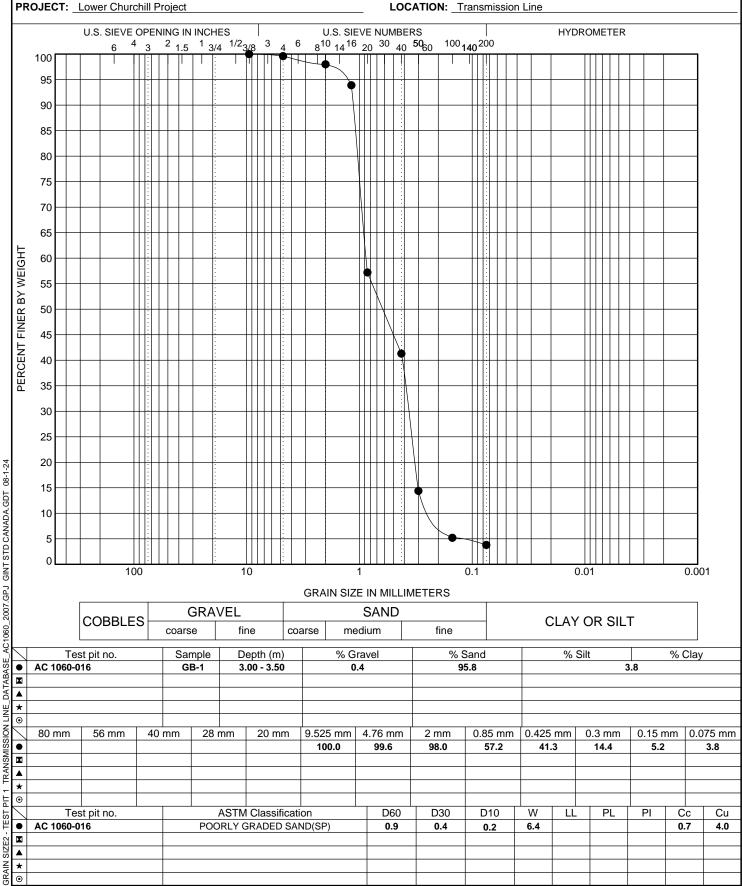
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SNC·LAVALIN

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

Dr Hydro SITE: _230 kV Transmission Line - Muskrat Falls to Gull Island





Test Pit: MF1120 - 8						
Firm:	Newfoundland and Labrador Hydro Date: 11-Sep-07					
Project:	Project: Lower Churchill Project – 230 kV Transmission Line – Muskrat Falls to Gull Island					
Contract No.	Contract No. MF1120 Location: N 5902362 E 0642104 Inspector: Dave Oldford					



Soil and Groundwater Conditions					
Depth (m) From - To		Description	Sample ID.	Sample Depth (m)	Sample Type
0.0 - 0.04	PEAT - black org	anic soil, rootlets, moist, loose.	NA	NA	NA
0.04 - 0.1	Topsoil, rootmat	with organics, loose, moist, brown.	NA	NA	NA
0.1- 4.5	Silty sandy GRAV light brown, loose	/EL with trace cobbles, trace boulders, e, moist.	1	2.0 - 3.0	Grab
Estimated Cobbles (%) 5 Estimated Boulders (%) 2		Estimated Boulders (%) 2	Estimated Max Diameter (m) 0.6		
Start Time: 8:10 am End		End Time: 8:50 am	Estimated Excav Volume (m ³)	vated	30
		General Notes			
Water running into test pit at 3.5 m mark. Rapid seepage.					
Moderate sloughing at 3.5 m.					
North and East	coordinates obtain	ned using Garmin Etrex Legend Cx GP	S.		

TEST PIT MF 1120-008

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SNC · LAVALIN

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project LOCATION: Lower Brook U.S. SIEVE OPENING IN INCHES U.S. SIEVE NUMBERS HYDROMETER 2 1.5 1 3/4 $^{1/2}$ 3/8 3 4 6 8 10 14 16 20 30 40 50 60 100 140 200 4 2 6 100 Τ Т Τ 95 90 85 80 75 70 ۲ 65 PERCENT FINER BY WEIGHT 60 9 55 50 e 45 40 35 30 25 20 15 10 5 0 100 0.1 10 0.01 0.001 1 **GRAIN SIZE IN MILLIMETERS** GRAVEL SAND COBBLES CLAY OR SILT fine coarse medium fine coarse Test pit no. Sample % Gravel % Sand % Silt % Clay Depth (m) • MF 1120-008 GB-1 4.00 - 4.50 38.5 28.6 27.1 * \odot 9.525 mm 4.76 mm 0.85 mm 0.425 mm 0.15 mm 0.075 mm 80 mm 56 mm 40 mm 28 mm 20 mm 2 mm 0.3 mm • 100.0 67.7 62.5 61.0 59.4 57.7 55.7 54.4 52.6 47.5 43.1 32.5 27.1 \star

D60

22.7

ASTM Classification

Sandy Silty GRAVEL

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▲ ★ Test pit no.

MF 1120-008



		Test Pit: MF1			
Firm:		and Labrador Hydro		Date: 11-	-Sep-07
Project:		Project – 230 kV Transmission I	_ine – Muskrat Falls	to Gull Island	
Contract No.	MF1120	Location: N 5902349	E 0641901	Inspector	r: Dave Oldford
A REAL PROPERTY OF A	CALCULATION OF STREET,		一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一 一		Se Mile
APR A		Soil and Groundwat	ter Conditions		
Depth (m) From - To		Soil and Groundwat	ter Conditions Sample	ID. Sample Depth (m)	Sample Type
	Topsoil, loose, i				Sample Type NA
From - To	SAND - some g	Description	Sample NA	Depth (m)	
From - To 0.0 - 0.8	SAND - some g boulder, moist, Gravely SAND	Description moist, brown, some rootlets. gravel, trace fines, trace cobbles,	SampleNAtraceNA	Depth (m)	NA
From - To 0.0 - 0.8 0.8 - 2.0	SAND - some g boulder, moist, Gravely SAND	Description moist, brown, some rootlets. gravel, trace fines, trace cobbles, loose, light brown, well graded. with trace fines, trace cobbles, tr	Sample NA trace NA	Depth (m) NA NA	NA NA
From - To 0.0 - 0.8 0.8 - 2.0 2.0 - 3.0 3.0	SAND - some g boulder, moist, Gravely SAND boulders, loose	Description moist, brown, some rootlets. gravel, trace fines, trace cobbles, loose, light brown, well graded. with trace fines, trace cobbles, tr	SampleNAtraceNA'ace1NA	Depth (m) NA NA 2.0 - 3.0	NA NA Grab NA
From - To 0.0 - 0.8 0.8 - 2.0 2.0 - 3.0 3.0 Estimated	SAND - some g boulder, moist, Gravely SAND boulders, loose Bedrock	Description moist, brown, some rootlets. gravel, trace fines, trace cobbles, loose, light brown, well graded. with trace fines, trace cobbles, tr to compact, moist, grey.	SampleNAtraceNAace1NA1Estimated	Depth (m) NA NA 2.0 - 3.0 NA Max Diameter (m) Excavated	NA NA Grab NA
From - To 0.0 - 0.8 0.8 - 2.0 2.0 - 3.0 3.0 Estimated	SAND - some g boulder, moist, Gravely SAND boulders, loose Bedrock Cobbles (%) 2	Description moist, brown, some rootlets. gravel, trace fines, trace cobbles, loose, light brown, well graded. with trace fines, trace cobbles, tr to compact, moist, grey. Estimated Boulders (%)	SampleNAtraceNA'ace1EstimatedVolume (m	Depth (m) NA NA 2.0 - 3.0 NA Max Diameter (m) Excavated	NA NA Grab NA 1.0

TEST PIT MF 1120-009

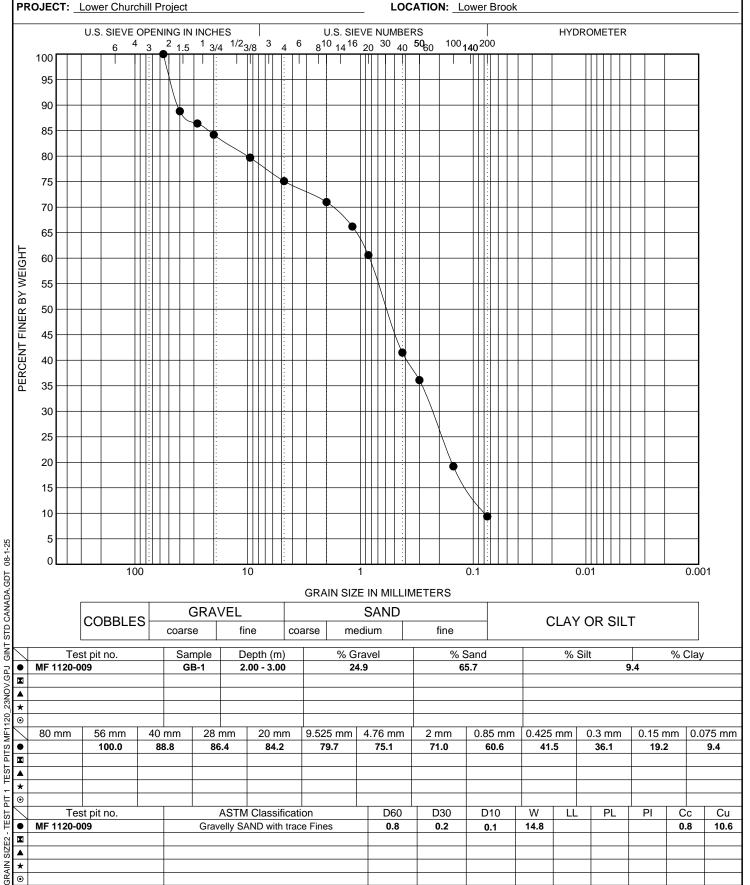
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SNC · LAVALIN CLIENT: Newfoundland and Labrador Hydro

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GRAIN SIZE DISTRIBUTION

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island



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Appendix C

Hand Auger Logs

HAND AUGER: AC 1060-TL-HA-1						
Firm:	Newfoundland Hydro	Project:	Lower Churchill Geotechnical Program Date: 17 Sep 20		17 Sep 2007	
Contract No.	AC 1060	Location:	N 5902414	E 0642815	Inspector:	DJD



PHOTOGRAPHS

SOIL AND GROUNDWATER CONDITIONS

Dept	h (m)	Description	Sample	Sample	Sample
From	То		No.	Depth (m)	Туре
0	0.01	Forest Litter & Moss			
0.01	0.25	TOPSOIL (SAND), fine grained, trace to some fines, poorly			
		graded, loose to compact, orangish-brown, damp, trace of			
		rootlets			
0.25	1.2	SAND, fine grained with some medium grained sizes, trace of	1	0.4 – 0.5	Grab
		fines, poorly graded, loose to compact, grayish-brown, damp			
		compact, brown below 0.5 m			
		mainthalan 0.7 m			
		moist below 0.7 m			
		End of Hand Auger at 1.2 m			
		Dry at Completion			
			1		

Est Max Diameter (m)					
Start Time:	10:30 am	End Time	10:45 am	Hole Dimensions:	50 mm

General Notes
Hand auger located approximately 85 m south of existing 3 pole structure (Structure No. 1133), at east bank of
Lower Brook crossing.
Location marked with recreational grade Garmin GPS (WPT 33)



TEST PIT AC 1060-TL-HA-1

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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION:	Transmission Line

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		HAND A	UGER: AC 106	0-TL-HA-2		
Firm:	Newfoundland Hydro	Project:	Lower Churchill Geot	echnical Program	Date:	17 Sep 2007 & Returned 25 Sept 2007
Contract No.	AC 1060	Location:	N 5902330	E 0642580	Inspector:	DJD



Dept	h (m)	Description	Sample	Sample	Sample
From	То		No.	Depth (m)	Туре
0	0.025	Forest Litter & Moss			
0.025	0.25	TOPSOIL (SAND), fine grained, trace to some fines, poorly			
		graded, loose to compact, orangish-brown, damp, trace of			
		rootlets			
0.25	3.0	SAND, fine grained with trace to some medium grained sizes,	1	1.0-1.2	Grab
		trace of fines, poorly graded, loose to compact, grayish-brown,			
		damp	2		Grab
		moist, compact below 0.5 m	3		Grab
		very moist below 0.7 m			
		End of Hand Auger at 3.0 m			
		Dry at Completion			

Est Max Diameter (m)					
Start Time:	11:10 am 17 Sept	End Time	11:30 am 17 Sep	Hole Dimensions:	50 mm
	12:15 pm 25 Sep		1:15 pm 25 Sep		

General Notes
Hand auger located approximately 85 m south of existing 3 pole structure (Structure No. 1137), at east bank of
Lower Brook crossing.
Location marked with recreational grade Garmin GPS (WPT 34)

GRAIN SIZE DISTRIBUTION



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TEST PIT AC 1060-TL-HA-2

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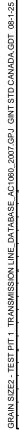
LOCATION: Transmission Line

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

U.S. SIEVE OPENING IN INCHES	U.S. SIEVE NUMBERS	HYDROMETER
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	AC ²		st pit no 'L-HA-2				PC	ASTN ORLY (P)			60).5		D30 0.3		D10 0.2	6.3		-	P	L	P	I	Cc 1.2		Cu 3.3
	AC ²						PC						?)										-	P	'L	P				
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		HAND A	UGER: AC 106	0-TL-HA-3		
Firm:	Newfoundland Hydro	Project:	Lower Churchill Geot	echnical Program	Date:	17 Sep 2007
Contract No.	AC 1060	Location:	N 5902450	E 0642443	Inspector:	DJD



Depth (m)		Description	Sample	Sample	Sample
From	То		No.	Depth (m)	Туре
0	0.01	Forest Litter			
0.01	······································				
		soft to firm, grayish-brown, wet, some partially decomposed			
		organic pockets			
		WATER AT 0.12 m			
0.25	1.2	SILTY CLAY, medium plastic, firm, grey, very moist, some	1	0.8-1.0	Grab
		sandy lenses			
		End of Hand Auger at 1.2 m			
		Dry at Completion			

Est Max Diameter (m)					
Start Time:	11:50 am	End Time	12 :10 pm	Hole Dimensions:	50 mm

General Notes
• Hand auger located approximately 3/4 down Lower Brook East Slope on a lower terrace, near base of old slide area.
 Estimate hole located approximately 15 to 20 m above Lower Brook water elevation.
Gravel and cobbles visible at tow of slope at brook edge.
Location marked with recreational grade Garmin GPS (WPT 35)

	HAND AUGER: AC 1060-TL-HA-4											
Firm:	Newfoundland Hydro	Project:	Lower Churchill Geot	echnical Program	Date:	17 Sep 2007						
Contract No.												



Dept	h (m)	Description	Sample	Sample	Sample
From	То		No.	Depth (m)	Type
0	0.02	Forest Litter			
0.02	0.45	TOPSOIL (SAND), fine grained, some fines, poorly graded,			
		loose to compact, orangish-brown, damp, trace of			
		Rootlets and some partially decomposed organic pockets			
0.45	1.2	SAND, fine grained with trace to some medium grained sizes,			
		trace of fines, poorly graded, loose to compact, grayish-brown,			
		damp			
		fine grained, trace to some fines, compact below 0.5 m			
		some fines, grey below 0.7 m			
		End of Hand Auger at 1.2 m			
		Dry at Completion			

Est Max Diameter (m)					
Start Time:	11:50 am	End Time	12 :10 pm	Hole Dimensions:	50 mm

General Notes							
 Hand auger located approximately 1/4 down Lower Brook East Slope. 							
 Location marked with recreational grade Garmin GPS (WPT 35) 							

HAND AUGER: AC 1060-TL-HA-5											
Firm:	Newfoundland Hydro	Project:	Lower Churchill Geote	echnical Program	Date:	9 Sep 2007					
Contract No.	AC 1060	Location:	N 5904380	E 0647648	Inspector:	David Oldford Calvin Miles					



Dept	h (m)	Description	Sample	Sample	Sample
From	То		No.	Depth (m)	Туре
0	0.1	Topsoil with root mat, some organics, black			
0.1	1.0	WEATHERED SAND – brown, with some iron oxide present very dense, moist,			
1.0	2.0	SAND – loose, moist, light grey, poorly graded,	1	1.2 - 2.0	Grab

Est Max Diameter (m)					
Start Time:	10:50 am	End Time	11 :10 am	Hole Dimensions:	50 mm

General Notes								
Hand auger located up from proposed switch yard area at Muskrat Falls								

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TEST PIT AC 1060-TL-HA-5

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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION: Transmission Line

		U.S. SIEVE						•			U.S. SI	EVE	NU	JMBE	RS			~		HYD	ROI	MET	ER				
	100	6 4	3	² 1.	5 ¹ 3/	4 ^{1/2} 3	3/8	3	4^{6}	8	¹⁰ 14 ¹			40	50 ₆₀	¹⁰⁰ 1	40 ²⁰	0								_	
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5										GRA	AIN SIZ	ZE II	N M	1ILLII	METER	s											
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		COBBLE	S	coai	rse	fi	ne		coa	arse	m	ediu	ım		fir	ne			C	LAY	0	RS	SIL				
	٦	Fest pit no.		Sa	ample	D	epth	ח (m)		% C	Grav	el			% S	and			%	Silt				%(Clay	
	AC 106	0-TL-HA-5			GB-1			2.00				0.0	-			98							1	.3		,	
*																											
	80 mm	n 56 mm	40	mm	28	 mm	2	0 m	m	9.52	25 mm	4	76 1	mm	2 mi	m	0.8	5 mm	0.425	mm	0	3 mi	m	0.15	mm	0.07	75 mm
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		Fest pit no.				ASTM		accif	icati	ion		<u> </u>		060	 D3	0	· ת	10	W		_	PL		PI	C		Cu
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5 ▲ [★												+									+		+		+		
50																											

	HAND AUGER: AC 1060-TL-HA-6												
Firm:	Newfoundland Hydro	Project:	Lower Churchill Geote	echnical Program	Date:	9 Sep 2007							
Contract No.	AC 1060	Location:	N 5892298	E 0630829	Inspector:	David Oldford Calvin Miles Glen Smith							

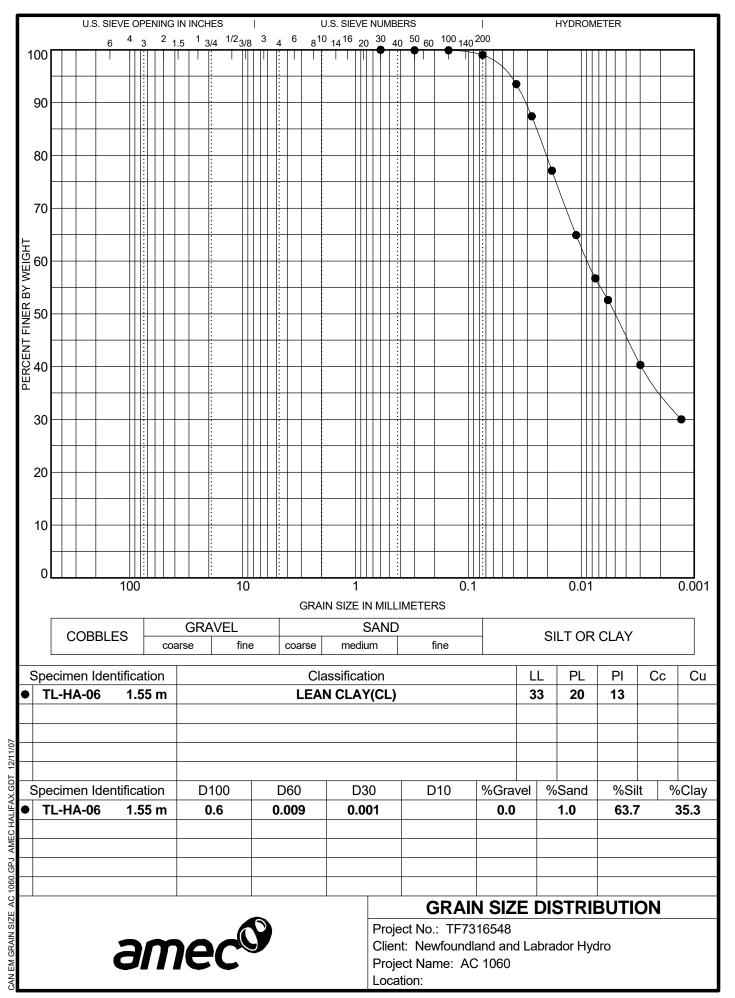
See Test Pit AC-1060-2

Dept	h (m)	Description	Sample	Sample	Sample
From	То		No.	Depth (m)	Туре
0	0.5	Roots and organics previously grubbed area			
0.5	2.6	SILT – trace sand, trace of clay, slightly plastic, firm, need			
		saturation, greenish grey			
			_		
			_		
			_		

Est Max Diameter (m)					
Start Time:	12:20 pm	End Time	12 :30 pm	Hole Dimensions:	50 mm

General Notes						
 Hand auger located on left had side of road going west where transmission line crosses road (E631000 – E630800) (N5892000 – N5892300) 						
• A test pit was dug in this area with an excavator. Test pit AC – 1060 – 2 with coordinates E0630859 N5892290						

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Appendix D

Bog Probing Results

) SNC+LAVALIN

			Bog P	Probing – Bog 1A		
Pro	ject:	AC1060 23	AC1060 230kV TL Muskrat Falls to Gull Island			Dave Oldford
Cli	ent:	Newfoundla	and and Labrad	orador Hydro Date Test: 26-Sept-07		
Proje	ct No.:	722855				
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking Southeast		outheast
1	643762	5902805	1.00			
2	643729	5902807	1.20			
3	643678	5902796	1.25			
4	643636	5902781	1.75			
5	643597	5902763	1.90			
6	643547	5902753	2.06	C. C. Strand		and the second se
7	643508	5902731	2.00			Call States
8	643465	5902714	2.17	East		Constant States
9	643424	5902690	1.80	X		
10	643384	5902665	1.70			
11	643344	5902649	1.50			The American
12	643303	5902623	1.25	TOTAL March		- 032MB00
13	643268	5902596	1.08	Bran C	and the second	destruction of the
14	643230	5902563	0.80	Existing Transmiss	ion	West
15	643194	5902540	1.02	Line		CON COL
16	643155	5902519	0.95	and the second	40 5 53	N. S. S. S. S. S.
17	643111	5902493	1.04	AND BEEN DON'T	10.14 S	
18	643073	5902466	0.65	Bog Probe Path		
19	643023	5902440	0.67	New Transmission	Line	
20	642984	5902411	0.60			



			Bog P	robing – Bog 2A		
Pro	oject:	AC1060 230kV TL Muskrat Falls to Gull Island		Tested By:	Dave Oldford	
Cli	ient:	Newfoundla	and and Labrad	or Hydro	Date Test:	26-Sept-07
Proje	ct No.:	722855				
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking West		
3	0629524	5891257	0.6		2B 2A	20

			Bog P	robing – Bog 2B		
Pro	ject:	AC1060 230kV TL Muskrat Falls to Gull Island		Tested By:	Dave Oldford	
Cli	ent:	Newfoundla	and and Labrad	or Hydro	Date Test:	26-Sept-07
Proje	ct No.:	722855				
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking West		
4	629414	5891205	0.40		- And and a second	Concession of the local division of the loca
5	629380	5891177	0.70	and the second se		and the second second
6	629359	5891169	0.50	the second second		and the strength of the
					2B 2A	2C



			Bog P	robing – Bog 2C		
Pro	ject:	AC1060 230kV TL Muskrat Falls to Gull Island		Tested By:	Dave Oldford	
Cli	ent:	Newfoundla	Newfoundland and Labrador Hydro		Date Test:	26-Sept-07
Proje	ct No.:	722855				
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking West		
1	629168	5891060	1.00			
2	629169	5891049	0.60	and the second se		and the second second
					2B 2A	20

			Bog P	robing – Bog 2D		
Pro	ject:	AC1060 23	230kV TL Muskrat Falls to Gull Island Tested By: Dave			Dave Oldford
Cli	Client:		nd and Labrad	or Hydro	Date Test:	26-Sept-07
Proje	ct No.:	722855				
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking Northeast		
7	628852	5890765	1.20	· · · · · · · · · · · · · · · · · · ·	III LIKE	C
8	628830	5890753	over 3.0			THE REAL PROPERTY.
				West		East



			Bog F	Probing – Bog 2E			
Pro	ject:	AC1060 23	AC1060 230kV TL Muskrat Falls to Gull Island Tested By:			Dave Oldford	
Cli	ent:	Newfoundla	nd and Labrac	lor Hydro	Date Test:	26-Sept-07	
Proje	ct No.:	722855					
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking Northwest		thwest	
9	628447	5890375	0.70		at - Marine	a state of the state of the state	
10	628408	5890349	0.67			and the second s	
11	628367	5890323	0.52	and the second s			
12	628321	5890291	0.80	West	SA VIIIA DA	alle your	
13	628279	5890272	0.80	and a substant	all and a manager of the		
14	628242	5890237	0.77				
						East	
				Bog Probe Path New Transmission	Line		

			Bog F	Probing – Bog 2F		
Pro	ject:	AC1060 23	0kV TL Muskra	t Falls to Gull Island	Tested By:	Dave Oldford
Cli	ent:	Newfoundla	and and Labrad	nd and Labrador Hydro Dat		26-Sept-07
Proje	ct No.:	722855				
Probe No. Easting		Northing Depth Penetrated (m)		Vie	w Looking No	rthwest
15	628169	5890158	0.50		ALLER ME THE PARTY OF	
16	628135	5890155	1.10	West	州市市市市市	
17	628096	5890121	0.80	W. Colling and a	「「ないないのない」	
				Bog Probe Path	Line	



			Bog P	Probing – Bog 2G		
Pro	ject:	AC1060 23	AC1060 230kV TL Muskrat Falls to Gull Island			Dave Oldford
Cli	ent:	Newfoundla	and and Labrad	lor Hydro	Date Test:	26-Sept-07
Proje	ct No.:	722855		-		· · ·
Probe No.	Easting	Depth			View Looking	West
18	628048	5890066	0.80		as more said and	
19	628014	5890033	0.90			West
20	627976	5890009	0.73		他们的自己的自己	Massing - Suito
21	627941	5889989	0.93		ALC: STREET, ST	这些教师们的教 上一、教师
				alles and an in	A Lugar	
						Californi, E
						East
						WI DEAL
				Bog Probe Path New Transmission	Line	

			Bog F	Probing – Bog 3A		
Pro	ject:	AC1060 230kV TL Muskrat Falls to Gull Island			Tested By:	Dave Oldford
Cli	ent:	Newfoundland and Labrador Hydro		Date Test:	26-Sept-07	
Proje	Project No.:					
Probe No.	Facting		Depth Penetrated (m)	Vie	w Looking So	uthwest
1	616489	5878724	1.60		States and the	State of the second
2	616458	5878691	0.40	the sugar in the	Street of the second	AND STREET, ST
3	616423	5878665	0.30	and the second states of the		West
4	616389	5878637	0.66	COLUMN STREET		STREET, STREET
5	616344	5878641	0.70	aller and a comp	CLARE -	Children and Shirts
				East		
				Bog Probe Path New Transmission	Line	



			Bog P	Probing – Bog 3B			
Pro	ject:	AC1060 23	0kV TL Muskra	rat Falls to Gull Island Tested By: Dave Oldford			
Cli	ent:	Newfoundla	and and Labrad	ador Hydro Date Test: 26-Sept-07			
Proje	ct No.:	722855					
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking South			
6	616024	5878398	1.55	And the second second	No. of the second second	Contraction of the Contraction	
7	615996	5878369	1.50	and the local division of	ALL CA		
				East East Bog Probe Path New Transmission	Line	West	

			Bog P	robing – Bog 4A		
Pro	ject:	AC1060 23	0kV TL Muskra	t Falls to Gull Island	Tested By:	Dave Oldford
Cli	ent:	Newfoundla	and Labrad	or Hydro	Date Test:	26-Sept-07
Proje	ct No.:	722855				
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking West		West
1	612543	5876767	0.43	and the second	-	and the second sec
2	612487	5876697	0.55	and the second	Wes	Contraction of the second s
3	612448	5876684	0.40		ALL OF THE	
4	612338	5876653	0.54	ALC: NOT A		11 10000
5	612278	5876651	0.90	and the second second		
6	612203	5876654	0.45	Contraction of the local division of the loc	*	THE HORSENING TO OF
7	612098	5876702	0.80	State of the local division of the local div		an a sheel of the hostern
8	612055	5876684	0.66	All the All all all and		the share and a state of the
9	612009	5876669	0.95			the literature
10	611965	5876644	0.85		NEW ADDRESS	A SALAR AND A SALAR AND
					Eas	
				Bog Probe Path New Transmission	Line	



			Bog P	Probing – Bog 5A			
Pro	ject:	AC1060 23	AC1060 230kV TL Muskrat Falls to Gull Island			Dave Oldford	
Cli	ient:	Newfoundla	and and Labrad	or Hydro	Date Test:	26-Sept-07	
Proje	ct No.:	722855					
Probe No.	Easting	Northing	Depth Penetrated (m)	Vie	ew Looking No	rthwest	
1	608326	5871840	1.03		- Contraction of the local division of the l		
2	608280	5871791	1.02	A DESCRIPTION OF THE OWNER OF THE			
3	608227	5871746	1.16	West		THUR WAR	
4	608165	5871700	1.40	K	Burn and the		
5	608128	5871669	2.80	A DECEMBER OF THE OWNER OWNER OF THE OWNER OWNER OWNE		Contra Contra Vale	
6	608087	5871618	2.00	and the second second	The state of the		
7	608044	5871518	2.03	the Post State No.		*	
8	607984	5871559	1.17		We see and the	Man Hills	
					而以中的此时,	East	
				No. 100 Labor 144	1月11日日月月	12月1日日常中国的 12月	
				31			
				Bog Probe Path			

			Bog P	Probing – Bog 6A		
Pro	ject:	AC1060 23	0kV TL Muskra	t Falls to Gull Island	Tested By:	Dave Oldford
Cli	ent:	Newfoundland and Labrador Hydro		or Hydro	Date Test:	26-Sept-07
Proje	ct No.:	722855				
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking Northeast		
1	607459	5870557	1.05		The local division of	
2	607498	5870584	1.07	AND REAL TOPIC OF		
3	607539	5870619	1.08	Les aria malina	East	The Supervision of the Supervision of the
4	607576	5870646	1.16	And The Mary of Station	15 haussener	
5	607623	5870677	1.25	UNDER LOTE	AND DE LA COMPANY	THE REAL PROPERTY OF
						West
				Bog Probe Path		



			Bog P	robing – Bog 7A			
Pro	ject:	AC1060 23	0kV TL Muskra	t Falls to Gull Island	Tested By: Dave Oldford		
Cli	ent:	Newfoundla	and and Labrad	or Hydro	Date Test:	01-Nov-07	
Proje	ct No.:	722855					
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking Northeast			
1	608442	5871296	1.10		Active States		
2	608475	5871325	2.56	and the second of the second	in the second	ACCESSION AND A DESCRIPTION OF A DESCRIP	
3	608499	5871361	2.02		Ren PART		
4	608546	5871391	0.83	المتلا المسرو الاستر فتعده	And Andrews I T. T.		
5	608599	5871450	1.25		的國際基礎主要	Alter and a state of the second	
6	608631	5871476	1.66		A BARANA PARA	Han In the second	
7	608678	5871507	1.17	All starts	atil Test to a	and the second of the	
8	608703	5871542	1.70		A LAND SALE	et an	
9	608721	5871592	1.22		PL PE	del trate to the total and	
10	608769	5871627	0.88	出行来在 因为1000			
11	608818	5871655	0.85	NUMBER OF STREET	Read Press		
12	608854	5871703	0.82				
13	608906	5871748	1.95				
14	608946	5871773	0.79				
15	608993	5871815	1.63				

			Bog P	robing – Bog 8A			
Pro	ject:	AC1060 23	0kV TL Muskra	t Falls to Gull Island	Tested By:	Dave Oldford	
Cli	ent:	Newfoundla	and Labrad	or Hydro	Date Test:	31-Oct-07	
Proje	ct No.:	722855					
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking Northeast			
1	612160	5874802	0.80	and the second			
2	612153	5874837	0.85	and the second se		1 - Frankling	
3	612158	5874909	0.66	and the second second		and the second se	
4	612169	5874962	1.07	and the second designed to be set of the second sec		and the second second	
5	612160	5875058	0.85	and the second of		State of Street, or other	
6	612189	5875124	0.75		Contraction of the		
7	612259	5875072	0.63		The second second		
8	612260	5875134	1.05	and the second s	particular and		
9	612243	5875195	0.77	1 2. Jon 199	A	and the second second	

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			Bog P	robing – Bog 9A			
Pro	oject:	AC1060 23	0kV TL Muskra	t Falls to Gull Island	Tested By:	Dave Oldford	
Cli	ient:	Newfoundla	and and Labrad	or Hydro	Date Test:	01-Nov-07	
Proje	ct No.:	722855					
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking Southwest			
1	612901	5875698	0.70				
2	612880	5875674	0.80			100 100	
3	612870	5875659	0.73	1 .			
4	612822	5875605	0.67	H A A		10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
5	612791	5875577	0.58	10 BA . I.			
				新日本市 省計畫	a fai was	A DECEMBER OF THE OWNER	
				Sec. Sec. 10	Rent for the		
				C CALLER STORE	- Friday - Contra		
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					A		
				Carl Carlo Carlos	and a set		

			Bog Pr	obing – Bog 10A				
Pro	ject:	AC1060 23	0kV TL Muskra	t Falls to Gull Island	Tested By:	Dave Oldford		
Cli	ent:	Newfoundland and Labrador Hydro			Date Test:	01-Nov-07		
Proje	ct No.:	722855						
Probe No.	Easting	Northing	Depth Penetrated (m)	View Looking Southwest				
1	612591	5875337	1.20			Contraction of the local division of the loc		
2	612563	5875300	1.47	and the second se		7-14-14-14-14		
3	612537	5875251	1.41			Second Second		
4	612531	5875171	1.32	1. ·		A state of the state		
5	612484	5875104	1.20	A BURGER ALL HILL	-			
6	612457	5875068	1.00	and the second second	ALCON & LOUIS	ALL DE LOS OF THE OWNER OWNER OF THE OWNER OWN		
7	612432	5874985	1.06	In Case of Case of Case	ALL PROPERTY.			
8	612399	5874914	0.82		- Connection	A CONTRACTOR OF		
9	612359	5874837	0.93			and the second		
10	612333	5874810	0.95	States and the		Sala Mart		
11	612294	5874770	1.16		Alter			

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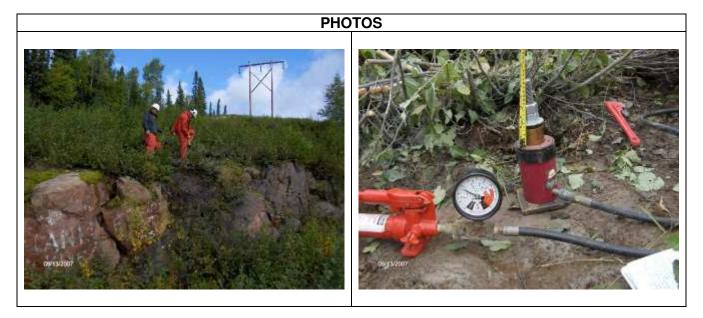
Appendix E

Anchor Testing Results

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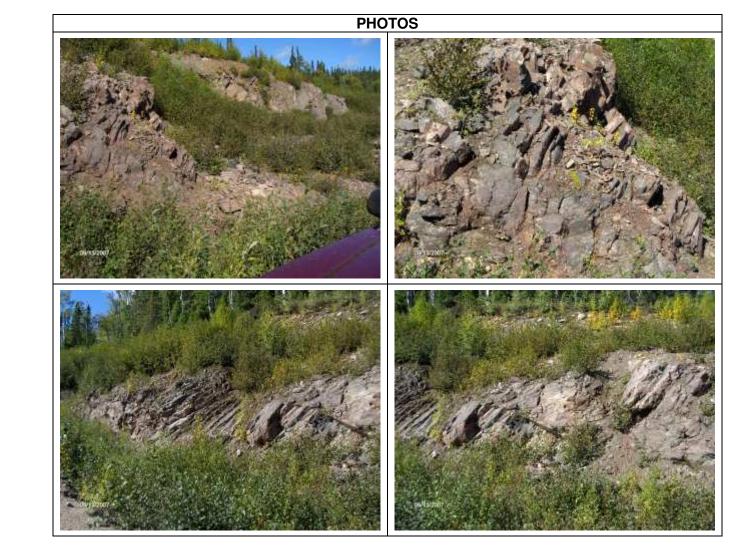
ANCHOR PULL OUT TEST: AC 1060-PO-1								
Firm: Newfoundland Hydro Project: Lower Churchill Geotechnical Program								
Contract No.	AC 1060	Location:	N 5901209 E 0640453 Inspector: DJD					
Date	Date Sept 16, 2007 Start 09:30 am Finish 11:20 am							

	TEST LOCATION							
•								
				on north side of Trans Labrador Highway (TLH), where				
		transmissior						
	existing	liansinissioi						
	D							
				ractured granite gneiss.				
•		eeping into h		m.				
•	Very eas	sy drilling 1.1						
				L-OUT TEST RESULTS				
TIN	/IE	Applied	Jack					
From	То	Load	Rise	Notes				
		(Tons)	(mm)					
				Start Test				
11:05	11:06	1.5	5.0	 Jack & rod turned slightly and settled in. 				
11.05	11.00	1.5	5.0	 ~ 5 mm rise in jack. 				
11.07	11.00	4.5		Jacked up to 4.5 tons				
11:07	11:09	4.5		Anchor began to slip in rock.				
11:10	11:11	6.0	51.0	Held at 6.0 tons.				
11:11	11:12	9.0						
11:12	11:14	17.0		• Loaded up to 17 tons with three pumps of jack handle.				
				Loaded up to 18 tons (overload for jack).				
11:14	11:16	18.0	0.0	Held at 18 tons for two minutes.				
				End of test.				



ANCHOR PULL OUT TEST: AC 1060-PO-2									
Firm:	Firm: Newfoundland Hydro Project: Lower Churchill Geotechnical Program								
Contract No.	AC 1060	Location:	N 5901422 E 0640832 Inspector: DJD						
Date	Date Sept 16, 2007 Start 11:45 am Finish 12:45 pm								

				TEST LOCATION
•	Locatior	n marked wit	h Garmin ree	creational grade GPS (WPT No. 32)
•	Test cor	nducted on re	ock outcrop	on north side of Trans Labrador Highway (TLH), in former
	quarry.			
			ROCK CO	ONDITION OBSERVATIONS
•	Rock ou	Itcrop predor	ninated by f	ractured granite gneiss.
•	Easy dri	lling from 1.	1 to 1.5 m.	
•	Very eas	sy drilling fro	m 1.5 to 1.7	m (rods dropping). Suspected shear zone.
•	Slight m	oisture at 1.0	0 m, but hole	e staying dry at end of drilling.
			PUL	L-OUT TEST RESULTS
TIN	1E	Applied	Jack	
From	То	Load	Rise	Notes
FIOIII	10	(Tons)	(mm)	
				 Lost two cones while trying to set anchor.
				Abandoned test.



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February 2008 Project No. 722850

Appendix F

Moisture Density Relationship

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SNC·LAVALIN

TEST PIT Hand Dug Test Pit 1

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION: Right Bank Lower Slope Pinus

-			115	S. SIEVE							т				J.S. S		/E N	11.38					- T			(1)	(00		(FT)					
			0.0	6	4 3	2	2 1.5	1 3	8/4 ^{1/}	2 _{3/8}	3	4	6	8 ¹	⁰ 14	16	20 20	30	40 40	50 ₆₀	100) 140	,200)		H	YDR		1611	ER				
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GRAIN SIZEZ - TEST PIT 1. TRANSMISSION LINE_DATABASE_AC1060_2007.GPJ GINT STD CANADA.GDT 08-1-25 [여★★★★ ★ ★ ★ ★ ★ ★ ★ ★	1																							\neg						+				
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SNC·LAVALIN

2007.GPJ GINT STD CANADA.GDT 08-1-25

AC1060

DATABASE

TEST PIT 1 TRANSMISSION LINE

GRAIN SIZE2

TEST PIT Hand Dug Test Pit 2

GRAIN SIZE DISTRIBUTION

CLIENT: _Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project LOCATION: Right Bank Upper Slope Pinus U.S. SIEVE OPENING IN INCHES U.S. SIEVE NUMBERS HYDROMETER ² 1.5 ¹ 3/4 ^{1/2}3/8 4 3 4 6 8¹⁰ 14¹⁶ 20³⁰ 40⁵⁰60 100 140 200 6 100 Τ 95 90 85 80 75 70 65 PERCENT FINER BY WEIGHT 60 55 50 45 40 35 30 25 20 15 9 10 ٣ 5 n 100 10 0.1 0.01 0.001 GRAIN SIZE IN MILLIMETERS GRAVEL SAND COBBLES CLAY OR SILT coarse fine coarse medium fine Test pit no. Sample Depth (m) % Gravel % Clay % Sand % Silt . Hand Dug Test Pit 2 GB-1 0.00 - 0.00 71.1 21.8 1.5 ۸ * ۲ 80 mm 56 mm 40 mm 28 mm 20 mm 9.525 mm 4.76 mm 2 mm 0.85 mm 0.425 mm 0.3 mm 0.15 mm 0.075 mm • 100.0 69.1 48.8 41.8 34.2 27.6 23.3 18.8 13.4 8.2 5.8 2.8 1.5 * ۲ Test pit no. **ASTM Classification** D60 D30 D10 W LL PL PI Сс Cu • Hand Dug Test Pit 2 POORLY GRADED GRAVEL with SAND(GP) 48.2 12.5 12.6 0.5 6.0 89.1 ۸ * ۲

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SNC·LAVALIN

TEST PIT Sand at Crossing 12 GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION: Sand Dune Near Stream Crossing 12

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MOISTURE DENSITY RELATIONSHIP



							Lab No:	704
Clie	ent:		Newfoun	dland and La	brador Hv	dro		
Pro	ject No	:	722855					
	ject:			230 kV TL Mi	iskrat to G	ull Island		
	nple #		AC1060-1					
	-	pe / Source:		It from cuts	in the road	embankm	_ ent on TLH	
		•						
Dat	e Samp	led:	Septem	ber 30, 2007	_ Samp	oled By	Dwayne Dr	ruggett
Dat	e Recei	ved	Sentem	ber 30, 2007	Drone	aration		
		····		501 00, 2007	_ 11666			
Per	cent Re	tained:		> 19mm	= 0.0%	······]	
			107			T	-	
	npactio	n Sta.	ASI	M D698	Method	C]	
Moi	isture C	ontent	8.9	11.5	14.1	16.7		
Dry	Density	y kg/m ³	1864	1887	1905	1842		
DRY DENSITY Kg/m ³	1940 1920 1900 1880 1860 1840							
	1820 .	9.0	10.0 11.	0 12.0 MOISTURE		14.0 15.() 16.0	17.0

Note :	Oversized Material C	orrection > 19mm	= 0.0%	
Maximum	Dry Density	1906 kg/m3	Corrected Dry Density	1906 kg/m3
Maximum I	Moisture	13.8 %	Maximum Moisture	13.8 %

Tested by, Ken Collier

Reviewed by,

Page 100 TEST PIT AC1060-TL-PR-01

﴾ SNC · LAVALIN

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project

LOCATION Transmission Lin

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MOISTURE DENSITY RELATIONSHIP

SNC·LAVALIN

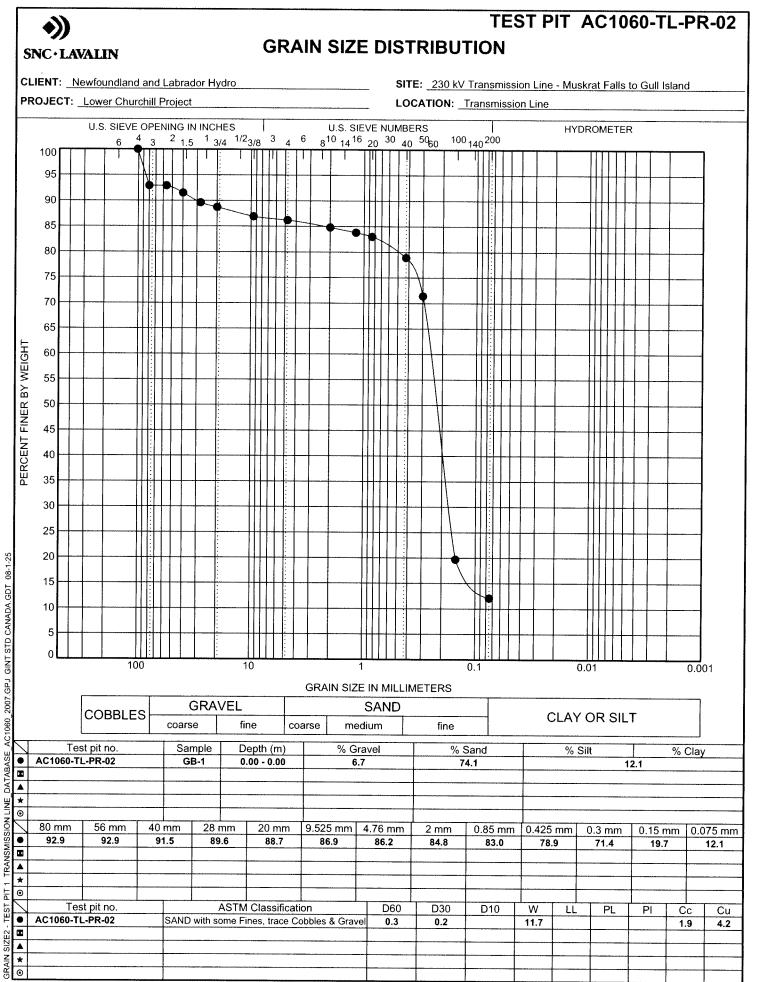
						Lab No:	705
Client	it:	Newfound	dland and La	brador Hyd	Iro		•
Proje	ect No:	722855				_	
Proje		AC 1060 2	230 kV TL Mu	skrat to Gu	ull Island		
Samp	ole #	AC1060-T	L-PR-02			_	
Samp	ole Type / Source:	Sand from	n cuts in the	road emba	nkment or	TLH	
Date	Sampled:	Septemb	oer 30, 2007	Samp	led By	Dwayne Dr	uggett
Date I	Received:	Septemb	oer 30, 2007	Prepa	ration		
Perce	ent Retained:	[> 19mm	= 11.3%]	
Comp	paction Std.	AST	M D698	Method	С]	
Moist	ture Content	4.4	6.0	9.6	11.5	1	
	Density kg/m ³	1938	1945	1881	1837		
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DRY DENSITY Kg/m ³ 81 51 51 81 51 51	960 940 920 900						
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		- 11.070		
Maximum Dry Density	1946 kg/m3	Corrected Dry Density	1998.7 kg/m3	
Maximum Moisture	5.6 %	Maximum Moisture	5.1 %	

Tested by, Ken Collier

Reviewed by,

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MOISTURE DENSITY RELATIONSHIP

•))
SNC-LAVALIN

										Lab I	No:	706
	ject No:			7228	55	ind and La				_		
	ject:					0 kV TL Mu	skrat to (Gull Is	land			
	nple # nplo Tym				60-TL-		the read					
5 ai	nple Typ	e / Sour	ce:	Silly	Clay Ir	om cuts in	the road	emba	пкте	nt on I	LH	
Dat	e Sample	ed:		Sep	tembe	r 30, 2007	Sam	pled	Ву	Dway	ne Dru	ıggett
Dat	e Receiv	ed:		Sep	tembe	r 30, 2007	Pre	paratio	on			
Per	cent Ret	ained:				> 19mm	= 0.0%		······]		
Cor	npaction	Std.			ASTM	D698	Method		С	7		
Moi	sture Co	ntont		1	0.4	11.8	14.8		10.0	-	4	
	Density				0.4 506	1613	14.8		18.8 689	20. 164		
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				MOI	STURE	DENSITY I	RELATION	ISHIP				
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	1730 1710											
g/m³	1730 1710											
'Y Kg/m ³	1730 1710											
NSITY Kg/m ³	1730 1710											
DENSITY Kg/m ³	1730 1710											
DRY DENSITY Kg/m ³	1730 1710 1690 1670 1650 1630											
DRY DENSITY Kg/m³	1730 1710 1690 1670 1650 1630 1610											
	1730 1710 1690 1670 1650 1630											
	1730 1710 1690 1670 1650 1630 1610											
	1730 1710 1690 1670 1650 1630 1610 1590											
	1730 1710 1690 1670 1650 1630 1610 1590 1570	10.0		12.0	13.0	14.0 15.0 MOISTURE (17.0	18.0	19.0	20.0	21.0

Reviewed by,

Maximum Moisture

18 %

18 %

Maximum Moisture

Tested by, Ken Collier

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TEST PIT AC1060-TL-PR-03

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION:	Transmission	Line

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g COBBLES Coarse fine coarse medium fine CLAY OR SILT	960_20				СС	BBI	LE	s⊢		coa					ne			coa	arse	Τ	m				Ţ		fi	ne						CI	LA	′ C	R	S	IL	Т						
Test pit no. Sample Depth (m) % Gravel % Sand % Silt % Clay	ACI									S	am	ple		D	ер		 m)									T			San	d		T			%	Silt				Т			% Cl	_ av		
AC1060-TL-PR-03 GB-1 0.00 - 0.00 0.0 8.4 91.6 X X X X Y		A	C106	50-T	L-PR	-03			-		GB	-1																											9	1.6						
▲	▲ پ								-				1													-																				
² ⊚ 80 mm 56 mm 40 mm 28 mm 20 mm 9.525 mm 4.76 mm 2 mm 0.85 mm 0.425 mm 0.3 mm 0.15 mm 0.075		8	0 m	m	5	6 mr		4	0 п	nm		28		 n		20	mn	, T	9.5	25	mm		. 76	 } m	m	†	2 m	m	0	85	m		0.42)5 r	nm	0	2	mn		To) 15		<u> </u>		75	
• •		1																	0.02																										91.6	<u>III</u>
	TRAN	+																																												
		<u> </u>																										-				+								$\left \right $						
Test pit no. ASTM Classification D60 D30 D10 W LL PL PI Cc C • AC1060-TL-PR-03 FINES with trace Sand 2.5	- IESI	A	C106																					D6	0		DB	80		D1	0	-			LL			PL			PI	+	Сс	-	Сι	\square
COBBLES coarse fine coarse medium fine CLAY OR SILT	SIZE2																															-		T		_						-		-		
	GRAIN *								Ŧ																	-						-		_								-				

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MOISTURE DENSITY RELATIONSHIP

SNC+LAVALIN

					Lab No:	707							
Client: Project No: Project:	722855	Newfoundland and Labrador Hydro 722855 AC 1060 230 kV TL Muskrat to Gull Island											
Sample #	AC1060-TL-	-											
Sample Type / Source:	Sand from	cuts in the	road emba	nkment or	TLH								
Date Sampled:	Septembe	Dwayne Di	ruggett										
Date Received:	Septembe	r 30, 2007	Prepa	ration									
Percent Retained:		> 19mm = 0.0%											
Compaction Std.	ASTM	ASTM D698 Method C											
Moisture Content	10.3	10.3 13.5 15.7 17.5											
Dry Density kg/m ³	1618	1649	1683	1667									
1700			RELATIONS										
1700													
1680													
1680													
1680 1680 1660 1660 1660 1660 1640													
1680 ^c W ^b J 1660 1660 1640 1640													

Corrected Dry Density

Maximum Moisture

Reviewed by,

1684.2 kg/m3

16.1 %

Maximum Dry Density 1684.2 kg/m3

16.1 %

Maximum Moisture

Tested by, Ken Collier

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SNC · LAVALIN

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TEST PIT AC1060-TL-PR-04 **GRAIN SIZE DISTRIBUTION**

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

	ROJE	CT: _	Lower Chu	urchill	Project LOCATION: Transmission Line																							
			U.S. SIEV					3	U.S. SIEVE NUMBERS ³ ₄ ⁶ ₈ ¹⁰ ₁₄ ¹⁶ ₂₀ ³⁰ ₄₀ ⁵⁰ ₆₀ ¹⁰⁰ ₁₄₀ ²⁰⁰										HYDROMETER									
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7007	COBBLES GRAVEL											١D					CLAY OR SILT											
	coarse fine coarse							······································	medium					ne														
ASE /	AC1		st pit no. ' L-PR-04			ample 3 B-1		epti .00 -			% (Grav 0.7	/el		_			Sand 6.9			%	Silt			2.4		% Cla	у
* 0							 		-																			
	80 ı	mm	56 mm	40) mm	28	mm		0 m 100.		9.525 mm 99.8	4	.76 99	mn 3	n	2 m 98.			5 mm 38.9	0.425			3 m		0.	15 m	im 0.	075 mm
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			st pit no.				ASTM							260		D3		D	10	W	W LL		PL		 F	21	Cc	Cu
• 8	AC1	060-T	L-PR-04			POC	ORLY (GRA	DED	SAI	ND(SP)			0.6		0.	4	C	.2	4.4							1.1	2.7
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MOISTURE DENSITY RELATIONSHIP

﴾ SNC-LAVALIN

Project No: 7 Project: 7 Sample # 7 Sample # 7 Sample Type / Source: 5 Date Sampled:	Newfoundla 722855 AC 1060 230 AC1060-TL-I Sand from c September September) kV TL Mu PR-05 cuts in the 28, 2007 28, 2007 > 19mm	skrat to Gu road emba Samp Prepa	ull Island	TLH Dwayne Du	ruggett									
Project No: 7 Project: 7 Sample # 7 Sample # 7 Sample Type / Source: 5 Date Sampled:	722855 AC 1060 230 AC1060-TL-I Sand from c September September) kV TL Mu PR-05 cuts in the 28, 2007 28, 2007 > 19mm	skrat to Gu road emba Samp Prepa	ull Island Inkment or Iled By		ruggett									
Project: Image: Compaction Std. Project: Image: Compaction Std.	AC1060-TL-I Sand from c September September ASTM	PR-05 cuts in the 28, 2007 28, 2007 > 19mm	road emba Samp Prepa	nkment or led By		ruggett									
Sample # 7 Sample Type / Source: 7 Date Sampled: Date Received: Percent Retained: Compaction Std.	AC1060-TL-I Sand from c September September ASTM	PR-05 cuts in the 28, 2007 28, 2007 > 19mm	road emba Samp Prepa	nkment or led By		ruggett									
Date Sampled: Date Received: Percent Retained: Compaction Std.	September September ASTM	28, 2007 28, 2007 > 19mm	_ Samp _ Prepa	led By		ruggett									
Date Received:	September ASTM	[•] 28, 2007 > 19mm	Prepa	-	Dwayne Di	ruggett									
Percent Retained:	ASTM	> 19mm	-	aration											
Compaction Std.			= 20.4%	••••••••••••••••••••••••••••••••••••••	ר										
		D698		> 19mm = 20.4%											
	EF		Method	C]										
Moisture Content	5.5	7.5	9.2	10.8											
Dry Density kg/m ³	1987	2043	2055	2020											
2060 2040 SULUE 2020 ANO 2000 2000	MOISTURE														
1980 - 1980 - 5.0 6.0	7.0	8.0		9.0	10.0	11.0									
		MOISTURE	CONTENT												

Note : Oversized Material Co	rrection > 19mm :	= 20.4%	
Maximum Dry Density	2056 kg/m3	Corrected Dry Density	2128.6 kg/m3
Maximum Moisture	8.8 %	Maximum Moisture	7.3 %

Tested by, Ken Collier

Reviewed by,

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SI	NC+J	LA	VALIN					I	GF	RA	IN	SIZ	E	D) {	ST	RII	BU	TIC	10	I									
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PR	OJEC	T: _	Lower Chu	Irchill	Proje	ect								-	I	LOC	ATIC	ON: _	Trar	nsm	issic	on Line								<u> </u>
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MOISTURE DENSITY RELATIONSHIP

SNC·LAVALIN

						Lab No:	709
Client: Project No Project: Sample # Sample Ty	o: ype / Source:	Newfoundla 722855 AC 1060 230 AC1060-TL- Sand from c) kV TL Mu PR-06	skrat to Gu	II Island	- - - - TLH	
Date Sam	pled:	September	r 30, 2007	Samp	led By	Dwayne D	ruggett
Date Rece	eived:	September	r 30, 2007	Prepa	ration		
Percent R	etained:		> 19mm	= 0.0%]	
Compacti	on Std.	ASTM	D698	Method	С]	
Moisture	Content	9.9	11.8	14.1	16.4	20.9	
Dry Densi	ty kg/m ³	1586	1616	1626	1660	1595	
1750 1730		MOISTURE	DENSITY I	RELATIONS	SHIP		
1730 1710 M b 1690 X 1670 1650 1630		MOISTURE					
1730 1710 پو 1690 پک 1670 ۱650 این 1650 او 1630	10.0 11.0	12.0 13.0	DENSITY I		HIP	19.0 20.0	21.0

Tested by, Ken Collier

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SNC·LAVALIN

TEST PIT AC1060-TL-PR-06

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

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MOISTURE DENSITY RELATIONSHIP st

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NC+LAVALIN	ĺ

Project: Sample #	AC 1060 23 AC1060-TL-	-PR-07				
Sample Type / Source:	Sandy Grav	vel from cu	ts in the ro	bad embar	nkment o	n TLH
Date Sampled:	Septembe	r 30, 2007	_ Samp	oled By	Dwayn	e Druggett
Date Received:	Septembe	r 30, 2007	Prepa	aration	41.000	
Percent Retained:		> 19mm	= 53.5%			
Compaction Std.	ASTM	D698	Method	C		
Moisture Content	9.3	11.7	12.4	7		
Dry Density kg/m ³	2093 MOISTURE	2103	2085] SHIP		
	2093					

Note : Oversized Material C	orrection > 19mm	= 53.5%	
Maximum Dry Density	2114 kg/m3	Corrected Dry Density	2273.4 kg/m3
Maximum Moisture	10.7 %	Maximum Moisture	5.8 %

Tested by, Ken Collier

Page 112 TEST PIT AC1060-TL-PR-07

SNC+LAVALIN

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GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION: Transmission Line U.S. SIEVE OPENING IN INCHES U.S. SIEVE NUMBERS HYDROMETER ²_{1.5} ¹_{3/4} ^{1/2}_{3/8} ³₄ ⁶ 8¹⁰ 14¹⁶ 20³⁰ 40⁵⁰60 100 140 200 4 3 6 100 Т T 95 90 85 ļ 80 75 70 65 PERCENT FINER BY WEIGHT 60 55 50 45 40 35 30 25 20 15 10 5 ÷ 0 100 10 0.1 0.01 0.001 **GRAIN SIZE IN MILLIMETERS**

1007					GRA	VEL				SAND					0000	-		
			DBBLES	соа	rse	fir	ne	coarse	me	dium	fine		C	JLAY	OR SIL	I		
u		Test pi			ample		epth (m)		% Gi			Sand	I	% S			% CI	ay
		D-TL-PF	R-07		GB-1	0.	00 - 0.00		48	.7		29.5	+		1	1.1		
	•												<u> </u>					
	80 mr		56 mm 69.8	40 mm 60.8	28		20 mn 46.5		5 mm 9.1	4.76 mm 30.6	2 mm 21.7	0.85 mm 13.0	0.425		0.3 mm 4.9	0.15 r 2.2		0.075 mm 1.1
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		Test pi					Classific			D60	D30	D10	W	LL	PL	PI	Cc	
1		D-TL-PF	R-07	PO	ORLY G	RADEI	D GRAVE	L with SA	ND(GP) 38.7	4.5	0.6	4.3				0.9	64.8
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MOISTURE DENSITY RELATIONSHIP

SNC·LAVALIN

					Lab No:	711
Client: Project No:	Newfoundl 722855	-				
Project:		30 kV TL Mu	skrat to Gu	ull Island	_	
Sample #	AC1060-TL					
Sample Type / Source	: Sand from	cuts in the	road emba	nkment or	n TLH	
Date Sampled:	Septembe	er 30, 2007	Samp	led By	Dwayne Dr	uggett
Date Received:	Septembe	er 30, 2007	Prepa	ration		
Percent Retained:		> 19mm	= 0.0%]	
Compaction Std.	ASTN	D698	Method	С		
Moisture Content	11.3	13.0	14.3	16.1]	
Dry Density kg/m ³	MOISTUR	E DENSITY F	1716 RELATIONS	1690 SHIP		
1740	······			L		
1740	······			L		
1740 1720 [©] E 1700 SY 2	······			L		
1720 E 1700 L 1680 L 1680	······			L		

Note .	Oversized material Col	rection > 19mm	= 0.0%	
Maximum	Dry Density	1726 kg/m3	Corrected Dry Density	1726 kg/m3
Maximum	Moisture	15 %	Maximum Moisture	15 %

Tested by, Ken Collier

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TEST PIT AC1060-TL-PR-08

SNC·LAVALIN

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION: Transmission Line

U.S. SIEVE OPENING IN INCHES U.S. SIEVE NUMBERS HYDROMETER 6 3 2 1,5 1,3/4 1/2,3/8 3 4 6 810 140 200 100 <t< th=""><th></th></t<>	
95 90<	
90 90<	
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80 75 70<	
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70 65 60 61 <	
65 H9 60 55 50 45 40 35 35 40 35 40 40 40 40 40 40 40 40 40 40	
HB 60 1<	
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	0.001
GRAIN SIZE IN MILLIMETERS	0.001
GRAVEL SAND	
COBBLES coarse fine coarse medium fine	
Test pit no. Sample Depth (m) % Gravel % Sand % Silt AC1060-TL-PR-08 GB-1 0.00 - 0.00 0.0 95.0 5.0	% Clay
AC1060-TL-PR-08 GB-1 0.00 - 0.00 0.0 95.0 5.0 1	
80 mm 56 mm 40 mm 28 mm 20 mm 9.525 mm 4.76 mm 2 mm 0.85 mm 0.425 mm 0.3 mm 0.15 r	mm 0.075 n
99.9 99.5 97.3 30.7	
Test pit no. ASTM Classification D60 D30 D10 W LL PL PI	Cc C
	1.2 2.

MOISTURE DENSITY RELATIONSHIP

SNC · LAVALIN

						Lab No:	712
Client:		Newfoundla	nd and I a	brador Hyd	iro		
Project	No	722855				-	
Project:		AC 1060 230) kV TI Mi	iskrat to Gi	ull Island	-	
Sample		AC1060-TL-				_	
-	" Type / Source:	Clayey Silt f		in the road	embankm	ent on TI H	
oumpic	Type / Oburce.	olayey olici					
Date Sa	mpled:	September	r 30, 2007	_ Samp	led By	Dwayne Dr	uggett
Date Re	ceived:	September	r 30, 2007	_ Prepa	aration		
Percent	Retained:		> 19mm	1 = 0.0%]	
Compac	ction Std.	ASTM	D698	Method	C]	
Moistur	e Content	13.3	15.8	17.9	20.9	22.1	
Dry Den	sity kg/m ³	1546	1586	1671	1674	1652	
1720 1700				RELATIONS			
1700 1680							
1700 1680							
1700 1680 ₅1660 ⊆ 1640 ∠							
1700 1680 " ^{m/b} 1660 1640 1620 1600							
1700 1680 "u"by Linn 1660 1640 1620 1600 1580 1560 1540							
1700 1680 (mb) 1660 1640 1620 1580 1540 1520		15.0 16.0	17.0 18 MOISTURE	.0 19.0	20.0 21.0	22.0 23.0	24.0

Tested by, Ken Collier

TEST PIT AC1060-TL-PR-09

•)) SNC · LAVALIN

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

PROJECT: Lower Churchill Project LOCATION: Transmission Line U.S. SIEVE OPENING IN INCHES U.S. SIEVE NUMBERS HYDROMETER 6 ⁴ 3 ² 1.5 ¹ 3/4 ^{1/2} 3/8 3 6 8¹⁰ 14¹⁶ 20 ³⁰ 40 ⁵⁰60 ¹⁰⁰ 140²⁰⁰ 100 ┼●┼╋╎ 95 90 85 80 75 70 65 PERCENT FINER BY WEIGHT 60 55 50 45 40 35 30 25 20 15 10 5 0 100 10 0.1 0.001 0.01 **GRAIN SIZE IN MILLIMETERS** GRAVEL SAND COBBLES CLAY OR SILT coarse fine coarse medium fine % Gravel % Sand Test pit no. Sample Depth (m) % Silt % Clay AC1060-TL-PR-09 GB-1 0.00 - 0.00 0.1 14.8 85.1 * 80 mm 56 mm 40 mm 28 mm 20 mm 9.525 mm 4.76 mm 2 mm 0.425 mm 0.3 mm 0.15 mm 0.075 mm 0.85 mm 100.0 99.9 99.6 98.2 96.2 94.6 89.5 85.1

D60

ASTM Classification

FINES with some Sand

D30

D10

W

LL

PL

PI

Сс

Cu

2007.GPJ GINT STD CANADA.GDT 08-1-25 AC1060 DATABASE ۲ E NE 0 **TRANSMISSION I** ۰ . ٨ PIT 1 Θ TEST SI7E2 **GRAIN**

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* 0 Test pit no.

AC1060-TL-PR-09

Page 116

Page 117

MOISTURE DENSITY RELATIONSHIP

					Lab No:444	<u>ا</u>
Client:	Newfoundla	and and La	brador Hvo	Iro		
Project No:	722855				_	
Project:	AC 1060 230	kV TL Mu	skrat to Gi	Ill Island	_	
Sample #	AC1060-TL-	PR-10			_	
Sample Type / Source:	Sand Dune	Near Pina'	s River			
Date Sampled:	Septembe	er 8, 2007	_ Samp	led By	Calvin Miles	
Date Received:	Septembe	er 8, 2007	Prepa	ration		
Percent Retained:		> 19mr	n = 0%]	
Compaction Std.	ASTM	D698	Method	С]	
Moisture Content	12.1	13.0	14.9	15.9		
	1					
Dry Density kg/m ³	MOISTURE	DENSITY	1852 RELATIONS	1676 SHIP		J
Dry Density kg/m ³						
1900 1850 [©] E 1800 [©] X ALIS 1750 U X Y 1700			RELATIONS		16.0	

Note :Oversized Material Correction > 19mm =0.0%Maximum Dry Density1856 kg/m3Corrected Dry Density1856 kg/m3Maximum Moisture14.8 %Maximum Moisture14.8 %

Tested by, Ken Collier

Page 118

•)) SNC · LAVALIN

TEST PIT AC1060-TL-PR-10

GRAIN SIZE DISTRIBUTION

CLIENT: Newfoundland and Labrador Hydro

PROJECT: Lower Churchill Project

SITE: 230 kV Transmission Line - Muskrat Falls to Gull Island

LOCATION: Sand Dune near Pinus

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	80	mm	56 n	nm	40	mm		28 n	nm	2	0 m	m	9.52	5 mm	4	1.76	mr	n	2 mm	1		5 mm 9.5	0.42	5 mm .8		3 mr 50.7			5 mn 3.1	n 0.0)75 mm 0.8
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		Te	st pit no).		T			ASTM	Cla	assi	ficati	on		1		D60	\int	D30		D	10	w			PL		PI		Cc	Cu
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MOISTURE DENSITY RELATIONSHIP SN

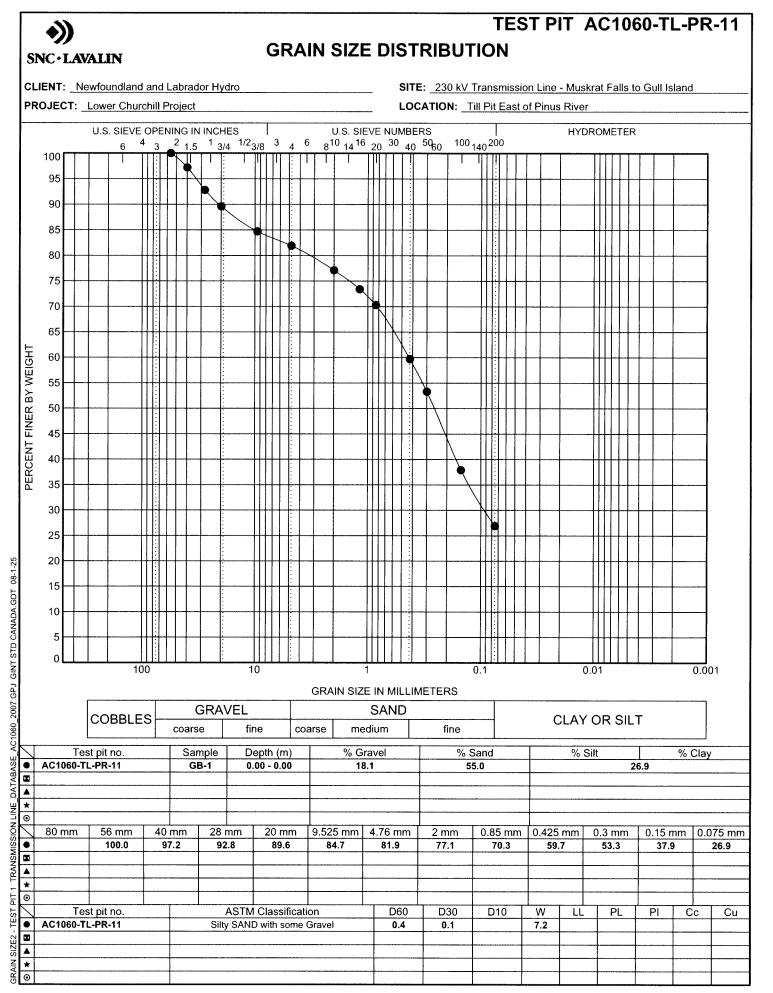
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SNC · LAVALIN

Client: Newfoundland and Labrador Hydro Project No: 722855 Project: AC 1060 230 kV TL Muskrat to Gull Island Sample # AC1060-TL-PR-11 Sample Type / Source: Glacial Till Pit East of Pina's River Date Sampled: August 29, 2007 Sampled By Calvin Miles Date Received: August 29, 2007 Preparation Percent Retained: > 19mm = 10.4% Compaction Std. ASTM D698 Method C Moisture Content 7.3 8.7 10.3 Dry Density kg/m ³ 2066 2086 2044 MOISTURE DENSITY RELATIONSHIP						Lab No:	445
Project No: 722855 Project: AC 1060 230 kV TL Muskrat to Gull Island Sample # AC1060-TL-PR-11 Sample Type / Source: Glacial Till Pit East of Pina's River Date Sampled: August 29, 2007 Sampled By Date Received: August 29, 2007 Preparation Percent Retained: > 19mm = 10.4% Compaction Std. ASTM D698 Method C Moisture Content 7.3 8.7 10.3	Client:	Newfoundia					
Project: AC 1060 230 kV TL Muskrat to Gull Island Sample # AC1060-TL-PR-11 Sample Type / Source: Glacial Till Pit East of Pina's River Date Sampled: August 29, 2007 Sampled By Calvin Miles Date Received: August 29, 2007 Preparation Percent Retained: > 19mm = 10.4% Compaction Std. ASTM D698 Method C Moisture Content 7.3 8.7 10.3 Dry Density kg/m ³ 2066 2086 2044				_			
Sample # AC1060-TL-PR-11 Sample Type / Source: Glacial Till Pit East of Pina's River Date Sampled: August 29, 2007 Sampled By Calvin Miles Date Received: August 29, 2007 Preparation Percent Retained: > 19mm = 10.4% Compaction Std. ASTM D698 Method C Moisture Content 7.3 8.7 10.3 Dry Density kg/m ³ 2066 2086 2044	-) kV TL Mu				
Date Sampled: August 29, 2007 Sampled By Calvin Miles Date Received: August 29, 2007 Preparation Percent Retained: > 19mm = 10.4% Compaction Std. ASTM D698 Method C Moisture Content 7.3 8.7 10.3	-			_			
Date Received: August 29, 2007 Preparation Percent Retained: > 19mm = 10.4% Compaction Std. ASTM D698 Method C Moisture Content 7.3 8.7 10.3	Sample Type / Source:	Glacial Till F					
Percent Retained: > 19mm = 10.4% Compaction Std. ASTM D698 Method C Moisture Content 7.3 8.7 10.3 Dry Density kg/m ³ 2066 2086 2044 MOISTURE DENSITY RELATIONSHIP 2080	Date Sampled:	August 29, 2007 Sampled By				Calvin Mile	S
Compaction Std. ASTM D698 Method C Moisture Content 7.3 8.7 10.3 Dry Density kg/m³ 2066 2086 2044 MOISTURE DENSITY RELATIONSHIP 2080 2080 2080 2080	Date Received:	August 29, 2007 Preparation		aration			
Moisture Content 7.3 8.7 10.3 Dry Density kg/m³ 2066 2086 2044 MOISTURE DENSITY RELATIONSHIP 2080 2080 2080 2080	Percent Retained:		> 19mm	= 10.4%]	
Dry Density kg/m ³ 2066 2086 2044 MOISTURE DENSITY RELATIONSHIP 2080	Compaction Std.	ASTM	D698	Method	C]	
Dry Density kg/m ³ 2066 2086 2044 MOISTURE DENSITY RELATIONSHIP 2080	Moisture Content	73	87	10.2	I		
2080							
	2060 CENSILY KO			RELATIONS			
2040		8.0	9.0	ii	10.0	······	11.0

Note : Oversized Material Correction > 19mm = 10.4%							
Maximum Dry Density	2129 kg/m3	Corrected Dry Density	2158.4 kg/m3				
Maximum Moisture	8.5 %	Maximum Moisture	7.8 %				

Tested by, Ken Collier

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Appendix G

Limitations

February 2008

Project No. 722850

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the test locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test locations may differ from those encountered at the test locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that a geotechnical consultant be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered at the test locations. The elevations used in this report are primarily to establish relative elevation differences between the test locations and should not be used for other purposes, such as grading, excavating, planning development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that the final design be verified as being consistent with the recommendations, and that the assumptions made in this analysis are valid.

Any comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test locations may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. SNC Lavalin Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.





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